13-301

Ohio | Third Frontier
Innovation Creating Opportunity

# Innovation Platform Program

## 2013 Request for Proposals

## Letter of Intent

| | |
|---|---|
| **Lead Applicant Institution** | **University of Toledo** |
| **Lead Applicant Contact Information** | **Name: James Trempe, PhD** |
| | **Title: VP Research** |
| | **Phone Number: 419-383-4252** |
| | **Email: James.Trempe@utoledo.edu** |
| **Project Title:** | Innovative Technology Platform for the Development of Spinal Devices of the Future |

| | | | |
|---|---|---|---|
| **Total Project Budget** | ~$ 3.0 Million | **Ohio Third Frontier Funds Requested** | ~$ 1.5 Million |

**Project Focus:**

- ☐ Advanced Materials (related to advanced polymers; ceramics; composites; carbon fibers and nanotubes; and, specialty metals and alloys)
- ☐ Aeropropulsion and Power Management
- ☐ Fuel Cells and Energy Storage
- xx☐ Medical Technology (related to imaging; surgical instruments/equipment; implant devices; and, regenerative medicine)
- ☐ Software Applications for Business and Healthcare
- ☐ Sensing and Automation Technologies
- ☐ Situational Awareness and Surveillance Systems
- ☐ Solar Photovoltaics
- ☐ Agribusiness and Food Processing

Please answer the following questions using no more than two additional pages. The Letter of Intent should address each question in order identifying each response. Do not include any trade secret information in this Letter of Intent.

1) Describe the proposed technology platform. Please refer to the Request for Proposals Section 2.1 second paragraph for the definition of a technology platform.
2) Please list all committed industry clients and their anticipated cash cost share contribution.
3) Describe the commercial products that will be developed and enter the market within the 3-year timeframe of the Grant.
4) Describe how the platform will provide a sustainable pipeline of technologies for commercialization.

**1. Technology Platform:**

Spinal disorders represent a very large segment of medical needs and opportunities. Overall, the associated economic losses are staggering (exceeding $80 billion/year). The aging of the population in western countries and industrialization of emerging nations is accelerating the demand for improved methods for prevention, diagnosis and treatment of spinal diseases. Meeting this demand is driving a comprehensive transformation of assessment and care. Advances in cell and molecular biology, biomaterials etc. are enabling new ways to understand disorders and be treated on a cellular level. While the pace of change/paradigm shift is accelerating, the design and use of these new technologies is somewhat fragmented, and inefficient. From this perspective, several opportunities to meet the challenges due to the paradigm shift exist. Some of these relate to new devices/materials to restore collapsed-vertebral body height, spinal alignment and function; development of new surgical tools and approaches for minimal surgical procedures (MIS), devices that could be manufactured at reduced costs (especially for the emerging countries) and development of ways to deliver local therapeutic drugs.

Ohio is in an excellent position to not only participate in this growth, but also to become a national and international leader in the next generation of spine care, research and product development. In order to be successful in the development of the products and bring them successfully to the market, it is essential to understand the pre-requisites, such as the following:

* Development of concepts based on market analysis, discussions with surgeons, industrial partners and talks/discussions at the conferences and the emerging device related seminars.

* Patent searches to ensure that the concept is reasonable and patentable. Based on the search, undertake concept modifications, if feasible.

* Assess the variations (in a way potential inventory) in shape and sizes (patient based anatomical variations), draw paper napkin sketches leading to formal Solidworks drawings resulting in further quantitative analyses following the worst-case scenarios.

* Using additive and/or subtractive manufacturing approaches, fabricate a few prototypes for preliminary testing as per ASTM Standards and implant those in cadavers as well as animals to get a clinical perspective.

* Following the first two steps, develop and evaluate biological products such as cements, nanotechnology based drug delivery systems and bioactive coatings to work in conjunction with implants, as described in the above. Furthermore, perform both in vitro and in vivo studies to evaluate their clinical response.

* Submit the design file to FDA for 510 k approval or further controlled clinical trials in U.S. and abroad.

The above steps clearly show that the product development requires an interdisciplinary team of surgeons, engineers, other allied health professionals and more importantly industry partners. Furthermore, the required facilities (pre-requisite) also are varied and numerous.

The team led by Vijay Goel, PhD, Sarit Bhaduri, PhD, and Anand Agarwal, MD at the University of Toledo is a cohesive and peer-recognized group of experts in the field. They have earned peer recognition at the national and international levels in basic and applied research, and the like. Over the years (as many as 12 + years at the University of Toledo and 20 years at other Institutions), the group with the support from the University Administration, funding from federal agencies, private foundation and industry have developed state-of-the-art labs at the University, leading to the establishment of Engineering Center for Orthopaedic Research Excellence – ECORE (a collaborative undertaking between Engineering and Orthopedics) in 2006.

**2. Committed Industry Clients:**

| Client | Contact | Commitment |
|---|---|---|
| X-Spine, Inc., Miamisburg, OH | D. Kirschman, MD, President & CEO | $300K over 3 years |
| Turning Point, LLC, Toledo, OH | Alan Schultheis, President & CEO | $100K over 3 years |
| *Joimax, Inc., Germany | Wolfgang Ries, President and CEO | $300K over 3 years |
| *Paradigm Spine, Inc., Germany | Guntmar Elsen, President and COO | $150K over 3 years |
| University of Toledo, Toledo, OH | James Trempe, PhD, VP Research | $200K over 3 years |
| University of Toledo, Toledo, OH | Nagi Naganathan, PhD, Dean | $100K over 3 years |

Besides this there will be (a) 25.5% Administrative Cost recovery that will be applied towards the cash match, as per the RFP, and (b) some in kind contributions from the University of Toledo. Thus, total is expected to be of the order of $1.5 Million.

* These companies will establish design/development offices at the University of Toledo, and Joimax will establish a manufacturing unit in Toledo as well.

**3. Commercial Products Representing Paradigm Shifts to Be Developed:**

Spinal Implants Suitable for Implantation through MIS Approaches: We have designed two spinal cages suitable for minimal surgery approaches and will work with clients to further develop the concepts and bring those to the market.

Implants with Reduced Manufacturing Costs: We are developing two such low-cost implants (pedicle screws). These pedicle screw designs will allow firm placement within osteoporotic spine pedicles as well, a perennial challenge thus far in the industry. Our clients are very eager to acquire/support the development of such innovative concepts.

Dynamic Interspinous Spacer (ISS) Fusion Device: The ISSs currently on the market are to reduce low back pain due to spinal stenosis without altering the spinal motion (at least in flexion) at the index and adjacent levels. Unsuccessful use of these devices in this country led us to develop a dynamic interspinous spacers that can be implanted using minimal invasive surgery (MIS) while affording an environment for the fusion of the spinous processes.

Bioactive Coating of Bio-inert Devices, like Polyetheretherketone (PEEK) Cages: As per the needs of our clients, we are developing a state-of-the-art nanostructured coating technology for orthopedic devices. Such coatings will promote osseointegration of implants, not feasible otherwise.

Newer Versions of the Exercise Machine to Strength Spinal/Core Musculature: At the request of the company, Turning Point, LLC of Toledo, we have developed a computer controlled machine that allows a low back pain patient to strengthen his/her core musculature. The product is on the market but is very expensive. Company has approached us to design another version at a reduced cost, with a plan to have multiple machines at the physical therapy centers and health clubs.

**4. Platform Will Provide a Sustainable Pipeline of Technologies for Commercialization:**

The proposed products address the paradigm shift in spine industry. With the anticipated resources from the proposed grant period and other resources at our disposal (testing and research projects from industry and funding from other private foundation), we will continue to upgrade our technology platform to meet the future challenges in Orthopedic Industry. We will also expand our collaborations with industry both within and outside Ohio. We will persuade industry from outside the State to consider locating a design, product development and manufacturing facility in Ohio, as we have done with Joimax, a Germany based company, and Turning Point, LLC of Toledo.

13-302

Ohio | Third Frontier
Innovation Creating Opportunity

# Innovation Platform Program

## 2013 Request for Proposals

## Letter of Intent

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|---|---|
| **Lead Applicant Institution** | **The Ohio State University** |
| **Lead Applicant Contact Information** | **Name: L. James Lee** |
| | **Title: Professor** |
| | **Phone Number: (614) 292-2408** |
| | **Email: lee.31@osu.edu** |
| **Project Title:** | Carbon Nanoparticles based Platform Technology for Transportation and Building Applications |

| | | | |
|---|---|---|---|
| **Total Project Budget** | $ 3,000,000 | **Ohio Third Frontier Funds Requested** | $ 1,500,000 |

**Project Focus:**

- x☐ Advanced Materials (related to advanced polymers; ceramics; composites; carbon fibers and nanotubes; and, specialty metals and alloys)
- ☐ Aeropropulsion and Power Management
- ☐ Fuel Cells and Energy Storage
- ☐ Medical Technology (related to imaging; surgical instruments/equipment; implant devices; and, regenerative medicine)
- ☐ Software Applications for Business and Healthcare
- ☐ Sensing and Automation Technologies
- ☐ Situational Awareness and Surveillance Systems
- ☐ Solar Photovoltaics
- ☐ Agribusiness and Food Processing

Please answer the following questions using no more than two additional pages. The Letter of Intent should address each question in order identifying each response. Do not include any trade secret information in this Letter of Intent.

1) Describe the proposed technology platform. Please refer to the Request for Proposals Section 2.1 second paragraph for the definition of a technology platform.

   We propose an Innovation Platform based on existing unique technology capabilities at The Ohio State University (OSU) in the area of carbon nanoparticles based nanocomposites and nanopapers with near-term commercialization potential in the transportation and building industries. Most pilot-scale equipment and facilities are available in the OSU laboratories.

2) Please list all committed industry clients and their anticipated cash cost share contribution.

For transportation applications, OmnovaSolutions- a leading polymer coating supplier in the US will collaborate with OSU and NIL as an industry client to develop new coating resins and technologies for enhanced surface erosion protection and EMI shielding of injection molded automotive panels. Their anticipated cash cost share is $450,000 for the 3-year funding period.

For building applications, Owens Corning Insulation Division- a world leading provider of thermal insulation foams will collaborate with OSU and NIL as an industry client to develop next generation insulation materials for improved performance using the environmental benign blowing agents. Their anticipated cash cost share is $450,000 for the 3-year funding period.

For nanocomposite and nanopaper synthesis, Nanomaterial Innovation Ltd. (NIL)- an OSU spin-off company will collaborate with OSU as an industry client to scale-up surface functionalization of carbon nanoparticles and production of nanocomposites and nanopapers. Their anticipated cash cost share is $100,000 for the 3-year funding period.

CK Technologies- a large injection molding company will join the team as a committed end-user to test and use the new carbon nanopaper based in-mold coating technologies for various automotive applications.

3) Describe the commercial products that will be developed and enter the market within the 3-year timeframe of the Grant.

For transportation applications, OmnovaSolutions will develop new resins so carbon nanopapers developed by OSU and NIL can be integrated into their in-mold coating technology as new coating products. CK Technologies will be one of the end users.

For building applications, Owens Corning Insulation Division will implement graphite/graphene enhanced polymers developed by OSU and NIL in their extrusion foaming lines to produce high-performance insulation materials.

4) Describe how the platform will provide a sustainable pipeline of technologies for commercialization.

Both transportation and building industries are important for Ohio's economic growth. However, strong competitions in the US and worldwide demand Ohio companies to develop advanced materials and manufacturing technologies for new products with improved performance. The proposed nanocomposites and nanopapers based on various carbon nanoparticles and associated surface functionalization technologies will provide a pipeline of advanced materials for several large and small Ohio companies to maintain and grow their business strengths.

13-303

Ohio | Third Frontier
Innovation Creating Opportunity

# Innovation Platform Program

## 2013 Request for Proposals

## Letter of Intent

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|---|---|
| **Lead Applicant Institution** | **Innovative Plastics and Molding, Inc.** |
| **Lead Applicant Contact Information** | **Name: Robert C. Joyce 6632 Maple wood Suite 311 Sylvania, Ohio 43560**<br>**Title: President**<br>**Phone Number: 419-346-8728**<br>**Email: rjoyce07@buckeye-express.com** |
| **Project Title:** | *"Cellulose Fiber Thermoplastic Compound Pellets for the Transportation"* |

| | | | |
|---|---|---|---|
| **Total Project Budget** | $2,500,000 | **Ohio Third Frontier Funds Requested** | $1,250,000 |

**Project Focus:**

X Advanced Materials (related to advanced polymers; ceramics; composites; carbon fibers and nanotubes; and, specialty metals and alloys)

Software Applications for Business and Healthcare

Aeropropulsion and Power Management

Sensing and Automation Technologies

Fuel Cells and Energy Storage

Situational Awareness and Surveillance Systems

Medical Technology (related to imaging; surgical instruments/equipment; implant devices; and, regenerative medicine)

Solar Photovoltaics

Agribusiness and Food Processing

Please answer the following questions using no more than two additional pages. The Letter of Intent should address each question in order identifying each response. Do not include any trade secret information in this Letter of Intent.

1) Describe the proposed technology platform. Please refer to the Request for Proposals Section 2.1 second paragraph for the definition of a technology platform.

2) Please list all committed industry clients and their anticipated cash cost share contribution.
3) Describe the commercial products that will be developed and enter the market within the 3-year timeframe of the Grant.
4) Describe how the platform will provide a sustainable pipeline of technologies for commercialization.

The automobiles, aerospace and truck manufacturers that have end products in the transportation industry have been investigating the use of various biomass additives in thermoplastics for years. They are interested in utilizing a thermoplastic biopolymer in instrument panels, seat parts, rear cargo shelves, storage shelves, and the like. The existing biopolymer applications are hidden or a subsurface. They are expensive and underperform, having poor physical properties like impact and unforgiving processing characteristics like odor. An inventive alloy composition is being proposed that includes a sustainable resource *"Cellulose Fiber Thermoplastic Compound Pellets for the Transportation"*. This material would be used in applications that are exposed in the interior having good ductility. Initial tests that were performed with the cellulose and thermoplastic polyolefin resin utilizing U.S. Patent 7,994,241 revealed an alloy composition with superior heat resistance, high flexural modulus with low specific gravity. The research objective would be to produce an advanced material while optimizing the thermal and mechanical properties of the cellulose and thermoplastic polyolefin compound for part production.

