

The logo for the state of Ohio, featuring a red outline of the state and the word "Ohio" in a bold, red, sans-serif font.

# Third Frontier

Innovation Creating Opportunity

2009 Annual Report



*An employee of Siemens is seen through the components of an electric motor at the company's plant expansion in Norwood, Ohio.*

The logo for the state of Ohio, featuring a white outline of the state and the word "Ohio" in a bold, white, sans-serif font.

Department of  
Development

Ted Strickland, Governor  
Lee Fisher, Lt. Governor

Lisa Patt-McDaniel, Director



*Governor Ted Strickland views a small cooling component during a tour of the Catacel Corporation – Garrettsville, Ohio.*



# Department of Development

**Ted Strickland**, Governor  
**Lee Fisher**, Lt. Governor

**Lisa Patt-McDaniel**, Director

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December 2009

**Ted Strickland, Governor, State of Ohio**  
**General Assembly, State of Ohio**

Dear Colleague,

We are pleased to present to you the 2009 Ohio Third Frontier Annual Report. The success of the program, as outlined in the personal stories and metrics in this report, demonstrate how a visionary and bipartisan commitment to Ohio's future continues to bring prosperity to the people and businesses of our state even in these challenging times.

The Ohio Third Frontier continues to support technology-based economic development in the State of Ohio through investments that not only create new products from Ohio ingenuity, but also create sustainable growth in companies in every stage of development. We understand that economic growth does not appear overnight, but rather through strategic and consistent investments in people and places.

In its seven years of operation, the Ohio Third Frontier is living up to its commitment to drive growth in company, job, and wealth creation throughout the state. SRI International, in partnership with Georgia Tech, completed an independent study of Ohio Third Frontier and related Ohio Technology-Based Economic Development programs. Their report showed that since inception, the Ohio Third Frontier has:

- Generated \$6.6 billion in economic activity in Ohio;
- Created 41,300 total jobs through December 2008;
- Significantly impacted the diversity and competitiveness of Ohio's manufacturers;
- Assisted in the formation, attraction, or initial capitalization of more than 570 companies; and
- Leveraged a \$10 return for every dollar invested during 2003 - 2008, with the expectation of increased impacts in the years to come.

We are proud to present the 2009 Ohio Third Frontier Annual Report, showcasing the accomplishments and milestones reached through our continuous investment in Ohio. The program is fostering widespread growth in the technology sector and enabling Ohio to continue its leadership in our fast-changing economic climate.

Sincerely,

Eric Fingerhut, Chair  
Ohio Third Frontier Commission  
Chancellor  
Ohio Board of Regents

Lisa Patt-McDaniel  
Ohio Third Frontier Commission  
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## Ohio Third Frontier: Making an Impact

In Technology-Based Economic Development, there is no such thing as a quick hit. Real success comes from having a sustained, comprehensive effort grounded in smart choices and arising from an understanding of the inherent technology and industry strengths of a state or region. Whether reinvigorating a long-standing industry or blazing new trails in an emerging technology sector, the goal of Technology-Based Economic Development investment is to be the spark that ignites spontaneous, market-driven growth which ultimately transcends the public investment. With ongoing care and nurturing, those seed investments become embedded deeply enough in the economic fabric of a locality that they will have a meaningful and lasting positive impact on wealth and job creation.

Ohio Third Frontier is blazing a new trail and creating a national model for future Technology-Based Economic Development efforts. Ohio Third Frontier was founded on the commitment to shape the future economy of the state through a portfolio of programs to support applied research and commercialization, entrepreneurial assistance, early-stage capital formation, and expansion of a skilled talent pool that can support technology-based economic growth. Co-opting a phrase from the national dialog on Technology-Based Economic Development, our strategic intention is to create an “innovation ecosystem” in Ohio that supports the efficient and seamless transition of great ideas from the laboratory to the marketplace.



Large tubes containing algae will be used in the control of carbon emissions at the University of Dayton – Dayton, Ohio.

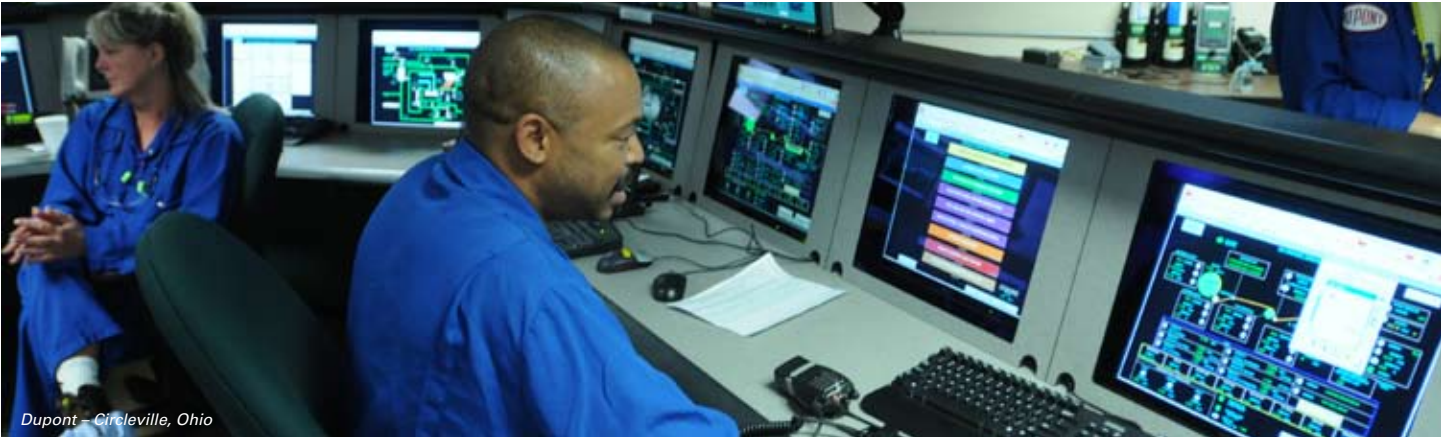
In its seventh year of operation, Ohio Third Frontier is living up to its commitment, implementing a clear and comprehensive strategy with a focus on Ohio’s traditional and emerging research and industrial strengths. In September 2009, SRI International, in partnership with Georgia Tech, completed an economic impact study of Ohio Third Frontier and related Ohio Technology-Based Economic Development programs. The study found that as of December 2008, \$681 million in State of Ohio expenditures related to Ohio Third Frontier had generated:

- \$6.6 billion of economic activity,
- 41,300 total jobs, and
- \$2.4 billion in employee wages and benefits.

This represents a nearly \$10 return on every dollar of Ohio’s investment in the period from 2003 - 2008, with the expectation of increased impacts in the years to come.

A key program strength identified by SRI is that Ohio looks strategically at the key factors that determine innovation capacity and makes investments on a scale that can make a difference. In support of this view, they reported that Ohio Third Frontier has made major contributions in the following areas:

- Ohio Third Frontier and related initiatives contributed to the major growth of venture capital investment in Ohio, from **\$243 million** in 2004 to **\$446 million** in 2008.
- More than **500 new companies** have been created, attracted, and capitalized by Ohio Third Frontier — each offering the potential for significant growth.
- **3,000 Ohio students** have been awarded internships with nearly 700 companies in 77 of Ohio’s 88 counties.
- Ohio Third Frontier has not only created economic opportunities and wealth in Ohio, its projects have improved Ohioans’ quality of life through advances in medical care, producing affordable and sustainable sources of advanced energy, and protecting Ohio’s environment through better use of natural materials and sensors for our safety and security. In doing so, Ohio Third Frontier has fostered the emergence of new technology clusters across the state, including **Biomedical Imaging, Fuel Cells, Photovoltaics, and Liquid Crystals/Flexible Displays.**
- Ohio Third Frontier, with its **long-term strategic approach, merit-based implementation, and its agility in responding to needs and opportunities**, is a pathway to the positive economic growth trajectory enjoyed by many other high technology regions within the United States and globally.