More specifically, within the 3 year term of the grant, there are two areas of project concentration, to produce an improved biopolymer material technology. The two advanced materials will include an advanced biopolymer material with better strength and heat resistance for under hood applications and a biopolymer compound with better ductility and flow for applications that require head impact. Each of these requirements will require different loadings of cellulose in the thermoplastic with additional ingredients for the compound. In addition, after testing and characterization, part production and further testing must be completed to industry specification. These tests could take up an additional 6-12 months after completion of compound.

The commercial value of the advanced material technology will be attractive because of the performance characteristics and cost equation. With improved material performance, manufacturers can reduce product mass by 10 to 20%, specifically, lowering the weight of the part by making it thinner. A thinner part with cellulose will cool quickly compared to 100% plastic, achieving faster cycle time, promoting lower energy costs. Furthermore, the processors who mold transportation products will like a bio material with improved thermal resistance to recycle without fear of burning after a single use. This new material composition will cost approximately $1.20 to $1.30 per lb., versus the competition cost at $1.40 to $1.50 per lb. and estimate in 2-3 years to capture 10% market share or 90 million lbs. per year , creating 75 jobs.

It is also anticipated that other industries will benefit, like processors who are thermo formers, injection molders, tooling companies and raw material suppliers. The local community college in Northwest Ohio can help with training to support operations, manufacturing and production personnel. We anticipate that since this technology was developed in the U.S. there will be a considerable amount of advanced biopolymer compound, as well as, product exported oversees; furthermore, creating more jobs.

Lead applicant Robert Joyce, President of Innovative Plastics and Molding, Inc. located in Northwest Ohio will be responsible for Ohio Third Frontier Innovation Platform program. The companies customers that include Amplas Compounding, and IVP Plastics with associated letters from clients the following comments; We are very interested in continuing to explore and expand products that the market has termed "Green". Those products include those that are reusable, recyclable, compostable, biodegradable, or are made from renewable resources. The current compostable offerings or those made from renewable resources that we have investigated have some market and application limitations. The major hurdles to finding a suitable offering to our customers are low heat deflection strength, low melt strength, high cost of finished part due to lower stiffness of the substrate. I expect that adding your FibreTuff material will reinforce the base polymer and provide improvements in the polymers stiffness, melt strength, and allow for a thinner stronger part resulting in a lower cost finished product.....utilizing US patent 7,994,241for compliance in molding sheet/films and containers.

A list of potential industry clients that will consider cost sharing include customers in the automotive, Tier two suppliers located in Ohio and in Michigan. There is also private funding available for cost sharing from industry veterans who have also been selected to participate in the company operation.

13-304

Ohio | Third Frontier
Innovation Creating Opportunity

# Innovation Platform Program

## 2013 Request for Proposals

## Letter of Intent

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|---|---|
| Lead Applicant Institution | University of Dayton Research Institute, 300 College Park, Dayton Ohio 45469-0120 |
| Lead Applicant Contact Information | Name: Victoria Kramb |
| | Title: Research Engineer |
| | Phone Number: 937-229-4067 |
| | Email: Victoria.Kramb@udri.udayton.edu |
| Project Title: | Environmental Durability of CMCs |

| | | | |
|---|---|---|---|
| Total Project Budget | $ 2,000,000 | Ohio Third Frontier Funds Requested | $ 1,000,000 |

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|---|---|---|
| Project Focus: | ☒ Advanced Materials (related to advanced polymers; ceramics; composites; carbon fibers and nanotubes; and, specialty metals and alloys) | ☐ Software Applications for Business and Healthcare |
| | ☒ Aeropropulsion and Power Management | ☐ Sensing and Automation Technologies |
| | ☐ Fuel Cells and Energy Storage | ☐ Situational Awareness and Surveillance Systems |
| | ☐ Medical Technology (related to imaging; surgical instruments/equipment; implant devices; and, regenerative medicine) | ☐ Solar Photovoltaics |
| | | ☐ Agribusiness and Food Processing |

Please answer the following questions using no more than two additional pages. The Letter of Intent should address each question in order identifying each response. Do not include any trade secret information in this Letter of Intent.

1) Describe the proposed technology platform. Please refer to the Request for Proposals Section 2.1 second paragraph for the definition of a technology platform.
2) Please list all committed industry clients and their anticipated cash cost share contribution.
3) Describe the commercial products that will be developed and enter the market within the 3-year timeframe of the Grant.
4) Describe how the platform will provide a sustainable pipeline of technologies for commercialization.

***1) Describe the proposed technology platform.***

The proposed Technology Platform consists of three critical technologies that will allow for implementation of ceramic matrix composite (CMC) systems into aerospace turbine engine applications through robust and economical durability testing: 1. Methods for achieving ultra-high test temperatures (i.e., above 2400°F), 2. Methods for measuring the deformation of materials at ultra-high temperatures, 3. Methods for achieving atmospheric conditions representative of the turbine engine environment. Technologies that can achieve these conditions are currently available in the research laboratories of the University of Dayton and its Research Institute (UDRI), and the engine manufacturer General Electric Aviation (GEA). However, in order for CMCs to be transitioned into commercial aerospace applications an extensive database of mechanical properties must be generated that thoroughly describe the material behavior over the entire range of anticipated operating conditions. This database can only be developed through the use of numerous commercial test facilities, all performing long term durability testing following well documented procedures and using reliable equipment and repeatable measurement systems. This Innovation Platform Proposal will describe the program led by UDRI that will develop or modify existing laboratory demonstrated ultra-high temperature furnaces, strain measurement systems, and environmental technologies to allow these devices to operate in a commercial production testing facility. A critical component of this transition effort will be to develop procedures and protocols for the commercial facilities so that the proper use of the technologies will result in creation of a reliable mechanical properties database that will validate the use of CMCs for turbine engine applications.

UDRI has an extensive history in transitioning advanced technologies from laboratory instrument to robust, repeatable, industrial products complete with documentation and training packages that ensure the technology will be used and advanced beyond the original customer basis. The IPP partners are fully supportive of this effort, and are anxiously anticipating the transition of these technologies into their commercial facilities, thus providing growth in their respective test areas.

***2) Please list all committed industry clients and their anticipated cash cost share contribution.***

The industrial clients participating in the IPP are shown in Table 1.

Table 1. For-profit IPP Collaborators

| Industrial Client | Role | Location | Anticipated Cost Share |
|---|---|---|---|
| GEA | OEM | Evendale, Ohio | $400,000 |
| Cincinnati Testing Labs. | Test vendor | Cincinnati, Ohio | $200,000 |
| Element | Test Vendor | Cincinnati, Ohio | $200,000 |
| Ceralink | Test Vendor | St. Clairsville, Ohio | $200,000 |

GEA is the industrial partner that is leading the technology pull. Corporate goals for implementation of CMCs into commercial turbine engines necessitate that robust and economical methods for conducting these mechanical tests be developed and transitioned to the commercial test facilities to support this transition effort. The commercial test vendors are in need of robust and economical methods for conducting these tests to allow their businesses to meet the growing demand for mechanical test data for CMCs.

***3) Describe the commercial products that will be developed and enter the market within the 3-year timeframe of the Grant.***

GE Aviation is moving towards commercial introduction of CMC materials in 2016 by incorporating a CMC component as bill of materials in the LEAP aircraft engine for next generation narrow-body commercial passenger transport service. GE currently has orders for over 4,000 of these engines with a production backlog extending for many years. CMC components require significant testing for certification by the FAA prior to entry into the commercial market, and development of a commercial testing capability in Ohio will be a critical part of making this material a commercial success. Plans also exist for exploiting this new class of materials in all future new gas turbine engine designs, including the new GE9X engine for twin-engine wide body service in 2019 and beyond. The commercial products resulting from the IPP effort that will support CMC implementation into these new aircraft engines are listed below in Table 2.

Table 2. Commercial Products Resulting from the IPP

| Product | Application | Specific Capability | Expected Transition Time |
|---|---|---|---|
| Ultra-high temperature furnace | Durability testing | Achieve temperatures up to 2700°F in oxidizing atmospheres | 6 months |
| Capacitance extensometer | Strain measurement | Output stability at 2700°F | 6 months |
| Vacuum system | Durability testing | Achieve temperatures up to 2700°F in minimum $10^{-6}$ torr vacuum | 1 year |
| Environmental chamber | Durability testing | Achieve temperatures up to 2700°F in steam and hot gaseous environments | 1-2 years |
| Product Use and Test Procedures | Durability testing | Procedures for instrument calibration, test setup, and data acquisition | 2-3 years |

During the final year of the program extensive validation and verification testing will be conducted at the test vendor sites. Vendor personnel will follow procedures developed under the IPP to verify that data acquired using the transitioned products is consistent with that obtained under laboratory conditions.

***4) Describe how the platform will provide a sustainable pipeline of technologies for commercialization.***

As CMCs are successfully implemented into commercial turbine engine applications, new components will be designed using these materials on future GEA engines. New component designs will require mechanical data acquired over increasing temperatures and varying environmental conditions. Furthermore, lot release testing and material qualification for new engines will require continuous growth in the mechanical testing services industry to meet this growing demand for durability data. By establishing the IPP collaboration, a consistent and streamlined process for transitioning new technologies from laboratory setups to production level test facilities will be made available to the industrial partners. The jobs created under the 3-year program of the proposed IPP will be sustained as CMCs are implemented into the currently targeted turbine engine components, and as new materials are developed. As new engine components are designed using CMCs, the demand for materials testing under these and new environmental conditions will necessitate a continual increase in the mechanical testing workforce to sustain this material supply chain.

13-305

Ohio | Third Frontier
Innovation Creating Opportunity

# Innovation Platform Program

## 2013 Request for Proposals

## Letter of Intent

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|---|---|
| **Lead Applicant Institution** | **Ohio University** |
| **Lead Applicant Contact Information** | **Name: Jason Trembly** |
| | **Title: Assistant Professor and Associate Director, Ohio Coal Research Center** |
| | **Phone Number: 740-331-4921** |
| | **Email: trembly@ohio.edu** |
| **Project Title:** | The Ohio Shale Platform: Advanced Materials for Cost Effective Wastewater Management and Well Completion |

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|---|---|---|---|
| **Total Project Budget** | $ 6,000,000 | **Ohio Third Frontier Funds Requested** | $ 3,000,000 |

**Project Focus:**

- ☒ Advanced Materials (related to advanced polymers; ceramics; composites; carbon fibers and nanotubes; and, specialty metals and alloys)
- ☐ Aeropropulsion and Power Management
- ☐ Fuel Cells and Energy Storage
- ☐ Medical Technology (related to imaging; surgical instruments/equipment; implant devices; and, regenerative medicine)
- ☐ Software Applications for Business and Healthcare
- ☐ Sensing and Automation Technologies
- ☐ Situational Awareness and Surveillance Systems
- ☐ Solar Photovoltaics
- ☐ Agribusiness and Food Processing

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2) Please list all committed industry clients and their anticipated cash cost share contribution.
3) Describe the commercial products that will be developed and enter the market within the 3-year timeframe of the Grant.
4) Describe how the platform will provide a sustainable pipeline of technologies for commercialization.

# Innovation Platform Program

**2013 Request for Proposals**

## Letter of Intent

1) **Describe the proposed technology platform. Please refer to the Request for Proposals Section 2.1 second paragraph for the definition of a technology platform.**

Ohio University (OHIO) possesses an existing internationally recognized Innovation Platform for the development of cost-effective shale wastewater management and well completion technologies located within the Institute of Sustainable Energy and the Environment (ISEE) and Institute of Corrosion and Multiphase Technologies (ICMT). Specifically, OHIO supports development efforts for a number of shale related not-for-profits and commercial organizations including but not limited to the Research Partnership to Secure Energy for America (RPSEA), Hess Corporation (HESS), Parker Hannifin, Exxon, ConocoPhillips, and Chevron. In addition to engaged industrial partners, OHIO has developed substantial intellectual property regarding cost-effective shale wastewater treatment techniques and well completion methodologies which are being transferred to industry partners for commercialization. The combination of OHIO's existing personnel, facilities, capabilities, and industrial partners make it well suited to develop commercial solutions/products to address the shale industry's most daunting challenges. In response to the Ohio Third Frontier's (OTF) Innovation Platform Program (IPP) request for proposal, OHIO proposes the establishment of the "The Ohio Shale Platform: Advanced Materials for Cost Effective Wastewater Management and Well Completion" to ensure the near-term and long-term future of Ohio's shale industry, which is projected to generate more than 200,000 jobs, $22 billion in economic output, $12 billion in wages, and $204 million of tax revenue by 2015 alone.

2) **Please list all committed industry clients and their anticipated cash cost share contribution.**

OHIO is developing a very strong industry team with the capabilities to commercialize and implement the solutions/products developed by the proposed Innovation Platform. Since agreements have not been finalized in regard to this OTF IPP opportunity, descriptions of each industry partner and anticipated cost share are provided.

**Shale Oil Producer:** This partner is an international leader in the development of shale oil production with annual revenue exceeding $38 billion worldwide in 2011 and is a Forbes 100 most trusted organization. Currently the organization produces shale oil from the Bakken shale play in North Dakota and possesses significant land holdings in the Utica shale play located in Ohio, which it began developing in 2012. Anticipated cash cost share from this partner is $800,000.

**Thermal/Fluids Processor:** This partner headquartered in Ohio is a leading thermal processing and fluids control organization with annual revenue of $12 billion in 2011. Currently the company is developing and evaluating existing products within its technology portfolio for

treatment of wastewater generated by shale wells. Anticipated cost share from this partner is $400,000.

**Tubular Manufacturer**: This partner has manufacturing facilities located within Ohio and is a leading tubular supplier to companies developing the Marcellus and Utica shale plays. Currently, this partner is working to develop a lower cost steel formulation which meets or exceeds existing well completion regulations. Anticipated cost share from this partner is $300,000.

**ECO2Capture (ECO2):** ECO2Capture Inc. is a startup company specializing in technologies to remediate air and water pollution, currently focusing on the algal sector. Located in Athens, Ohio, ECO2Capture Inc. has worked with Ohio University through an Ohio Third Frontier TSVF grant and is negotiating for licenses of Ohio University technology.

**3) Describe the commercial products that will be developed and enter the market within the 3-year timeframe of the Grant.**

Commercial products to be developed and enter the market within the 3-year timeframe of the Ohio Shale Platform include the integrated precipitative supercritical (IPSC) process and a low cost tubular steel formulation. The IPSC process is a flexible technology for the treatment of wastewater from shale wells which is capable of selectively removing a host of contaminants including suspended solids, dissolved solids, hydrocarbons, and normally occurring radioactive material (NORM). Under the proposed Innovation Platform, OHIO will complete the final field demonstration testing necessary to license the technology for market entry which will generate additional jobs associated with the Ohio shale industry. In addition, OHIO will finish development of a lower cost tubular steel formulation which has demonstrated to possess properties similar to existing steel formulation used for well completion. This formulation will be manufactured by OHIO's tubular manufacturer partner, generating additional jobs within Ohio's manufacturing and shale industries.

**4) Describe how the platform will provide a sustainable pipeline of technologies for commercialization.**

The proposed Ohio Shale Platform is well positioned to provide a sustainable pipeline of marketable commercial products for the Ohio shale industry due its strong industrial partners and OHIO's facilities and capabilities. During and after the initial 3-year term of the proposed program, the industrial partners will have the authority to change the directive of the Ohio Shale Platform to address industry's most daunting issues to cost-effective shale development which can be addressed by OHIO's existing capabilities/facilities. The collaborative environment created by the OTF-supported Ohio Shale Platform will accelerate the time necessary to develop solutions/products to industrial issues, ensuring the long-term economic impact of Ohio shale.

13-306

# Innovation Platform Program

## 2013 Request for Proposals

## Letter of Intent

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|---|---|
| **Lead Applicant Institution** | **Case Western Reserve University** |
| Lead Applicant Contact Information | **Name**: Chung Chiun Liu |
| | **Title:** Distinguished University Professor |
| | **Phone Number:** 216-368-2935 |
| | **Email:** cxl9@case.edu |
| **Project Title:** | Single-use, disposable cost-effective biosensors for the diagnosis of various diseases. |

| | | | |
|---|---|---|---|
| **Total Project Budget** | $ 5,000,000.00 | **Ohio Third Frontier Funds Requested** | $ 2,500,000.00 |

**Project Focus:**

- ☐ Advanced Materials (related to advanced polymers; ceramics; composites; carbon fibers and nanotubes; and, specialty metals and alloys)
- ☐ Aeropropulsion and Power Management
- ☐ Fuel Cells and Energy Storage
- ☒ Medical Technology (related to imaging; surgical instruments/equipment; implant devices; and, regenerative medicine)
- ☐ Software Applications for Business and Healthcare
- ☐ Sensing and Automation Technologies
- ☐ Situational Awareness and Surveillance Systems
- ☐ Solar Photovoltaics
- ☐ Agribusiness and Food Processing

Please answer the following questions using no more than two additional pages. The Letter of Intent should address each question in order identifying each response. Do not include any trade secret information in this Letter of Intent.

1) Describe the proposed technology platform. Please refer to the Request for Proposals Section 2.1 second paragraph for the definition of a technology platform.
2) Please list all committed industry clients and their anticipated cash cost share contribution.
3) Describe the commercial products that will be developed and enter the market within the 3-year timeframe of the Grant.
4) Describe how the platform will provide a sustainable pipeline of technologies for commercialization.

**1) Describe the proposed innovation platform in the context of the definition in section 2.1 of the RFP.**

This Innovation Platform proposal proposes employing a unique, inexpensive, *in vitro* bio-sensing diagnostic technology platform to commercialize a portfolio of products that detect important biomarkers of various diseases, including cancers. This platform diagnostic technology employs a single-use, disposable, electrochemical based biosensor (strip). The biosensor is manufactured by thick film screen-printing, laser ablation and other established micro-fabrication techniques and can be produced cost-effectively on a large scale production basis. Therefore, a biosensor industry focusing on the detection of various biomarkers of different diseases for early identification and point of care evaluation can be established in Northeast Ohio.

The proposed platform biosensor prototype has been designed, manufactured in production-scale quantity, and demonstrated to detect important biomarkers of various diseases with excellent results. Alpha-methylacy-CoA racemase (AMACR), a unique prostate cancer biomarker, and lysyl oxidase like-2, (LOXL2)- , an important biomarker for the metastasis of breast cancers, respectively, have been evaluated with the platform biosensor prototype using blood, serum and/or urine samples of patients. Accordingly, the initial commercial applications based on this platform technology will be single-use, disposable biosensors for the prostate cancer biomarker, AMACR and the metastasis of breast cancers biomarker, LOXL2 detection. These disposable biosensors require only 1 μL of blood, serum and /or urine samples and are inexpensive to fabricate. In addition, these biosensors eliminate the costly and painful biopsy procedure currently used to detect these types of cancers.

The platform electrochemical biosensor consists of a three-electrode configuration. The working and the counter electrodes can be nano- metal, nano-metal oxide/carbon electrodes, or thin gold based electrodes depending on the biomarkers chosen for detection. The electrode materials are selected based on the catalytic effect of the materials. The reference electrode is Ag/AgCl, formed by a thick film screen-printing technique. A pre-determined electrical potential governed by the Gibbs free energy principle and the test medium environment is applied between the working and the reference electrode to oxidize (or reduce) an electrochemically active species, such as $H_2O_2$, generated by an enzymatic reaction with properly selected substrates. The operational principle of detecting AMACR and LOXL2 for prostate cancer and metastasis identification in breast cancers respectively is based on the detection of $H_2O_2$ generated by respective enzymatic reactions. We have also successfully cross-linked the gold based working electrode in the platform biosensor prototype, with thiol groups chemically. Selective anti-bodies can then be anchored to the gold working electrode. An electrochemical measurement technique, pulse cyclic voltammetry, (PCV) is applied to detect the corresponding anti-gens. This is the basic principle of detecting CA125 (carbohydrate antigen 125) and OVX 1 anti-gens for ovarian cancers and advanced glacation end-product (AGE) for diabetic applications.

At this juncture, we have: 1) established a unique technical approach to disease detection, designed and manufactured a platform structure of a single-use, disposable *in vitro* inexpensive biosensor prototype, 2) identified important biomarkers in various diseases and carried out testing and evaluation using blood, serum and/or urine samples of patients confirming the applicability of this innovative platform technology, 3) identified important biomarkers in various diseases the applicability of this innovative platform technology, 4) tested and determined that single-use, disposable *in vitro* biosensors for AMACR and LOXL2 biomarkers for prostate cancers and metastasis of breast cancers, respectively, will be the initial foci of commercial entities in the biosensor industry based on our study thus far, and 5) undertaken preliminary studies on other important biomarkers have been undertaken, guaranteeing the continuous expansion of this platform technology in the *in vitro* biosensor industry.

The innovation capabilities and capacities of this proposed platform technology have been established by the lead applicant institution, Case Western Reserve University. Two provisional patent applications were filed in August and September 2012 respectively, protecting the basic intellectual properties of this platform technology. This platform technology can be a vehicle providing direct opportunities for bio-sensing applications for independent Ohio for-profit companies.

*Support requested.* The total support required for this proposed 3-year project is estimated to be $ 5 million with support requested from the Ohio Third Frontier program for $2.5 million. At the completion of the3-year timeframe, we will reach the stage of commercial deployment. The majority of project funding

requested will be used for man-power for sample testing, data analysis, commercialization, and additional advancement of this platform technology.

*Meeting the needs of Ohio companies and building on a growing biosensor industry.* While in the past, Conductive Technologies, York, PA, has fabricated the biosensor prototype for this Innovation Platform Project, the manufacturing capability for these thick film screen-printed biosensors will be built in Northeast Ohio. We have identified Bluespark Technologies of Westlake, Ohio as our manufacturer partner in this endeavor. Bluespark Technologies, established in 2003, has engaged in the development of thin battery technology using thick film screen printing technology. Therefore, they have the perfect skill base in dimensions and tolerance to match our needs in screen-printing our biosensor prototypes. The commitments from Bluespark Technologies to fabricate the biosensor and Flocel (described below in 4)) to fabricate the biometer ensure that our research and commercialization plan is in place and will create jobs in Northeast Ohio and make the region an important contributor to Ohio's biosensor industry. Chung Chiun Liu, Distinguished University Professor, Wallace R. Persons Professor of Sensor Technology and Control, Professor of Chemical Engineering and Director of Electronics Design Center of Case Western Reserve University, Cleveland, Ohio will serve as the technical director of this proposed project guiding it to reach the successful stage of commercialization.

**2) List all committed industry clients and their anticipated Cash Cost Share contribution.**

Both Bluespark Technologies and Flocel are the industrial partners in this Innovation Platform proposed endeavor. They will contribute their expertise and skills to ensure the success not only to commercialize the biosensor system but also to assist in establishing an industry in Northeast Ohio based on single –use, disposable *in vitro* cost effective biosensors for detection of various diseases. Our ultimate goal is to establish a biosensor industry in the State of Ohio, Northeast Ohio in particular, and the contributions of these industrial partners and their technologies can make this goal a reality.

**3) Describe the commercial products that will be developed and enter the market within the 3-year timeframe of the Grant.**

Other novel and unique biomarkers will be selected and evaluated based on this platform technology, adding new commercial entities and sustaining the growth of this innovative biosensor industry. These other biomarkers which these biosensors could identify include CA125 (carbohydrate antigen 125) and OVX1 of ovarian cancers as well as advanced glacation end-products (AGE) of diabetic patients and others. Preliminary studies of these biomarkers using the platform biosensor prototype have already yielded excellent results. Detection of CA125 is the common biomarker detection of ovarian cancers, but it has limited accuracy. The detection of OVX1, another biomarker for ovarian cancers appears to be complementary to CA125 measurement. Therefore, the use of a two-biosensor array, one measuring CA125, the other detecting OVX1 will enhance the reliability of ovarian cancer detection using two cost-effective single-use, disposable biosensors developed in this innovative platform technology.

**4) Describe how the platform will provide a sustainable pipeline of technologies for commercialization.**

This platform technology is commercially appealing based on its: 1) broad applications that aim at large markets in the US and developing countries, 2) ease of handling and broad deployment, 2) low production and delivery costs,( i.e. markets that cannot bear expensive equipment or the deployment of trained operators). The appeal is predicated on the basis that the output of this biosensor is electrical current that can be displayed and recorded with a simple hand-held meter and that does not require expensive equipment or skilled operators. Preliminary design and construction of this meter has been completed, serving as a base for the future advancement in commercialization. Flocel, a Northeast Ohio based company established in 2004, has agreed to be an industrial partner in this project in design and construction of the meter which will house the biosensor. Flocel has the experience and skill to undertake this electrical engineering endeavor. They have been involved in many electrical engineering research and commercial development projects for Cleveland Medical Devices Inc., Cleveland, Ohio.

13-307

Ohio | Third Frontier
Innovation Creating Opportunity

# Innovation Platform Program

## 2013 Request for Proposals

## Letter of Intent

| | | | |
|---|---|---|---|
| **Lead Applicant Institution** | The Ohio State University (on behalf of the Ohio Technology Consortium) | | |
| **Lead Applicant Contact Information** | **Name:** Pankaj Shah | | |
| | **Title:** Executive Director OARnet & OSC | | |
| | **Phone Number:** 614-292-1486 | | |
| | **Email:** pshah@oh-tech.org | | |
| **Project Title:** | The Center for Industrial Modeling, Simulation and Analysis | | |
| **Total Project Budget** | $ 6,000,000 | **Ohio Third Frontier Funds Requested** | $ 3,000,000 |
| **Project Focus:** | ☒ Advanced Materials (related to advanced polymers; ceramics; composites; carbon fibers and nanotubes; and, specialty metals and alloys) | ☒ Software Applications for Business and Healthcare | |
| | ☐ Aeropropulsion and Power Management | ☐ Sensing and Automation Technologies | |
| | ☒ Fuel Cells and Energy Storage | ☐ Situational Awareness and Surveillance Systems | |
| | ☐ Medical Technology (related to imaging; surgical instruments/equipment; implant devices; and, regenerative medicine) | ☒ Solar Photovoltaics | |
| | | ☐ Agribusiness and Food Processing | |

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1) Describe the proposed technology platform. Please refer to the Request for Proposals Section 2.1 second paragraph for the definition of a technology platform.
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4) Describe how the platform will provide a sustainable pipeline of technologies for commercialization.

# The Center for Industrial Modeling, Simulation & Analysis

## 1. THE PROPOSED TECHNOLOGY PLATFORM:

The Ohio Supercomputer Center (OSC), part of the Ohio Technology Consortium based at The Ohio State University, proposes to leverage and build upon existing computational architecture, infrastructure and expertise to provide advanced modeling, simulation and analysis (MS&A) tools, applications, training and expertise to small and medium businesses (SMBs) in order to facilitate their adoption and usage of high performance computing capabilities and techniques.

Computer based MS&A has become the third path to discovery along with theory and experimentation. MS&A uses mathematical representations of complex phenomena to provide insights into the behavior of systems. It affords the opportunity to visualize the unattainable—phenomena that are too small (atoms and molecules), too large (galaxies and the universe), too fast (photosynthesis), too slow (geological processes), too complex (automobile and jet engines), or too dangerous (toxic materials and warfare simulations).

MS&A has become accurate enough, and in some cases predictive enough, to supplement or replace expensive and lengthy trial and error tests that impede agility and innovation. Large manufacturers have sufficient resources and need to justify the investment in computer equipment, software and expertise and can effectively use this capability for their competitive advantage. Adoption within their supply networks, however, is minimal and quickly becoming insufficient to meet the growing demands of the large manufacturers.

Most of the proposed team members are part of the successful Department of Commerce's Economic Development Administration (EDA) funded National Digital Engineering and Manufacturing Consortia (NDEMC) program, which is piloting projects that demonstrate the business value of advanced MS&A tools. An awarded program will allow the team to transition this effort into a more widely available general product for use by Ohio businesses and industries.

## 2. COMMITTED INDUSTRY CLIENTS AND ANTICIPATED CASH COST SHARE:

The National Digital Engineering and Manufacturing Consortia (NDEMC), which includes the following Ohio for-profit companies:

- P&G
- Lockheed Martin
- GE Energy

Note, NDEMC also includes members from outside Ohio and the federal government, such as the Council on Competitiveness, Purdue University, the University of Illinois, NASA, the National Center for Manufacturing Sciences, the John Deere Company, and the Department of Energy.

NDEMC members are anticipated to provide a total of $3,000,000 in cash cost share.

## 3. COMMERCIAL PRODUCTS TO BE DEVELOPED WITHIN 3 YEARS:

A best-case outcome would be that, as a result of SMBs solving their own problems using this technology platform, purpose-built web based applications will be created that will have persistent positive impact for these companies.