The SRI evaluation also compared Ohio's program to other notable technology-based success stories: Research Triangle Park (North Carolina), Austin (Texas), Silicon Valley, and the Route 128-Boston metropolitan area. SRI identified four structural characteristics that these regions share that are also present in our state because of Ohio Third Frontier and associated programs:

1. Research-intensive companies and universities, producing world-class research and training a world-class workforce;
2. Visionary regional leaders;
3. Networks that involve business, research, and finance; and,
4. Strong entrepreneurship support infrastructure, including early-stage capital and support for technology transfer and early-stage companies.



In conclusion, SRI stated the following about Ohio Third Frontier's (OTF) economic impact:

"It is important to note that the \$6.6 billion impact is only for the OTF expenditures to date. These investments are likely to generate larger impacts in the years to come for several reasons. First, a majority of OTF funds remain to be spent. Some OTF funds have not yet been awarded, and some funds awarded have not yet been entirely spent. The economic impact of the program is expected to increase significantly over the next five to ten years. Second, the OTF is generating successful outcomes in spite of the longest U.S. recession in the post-World War II era. The diminished demand, financial capital, business activity, and job losses associated with the recession weigh down the net economic impacts generated by the OTF investments. However, it is likely that the new products and processes being commercialized by Ohio companies and the new industries that are emerging will be in a position of strength during the next global expansion."

The findings of the SRI report confirm that Ohio is truly unique in its approach to Technology-Based Economic Development, and that the initiative has produced significant and measurable results in a relatively short period of time.

SRI International's report titled "Making an Impact: Assessing the Benefits of Ohio's Investment in Technology-Based Economic Development Programs" is available at [www.thirdfrontier.com](http://www.thirdfrontier.com).

## Ohio Investment Capital: Growth and Resilience in a Tough Economy

Capital is the lifeblood of any business, but especially small, start-up technology-based businesses. Access to capital is a critical factor that often determines whether a great idea ever becomes reality. Recognizing this, Ohio has made capital formation a pillar of its technology-based economic development strategy. Mindful of the need to have sufficient capital resources available at all stages of a company's creation and maturation, Ohio has been one of few states to foster capital growth across the entrepreneurial continuum from the earliest pre-seed stage funding through later stage venture capital. It has accomplished this through OhioThird Frontier, the Technology Investment Tax Credit Program, and the Ohio Venture Capital Authority. Applying this comprehensive and sustained strategy, Ohio has made significant progress in a relatively short period of time.

### Arisdyne Systems, Inc. – Innovation for the Alternative Fuel Industry

The ethanol industry is under pressure to be competitive with petroleum-based fuels and to increase yields to a level that makes renewable fuels not just an option, but a cost effective and profitable segment of our alternative energy economy. Innovative companies such as Cleveland-based Arisdyn Systems Inc. aim to help ethanol producers increase yields and reduce the cost per gallon. In March 2008, Arisdyn was awarded a \$1 million grant from the OhioThird Frontier Advanced Energy Program. The company has secured more than \$7.5 million in private equity funding during its first year of operation, including out-of-state investments from Houston-based Chevron Technology Ventures and Georgia-based Cordova Ventures.



Dr. Michael Camp



In his recently published "2008 Ohio Venture Capital Report – Steady Focus in Uncertain Times," Dr. Michael Camp, Director of the Center for Entrepreneurship at The Ohio State University's Fisher College of Business, reported that "in a year when the U.S. venture capital industry realized not just a decline in total investment, but one of the more significant drops in the last 30 years, Ohio's total venture capital investment in 2008 was \$446 million in nearly 200 companies."

One of the most notable findings of the report was that Ohio's early-stage investment capital increased from \$143 million in 2007 to \$283 million in 2008.

This represented a 67 percent increase in year-to-year investment activity at a time when the national investment activity level decreased by 20 percent. The momentum has been generated, in part, by OhioThird Frontier's steady investment in more than 40 pre-seed funds, and more than \$30 million in Technology Investment Tax Credits issued to active angel investors in the last several years. Dr. Camp observed that, "Ohio's angel investment community is one of the strongest and most active in the nation with more than \$186 million in cumulative investment in the last five years."

According to the same study, between 2004 and 2008, total venture capital investment in Ohio grew by 13.2 percent per year (from \$243 million to \$445.6 million) – **more than double the annual growth rate of total U.S. venture capital investment during the same five-year period (5.1 percent per year)**. The Ohio Venture Capital Authority has contributed significantly to the growth of venture capital activity in Ohio. As of September 30, 2009, the Ohio Capital Fund has committed \$108 million to 17 Ohio-based and four out-of-state funds. Those 17 Ohio-based funds include eight that have established a new presence in the state. Collectively, these new-to-Ohio funds give Ohio companies



Rosalyn Baxter-Jones, MD (pictured) along with Michael Ross, MD and Dean Koch founded CerviLenz Inc. in 2008.



### CerviLenz – Predicting Preterm Birth Risk

More than 500,000 babies are born preterm every year and are at risk of lifelong, even life-threatening health problems. Every day of pregnancy is important for the baby, and every baby deserves a healthy start on life. CerviLenz, Inc., based in Chagrin Falls, can help. CerviLenz makes a disposable tool to help doctors and midwives easily assess whether a pregnancy is at higher risk for preterm birth. In the spring of 2008, CerviLenz received \$350,000 from Ohio Third Frontier partner JumpStart, Inc. A few months later, CerviLenz received \$200,000 in seed financing from the North Coast Angel Fund. In May 2009, CerviLenz raised \$4 million in the company's initial round of venture funding from two Midwest venture capital firms: Chrysalis Ventures and Arboretum Ventures.

access to more than \$600 million in venture capital for later stage investments. The four out-of-state funds represent more than \$1.6 billion of venture capital that is also within reach of Ohio technology companies.

While Ohio was not immune to the downturn in later-stage venture capital, our state did show greater resilience than the nation as a whole. At a time when many other states realized declines of as much as 50 percent in the year-to-year investment activity from 2007 to 2008, the decrease in Ohio's venture capital investment was slightly less than 4 percent.

In total, Dr. Camp's report suggests that Ohio has done a good job in utilizing its strengths and attracting investment in Ohio companies that, in the past, would more than likely have found its way to east and west coast opportunities.

A cautionary note was given in the Camp report that overall investment nationally may decline for the next several years, and that both public and private efforts in Ohio must continue to focus sharply on making the state's portfolio companies highly attractive to follow-on capital if these positive results are to continue. There is no question that Ohio is up to the challenge. The SRI Report, summarized on page four of this report, determined that Ohio Third Frontier and other state programs have not only dramatically increased the availability of early-stage capital, but have also markedly improved the entrepreneurial environment in Ohio that gives rise to investment-worthy companies. SRI stated that, "The Ohio Third Frontier has successfully filled in the missing elements of risk capital and entrepreneurial skills, and catalyzed the connections between the various elements in the technology commercialization continuum ensuring that the whole is greater than the sum of its individual parts."

With meaningful and sustained support of activities across the spectrum of entrepreneurial needs, Ohio will weather the tough economy and continue to be a winner in the investment capital arena.



### CH Mack – Providing Solutions for Long Term Care

CH Mack Inc., based in Cincinnati, provides a case management solution that extends the promise of consolidated Electronic Medical Records to long-term care scenarios. These solutions enable healthcare, human services, and managed care organizations to reduce healthcare costs, improve quality of care, and shorten access time for delivery of services to a rapidly growing population in need of health and human services. CH Mack provides true seamless integration with both provider and payor systems. To date, CH Mack, a portfolio company of Ohio Third Frontier Partner Queen City Angels, has received more than \$7 million in private equity including an investment from Draper Triangle Ventures.

# Biomedical

## Ohio's Leading Biomedical Imaging Cluster

Ohio has a long and rich history in the development and manufacturing of biomedical imaging equipment dating to 1930 with the establishment of the Picker X-Ray Corporation in Cleveland. Today, the industry is rapidly growing in Ohio, becoming the world's premier location for biomedical imaging.

However, just a few years ago this bright future in Ohio was uncertain. Ohio Third Frontier investments supported the industry at a critical time and assured its future in Ohio. Continued support from Ohio Third Frontier is helping the biomedical imaging cluster mature into a global leader, responsible for nearly 3,000 Ohio jobs.