- Primary center product: a 'one-stop online shop' providing relatively easy to access and use MS&A resources for SMBs, which will include:
  - Information on expertise, hardware, software and training available from the center
  - An 'e-commerce' feature to streamline purchasing and account management
- Secondary center products: specific 'web apps' developed by the center in conjunction with client SMBs using this platform, such as:
  - A container filling tool that simulates the flow of material into various containers
  - A heat sink prediction tool to model the performance of heat sinks in small electronic device
- Tertiary center products: resulting new and improved manufacturing processes and products developed by SMBs using the web apps the center makes available, such as:
  - New plastic bottles / jugs product lines that utilize less plastic but retain the same strength
  - Improved efficiency from alternative energy sources such as fuel cells and photovoltaics

## 4. POTENTIAL SUSTAINABLE PIPELINE OF TECHNOLOGIES FOR COMMERCIALIZATION:

The center will charge fees for usage of the developed MS&A resources, once it demonstrates a good return on investment value to the initial SMB clients. This will result in a sustainable pipeline of:

- New SMBs that hear about the center from the media and peers
- Additional projects / usage from existing SMB clients.

As SMBs utilize these technologies, they will be able to significantly increase their competitiveness, innovation capacity, job retention and growth resulting in an improved the bottom line. This success will result in a positive feedback cycle of more projects and clients for the center as SMBs continually try to innovate and expand in order to grow and thrive in the modern economy.

13-308

# Innovation Platform Program

## 2013 Request for Proposals

## Letter of Intent

| | |
|---|---|
| **Lead Applicant Institution** | **Cleveland State University** |
| **Lead Applicant Contact Information** | **Name: Dr. Taysir H. Nayfeh** |
| | **Title: Professor** |
| | **Phone Number: (216)-687-6967** |
| | **Email: t.nayfeh@csuohio.edu** |
| **Project Title:** | Ultra Conductive Copper-Carbon Nanotube Wire |

| | | | |
|---|---|---|---|
| **Total Project Budget** | $ 2,875,000 | **Ohio Third Frontier Funds Requested** | $ 1,400,000 |

**Project Focus:**

- ☒ Advanced Materials (related to advanced polymers; ceramics; composites; carbon fibers and nanotubes; and, specialty metals and alloys)
- ☐ Aeropropulsion and Power Management
- ☐ Fuel Cells and Energy Storage
- ☐ Medical Technology (related to imaging; surgical instruments/equipment; implant devices; and, regenerative medicine)
- ☐ Software Applications for Business and Healthcare
- ☐ Sensing and Automation Technologies
- ☐ Situational Awareness and Surveillance Systems
- ☐ Solar Photovoltaics
- ☐ Agribusiness and Food Processing

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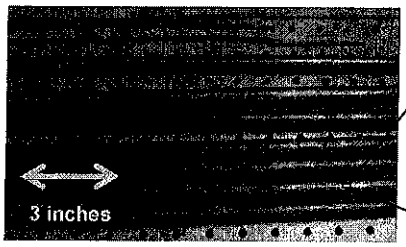
3. Describe the commercial products that will be developed and enter the market within the 3-year timeframe of the Grant.
4. Describe how the platform will provide a sustainable pipeline of technologies for commercialization.

## 1. Describe the proposed technology platform.



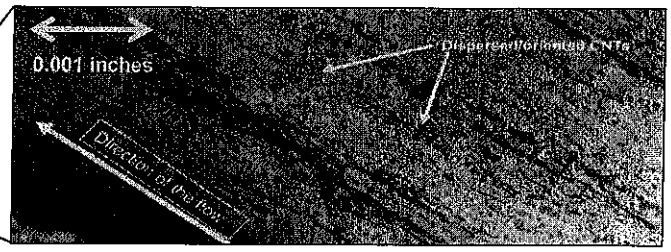




***Figure 1.*** *Hot-extruded 5/8th-inch and 1/8th-inch diameter ultraconductive copper rod before it is cold-drawn into finer and finer wire diameters*

***Figure 2.*** *Longitudinal-section of ultraconductive copper rod showing filaments of carbon nanotubes, which increase the wire's room-temperature electrical conductivity to more than 200% of pure copper*

Electrical conductors are central to all aspects of the electricity system; however, the nature of the conductors used in generators, transmission and distribution lines, transformers and motors has changed little in the last century. The world relies on copper and aluminum for nearly all bulk electrical applications. A conducting material with higher conductivity, improved mechanical properties and lighter weight than conventional copper and aluminum conductors would be a game changing development for electricity systems.

Pure copper and aluminum have poor mechanical properties, high overall weight, creep/fatigue, resistive losses and significant limitations in current-carrying capacity. Copper is a better electrical conductor, and modern applications show an increasing demand for better heat and electric current-carrying capacity at the level beyond copper base materials. Nanocarbon materials, such as carbon nanotubes and graphene, have attracted attention due to their high electrical, thermal conductivity and exceptional mechanical properties; they could be used to improve conductivity in traditional copper wire.

The proposed Ohio Third Frontier Innovation Platform Program (OTF IPP) project will continue the manufacturing development and commercialization of hot-extruded ultraconductive copper (UCC) wire that has been pioneered at the Cleveland State University (CSU). UCC is a composite of carbon nanotubes (CNTs) in a copper matrix. CSU's UCC work has generated international recognition and issued patents with others in process. CSU's innovation platform resources have developed a hot-extrusion process that transforms 100-pound copper billets containing CNT precursors into UCC rod containing continuous filaments of conductive CNTs (See Figures 1 & 2 above). That rod has then been cold-drawn into many hundreds of feet of UCC wire. The electrical conductivity of CNTs is more than 100 times greater than the conductivity of pure copper. Suspending CNTs in copper produces a composite material having an electrical conductivity higher than that of copper. CSU's intellectual property that is most valuable to UCC production concerns the management of (1) the CNT/copper conductive interface, and (2) the required distribution and alignment of the CNTs within the composite material.

More than 65 percent of all copper shipped today is used in products that carry electricity. Most of that electrical copper is in the form of wire. The International Copper Association expects a strong market demand for UCC. The introduction of UCC into electrical products can both increase their electrical efficiency and lower their weight/size. Early markets for UCC will be aerospace motors and wiring, satellite components, military motors/electronics and power distribution networks for deep sea oil drilling. In the longer term, UCC products are expected to penetrate mainstream electrical markets such as industrial motors, transmission wire, automotive wiring harnesses, transformers and building wire. UCC wire is a platform technology that will underpin and grow sales of many of the engineered products made in Ohio today.

The proposed OTF IPP project will not only perfect the current manufacturing system for UCC but also further develop it for the production of UCC beryllium-copper wire. Today, more than 50 percent of the world's beryllium copper products are manufactured in Ohio. Those products include motor brushes, satellite components, springs, spring wire, load cells, low-current contacts for batteries and electrical connectors.

Increasing the electrical conductivity of beryllium copper is expected to significantly grow sales volumes in those applications.

2. **Please list all committed industry clients and their anticipated cash cost share contribution.**

The CSU program will include the following two committed Ohio industry partner "clients" to further the late-stage development of client directed product innovations.

**Materion Corporation:** Headquartered in Mayfield Heights, Ohio, Materion Corporation supplies highly engineered advanced enabling materials to global markets. Products include precious and non-precious specialty metals, inorganic chemicals and powders, specialty coatings, specialty engineered beryllium alloys, beryllium and beryllium composites, and engineered clad and plated metal systems. As the world's only integrated "mine-to-mill" supplier of beryllium-based products, Materion provides beryllium, beryllium composites, beryllium-copper and other specialty engineered beryllium alloys to a variety of end customers. Materion's anticipated OTF IPP cash cost share contribution is $1.1 million.

**Ramco Electric Motors:** Headquartered in Greenville, Ohio, Ramco Electric Motors is an AS9100 certified establishment for the manufacture of electric motors and related components for use in industrial, military, and aerospace applications. Ramco Electric Motors' anticipated OTF IPP cash cost share contribution is $125,000.

3. **Describe the commercial products that will be developed and enter the market within the 3-year timeframe of the Grant.**

Client directed product innovations will incorporate the UCC and beryllium-copper wire and rod to develop commercial applications within 3 years of project commencement. For example, the wire will be used by Materion customers to provide electrical components into aerospace and satellite applications.

4. **Describe how the platform will provide a sustainable pipeline of technologies for commercialization.**

CSU's UCC innovation platform will be utilized by industry partners to create a robust development pipeline with multiple near-term commercialization opportunities for Ohio. This innovation pipeline will include electrical and manufacturing technologies for unmanned aerial vehicles, satellites, extrusion equipment, winding equipment, transformer manufacture, wind turbine generators, steam turbine generators, small and large industrial induction motors, electrical transmission cables, high speed communications cables, cables for undersea power distribution networks for deep sea oil drilling.

In addition, products and applications will build upon the commercialization of UCC. The addition of carbon nanotubes to copper will have the same effect on electrical uses that the addition of carbon to iron (to form steel) had on structural uses: new applications will emerge that cannot be anticipated at the point the new material was first commercialized. The CSU project team envisions a new family of copper-carbon nanocomposite materials with electrical conductivity far greater that available from copper or aluminum. Ohio has an exciting opportunity to benefit from those new applications.

13-309

Ohio | Third Frontier
Innovation Creating Opportunity

# Innovation Platform Program

## 2013 Request for Proposals

## Letter of Intent

| | | | |
|---|---|---|---|
| **Lead Applicant Institution** | **Summa Health System** | | |
| **Lead Applicant Contact Information** | **Name: Steven P. Schmidt, Ph.D.** | | |
| | **Title: Vice-President, Clinical Research and Innovation** | | |
| | **Phone Number:** (330)375-7078 | | |
| | **Email:** schmidts@summahealth.org | | |
| **Project Title:** | Development and Commercialization of JVS-100 as a Regenerative Therapy Platform for Acute and Chronic Disease | | |
| **Total Project Budget** | $ 6,000,000 | **Ohio Third Frontier Funds Requested** | $ 3,000,000 |
| **Project Focus:** | ☐ Advanced Materials (related to advanced polymers; ceramics; composites; carbon fibers and nanotubes; and, specialty metals and alloys) | ☐ Software Applications for Business and Healthcare | |
| | ☐ Aeropropulsion and Power Management | ☐ Sensing and Automation Technologies | |
| | ☐ Fuel Cells and Energy Storage | ☐ Situational Awareness and Surveillance Systems | |
| | X Medical Technology (related to imaging; surgical instruments/equipment; implant devices; and, regenerative medicine) | ☐ Solar Photovoltaics | |
| | | ☐ Agribusiness and Food Processing | |

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3) Describe the commercial products that will be developed and enter the market within the 3-year timeframe of the Grant.
4) Describe how the platform will provide a sustainable pipeline of technologies for commercialization.

SUMMA
Health System

December 20, 2012

Steven P. Schmidt, PhD
Chief Operating Officer
Summa Foundation

Vice President
Clinical Research & Innovation

Medical Education & Research
Office of Research Administration

Summa Akron City Hospital
525 East Market Street
Professional Center South
Suite G-1
Akron, Ohio 44304

Phone (330) 375-4045
Direct Line (330) 375-6647
Fax (330) 375-4185

Email
schmidts@summahealth.org

Ohio Department of Development
Technology and Innovation Division
Attention: Innovation Platform Program (IPP)
77 South High Street, 25th Floor
Columbus, OH 43215

RE: "Development and Commercialization of JVS-100 as a Regenerative Therapy Platform for Acute and Chronic Disease"

**Summa Health Systems intends to submit a $3 million proposal to the Innovation Platform Program for Commercialization of JVS-100 as a regenerative therapy for acute and chronic disease.** Regenerative Medicine is characterized by identification and use of therapies that do not merely treat the symptoms of disease but rather actively repair injured and diseased tissue by rebuilding functional vessels, modulating immune response, preventing cellular death and facilitating wound repair and new tissue growth. The platform technology described in this proposal, JVS-100, was discovered by an Ohio native (Marc Penn, MD, PhD Director of Research, Summa Cardiovascular Institute; Professor of Integrative Medical Sciences, Northeast Ohio Medical University) and is being commercialized as a regenerative therapy by two Ohio companies, Juventas Therapeutics and SironRX Therapeutics, in the fields of cardiovascular disease and dermal wound repair, respectively. In addition, SironRX also includes a service arm that supports all manufacturing, shipping, storage and bioassay work associated with JVS-100 clinical development. JVS-100 is the subject of multiple Phase II clinical trials and is anticipated to enter the marketplace within the 3-5 year project period. Serving as industry clients for this proposal, Juventas and SironRX will contribute a minimum $1.5 million cost share.

JVS-100, a novel technology with a strong intellectual property portfolio, is an ideal platform to generate a sustainable pipeline of products and technologies for commercialization in both the near and long term. The biology and commercial potential for JVS-100 are well defined with the potential for new products to be generated for a variety of different therapeutic areas. Industry infrastructure necessary to introduce JVS-100 to the marketplace as well as support platform expansion already exists through the form of two venture-backed start-up companies. The funding requested will directly support key activities necessary to retain commercialization related activities within Ohio and expand the platform to include a broader product offering. Investment into the development and optimization of key components in the manufacturing process will be completed by Dr. Penn and transferred to SironRX, which will serve as the commercial supplier for these services. Similarly, formulation and delivery optimization will allow for expanded product potential that will support existing activities at Juventas and SironRX. The proposed project will build on core strengths of three

SUMMA
Health System

well-established Ohio organizations to accelerate and expand an already proven technology platform in the regenerative medicine field.

Steven P. Schmidt

Steven P. Schmidt, PhD
Chief Operating Officer, Summa Foundation
Vice-President, Clinical Research & Innovation

13-310

# Innovation Platform Program

## 2013 Request for Proposals

## Letter of Intent

| | |
|---|---|
| **Lead Applicant Institution** | **University of Akron** |
| **Lead Applicant Contact Information** | **Name: Robert A. Weiss** |
| | **Title: Hezzleton E. Simmons Prof. of Polymer Engineering** |
| | **Phone Number: 330-972-2581** |
| | **Email: rweiss@uakron.edu** |
| **Project Title:** | **ELECTRIC FIELD DIRECTED SELF ASSEMBLY OF MEMBRANES FOR ENERGY STORAGE AND FUEL CELLS** |

| | | | |
|---|---|---|---|
| **Total Project Budget** | $ 6.0M | **Ohio Third Frontier Funds Requested** | $ 3.0M |

**Project Focus:**

- ☐ Advanced Materials (related to advanced polymers; ceramics; composites; carbon fibers and nanotubes; and, specialty metals and alloys)
- ☐ Aeropropulsion and Power Management
- ☒ Fuel Cells and Energy Storage
- ☐ Medical Technology (related to imaging; surgical instruments/equipment; implant devices; and, regenerative medicine)
- ☐ Software Applications for Business and Healthcare
- ☐ Sensing and Automation Technologies
- ☐ Situational Awareness and Surveillance Systems
- ☐ Solar Photovoltaics
- ☐ Agribusiness and Food Processing

# ELECTRIC FIELD DIRECTED SELF ASSEMBLY OF MEMBRANES FOR ENERGY STORAGE AND FUEL CELLS

THE UNIVERSITY OF AKRON (Akron, OH), AKRON POLYMER SYSTEMS (Akron, OH), ASHLAWN ENERGY (Painesville, OH), POLYONE (Avon Lake, OH), STRATUM ENERGY SYSTEMS (Cleveland, OH)

Permselective membranes can be manufactured by blending ion-conducting polymers with a tough, durable non-conducting matrix materials. The efficacy of this approach is generally limited by the through thickness percolation of the conductive component. For example, a Vanadium Redox Flow Battery (V-RFB) uses an ion-conducting membrane that requires V-ion conductivity through the membrane. Similarly, proton exchange membranes for fuel cells require high proton conductivity. To achieve the high conductivity, high loadings of the conductive polymer are required, which leads to excessive water swelling of the membrane that mechanically compromises the membrane durability. Typical polymer blends achieve through-thickness percolation for ~15-20% of the minor (conductive) component, but membrane designs usually use 20-30% of the conductive material to ensure percolation. The problem of the inefficient use of the conductive polymer phase is that the two-phase morphology achieved by blending two polymers produces random mixing with tortuous pathways. As a result, the dispersed phase is random (see Figure 1a), and at percolation the connectivity is also random. In addition to the desired through plane pathways, in in-plane pathways are also produced and those do not contribute to the ion-transport through the membrane. A more desirable morphology is one in which the conductive pathway is preferentially in the z-direction (through-thickness), see Figure 1(b). This morphology also has the advantage of achieving 1-D percolation at lower conductive phase concentrations, which more efficiently utilizes the conductive material.

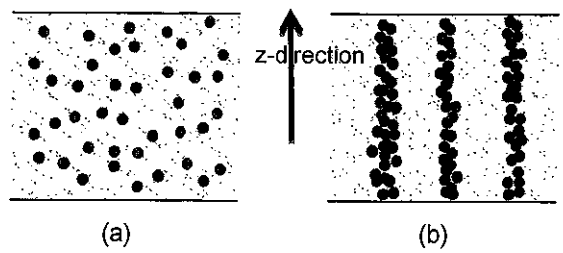


**Figure 1.** Schematic of a polymer blend with a minor conductive phase (red): (a) conventional random morphology; (b) aligned conductive phases.

We have developed a unique 70 ft roll-to-roll manufacturing platform with electrical field (up to 15 kV) alignment capabilities. A solution cast polymer film can be aligned to develop oriented two-phase morphologies during roll-to-roll processing as shown in Figure 2. Moreover, graded or other asymmetric membrane structures can be fabricated using a slot die and/or triple doctor blade for up to three distinct layers in a single processing step. The actual applied field strength is controlled by control of plate gap and various AC or DC fields can be applied as required for the operation. Polymer blends can be used to generate aligned phases at micrometer or sub-micrometer l scales with the application of an electronic field during processing. The roll-to-roll capabilities enable rapid scale-up to prototypes for testing the performance of the membranes.

The electric field assisted alignment described above can be used to direct the orientation of a dispersed conductive phase in the z-direction for a membrane to produce directional percolation of conductive material. This is expected to increase conductivity substantially without increasing the conductive material content. Or conversely for a specific required conductivity, the amount of conductive material can be minimized to

promote improved mechanical durability of the membrane, since the water-swollen conductive phase is the weak link in such materials.

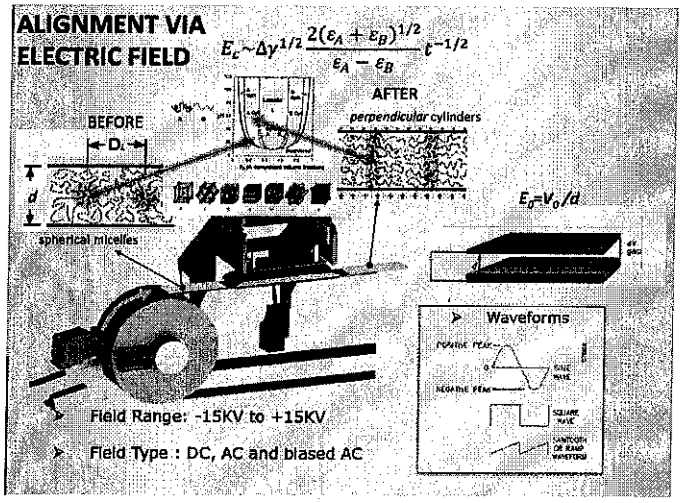


**Figure 2.** Schematic of the electric field orientation component of a roll-to-roll film line at the University of Akron (Department of Polymer Engineering).

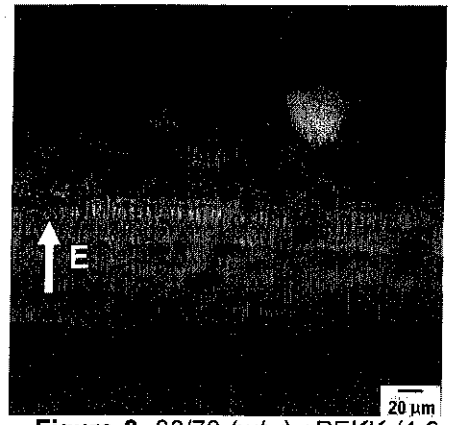


**Figure 3.** 30/70 (w/w) sPEKK (1.9 meq/g)/PEI blend aligned normal to the plane of the membrane at 200°C using a 1 kV/cm (20 Hz) electric field.

Figure 3 illustrates how an electric field can align the conductive phase of a PEM prepared from a blend of 30 wt% sulfonated poly(ether ketone ketone), sPEKK, and a poly(ether imide), PEI, matrix. The alignment here of the sPEKK phase is in the z-direction, and this produced a 1-2 order of magnitude increase in the through-plane proton conductivity.

The proposal involves producing improved permselective membranes for energy storage and PEM fuel cell applications. Three materials will be developed and considered for producing commercial membranes: 1) a proprietary sulfonated fluorinated polymer produced by Akron Polymer Systems (APS), sulfonated poly(ether ether ketone), sPEEK, which is similar to the sPEEK described above, but it is much easier to work, and 3) sulfonated polyimide, sPI. PEEK and PI are commercially available from PolyOne Corp. (PO). The University of Akron has extensive experience with preparing sulfonated polymers. The commercial products that will be enabled by the processing platform are unique and improved permselective membranes suitable for VRFB, PEM fuel cells, lithium ion-batteries and for water purification (e.g., reverse osmosis).

The tasks for each partner for this proposal and their anticipated cost-share (in parentheses) are as follows. APS (<u>$250k</u>) will produce and supply the sulfonated fluoropolymer. The University of Akron (<u>$1.67M</u>) will participate in the material development with PO (<u>$750k</u>) and lead the demonstration of the pilot plant scale platform to produce aligned ion-conducting membranes in a roll-to-roll process. Ashlawn Energy, AE, (<u>$230k</u>) will evaluate the membranes in a VRFB demonstration unit and implement the membranes into a commercial energy storage system. Stratum Energy Systems, SES ($100k) will develop a low-cost fuel cell pack. APS an PO will provide channel for selling commercial functionalized polymers and/or membranes to the energy, water purification, electrical, electronics and automotive markets. AE markets commercial VRFB facilities and SES markets niche PEM fuel cells.

13-311

Ohio | Third Frontier
Innovation Creating Opportunity

# Innovation Platform Program

## 2013 Request for Proposals

## Letter of Intent

| | |
|---|---|
| **Lead Applicant Institution** | **Kent State University, 114 Cartwright Hall, P.O. Box 5190, Kent, Ohio 44242-0001** |
| **Lead Applicant Contact Information** | **Name: W. Grant McGimpsey, Ph.D.** |
| | **Title: Vice President, Research and Sponsored Programs** |
| | **Phone Number: 330-672-0717** |
| | **Email: wmcgimps@kent.edu** |
| **Project Title:** | "bioFLEX™ Platform Project: Liquid Crystal-based Biosensors for Wound Healing" |

| | | | |
|---|---|---|---|
| **Total Project Budget** | $4,000,000.00 | **Ohio Third Frontier Funds Requested** | $ 2,000,000.00 |

**Project Focus:**

- ☐ Advanced Materials (related to advanced polymers; ceramics; composites; carbon fibers and nanotubes; and, specialty metals and alloys)
- ☐ Aeropropulsion and Power Management
- ☐ Fuel Cells and Energy Storage
- X☐ Medical Technology (related to imaging; surgical instruments/equipment; implant devices; and, regenerative medicine)
- ☐ Software Applications for Business and Healthcare
- ☐ Sensing and Automation Technologies
- ☐ Situational Awareness and Surveillance Systems
- ☐ Solar Photovoltaics
- ☐ Agribusiness and Food Processing

Please answer the following questions using no more than two additional pages. The Letter of Intent should address each question in order identifying each response. Do not include any trade secret information in this Letter of Intent.

1) Describe the proposed technology platform. Please refer to the Request for Proposals Section 2.1 second paragraph for the definition of a technology platform.
2) Please list all committed industry clients and their anticipated cash cost share contribution.
3) Describe the commercial products that will be developed and enter the market within the 3-year timeframe of the Grant.
4) Describe how the platform will provide a sustainable pipeline of technologies for commercialization.

## LETTER OF INTENT – ADDITIONAL TWO PAGES – INNOVATION PLATFORM PROGRAM

**"bioFLEX™ Platform Project: Liquid Crystal-based Biosensors for Wound Healing"**

**Kent State University**

### 1) PROPOSED TECHNOLOGY PLATFORM

Kent State University researchers are working to develop new approaches for effective remote medical treatment through the application of flexible biomedical devices. Using biocompatible electronic diagnostic and therapeutic systems on and in the body will provide superior monitoring of aging and non-compliant patients and more effective wound healing in both clinical and non-clinical settings.

This bioFLEX ™ technology platform represents the integration of advanced materials such as liquid crystals, biosensors, biocompatible coatings, power and communications modules into a single small flexible device that can be attached to the surface of the body and/or implanted in the body and operate on-demand to measure and transmit physiological information and to deliver therapeutics.

bioFLEX™ can provide diagnostic information about the patient, such as physiological vital signs and specific biomarkers that are important for diagnosing chronic disease, acute disease, and acute trauma. They also have the potential to be therapeutic devices by storing and releasing chemical or cell therapies upon demand or upon receiving internal feedback.

This initiative grew from Kent State's previous basic and applied research in advanced materials, such as liquid crystals, and our experience in making devices flexible. Kent State faculty researchers have expertise in surface chemistry, surface modification, biocompatibility, implanted prosthetics, nanoscience, nanomaterials, and liquid crystals, and the university is known world-wide for its Liquid Crystal Institute (LCI) which led the development of liquid crystal technologies for displays, flexible electronics and more recently medical devices and biosensors.

The University is now uniquely positioned to operate in the flexible biomedical device field and make a substantial contribution to research and the development of this new platform technology.

### 2) COMMITTED INDUSTRY CLIENTS & ANTICIPATED CASH COST SHARE CONTRIBUTION

| | |
|---|---|
| Clients' Contribution: | $1,000,000.00 |
| Kent State University Contribution: | $1,000,000.00 |
| Total Anticipated Cash Cost Share Contribution: | $2,000,000.00 |

Industry Clients:
GOJO Industries, Inc., Akron, OH
Vanceve Medical Technologies, Division of Avery Dennison, Mentor, OH

## 3) COMMERCIAL PRODUCTS TO BE DEVELOPED AND ENTER MARKET

The primary indication this platform seeks to address is chronic wound care, such as those seen in diabetic ulcerations. A 2009 study noted that approximately $25 Billion is spent annually in the U.S. on human skin wounds alone.

Accordingly, together with partners at GOJO industries and Avery Dennison's Vanceve Medical Technologies, we seek to develop the next generation of biocompatible sensors, integrated into topical wound dressings, capable of monitoring healing prognosis and the body's inflammatory response. Coupled with a responsive drug delivery system, this type of "smart" bandage will provide on-demand therapeutics in real-time to the healing wound, reducing the need for prolonged hospitalizations and / or physician visits.

## 4) HOW PLATFORM WILL PROVIDE A SUSTAINABLE PIPELINE OF TECHNOLOGIES FOR COMMERCIALIZATION

While we have focused on wound healing as an efficient means of organizing and planning our research the results will have much broader impact. It will develop the techniques required to effectively couple liquid crystal orientation with the presence of pathogens, proteins and related biomarkers into a single fiber.

The resulting ability to detect a wide ensemble of physical parameters and biological inputs will allow the development of more effective and complex therapeutic responses tailored to meet the needs of individual patients. Once an understanding of this process is developed, fiber arrays that can detect and respond to a broad spectrum of inputs can be designed for use in an ever expanding ensemble of biosensor applications. Their small size and extreme flexibility make them compatible in almost any biological or medical environment.

Electro-spinning and co-extrusion are well-understood techniques for forming fibers that can be used to produce disposable devices in high volume, at low cost, and using materials and manufacturing processes consistent with production of medical devices.