In 2001, Philips Medical Systems – a world leader in medical technology based in the Netherlands – acquired Marconi Medical which Cleveland's Picker X-Ray had evolved to become through a series of acquisitions. Due to currency exchange rates and external factors, strong consideration was being given to relocating manufacturing operations to Europe. Capital opportunities created by Ohio Third Frontier became a major factor in the decision to keep Magnetic Resonance Imaging (MRI) manufacturing in Ohio and to expand new instrument development in our state.

In 2003, with funding from Ohio Third Frontier, The Ohio State University established the Wright Center of Innovation in Biomedical Imaging. A major goal of this award was the development of an Ultra High Field 7.0 Tesla MRI scanner that generates body scan images with extremely high resolution relative to current technology. The project is a collaboration with Philips Medical Systems and Case Western Reserve University.

As a result of the creation of the Wright Center, Philips decided to keep development of new imaging devices and manufacturing in Ohio. Additional Ohio Third Frontier grants have helped to advance the goals of the Wright Center and solidify Philip's corporate commitment to Ohio. Today, Philips Medical Systems is headquartered in Cleveland, representing a major anchor company within Ohio's growing biomedical imaging cluster. Ohio can also lay claim to the development and manufacture of the world's most advanced commercially available MRI.

The Ohio Third Frontier award that established the biomedical imaging center reinforced the collaborations between world-class academic institutions in Ohio and companies developing state-of-the-art imaging systems. Industry clusters in fast moving high technology areas invariably have strong links to near-by academic centers of excellence. In the development of a new technology, some aspects of a project are best accomplished in an academic setting and some require the resources of a commercial company. Ohio Third Frontier awards are structured to require these relationships and have strengthened both sides of these partnerships in an effort to make Ohio's economy greater than the sum of its parts.



*The Ohio State University – Columbus, Ohio.*

To move academic expertise in Ohio to the next level and further broaden the scope of biomedical imaging expertise, Ohio Third Frontier awarded one of its largest grants in the Ohio Research Scholars Program to the biomedical imaging arena. This award has supported a total of five endowed research positions: two at The Ohio State University, two at Case Western Reserve University, and one at Wright State University. The imaging groups at their respective academic institutions are among the most actively involved with the medical industry by virtue of their graduates being in high demand. Discussing students in the Imaging Physics group, Professor Robert Brown of Case Western said, "I don't even write letters of recommendation anymore – they just get hired."

The Ohio Research Scholars Program award brought the direct involvement of Cardinal Health of Dublin, Ohio into the imaging cluster. Cardinal Health is the leading provider of radiopharmaceuticals for molecular imaging in the United States. Quickly growing in importance, molecular imaging uses radioactive molecules that bind to targeted sites in the body, allowing enhanced imaging for early



*Quality Electrodynamics (QED) was founded to design and manufacture new magnetic coil technology that is the heart of an MRI scanner.*

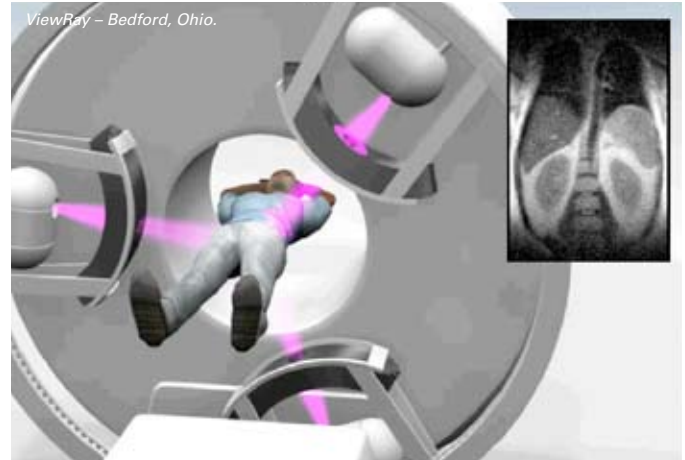
detection of specific diseases. Early detection leads to faster diagnoses and better outcomes for patients. In this partnership, Cardinal Health will work with academic researchers on the development of new imaging agents, while Philips focuses on improving the capabilities of the imaging system used in conjunction with the molecular agents.

As a result of Ohio's imaging expertise and resources, new start-up companies are forming and creating new jobs for Ohioans. For instance, three years ago, with assistance from Ohio Third Frontier, Quality Electrodynamics (QED) was founded to design and manufacture new magnetic coil technology that is the heart of an MRI scanner. QED's CEO holds a Ph.D. from Case Western Reserve's Physics department in magnetic resonance imaging. QED has already created 40 jobs and expects to reach 80 this year. With the world-class imaging research programs at nearby academic institutions and experienced workers trained at other imaging companies, QED found talented employees to support its rapid expansion. Many employees are engineering or physics graduates, helping to keep our intellectual capital in Ohio.

Similar to QED, there are scores of companies in Ohio that represent a supply chain for the tens of thousands of parts that go into an imaging device. The expertise in these smaller companies contributes to the innovation represented by new imaging systems in the form of advanced components. Hypertech Research, Inc., in Columbus, with assistance from Ohio Third Frontier, is developing specialty wire that will create the superconducting capacity needed to make an MRI coil work without the need for the supercooling that is accomplished today with an expensive and limited supply of liquid helium.



*Lt. Governor Lee Fisher visits Quality Electrodynamics (QED) – Cleveland, Ohio.*



*ViewRay – Bedford, Ohio.*

Companies located outside of Ohio are also recognizing the advantages of being near the resources associated with Ohio's biomedical imaging cluster. ViewRay, now located in Bedford, Ohio, was founded in Florida but relocated to be near the expertise in imaging and Ohio's existing supply chain advantages. Technology being developed by ViewRay, with assistance from the Ohio Third Frontier, will allow the simultaneous acquisition of MRI images to detect any internal motion of organs during delivery of radiation therapy associated with cancer treatment. If detected, the instrument will turn off the radiation beam to prevent damage to healthy tissue.

The exact targeting of the tumor and calculating the dose actually received is one of the major challenges of radiation therapy. Design and construction of an instrument that integrates an MRI with radiotherapy sources is an extremely complex undertaking.

Grounded in a long history in Ohio, the biomedical imaging industry is enjoying a resurgence in our state, partly due to the targeted, well-timed investments made by Ohio Third Frontier. With state-of-the-art research institutions, world-class companies large and small, and a growing base of talent, Ohio's biomedical imaging cluster is becoming a powerhouse of new innovation and a magnet for the attraction and expansion of leading imaging companies throughout the world.

# Manufacturing

## Making Things Well Still Matters

### Manufacturing Our Energy Future

Inventing a better mousetrap or an advanced energy solution takes a great deal of inspiration, insight, and hard work. However, much of the real work starts when a great idea is being reduced to practice and made ready to meet a specific market demand. Not only must a successful new technology work, it must address customer needs for usability, cost, quality, and reliability.



Governor Ted Strickland examines a wind turbine component at Lincoln Electric - Cleveland, Ohio.

This is where Ohio's spirit of invention and innovation couples powerfully with its manufacturing heritage. Companies with long histories of manufacturing excellence in Ohio are proving invaluable in turning great ideas into viable products, finding new opportunities in emerging growth markets and creating new wealth and jobs for Ohioans.

One such company is Tremco Inc. Established with \$100,000 in 1928 by William C. Treuhaft, Tremco Inc. in Beachwood, Ohio has been a manufacturer of sealants and protective coatings for commercial and industrial building roofs since its beginning. With assistance from Ohio Third Frontier, Tremco is planning to leverage its 80 years of expertise in building materials and service to become a player in the deployment of photovoltaic (PV) panels for commercial structures.

Tremco identified a problem in first generation solar panel installation on buildings, often referred to as bolt-on installation. The aesthetic is unsightly to many and more importantly, may interfere with the primary function and maintenance of the external building structure. A more elegant solution that may lead to wider adoption of PV systems is called Building Integrated Photovoltaics (BIPV), that make the PV a designed-in feature of building structures like roofs and walls, not an add-on. Tremco is partnering with another Ohio Third Frontier supported company, Xunlight Corporation, which manufactures state-of-the-art flexible PV panels, to gain a leadership position in BIPV roof systems market.