13-312

# Innovation Platform Program

## 2013 Request for Proposals

## Letter of Intent

| | |
|---|---|
| **Lead Applicant Institution** | **University of Akron,** The University of Akron, 302 Buchtel Common, Akron, OH 44325-2102 |
| **Lead Applicant Contact Information** | **Name: Miko Cakmak,** Polymer Engineering Dept. The Univ. of Akron, Akron, OH 44325 |
| | **Title: Harold A. Morton chair, Distinguished Professor of Polymer Engineering** |
| | **Phone Number: 330-972-6928** |
| | **Email: cakmak@uakron.edu** |
| **Project Title:** | Transparent conductive flexible film manufacturing and Commercialization for Flexible Electronic Devices |

| | | | |
|---|---|---|---|
| **Total Project Budget** | $ 3,000,000 | **Ohio Third Frontier Funds Requested** | $ 3,000,000 |

**Project Focus:**

- ☒ Advanced Materials (related to advanced polymers; ceramics; composites; carbon fibers and nanotubes; and, specialty metals and alloys)
- ☐ Aeropropulsion and Power Management
- ☐ Fuel Cells and Energy Storage
- ☐ Medical Technology (related to imaging; surgical instruments/equipment; implant devices; and, regenerative medicine)
- ☐ Software Applications for Business and Healthcare
- ☐ Sensing and Automation Technologies
- ☐ Situational Awareness and Surveillance Systems
- ☐ Solar Photovoltaics
- ☐ Agribusiness and Food Processing

# Letter of Intent

## Project Summary

Flexible Electronics is a rapidly emerging industry that will transform the manner in which we interact with everyday devices such as sensors, displays, LED lighting, photovoltaics through enabling bending and rolling of the device into ergonomic form factors and conformal devices. The market for flexible electronics is projected to be $350 billion by 2025. Many current electronics in rigid form on glass use transparent and electrically conductive electrodes as a critical active component (such as displays and solar cells). The most widely used transparent conductor is indium tin oxide (ITO), which can be coated on glass or polymer. ITO coated plastics are limited to gentle curvatures with significant fatigue if bent repeatedly. This property prevents rollable displays that could be put away due to cracking of the ITO during repeated rolling and unrolling into scroll of small radii of curvature.

At the University of Akron, a novel roll to roll hybrid pilot scale machine was developed as part of the previously funded Wright Center of Innovation CMPND. With this hybrid machine endless nanosized (with diameters 200 nm or less) conductive nanowires are partially embedded in the surface of cast solution of polymer or photocurable monomer and subsequently the films are dried or photocured to capture these essentially endless nanofibers forming a conductive network at and near their surface. With this continuous process, high transparency and moderate electrical conductivity have been achieved, which has enabled successful small scale demonstrators of switchable flexible windows and transparent window heaters. With this key development of electrospinning/film casting hybrid process, medium scale films have been produced and sampled. Because the nanofibers are partially embedded in transparent medium at or near one of their surfaces, they do not have a distinct interface that is prevalent in other transparent conductive film forms. The presence of distinct interface is the inherent weakness of these competing technologies that lead to delamination and/or cracking. Cyclic bending testing around small curvatures of these nanofiber embedded films show no changes in conductivity and other critical properties after undergoing several hundred cycles of bending, while the same testing using competing films (ITO) leads to cracking/delamination and loss of conductivity (device failure). Thus, this hybrid process is an enabling technology for the advancement of flexible electronics.

This hybrid process can be applied to wide range of conductive materials to form nanowires/fibers as well as wide range of polymers or photocurable monomers to form the matrix. Therefore this technology represents a flexible platform technology.

The main objective of this proposal is to further develop, optimize and commercialize high conductivity flexible/transparent films through the use of materials of higher conductivity while matching the refractive index between the fibers and matrix materials with dial-able optical properties either through solution or photocurable resin route. We have also demonstrated that these films are easily laser patterned to be used as flexible circuits. This technology is also suitable for very high conductivity applications such as flexible circuits where transparency may be sacrificed for high conductivity while still maintaining flexibility.

This project represents a close supply chain partnership between Akron Polymer Systems Inc, The University of Akron ($1.6M) ,Kent Displays Inc ( $600,000) Alpha Micron inc ( $400,000) and Cubbison Inc ($200,000). Akron Polymer Systems is a specialty resin manufacturer that will

provide key expertise in transparent high performance resins including colorless soluble polyimides as well as photocurable monomers. The University of Akron will integrate these materials and conductive materials using multi-nozzle electrospinning (36 nozzles) platform mounted downstream of solution/monomer casting line and produce pilot scale flexible transparent conductive films. Kent displays will then integrate these materials into flexible displays and Alpha Micron will use these transparent conductive films in their switchable eyewear, autodimming mirrors and switchable windows and Cubbison will incorporate them in their touchscreens designed for medical and consumer devices. At the end of this proposed activity, the University of Akron plans to spin off manufacturing company to produce these transparent conductive films.

13-313

Ohio | Third Frontier
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# Innovation Platform Program

## 2013 Request for Proposals

## Letter of Intent

| | |
|---|---|
| **Lead Applicant Institution** | **The Ohio State University** |
| **Lead Applicant Contact Information** | **Name: John Lannutti** |
| | **Title: Professor** |
| | **Phone Number: (614) 292-2408** |
| | **Email: lannutti.1@osu.edu** |
| **Project Title:** | Nanobiomaterials based Platform Technology for Medical Applications |

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|---|---|---|---|
| **Total Project Budget** | $ 3,000,000 | **Ohio Third Frontier Funds Requested** | $ 1,500,000 |

**Project Focus:**

- ☒ Advanced Materials (related to advanced polymers; ceramics; composites; carbon fibers and nanotubes; and, specialty metals and alloys)
- ☐ Aeropropulsion and Power Management
- ☐ Fuel Cells and Energy Storage
- ☒ Medical Technology (related to imaging; surgical instruments/equipment; implant devices; and, regenerative medicine)
- ☐ Software Applications for Business and Healthcare
- ☐ Sensing and Automation Technologies
- ☐ Situational Awareness and Surveillance Systems
- ☐ Solar Photovoltaics
- ☐ Agribusiness and Food Processing

Please answer the following questions using no more than two additional pages. The Letter of Intent should address each question in order identifying each response. Do not include any trade secret information in this Letter of Intent.

1) Describe the proposed technology platform. Please refer to the Request for Proposals Section 2.1 second paragraph for the definition of a technology platform.

   We propose an Innovation Platform based on existing unique nanobiomaterials technology capabilities in the Center for Affordable Nanoengineering of Polymeric Biomedical Devices (CANPBD) at The Ohio State University (OSU). CANPBD is a large Nanoscale Science and Engineering Center (NSEC) funded by National Science Foundation in 2004 via a 10-year and $25.7M grant. Three advanced materials and devices- biodegradable polymeric nanofibers for tissue engineering and regenerative medicine, multifunctional lipoplex nanoparticles for early

detection of cancer and virus infection, and biodegradable implant devices for controlled drug release have reached near-term commercialization potential. The medical applicability of prototypes is being evaluated by OSU Comprehensive Cancer Center and Center for Regenerative Medicine and Cell Based Therapy, and their business development has been initiated by several start-up companies with successful SBIR funding. Further industry engagement and commercialization will be supported by BioOhio and its member companies. Most pilot-scale equipment and facilities are available in the OSU laboratories.

2) Please list all committed industry clients and their anticipated cash cost share contribution.

Two Ohio companies are committed as industry clients. More will likely join before proposal submission. Nanofiber Solutions, LLC will collaborate with CANPBD at OSU to further develop their polymeric nanofiber based tissue scaffolds for regenerative medicine and wound healing applications. Their anticipated cash cost share is $300,000 for the 3-year funding period. Nanomaterial Innovation Ltd. (NIL) will collaborate with CANPBD at OSU to commercialize lipoplex nanoparticles containing molecular beacons for detection of extracellular RNAs as early cancer biomarkers. Their anticipated cash cost share is $150,000 for the 3-year funding period.

3) Describe the commercial products that will be developed and enter the market within the 3-year timeframe of the Grant.

Nanofiber Solutions will develop multifunctional nanofibers with CANPBD at OSU to serve for cell substrates and tissue scaffolds. The anticipated near-term medical applications include wound healing and tissue engineered tracheas.

Nanomaterial Innovation Ltd. (NIL) will develop low-cost biochips based on tethered lipoplex nanoparticles containing molecular beacons to capture and detect circulating tumor cells (CTCs) and tumor derived exosomes in blood and body fluids for non-invasive early cancer detection. A near-term medical application is in situ imaging of wound healing.

4) Describe how the platform will provide a sustainable pipeline of technologies for commercialization.

Advanced nanomaterials and new medical technology are essential for Ohio's economic growth. Although Ohio industry is known for its technical strength and commercialization in polymers and other materials for traditional markets, the application of advanced materials for new products which address the needs in the fast growing medical market remains weak. The proposed nanobiomaterials based platform technology will provide a pipeline of advanced materials and medical technology for many Ohio companies to grow their business strengths.

13-314

Ohio | Third Frontier
Innovation Creating Opportunity

# Innovation Platform Program

## 2013 Request for Proposals

## Letter of Intent

| | |
|---|---|
| **Lead Applicant Institution** | The Ohio State University |
| **Lead Applicant Contact Information** | **Name: Mike Sumption**<br>**Title: Professor, Materials Science and Engineering**<br>**Phone Number:** 614-688-3684<br>**Email: sumption.3@osu.edu** |
| **Project Title:** | Multiscale, Multimode, Subsurface Analysis and Defect Detection for Advanced Manufacturing |

| | | | |
|---|---|---|---|
| **Total Project Budget** | $ 2M | **Ohio Third Frontier Funds Requested** | $2M |

**Project Focus:**

- [x] Advanced Materials (related to advanced polymers; ceramics; composites; carbon fibers and nanotubes; and, specialty metals and alloys)
- [ ] Aeropropulsion and Power Management
- [ ] Fuel Cells and Energy Storage
- [ ] Medical Technology (related to imaging; surgical instruments/equipment; implant devices; and, regenerative medicine)
- [ ] Software Applications for Business and Healthcare
- [x] Sensing and Automation Technologies
- [ ] Situational Awareness and Surveillance Systems
- [ ] Solar Photovoltaics
- [ ] Agribusiness and Food Processing

**Proposed Technology Platform**

The OTF Innovation Platform is Multiscale, Multimode Subsurface Analysis and Defect Detection for Advanced Manufacturing. The platform, which brings together OSU's Center for Electron Microscopy and Analysis (CEMAS), Center for Superconducting and Magnetic Materials, and members of OSU's Manufacturing Institute is focused on expanding OSUs existing platform for commercially relevant materials analysis, imaging, and defect testing. Our platform has internationally recognized expertise in the area, access to needed facilities for putting the proposed platform development in proper context, and unique hardware modeling capabilities and computational talent. We also have a long-standing engagement with a large number of relevant industrial partners, and a strong record in creating intellectual property and in research commercialization of innovative products.

In the development of a large number of advanced materials, processes, and products, the need to image and otherwise detect the substructure of the material at multiple scales and in various modes is needed in

order to understand the formation processes, microstructures, and defect structures which develop. The understanding of such structures and properties is critical to the proper manufacture of the products and their commercial viability.

Working with a core set of clients, we will first develop our existing platform, expanding it to one that is truly multiscale and multimode. This will include the incorporation of high resolution 3-D x-ray imaging techniques and electromagnetic defect detection into the existing platform. We will focus on advanced manufacturing approaches with feedback cycles to enable improved products and processes. However, the platform is very generally applicable to manufacturing process and product improvement. We envision a series of manufacturing technologies which this will platform will aid, creating a sustainable pipeline of technologies for commercialization.

**Committed Industry Clients and anticipated cost share contribution:**

*Primary partners for IPP proposal:*
Hyper Tech Research (Columbus, OH), Jackson Tube Service (Piqua, OH), ITW-Hobart (Troy, OH)

The primary partners are committed to provide cost-share for estimated request ($2M).

**Commercial Products that will be developed include the following:**

Improved flux cored welding wire
Improved superconductor wire for medical applications
Improved welded tubing for automotive applications
Improved Equipment for making small diameter tubing

**Sustainable Pipeline of Technologies for Commercialization**

More economical small tubing – Cu, Stainless steel,
Additional new flux cored welding wires
Improved superconductor wire for wind and other applications
Improved forming and welding processes for various applications

13-315

Ohio | Third Frontier
Innovation Creating Opportunity

# Innovation Platform Program

## 2013 Request for Proposals

## Letter of Intent

| | | | |
|---|---|---|---|
| **Lead Applicant Institution** | **The Ohio State University** | | |
| **Lead Applicant Contact Information** | **Name: L. James Lee** | | |
| | **Title: Professor** | | |
| | **Phone Number: (614) 292-2408** | | |
| | **Email: lee.31@osu.edu** | | |
| **Project Title:** | Carbon Nanoparticles based Platform Technology for Transportation and Building Applications | | |
| **Total Project Budget** | $ 3,000,000 | **Ohio Third Frontier Funds Requested** | $ 1,500,000 |
| **Project Focus:** | x☐ Advanced Materials (related to advanced polymers; ceramics; composites; carbon fibers and nanotubes; and, specialty metals and alloys) | ☐ Software Applications for Business and Healthcare | |
| | ☐ Aeropropulsion and Power Management | ☐ Sensing and Automation Technologies | |
| | ☐ Fuel Cells and Energy Storage | ☐ Situational Awareness and Surveillance Systems | |
| | ☐ Medical Technology (related to imaging; surgical instruments/equipment; implant devices; and, regenerative medicine) | ☐ Solar Photovoltaics | |
| | | ☐ Agribusiness and Food Processing | |

Please answer the following questions using no more than two additional pages. The Letter of Intent should address each question in order identifying each response. Do not include any trade secret information in this Letter of Intent.

1) Describe the proposed technology platform. Please refer to the Request for Proposals Section 2.1 second paragraph for the definition of a technology platform.

   We propose an Innovation Platform based on existing unique technology capabilities at The Ohio State University (OSU) in the area of carbon nanoparticles based nanocomposites and nanopapers with near-term commercialization potential in the transportation and building industries. Most pilot-scale equipment and facilities are available in the OSU laboratories.

2) Please list all committed industry clients and their anticipated cash cost share contribution.

For transportation applications, OmnovaSolutions- a leading polymer coating supplier in the US will collaborate with OSU and NIL as an industry client to develop new coating resins and technologies for enhanced surface erosion protection and EMI shielding of injection molded automotive panels. Their anticipated cash cost share is $450,000 for the 3-year funding period.

For building applications, Owens Corning Insulation Division- a world leading provider of thermal insulation foams will collaborate with OSU and NIL as an industry client to develop next generation insulation materials for improved performance using the environmental benign blowing agents. Their anticipated cash cost share is $450,000 for the 3-year funding period.

For nanocomposite and nanopaper synthesis, Nanomaterial Innovation Ltd. (NIL)- an OSU spin-off company will collaborate with OSU as an industry client to scale-up surface functionalization of carbon nanoparticles and production of nanocomposites and nanopapers. Their anticipated cash cost share is $100,000 for the 3-year funding period.

CK Technologies- a large injection molding company will join the team as a committed end-user to test and use the new carbon nanopaper based in-mold coating technologies for various automotive applications.