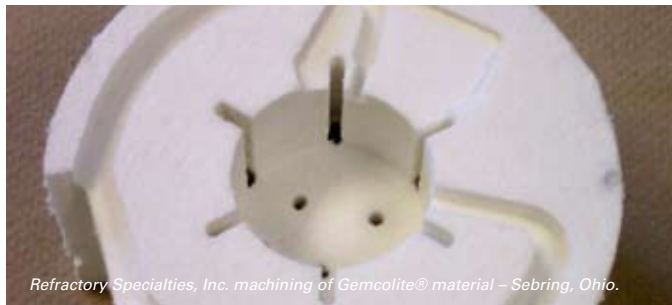
Tremco Inc. state-of-the-art customized photovoltaic roofing systems.



With its expertise in traditional roofing solutions, Tremco is addressing the engineering challenges of creating a BIPV roof that is functional in creating energy and protecting the building integrity and less architecturally obtrusive. A unique feature will allow for the removal of the PV module from the protective roof membrane for roof maintenance and eventual recycling. If developing a useful renewable energy solution isn't green enough, Tremco will offer a "cradle-to-cradle" business model, allowing the leased roof system, at the end of its service life, to be deconstructed, recycled, and reused as raw materials for a new roof. Alliance Schools in Stark and Mahoning Counties will test the Tremco product on their facilities, collaborating with Tremco to capture a piece of the growing global BIPV market, estimated at \$1 billion next year.



For more than 40 years, Refractory Specialties, Inc. (RSI) in Sebring, Ohio has supplied insulation and other products for managing high-temperature manufacturing processes in an array of traditional industries. Watching the growth of the nascent fuel cell industry in Ohio and elsewhere, RSI identified an opportunity to extend its expertise to improve the advanced manufacturing techniques required to produce the functional heart of a Solid Oxide Fuel Cell (SOFC), called the fuel cell stack.



*Refractory Specialties, Inc. machining of Gemcolite® material – Sebring, Ohio.*

Often made of ceramic materials, the components of the fuel cell stack must be fired in a kiln, like a clay pot, at very high temperatures. Unlike a clay pot, the precise manufacturing tolerances that are required for the fuel cell stack components to ultimately do their job of converting hydrogen to electricity present many challenges.

With funding from OhioThird Frontier, RSI is developing state-of-the-art SinterLyte™ kiln furniture, the stands that support the stack material while being fired. The new furniture will maintain the required shape of the part and keep it from picking up contaminating materials during the process, both of which would effect how the final product functions. This solution must not impart significant additional cost to the manufacturing of the final fuel cell system.

When successful, RSI will help meet the U.S. Department of Energy's goals for the cost per kilowatt hour of generating electricity from an SOFC, commercializing a product here in Ohio that will enable companies such as Ceramic Fuel Cells Limited (Australia), Wartsilla (Finland), Versa Power, Delphi, Rolls-Royce, and Siemens Power to deploy stationary fuel cells the world-over. These systems would generate grid electricity from an alternative energy source at prices competitive with traditional fossil fuel power plants, growing sales of RSI's enabling product to an estimated \$25 million by 2014.

Parker Hannifin was established in 1918 by Arthur L. Parker as Parker Appliance Company to manufacture a novel pneumatic brake system for trucks and buses. The company, headquartered in Cleveland, Ohio, is now a world leader in motion control technologies for industries such as automotive and aerospace. Parker's history with braking systems expanded with their Aircraft Wheel and Brake Division, where they became a dominant supplier of brakes for helicopter rotors.

Parker Hannifin recognizes that its expertise in rotor brakes has distinct transferability in the fast-growing renewable energy industry – brakes for wind turbines operate very similarly to those used to control rotational forces in helicopter blades. With assistance from OhioThird Frontier, the company believes it can provide a brake product that meets wind industry demands for a more effective and reliable system; is easier to maintain; and has a significantly lower life-cycle cost.

When successful, Parker will have a superior Ohio-manufactured braking solution focused on the world's fastest growing wind energy market – the United States. Taking market share away from the Danish company that currently controls 60 percent of the global market for wind turbine brakes, Parker expects to take part in the growing domestic wind energy supply chain, providing quality and cost advantages to original equipment manufacturers such as GE Wind and Vestas when compared to off-shore suppliers.



*Parker Hannifin supplies rotor brakes for the fast-growing renewable energy industry.*

# National Security

## Hand in Hand: National Security and Economic Security

War struck home in 2005 when word reached the families of 23 Ohioans from Columbus-based Lima Company, 3<sup>rd</sup> Battalion, 25<sup>th</sup> Marines that their loved ones had been killed in action in Iraq. Many others had been seriously injured – all in just two horrible incidents.

Protecting our servicemen and women, outfitting them with the best possible equipment, and developing ways to improve their survivability and quality of life if wounded are goals that are universally accepted as a high priority for research, and are a prominent theme within Ohio Third Frontier. New technologies that protect our service members also result in good jobs for Ohioans who make next-generation intelligence gathering sensors and medical devices, helping our brave young men and women avoid injury first and live stronger and better lives in the event that they do need to heal when they come home.

Ohio Third Frontier funds research that will greatly reduce casualties of war by improving the intelligence and data gathering capabilities of today's military and first responder communities. The University of Dayton Research Institute and its industrial research partners at the Institute for Development and Commercialization of Advanced Sensor Technology (IDCAST) are developing the world's most sophisticated remote sensing systems.



Larrell Walters, Director of IDCAST – Dayton, Ohio.

Used for intelligence surveillance, the layered sensing systems being developed will ensure that American soldiers have the best possible information about combatant movements and capabilities regardless of weather conditions, camouflage, or location.

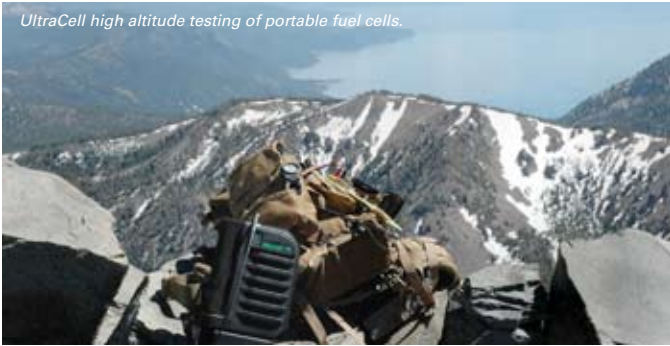
Capturing and combining information from a variety of sophisticated sensor systems provides a superior overall intelligence picture compared to dependence on just one sensor system. Sophisticated cameras operating at different parts of the electromagnetic spectrum, electronic signature recognition, data integration software, and advanced visualization are all under development by Ohio Third Frontier partners.



Other types of sensors being developed by Ohio Third Frontier partners include pathogen detections systems to protect the military from chemical and biologic threats and biometric systems for facial and real-time fingerprint recognition that will help guard against terrorism. Research and development projects being conducted by IDCAST and its partners support the needs of the Air Force Research Laboratory and its Sensor Directorate, centered at Wright-Patterson Air Force Base. Companies throughout Ohio are partnering to provide the devices and equipment needed by the military, including well-established companies such as L3 Communications and Woolpert Associates, to new start-up companies such as Photon-X.



*A Marine salutes during a ceremony for the Columbus-based Lima Company, 3rd Battalion, 25th Marines Memorial held at the Statehouse.*



*UltraCell high altitude testing of portable fuel cells.*

Power supplies are also crucial in a combat environment. To take advantage of the newest intelligence gathering technologies, the military and other first responders require assured power supplies. Today's soldier must carry up to 15 pounds of batteries for a week-long mission and the demand for personal electronic devices and electrical power is still growing. One promising technology to reduce weight and ensure reliable power are portable fuel cells operating from small replaceable canisters that are the hydrogen source to run the cells. UltraCell of Dayton is an Ohio Third Frontier funding recipient, conducting research and scale-up manufacturing here in Ohio.

Similarly, larger scale fuel cells to power mobile data centers in battlefield conditions, as well as those necessary to power tanks and other vehicles, are being developed with Ohio Third Frontier funding. The benefits of mobile fuel cells are many, including the ability to provide power without the heat signature that conventional diesel generators emit, making safer technology for soldiers operating in "stealth" modes.

Unfortunately, as proven by the tragedy of Lima Company, servicemen and women are injured in the line of duty even with the best equipment and intelligence gathering. Ohio Third Frontier is funding pioneering work to provide better medical care and more quickly and fully restore injured service members to productive and fulfilling lives. Anchored by Ohio Third Frontier investments at the Cleveland Clinic and Case Western Reserve University in tissue engineering and regenerative medicine, Ohio now proudly operates two major federal research centers that are focused on improving health care for wounded soldiers – the Armed Forces Institute of Regenerative Medicine and the Veteran Administrations Center for Functional Electric Stimulation.

The Regenerative Medicine Center's mission is to accelerate the development of new technologies focused on the regeneration of bone, muscle, tendon, nerve, and blood vessels damaged by combat injuries. Adult stem-cell research enables scientists at the Cleveland Clinic and Case Western Reserve to provide advanced therapies that alleviate suffering, accelerate healing, and improve therapeutic success in treating trauma victims. The Functional Electric Stimulation Center at the Cleveland Veteran Administrations Hospital is developing a family of technologies that use external electrical stimulation to activate muscles, causing them to contract and relax, thereby gaining functionality. Ohio Third Frontier grants have gone to companies such as Ohio Willow Wood to develop high-tech prosthetics that use advanced materials to greatly improve mobility, to Artericyte to develop artificial blood, and to the University of Akron for advancements in burn and wound healing.

Ohio has an established tradition of military support. From Wright-Patterson Air Force Base to NASA Lewis Research Center to General Electric Aviation, Ohio is at the forefront of research, development, and commercialization of technologies that enhance the capability, effectiveness, and safety of Americans. Ohio Third Frontier is proud to contribute to the technologies that help keep our soldiers safe, as well as aid in commercializing the technologies that create good jobs for Ohioans.



*Governor Ted Strickland views a Black Hawk military helicopter at the GE Aviation headquarters – Cincinnati, Ohio.*

# Advanced Materials

## Ohio Companies Making a Material Difference in Advanced Energy

In recent years, Ohio has made significant commitments to the support of advanced and alternative energy solutions, including the adoption of renewable portfolio standards and a State Job Stimulus program in advanced energy. Ohio Third Frontier has also made major investments, accelerating the success of advanced energy projects and industries in Ohio. Underlying many of the successes in advanced energy is Ohio's breadth and depth of world-class competencies in the area of advanced materials, which has also been a major focus for investment by Ohio Third Frontier. Whether improving on more mature energy technologies such as wind turbines or leading the development of next generation solar, research and commercialization of advanced materials is making Ohio a recognized source for alternative and renewable energy solutions.

Located in Kent, AlphaMicron, Inc. has been capitalizing on the depth of liquid-crystalline materials expertise that has emerged at Kent State University over the past two decades and has given rise to the Liquid Crystal Display industry. A major product focus of the company has been the use of liquid crystal materials to create actively lightening and darkening lenses for motorcycle helmets, ski goggles, and designer sunglasses. The same switchable property of the liquid crystals that makes these applications possible is now being applied, with Ohio Third Frontier funding, to an energy conservation product.



AlphaMicron – Kent, Ohio.

AlphaMicron is developing the world's first auto-adjusting "Adaptive Window." The window is based on the company's VALiD™ liquid crystal-based technology to create an adaptive film that can be laminated to windows and has a self-regulating and photovoltaic-powered electronically controllable tint. The window will transmit more winter sunlight to assist with heating and less summer sunlight to minimize overheating, thus transforming windows from a source of energy loss to one of energy gain. Market applications targeted for AlphaMicron's window include greenhouses, automobiles, and office and residential buildings.



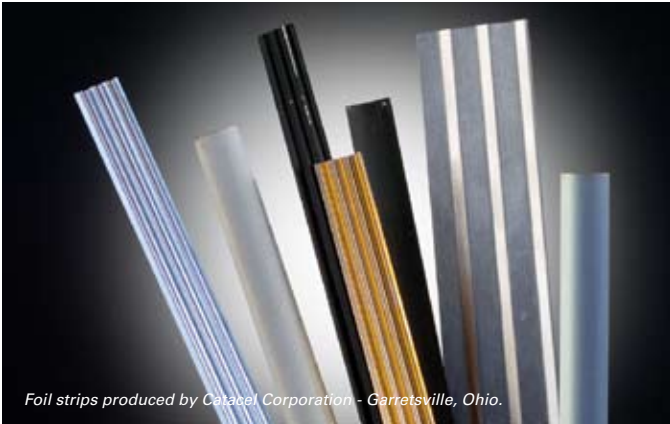
WebCore Technologies' advanced polymer composite materials.

Several years ago, Miamisburg's WebCore Technologies, Inc. began working closely with leading research laboratories including the Air Force Research Lab, located at the Wright-Patterson Air Force Base in Dayton and the NASA Glenn Research Center in Cleveland, to develop an advanced polymer composite panel system. Initially, the product concepts focused on marine (e.g., bulkheads) and infrastructure (bridge decks) applications that could benefit from the new material which is lighter, stronger, and more durable than the steel and other metals it would replace. These very same properties may make WebCore's technology an ideal material solution for the wind power industry.

The company is now developing the TYCOR® polymer composite material to provide a new, readily available core material for wind turbine blades. With assistance from Ohio Third Frontier, WebCore has developed a reliable supply of TYCOR® to improve wind turbine blade performance while decreasing overall turbine manufacturing costs. WebCore has partnered with leading wind turbine blade manufacturers and other suppliers in Ohio, Pennsylvania, Indiana, and Maine to build capabilities that are expanding Ohio's wind power supply chain and developing wind turbine blade composite core manufacturing in Ohio.



Employees of Catacel Corporation listen as Governor Ted Strickland discusses education reform for a stronger economy.



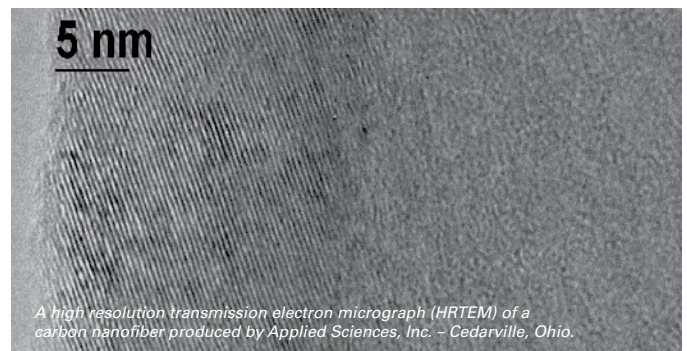
Foil strips produced by Catacel Corporation - Garrettsville, Ohio.

In 1985, at a time when the catalytic converter industry was in its infancy, Camet Co. in Hiram, Ohio was founded on a new catalytic technology invented by Dr. William Retallick. Camet Co. created, developed, and manufactured new emission control products made from metal foils with catalytic coatings. Between 1985 and 2000, three Camet Co. team members – Dr. William B. Retallick, Richard Cornelison, and William Whittenberger – achieved international recognition in the catalytic converter industry as experts in catalysis, metal foil substrate design, and the invention and commercialization of superior catalyzed metal substrate products for catalytic air pollution clean up. In 2001, the three created Catacel Corporation in Garrettsville, Ohio, to use crossover technology from the exhaust treatment business, creating and commercializing new metal substrate products for heat exchange.

Still located in Garrettsville, Catacel Corporation, with funding from Ohio Third Frontier, has become the unsurpassed authority in catalytic heat exchange solutions utilizing their advanced metal foil material. A primary market for Catacel's technology is the fuel cell industry, in which the metal foils help manage the heat coming from the chemical reactions that reform natural gas and other hydrocarbons into the hydrogen on which a fuel cell operates. The technology allows reactors to be made smaller, lighter, more durable, and energy efficient than competing solutions, lowering the manufacturing and operating costs of the fuel cells. Fuel cells are expected to contribute to the technologies that will satisfy Ohio's requirement for alternative energy production by our electric utilities.

Applied Sciences, Inc. (ASI), located in Cedarville, was founded in 1984 by researchers from the defense scientific community to conduct pioneering work in the development of carbon nanofibers. Composites made from carbon nanofibers are lightweight, strong, and have unique electrical and thermal properties that make them ideal for high-performance aerospace applications. An early goal of the company was to be able to produce the carbon materials in a quantity and at a cost that would move them from specialty applications where expense is less important than performance, to their wider use in commercial aviation and automotive applications.