3) Describe the commercial products that will be developed and enter the market within the 3-year timeframe of the Grant.

For transportation applications, OmnovaSolutions will develop new resins so carbon nanopapers developed by OSU and NIL can be integrated into their in-mold coating technology as new coating products. CK Technologies will be one of the end users.

For building applications, Owens Corning Insulation Division will implement graphite/graphene enhanced polymers developed by OSU and NIL in their extrusion foaming lines to produce high-performance insulation materials.

4) Describe how the platform will provide a sustainable pipeline of technologies for commercialization.

Both transportation and building industries are important for Ohio's economic growth. However, strong competitions in the US and worldwide demand Ohio companies to develop advanced materials and manufacturing technologies for new products with improved performance. The proposed nanocomposites and nanopapers based on various carbon nanoparticles and associated surface functionalization technologies will provide a pipeline of advanced materials for several large and small Ohio companies to maintain and grow their business strengths.

13-316

# Innovation Platform Program

## 2013 Request for Proposals

## Letter of Intent

| | |
|---|---|
| **Lead Applicant Institution** | **Case Western Reserve University** |
| **Lead Applicant Contact Information** | **Name: P. Hunter Peckham, Ph.D.** |
| | **Title: Donnell Institute Professor** |
| | **Phone Number: 216-778-3480** |
| | **Email: pxp2@case.edu** |
| **Project Title:** | Commercialization of an Innovative Neuromodulation and Neurostimulation Technology Platform |

| | | | |
|---|---|---|---|
| **Total Project Budget** | $ 6,000,000 | **Ohio Third Frontier Funds Requested** | $ 3,000,000 |

**Project Focus:**

- ☐ Advanced Materials (related to advanced polymers; ceramics; composites; carbon fibers and nanotubes; and, specialty metals and alloys)
- ☐ Aeropropulsion and Power Management
- ☐ Fuel Cells and Energy Storage
- ☒ Medical Technology (related to imaging; surgical instruments/equipment; implant devices; and, regenerative medicine)
- ☐ Software Applications for Business and Healthcare
- ☐ Sensing and Automation Technologies
- ☐ Situational Awareness and Surveillance Systems
- ☐ Solar Photovoltaics
- ☐ Agribusiness and Food Processing

**Proposed Technology Platform**

Case Western Reserve University (CWRU) and its Ohio for-profit clients are partnering to launch the commercialization of a revolutionary implantable neuromodulation device platform to treat a wide array of clinical indications. This new implantable device, called the OMNISTIM™ System, has been developed at CWRU through the work of investigators with significant experience in the development of active implantable medical devices. The Omnistim System is an implantable neuromodulation device platform designed to treat a multitude of clinical indications, including motor paralysis, spasticity and pain. The Omnistim System has been conceptualized, designed, and tested over the past decade, resulting in a fully developed system ready for use. The OTF Innovation Platform Program (IPP) will support the final steps necessary to launch this breakthrough platform technology, specifically the completion of the necessary manufacturing, regulatory and quality assurance procedures to successfully obtain regulatory approval from the US Food and Drug Administration to market and sell the Omnistim System in the US. CWRU is partnering with NDI Medical, an Ohio-based for-profit medical device company with extensive experience in the development, manufacturing, regulatory approval, and commercialization of neuromodulation medical devices. Customers are already in line and waiting for the Omnistim System, including a client on this project, SPR Therapeutics.

The Omnistim System is a modular, scalable, and configurable network of fully implanted devices capable of meeting or exceeding the needs of a broad class of neuromodulation applications. Each Omnistim module contains local processing capabilities and can be programmed through a transcutaneous wireless link. The modules are networked using a single cable that distributes power and provides a data communication link between each module. The configurable networked architecture and ease of programmability allows the Omnistim System to be applied equally well to patients with modest disabilities, using a few components, to severe disabilities, requiring additional components. This novel architecture also facilitates system expansion, technical upgrades, and functional enhancements. Omnistim System configurations can be designed for a wide variety of clinical applications, including providing motor function in spinal cord injury, stroke, and multiple sclerosis, as well as spasticity control and pain relief in a wide range of neurological and orthopedic disorders. The Omnistim System provides a foundation which enables efficient technical refinements that optimize implementation of the system for each targeted indication.

The Omnistim System fits the IPP's definition of a platform technology in every way. It is a unique implantable device technology platform developed to treat a wide array of clinical indications, which contrasts the "single device-single application" strategy that has been utilized by the medical device industry to date. The Omnistim System exploits the expertise, unique capabilities, strengths, talents, equipment, and facilities of the academic and commercial partners in this proposal. Specifically, the research expertise at CWRU has conceived and developed this technology over the past ten years and it is now ready to transfer to commercial partners. NDI Medical brings unique expertise as an implantable medical device manufacturer in the State of Ohio, providing the critical link between research development and commercialization of the Omnistim System. SPR Therapeutics has a track record of executing clinical studies and obtaining regulatory approvals to commercialize neurostimulation devices, and is poised to begin marketing the Omnistim System within the timeframe of this proposal. The Omnistim System is an innovative implantable device platform technology that is ready for near-term commercialization by independent Ohio for-profit companies, resulting in wealth and employment opportunities within Ohio.

**Committed Industry Clients**

NDI Medical/NP Systems
22901 Millcreek Blvd
Cleveland, OH 44122
Committed Cash Cost Share: $1M

SPR Therapeutics
22901 Millcreek Blvd
Cleveland, OH 44122
Committed Cash Cost Share: $0.5M

*These two clients are independent Ohio for-profit companies, as specified in the RFP.*

**Commercial Products to be Developed**

The first two clinical applications targeted for market entry with the Omnistim System are an upper extremity motor neuroprosthesis for spinal cord injury (SCI), called the Omnistim-UE, and a system for pain relief following limb amputation, called the Omnistim-AP. There is a significant market for these two indications. Clinical data suggest that the Omnistim is a safe and effective option, and presently available therapies are not sufficient. These products will be marketed by our customer-clients on this project, SPR Therapeutics and NP Systems, a medical device company to be formed as part of this Program. Potential customers are already in line and waiting for products. These two applications serve as an excellent starting point for commercialization due to the existing data indicating a high likelihood of clinical success coupled with expertise in these applications within the Ohio-based clients in this proposal. Further clinical applications have been identified and will be evaluated in order to expand the customer base and magnitude of sales of the Omnistim.

**Platform Sustainability**

CWRU's implantable device platform technology is designed to be used for the treatment of a vast array of clinical indications, resulting in a long pipeline of future products. Maintaining platform sustainability will be achieved through the following strategies:

- **Build a product development and manufacturing base in Ohio for the platform product.** The biomedical industry is a driving force in Cleveland, making up 18% of the region's economy and attracting $925M new investment since 2003. CWRU is collaborating with NDI Medical and their suppliers, primarily in Ohio, for the manufacture of all components.
- **Expand and strengthen the intellectual property position.** The Omnistim System represents a novel, proprietary approach to a variety of clinical indications, and key personnel will continue to expand the portfolio of intellectual property to protect the design and use of the product globally.
- **Partner with NDI Medical, SPR Therapeutics, and NP Systems.** CWRU will work with NDI Medical to manufacture products, and with SPR Therapeutics and NP Systems to market and sell products. Expansion of the Omnistim's indications beyond motor function and pain will result in the creation of additional medical device companies in Ohio that will require highly-paid clinical, regulatory, sales, marketing, education & training, and administrative staff.
- **Expand the Omnistim product line.** The modular design of the Omnistim System makes it capable of meeting the requirements of a multitude of clinical indications. As commercialization efforts are underway for restoration of upper extremity function in SCI and treatment of post-amputation pain, new clinical studies will be conducted to investigate the safety and effectiveness of the system for additional clinical indications. New products within the Omnistim line will ensure that this Program results in the continuous generation of jobs and revenue in the State of Ohio, for many years beyond the project period of this grant.

13-317

Ohio | Third Frontier
Innovation Creating Opportunity

# Innovation Platform Program

## 2013 Request for Proposals

## Letter of Intent

| | |
|---|---|
| **Lead Applicant Institution** | **Ohio State University** |
| **Lead Applicant Contact Information** | **Name: Liang-Shih Fan** |
| | **Title: Professor** |
| | **Phone Number: 614-688-3262** |
| | **Email: fan.1@osu.edu** |
| **Project Title:** | Commercialization of Metal Oxide Composite Manufacturing for Advanced Energy Conversion and Storage |

| | | | |
|---|---|---|---|
| **Total Project Budget** | $ 5,400,000 for 3 years | **Ohio Third Frontier Funds Requested** | $ 2,700,000 for 3 years |

**Project Focus:**

- ☒ Advanced Materials (related to advanced polymers; ceramics; composites; carbon fibers and nanotubes; and, specialty metals and alloys)
- ☐ Aeropropulsion and Power Management
- ☒ Fuel Cells and Energy Storage
- ☐ Medical Technology (related to imaging; surgical instruments/equipment; implant devices; and, regenerative medicine)
- ☐ Software Applications for Business and Healthcare
- ☐ Sensing and Automation Technologies
- ☐ Situational Awareness and Surveillance Systems
- ☐ Solar Photovoltaics
- ☐ Agribusiness and Food Processing

Please answer the following questions using no more than two additional pages. The Letter of Intent should address each question in order identifying each response. Do not include any trade secret information in this Letter of Intent.

1) Describe the proposed technology platform. Please refer to the Request for Proposals Section 2.1 second paragraph for the definition of a technology platform.

The Ohio State University (OSU) Clean Energy Laboratory has developed an innovation platform for synthesizing cost-effective metal oxide composite materials for advanced energy conversion and storage system applications. OSU is one of the leaders in the development of a metal oxide based chemical looping process, an advanced technology for Ohio coal and shale/natural gas conversions to

electricity, hydrogen, syngas, liquid fuels, and chemicals with low cost, low carbon emission, and high efficiency. The metal oxide composite materials are also capable of storing thermal kinetic and chemical potential energy, serving as inexpensive, high density energy storage media (enabling the selective generation of heat, electricity, chemicals, and fuels upon demand) as well as precursors for chemical feedstocks and advanced carbon based nano- materials.

Over the past 15 years, more than $45,000,000 has been invested from federal, state and industry to develop OSU's patented chemical looping technology platform. This technology has successfully demonstrated a fully integrated, 25$kW_{th}$ sub-pilot syngas chemical looping (SCL) and coal-direct chemical looping (CDCL) units for gaseous and solid fuel conversions, respectively. The successful demonstration of these two units was achieved through the development of OSU's patented complex metal oxide composite materials exhibiting low cost, high reactivity and selectivity combined with mechanical strength. OSU's research team, in collaboration with industrial partners, is further scaling up the SCL and CDCL processes to validate their cost and technical performance through pilot demonstrations. DOE has awarded funding for a 250 $kW_{th}$ pressurized, pilot SCL unit that will be fully constructed and operational Q4 of 2013. The CDCL unit is in the design phase for commercial piloting. Also, OSU is working with National Renewable Energy Laboratory (NREL) to develop stable metal oxide composite materials as an energy storage media for the concentrated solar process (CSP).

The proposed innovation platform will manufacture the required metal oxide composite materials for these advanced processes. This platform will leverage the OSU's extensive knowledge on composite material synthesis in this last stage of development, ensuring the particle is commercially produced with high reactivity, thermal capacity, and strength at minimal cost. Under this IPP, OSU will work closely with Ohio-based technology investment and validation partners such as the new OSU/OU University Innovation Fund, Battelle's Energy and Environment Group for conversion of carbon feedstock to higher value products/chemicals and Ohio-based industrial partners/clients, such as American Electric Power (AEP, Columbus, OH), Babcock & Wilcox (B&W, Barberton, OH), and First Energy (FE, Akron, OH). This consortium will scale up the metal oxide composite material synthesis for commercial application to the energy production and storage markets within 3 years. The outcome of the platform will significantly impact multiple Ohio industry sectors, including energy (both conventional and renewable), alternative and unconventional fuels, chemicals, advanced materials, engineering/design, and particle/catalyst manufacturing. This technology will create new and valuable high-tech jobs and business opportunities by supporting existing Ohio industry as well as commercializing new innovation focused on newly emerging Ohio technology clusters, assets, programs and investments.

2) Please list all committed industry clients and their anticipated cash cost share contribution.

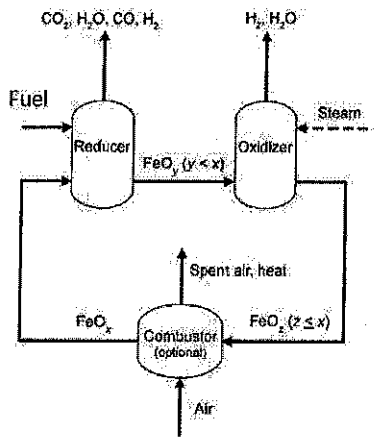
Dominion Capital University Innovation Fund 1 will commit a minimum of $2,700,000 to ensure a matching cost share with the program, from the Columbus Ohio Office, under the direction of Brandon Lloyd, and also anticipates significantly more investment from the fund and existing syndication relationships within the industry consortium for commercialization of the technology. OSU and the private partners and investors will commercialize this platform within the 3 year time frame listed as part of the program. It is also anticipated that Battelle, B&W, AEP, Dow, and FE will also contribute cost share within specific support activities based on each members' ability to positively and efficiently contribute to the programs objectives.

3) Describe the commercial products that will be developed and enter the market within the 3-year timeframe of the Grant.

The proposed platform will develop and synthesize complex metal oxide materials as commercial products used for clean energy conversion and storage. In one pathway of this innovation platform, iron oxide based composite materials will be developed and synthesized for chemical looping combustion and gasification applications as shown in Figure 1. The iron oxide composite material will be used to indirectly provide oxygen to the fuel (gaseous or solid) to selectively generate high purity reactive gases or $CO_2$ for sequestration and/or utilization via enhanced oil recovery without the need for an energy intensive air separation unit or other gas-gas separation techniques for $CO_2$ capture.

In another pathway, the metal oxide composite material can also be designed and applied for energy storage where chemical fuels, heat, and/or electricity can be selectively released upon demand. For example, Figure 2 shows a scheme of a CSP for electricity generation from solar energy. Excess heat from the CSP system during peak daylight hours can be stored in the composite materials. Additionally, the iron oxide composite materials can be synthesized for chemical potential energy storage in reduced metallic iron composite form where the chemical energy can be selectively recovered as heat, electricity, and other chemical forms through combustion, gasification, or other chemical reaction routes.