With funding from Ohio Third Frontier, ASI has more recently applied its carbon material expertise to pursue substantial improvements in lithium-ion battery technology. Anodes (i.e., the positive pole of the battery) made from ASI's silicon-coated carbon nanofibers would extend the mileage of hybrid- and all-electric vehicles to a range competitive with internal combustion engines. Partnering with General Motors and Michigan's A123 Systems, Inc., a leading manufacturer of lithium-ion batteries, ASI is further strengthening Ohio's electric vehicle supply chain and leveraging the transition to electric vehicles, providing a strong case for Ohio-based production of lithium-ion batteries and stimulating the development and manufacturing of electric automobiles in Ohio.



A high resolution transmission electron micrograph (HRTEM) of a carbon nanofiber produced by Applied Sciences, Inc. - Cedarville, Ohio.

Ohio's dominance in iron and steel, polymers, and various chemicals has positioned our state to make scientific and technological breakthroughs in new, advanced materials that are revolutionizing many industrial and consumer products. Advanced materials are platforms on which to build world-class competencies in many rapidly growing industrial sectors. The impact of these new materials on the advanced energy industry is one such application that promises to write the next chapter in our materials expertise.

# Education

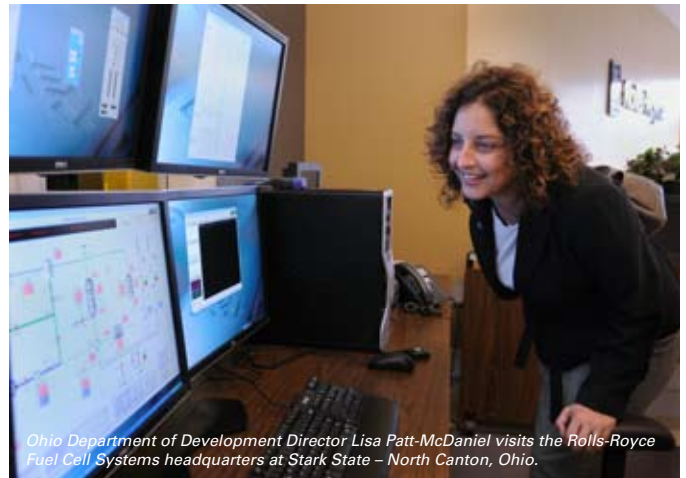
## Growing Role of Two-Year Colleges in the Ohio Third Frontier

Did you know that 45 percent of all undergraduate students begin their studies at a two-year college? Ohio's two-year college system consists of 23 technical and community colleges located in every corner of our state. These two-year colleges have played an important role in economic development, providing highly responsive education and training opportunities tailored to the needs of their local communities. The unique and intimate relationships these schools develop with the businesses in their regions have allowed some to explore new kinds of collaborations that have made them vital to fulfilling the goals of Ohio Third Frontier.

Chancellor Eric Fingerhut (bottom center) is joined by Choose Ohio First Scholars at the Statehouse - Columbus, Ohio.



Stark State College of Technology, located in North Canton, has become a world-class leader in fuel cell technology development and training. With funding from Ohio Third Frontier, Stark State serves the state's fuel cell industry by catalyzing prototype creation, curriculum development, and workforce preparation. The showcase for all these activities is the College's Fuel Cell Prototyping Center. This state-of-the-art facility was instrumental in attracting Rolls-Royce Fuel Cell Systems to establish its North American headquarters at Stark State, further expanding the college's fuel cell test capabilities and curriculum.



Several students in Stark State's fuel cell program have been interns at Rolls-Royce Fuel Cell Systems, matriculating to full-time employment after completing their studies. Stark State continues to garner extensive state, federal, and industry support for its fuel cell activities. The school has developed new business relationships that include Contained Energy and Lockheed Martin amongst others, expanded its fuel cell campus with the new Fuel Cell Services Learning Center, and helped spur the concentration of fuel cell research, education, and business activity - causing the area to be dubbed the Ohio Fuel Cell Corridor.

Community colleges also recognize that strong partnerships grow Ohio's economy. Lima-based American Trim and Ohio Third Frontier worked with Rhodes State College, located in Lima, to establish two centers to develop and commercialize advanced manufacturing methods for functional, decorative, and environmentally friendly thin-film coating and finishing processes.



The Advanced Materials Commercialization Center (AMCC) is utilizing physical vapor deposition finishing for a near-chrome process for full-size bumpers and trim parts for the heavy-duty truck industry. The process is far “greener” than chrome plating, and with the new technology American Trim, expects to bring finishing jobs that have steadily gone to less environmentally rigid overseas locations back to the United States. The Materials Deposition Center (MDC) is scaling up coating technologies into production-scale application systems for various projects including a low-cost finish that simulates stainless steel for refrigerators, ovens, microwaves, and washers and dryers.

As these two centers help the company advance new manufacturing techniques to improve the competitiveness of its products, Rhodes State College uses these same resources to educate and train students with the technical know-how needed by American Trim to effectively utilize these promising new techniques.



*The Advanced Materials Commercialization Center (AMCC) offers powder coating or wetspray application in its state-of-the-art coating booth – Lima, Ohio.*

With support from Ohio Third Frontier and its successful experience with the Great Lakes Innovation & Development Enterprise (GLIDE) incubator, Lorain County Community College has created the LCCC Innovation Fund. The Fund represents a unique approach that effectively blends the college’s education and economic development



*The Great Lakes Innovation & Development Enterprise (GLIDE) provides grants through its LCCC Innovation Fund – Elyria, Ohio.*

goals in support of entrepreneurial business activity in Northeast Ohio. With the Fund, LCCC provides grants (up to \$100,000) to promising technology-based start-ups located or willing to locate within the 21 counties of Northeast Ohio.

The awards are made to help technology-oriented entrepreneurs progress through the commercialization continuum by providing resources to help validate the technologies and business models at the start-ups. In return, recipients of Innovation Fund awards are required to provide an entrepreneurial education opportunity or an internship for students, faculty, or staff of LCCC and/or one of the Innovation Fund’s partnering higher education institutions. Using this approach, LCCC is filling the pipeline in Northeast Ohio with highly desirable technology deals that are primed for investment by Ohio Third Frontier supported pre-seed funds such as JumpStart and the North Coast Angel Fund. They are also helping to educate Ohio’s next generation of entrepreneurs.

Stark State College of Technology, Rhodes State College, and Lorain County Community College are playing a vital role in the Ohio Third Frontier by developing strategic alliances that address the commercialization needs of Ohio’s business community and the development of a technically competent pool of talent in our state. Building on their traditional educational and training strengths, these three schools have demonstrated the potential for the state’s technical and community college system as a whole to use Ohio Third Frontier support to pursue innovative new activities that can catalyze technology-based economic development in their respective communities.

# Success

## Ohio Third Frontier: People are the Heart of Our Success

### New Opportunities

In January 2008, the company that Michael Dia had joined 13 years earlier decided to downsize its operation. Michael suddenly found himself without a job. Forty-eight years old with a wife and four children to support, time was not on Michael's side. Having only six months of unemployment benefits, Michael knew he had to move fast and use every resource available. He registered at The Source, a Toledo-based unemployment and job services organization, and constantly searched the Internet and checked *The Toledo Blade* for jobs in his area. Michael said he never imagined that looking for a job would be a full-time job in itself.

Feeling as if his luck was running out, Michael received an electronic announcement from Owens Community College's placement office about a company called Xunlight Corporation. Xunlight, a rapidly growing solar company in Toledo, has been aggressively adding jobs since receiving Ohio Third Frontier advanced energy awards and substantial venture capital investment. Michael was hired to use the skills he had learned as a stockroom technician at his prior position to become a team leader, helping other employees with development of computer, organizational, and mechanical skills. Although other opportunities became available, Michael chose to remain with Xunlight because it is a company in an industry of the future, offering both job security and a way to make a difference supplying clean, renewable energy solutions.



Michael Dia –  
Xunlight Corporation – Toledo, Ohio.

"Xunlight Corporation has been fortunate to have received a great deal of support from the State of Ohio over the years, and the Third Frontier program specifically has helped the company establish a solid foundation for a successful company going forward," said CEO Dr. Xunming Deng.

In February 2009, Matt Garver joined thousands of others in a similar situation by becoming a displaced employee as a result of a chemical company layoff. Matt immediately began seeking employment through temporary agencies and numerous other employment opportunity outlets. He sought a position where his unique skill set could be utilized and he could continue to grow and advance in his science and technology-related career.



Matt Garver – Zyvex Performance Materials – Columbus, Ohio.

Enter Zyvex Performance Materials, a Columbus-based producer of nanotechnology-enhanced composite materials used to improve the performance of familiar products such as golf clubs, baseball bats, and bicycles, as well as more high-tech applications in aerospace and marine products. Through a temporary agency, Matt began work in February 2009 with Zyvex. At the time, Zyvex was not in a position to offer Matt permanent, full-time employment. With the help of Ohio Third Frontier funding in April 2009, Matt was hired full-time in June as a Laboratory Technician. The company is highly satisfied with Matt, who it says has been an excellent addition to the Zyvex team, assisting in the advancement of high-level projects and aiding in next-generation technology.

### Ohio Research Scholar

Heinz Robota, a synthetic-fuels chemist, joined the University of Dayton Research Institute (UDRI) as one of the 26 endowed research positions created by the Ohio Research Scholars Program. Robota, an expert in synthetic fuels chemistry and catalysis, will be involved in ramping up research at the Air Force's Assured Aerospace Fuels Research Facility in Dayton.

UDRI and the Air Force Research Laboratory have been working jointly to create the nation's first federal research test facility dedicated to developing new, improved jet fuels from coal and biomass. Robota has more than 30 years experience in fuels, emissions, catalysis, and



*Xunlight Corporation CEO Dr. Xunming Deng engages in discussion with an employee about Xunlight's renewable energy solutions products.*

materials technologies. He most recently worked at Range Fuels Inc., an alternative fuels start-up in Broomfield, Colorado, and as a director of research at the Syntroleum Corp. in Tulsa, Oklahoma. Robata holds 13 patents and spent two years as an Alexander von Humboldt Fellow at the University of Munich.

Jointly sponsored by the Ohio Third Frontier and Ohio Board of Regents, the Ohio Research Scholars Program awarded a total of five endowed scholar positions to the University of Cincinnati and its collaborators UDRI and The Ohio State University to create the Center for Intelligent Propulsion and Advanced Life Management, which was created to advance next-generation jet engines.



Heinz Robota joined the University of Dayton Research Institute Oct. 5 to lead efforts at the Air Force's new Assured Aerospace Fuels Research Facility (AAFRF). AAFRF will be the nation's first federal research test facility dedicated to developing new and improved jet fuels from coal and biomass. Dr. Robota, whose position is funded through the Ohio Research Scholars Program, credits the Ohio

Department of Development, Ohio Board of Regents, and the state's Third Frontier Program for providing the leadership and funding that made this position possible. "The State's foresight and investments in bringing high powered research talent to Ohio will help raise the State's level of technology innovation, spawning new companies and products that will grow jobs," Robota said.

## Ohio Third Frontier Interns

Summit Data Communications (SDC), located in Akron, makes radio cards that slip into mobile devices, handheld bar-code readers, wireless cash registers, and portable ultrasound machines that allow the devices to communicate with a base location from challenging environments. A young technology company currently housed in an Edison Incubator, the Akron Global Business Accelerator, SDC was looking for cost-effective ways to add technically qualified employees to support the company's growth, especially in these tough economic times. SDC has since hired seven Ohio Third Frontier Interns.

"Our industry, and by extension, our company, requires fairly specific employee skills," said Ron Seide, SDC's president. "Finding people that already have these skills is a difficult and expensive process. Alternatively, one

can bring in recent college graduates and provide them with specific career training. The Third Frontier Internship Program has enabled us to take this latter approach in that it defrays a substantial portion of these training expenses."

Of the seven interns, two have been hired as full-time employees. James Kalbfleisch, who earned a bachelor's degree in Computer Science from the University of Akron, is now on SDC's software development team writing test and automation programs. Dan Haas, also a graduate from UA in Management Information Systems, is managing the company's internal information systems and working as webmaster.

For 25 years, Bionix Development Corporation, located in Toledo, Ohio, has been a leader in the development, manufacturing and marketing of innovative medical devices including products for ear care, wound treatment, and even a novel formula bottle to help premature babies learn how to oral feed. A small manufacturer in a highly competitive market space, Bionix continually looks to manage costs.

The company discovered the Ohio Third Frontier Internship Program, using it to help cover the costs of a summer co-op student. Through the program, Bionix found Tamara Masters, an undergraduate student in the Biomedical Engineering Program at the University of Cincinnati.

She worked in the company's Product Development Department on devices for the radiation therapy market. As an intern with Bionix, she was given many challenging tasks including work on 3-D CAD modeling, prototyping, and creation of the design documentation needed for the launch of a new medical device.

"My experience at Bionix gave me the opportunity to apply classroom concepts and develop new engineering skills to help in my future career," Masters said.

The ability of the Ohio Third Frontier Internship Program to facilitate matchmaking between students with specific skills and companies that can use those skills to address immediate needs creates a positive result for everyone involved.

"With Tamara's assistance, we were able to get more products to market faster than we normally would have," said Product Development engineer Edward Markewitz.

## FY 2009 Financial Information

**Total Awards:** \$131,479,588

**Sources:** Third Frontier Research and Development Fund; Wright Capital Fund; Biomedical Research and Technology Transfer Trust Fund; and Third Frontier Action Fund

Program	Number of Awards	Amount (dollars)
Third Frontier Fuel Cell Program	7	\$5,298,393
Third Frontier Advanced Energy Program	9	\$9,154,192
Success and Pre-Seed Fund Initiative	6	\$8,000,000
Engineering & Physical Science Research and Commercialization Program	4	\$18,963,919
Biomedical Research and Commercialization Program	5	\$23,329,278
Wright Projects	8	\$23,788,228
Ohio Research Scholars Program*	10	\$29,510,333
Ohio Research Commercialization Grant Program	6	\$2,099,898
Third Frontier Internship Program**	N/A	\$1,499,400
Targeted Industry Attraction	1	\$160,000
Research Incentive	N/A	\$6,000,000
Administrative Expenses	N/A	\$3,675,947
<b>Total Expenditures</b>		<b>\$131,479,588</b>

\*Original awards made in FY 2008 with funding to come from FY 2008 and FY 2009 budgets

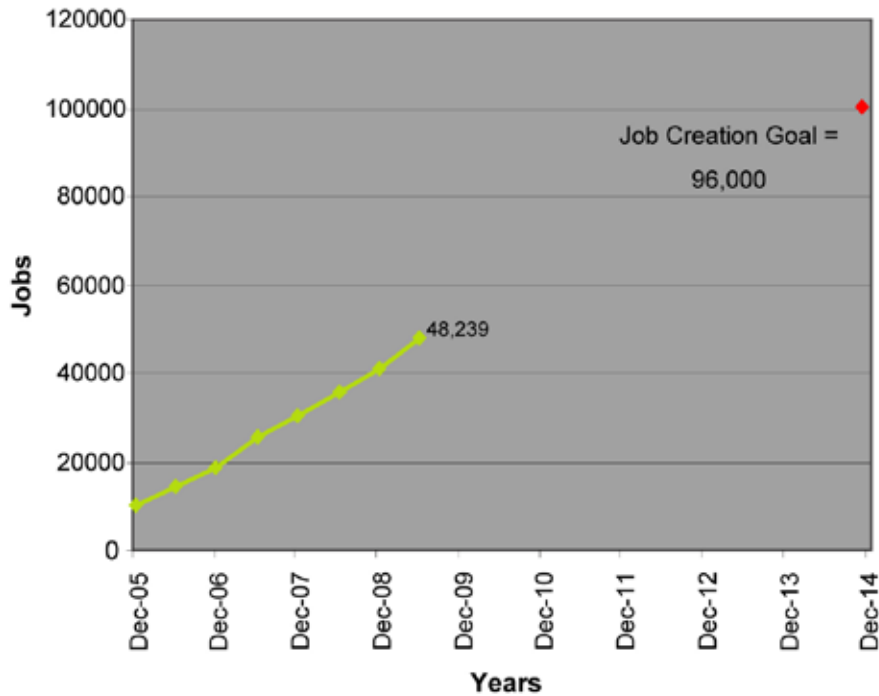
\*\*Twelve regionally-based organizations coordinate deployment of internship funds at up to \$3,000 per position

## Performance Metrics

Performance Criteria	As of 6/30/08	As of 6/30/09
State Funds Awarded	\$873,462,907	\$970,096,816
State Funds Expended	\$343,299,994	\$468,983,968
Cost Share Reported	\$891,522,131	\$972,156,606
Leveraged Dollars	\$3,075,785,242	\$4,105,697,454
Leverage Ratio	8.9 : 1	8.8 : 1
Direct Jobs Created and Retained	6,795	8,527
Total Jobs Created and Retained*	35,792	48,000
Companies Created, Attracted, and Capitalized	466	571
Average Salary	\$64,237	\$67,087
Cost Per Job	\$50,520	\$54,999

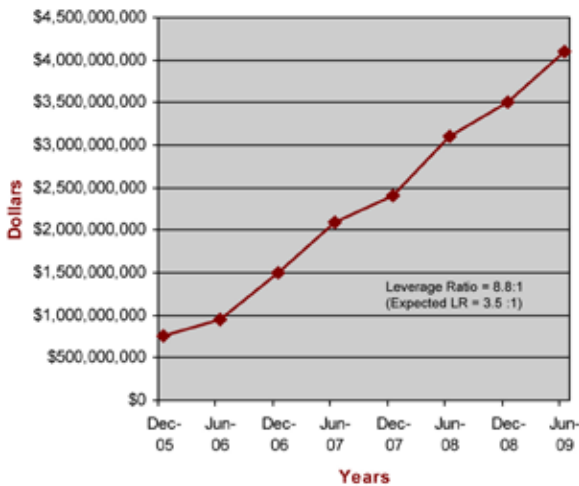
\*Metric based on multiplier from 2009 SRI Report, "Making an Impact: Assessing the Benefits of Ohio's Investments in Technology-Based Economic Development Programs."

## Total Direct and Indirect Jobs

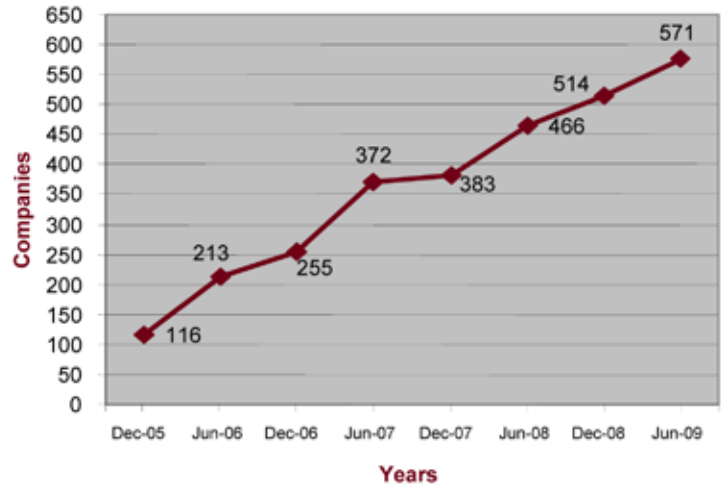


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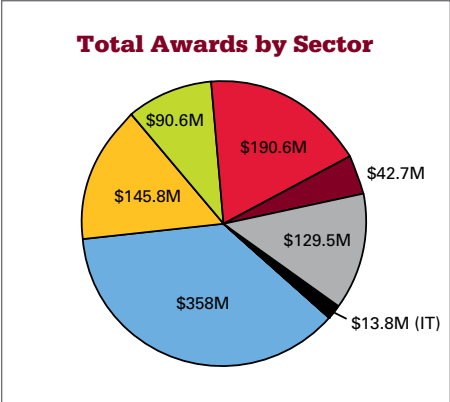
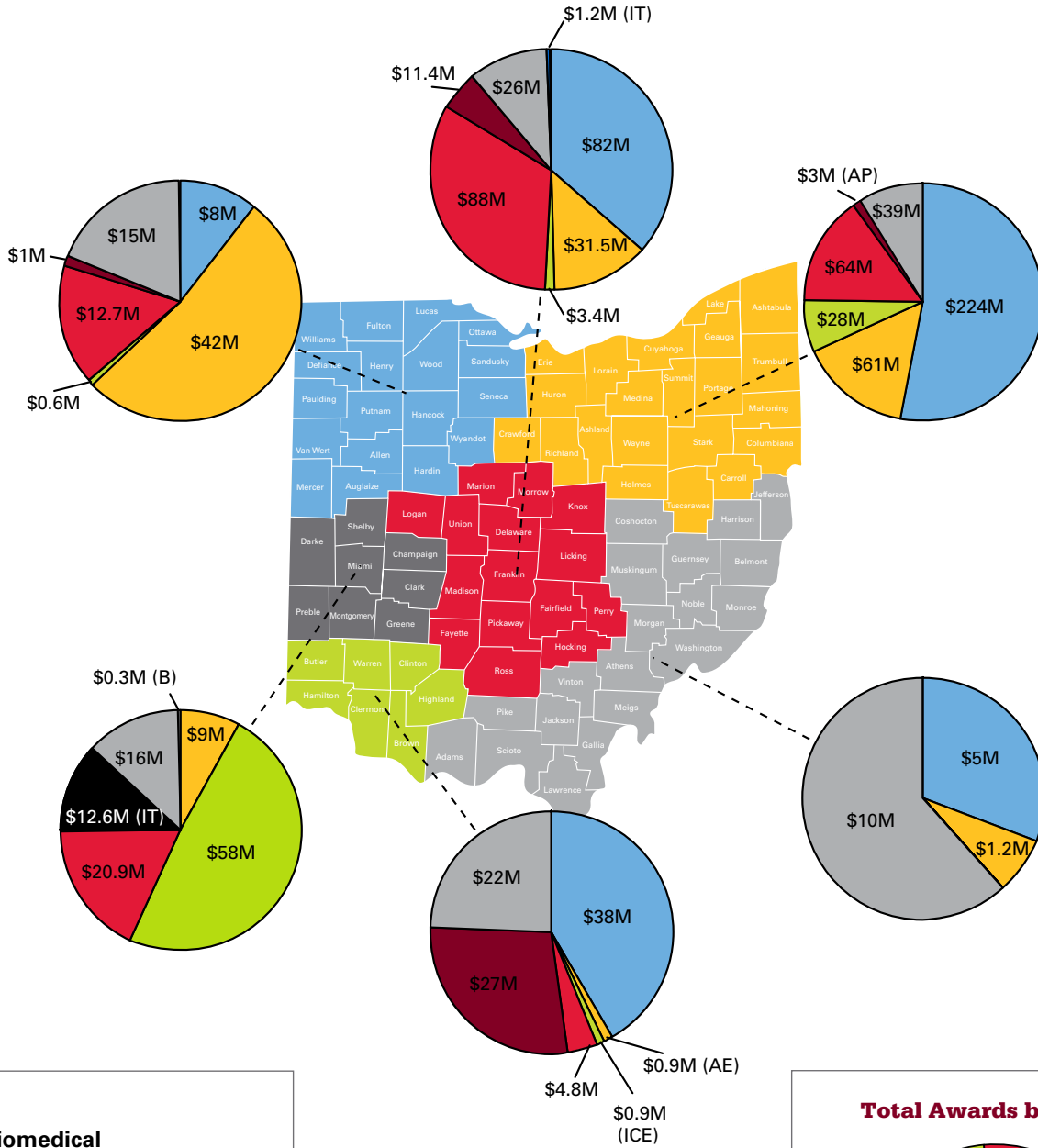
## Leveraged Dollars



## Companies Created, Attracted, and Capitalized



## Ohio Third Frontier Funds Awarded by Sector



- Biomedical
- Advanced Energy
- Instruments, Controls & Electronics
- Advanced Materials
- Advanced Propulsion
- Investment Funds



*Governor Ted Strickland speaking at the GE Aviation headquarters – Cincinnati, Ohio.*



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