Thus, the outcome of this platform will produce multiple products applicable to diversified customers and industry such as power generation (conventional and renewable), high valued chemicals/polymers, liquid fuels and reacting gases used for new advanced materials production such as graphene, CNT's, and carbon fiber. This platform technology diversifies and beneficiates Ohio coal and gas feed stocks with minimal carbon emissions and a very real diversification into other strategic and newly emerging Ohio technology programs.



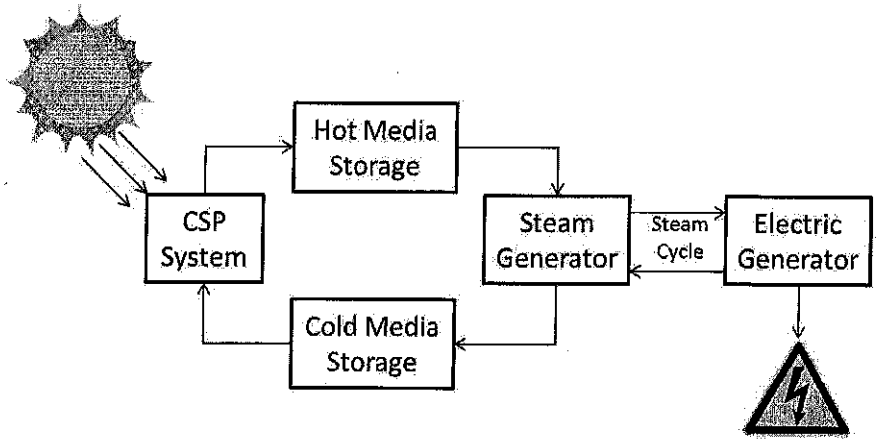




Figure 1. OSU Chemical Looping Process. Figure 2. CSP System with Thermal Energy Storage.

4) Describe how the platform will provide a sustainable pipeline of technologies for commercialization.

The development of this Innovation platform will ensure a highly reactive and strong composite material is developed for the OSU chemical looping technology. The chemical looping processes are highly sensitive to the costs associated with composite material attrition/deactivation. Therefore, the success of this innovation platform is an essential pipeline for the commercialization of the chemical looping technologies. This platform will use the OSU sub-pilot chemical looping units to confirm the commercial viability of the metal oxide material. One possible commercialization pathway is to license OSU's chemical looping technology to boiler companies such as B&W, and form a metal oxide material manufacturing plant in Ohio. The chemical looping boilers and metal oxide materials will be supplied to utility industries such as AEP and FE for efficient Ohio coal conversion to power generation with >95% carbon capture and <35% increment in cost of electricity. This platform technology can also facilitate and increase the flexibility, efficiency, and value of the Ohio shale gas conversions. While most State's shale gas deposits are being developed for power and possible fuels applications, the composite materials synthesized through this platform can help diversifying the shale gas deposits into chemicals and polymers for existing Ohio operations, as well as providing hydrogen that can be used in cracking plants and fuel cells. Both Shell and Chesapeake Energy have shown great interests in applying the metal oxide composite material in a modular design suitable for a gas field with peak production for 4-5 years, which can be commercialized in 3 years after the 250 $kW_{th}$ SCL pilot demonstration. This platform will also develop a low cost and stable energy storage metal oxide composite material to selectively release hydrogen and/or heat to provide an economic means for sustained, uninterrupted, electricity generation from renewable and fossil energy based utility systems as well as high value chemicals and liquid fuels.

13-318

Ohio | Third Frontier
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# Innovation Platform Program

## 2013 Request for Proposals

## Letter of Intent

| | |
|---|---|
| **Lead Applicant Institution** | **The University of Akron** |
| **Lead Applicant Contact Information** | **Name: Matthew L. Becker, PhD** |
| | **Title: Associate Professor of Polymer Science** |
| | **Phone Number: (330) 972-2834** |
| | **Email: becker@uakron.edu** |
| **Project Title:** | Akron Functional Materials Center |

| | | | |
|---|---|---|---|
| **Total Project Budget** | $ 6,000,000 | **Ohio Third Frontier Funds Requested** | $ 3,000,000 |

**Project Focus:**

- ☐ Advanced Materials (related to advanced polymers; ceramics; composites; carbon fibers and nanotubes; and, specialty metals and alloys)
- ☐ Aeropropulsion and Power Management
- ☐ Fuel Cells and Energy Storage
- ☒ Medical Technology (related to imaging; surgical instruments/equipment; implant devices; and, regenerative medicine)
- ☐ Software Applications for Business and Healthcare
- ☐ Sensing and Automation Technologies
- ☐ Situational Awareness and Surveillance Systems
- ☐ Solar Photovoltaics
- ☐ Agribusiness and Food Processing

Please answer the following questions using no more than two additional pages. The Letter of Intent should address each question in order identifying each response. Do not include any trade secret information in this Letter of Intent.

1) Describe the proposed technology platform. Please refer to the Request for Proposals Section 2.1 second paragraph for the definition of a technology platform.
2) Please list all committed industry clients and their anticipated cash cost share contribution.
3) Describe the commercial products that will be developed and enter the market within the 3-year timeframe of the Grant.
4) Describe how the platform will provide a sustainable pipeline of technologies for commercialization.

## 1) Describe the Proposed Technology Platform

The Akron Functional Materials Center (AFMC) is a unique national resource focused on elevating the technology readiness level (TRL) of research discoveries for new polymeric and biopolymeric materials. The AFMC is an industrially-focused, open innovation research consortium that accelerates the materials development and commercialization timeline utilizing combinatorial and high throughput (C&HT) materials strategies. The AFMC contains a suite of "resource" level facilities of established C&HT tools to assist researchers and innovators with dedicated design, fabrication and optimization of polymeric materials, processes and bio-constructs. These instruments and expertise comprise unique knowledge sets and technology infrastructure unlike any other and our capabilities have drawn collaborators and members to the AFMC from around the world.

The *Functional Biomaterials Platform* of the AFMC has generated numerous chemical approaches to generating translationally-relevant polymeric biomaterials for use as nanofiber precursors. These materials have been IP-protected and recently published with significant interest received from outside entities. Our *short-term goal* is to improve the commercial availability of functionalized xenograft tissue for regenerative medicine applications. The overall *objective of this proposal* is to advance the chemical methodology and processing techniques to reinforce and biologically derivatize DCM and tissues with polymers, peptides and proteins designed to elicit specific responses. The development of a functional, tissue specific DCM materials would revolutionize the treatment of soft tissue injuries, wound care.

The *Advanced Formulations Platform* of the AFMC will use combinatorial methods to identify and optimize formulations and performance characteristics for new polymer-based radiopaque (RO) materials. The combinatorial techniques enable vast knowledge acquisition rapidly while using small quantities of materials. Our *short-term goal* is to exploit these techniques to greatly accelerate the materials optimization and commercialization process for improved radiopaque (RO) materials and devices.

## 2) Participating Institutions and Anticipated Cost Share

| Institution | Lead | Committed Cost Share |
|---|---|---|
| The University of Akron | Matthew L Becker, PI | 800,000 |
| The Austen Bioinnovation Institute in Akron | Frank L Douglas | 450,000 |
| PolyOne | Thomas Hughes | 750,000 |
| Viscus Biologics | Thomas Neenan | 600,000 |
| SNS Nanofiber | Laura Frazier | 400,000 |
| | **Total** | 3,000,000 |

## 3) Describe the commercial products that will be developed and enter the market within the 3-year timeframe of the Grant

Our new polymer-based radiopaque (RO) materials will impact Adult and Pediatric markets

1) Catheter formulations for use in medical applications

2) Lead free Radiopaque compounds for minimally invasive surgery

3) Lead free Radiopaque compounds for use in medical equipment such as X-Ray machines and CT scanning machines

Our nanofiber-derivatized decellularized tissue products will combine the advantageous properties of decellularized tissue and polymeric nanofibers to impact 3 distinct markets: Military, Adult Civilian and Pediatric

1) "Universal NanoMat" for on demand functionalization
2) Peptide functionalized degradable burn lasenges
3) Degradable hernia meshes
4) Degradable wound dressing
5) Synthetic skin grafts
6) Advanced hemostatic materials
7) Bandages for non-healing ulcers
8) Antimicrobial bandages and wound dressings

**4) Describe how the platform will provide a sustainable pipeline of technologies for commercialization**

The AFMC was founded in 2010 through a joint initiative between The University of Akron (UA) and the Austen Bioinnovation Institute in Akron (ABIA). Currently, the AFMC has 22 industrial members (8 from within Ohio) across multiple technology and market sectors. The members drive the innovation platforms and our continued value added proposition will continue to aid members in their innovation and commercialization efforts. The materials research community is striving to capture the translational acceleration and cost savings that occurred in the pharmaceutical industry during the 1990's, which was enabled by adoption of combinatorial and high-throughput strategies. The innovation platforms within the AFMC are able to mobilize a number of home-built and rapidly reconfigurable tools to fabricate multi-component substrates possessing a wide variation in material compositions and properties and quickly identify regions and compositions of interest using relevant characterization techniques. The process can be defined iteratively and sequentially to cover wide swaths of materials and compositional space rapidly that, in years past, slowed tremendously the formulation and optimization process. This approach affords rapid knowledge gain and the ability to leverage existing materials and supply chains into new products and wealth.

The team that we have assembled has all the expertise needed to make an impact in this market now. The University of Akron has an established, internationally-recognized expertise in polymers and biomaterials. The Austen BioInnovation Institute in Akron contains the unique regulatory and rapid prototyping skills and structure needed to draw new projects directly from patients and clinicians; and then shepherd them through the entire commercialization process. PolyOne Corporation, SNS Nanofibers and Viscus Biologics have independently demonstrated development and manufacturing capabilities, commitment to Ohio and the ability to market and distribute products both nationally and globally. The AFMC aims to accelerate their efforts.

13-319

Ohio | Third Frontier
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# Innovation Platform Program

## 2013 Request for Proposals

## Letter of Intent

| | |
|---|---|
| **Lead Applicant Institution** | **The University of Toledo** |
| **Lead Applicant Contact Information** | **Names: Sasidhar Varanasi and Sridhar Viamajala** |
| | **Title: Professor and Assistant Professor** |
| | **Phone Number: (419)530-8093** |
| | **Email:sasidhar.varanasi@utoledo.edu; Sridhar.viamajala@utoledo.edu** |
| **Project Title:** | Center for Bio-Refining: Production of Material Precursors and Value-Added Products from Biomass Feed Stocks Relevant to Ohio Economy |

| | | | |
|---|---|---|---|
| **Total Project Budget** | $6,000,000 | **Ohio Third Frontier Funds Requested** | $3,000,000 |

| | | |
|---|---|---|
| **Project Focus:** | ☒ Advanced Materials (related to advanced polymers; ceramics; composites; carbon fibers and nanotubes; and, specialty metals and alloys) | ☐ Software Applications for Business and Healthcare |
| | ☐ Aeropropulsion and Power Management | ☐ Sensing and Automation Technologies |
| | ☐ Fuel Cells and Energy Storage | ☐ Situational Awareness and Surveillance Systems |
| | ☐ Medical Technology (related to imaging; surgical instruments/equipment; implant devices; and, regenerative medicine) | ☐ Solar Photovoltaics |
| | | ☒ Agribusiness and Food Processing |

(1) Proposed technology platform

University of Toledo has developed mutiple patent-protected innovative *bio-refining platform* for conversion of biomass, derived both from agricultural crops and algae, to material precursors and value-added products. Some of the patents resulting from this technology platform are already licensed by for-profit Ohio companies. Through this proposal, The University of Toledo (the Lead Applicant) seeks funds from the state of Ohio to support close collaboration with the industrial partners to advance these *bio-refining platform* based innovations to the point of commercialization.

Under the general umbrella of bio-refining platform, the two main routes widely investigated for producing fuels, material precursors, and value-added products from various biomass sources are: (i) biochemical or (ii) thermochemical methods.

In the former, lignocellulosic/algal biomass is fractionated into their major components (cellulose, hemicellulose and lignin in case of lignocellulose; protein, starch and lipids in case of algae and oil-seeds) and

the subsequent hydrolysis of the carbohydrate polymers (cellulose, hemicellulos and starch) to their constituent sugars. These sugars form the precursors for the production of liquid fuels such as ethanol, butanol or other liquid hydrocarbons and furans (via fermentation and/or other catalytic processes). This approach is widely known as "The Sugar Platform". Residual Lignin (in case of lignocellulose) serves as a valuable aromatic polymeric feedstock for producing a variety of products like Benzene, Toluene, Xylene (BTX) or carbon fibers. Lipids (in case of algae and oil-seeds) can be converted to diesel, and other value–added products, viz., lubricants and surfactants.

In the thermo-chemical approach, the biomass (either lignocellulose or algae) is pyrolyzed to recover bio-oils that can be deoxygenated and/or hydro-treated (through catalytic means) to produce liquid transportation fuels and/or value-added products. Alternatively, the pyrolysis products can be subjected to steam reformation to produce "Syn-Gas". The syn-gas serves as a replacement for natural gas or can be converted to a mixture of liquid alcohols (viz, methanol, ethanol, and butanol) via Fisher-Tropsch (FT) synthesis. The solid residue obtained following thermochemical treatment provides "bio-char" that has a variety of applications.

(2) Committed industry clients

(a) SuGanit Systems Inc.; Mr. Praveen Paripati, President
Research Incubation Center; Suite #201; 2400 Dorr Street
Toledo, OH

(b) Red-Lion Bio-Energy; Mr. Alex Johnson, President
387 West Dussel Drive; Maumee, OH

(c) Recombinant Innovations Inc. Dr. Peter Hug, President
Glendale Avenue; Toledo, OH

(d) Algae Producers of America; Rick Johnson, President
Cleveland, OH

(e) Center for Innovative Food Technologies (CIFT);
Mr. David Beck, Director; AirPort Hwy.; Toledo, OH

We anticipate that these industrial collaborators will contribute at least 50% of the required cost share.

Our industrial collaborators include: a lignocellulose-derived sugar-based process developer (SuGanit Systems inc.), a syn-gas producer (Red-lion Bioenergy) that is interested in converting syn-gas from various biomass sources (rice-hulls, algae etc.) to liquid fuels through FT synthesis, and an algae-based product developer (Algae Producers of America) and companies that are interested in producing fuels and lubricants from vegetable oil and algal oil sources (Recombinant Innovations and CIFT). We anticipate that these companies

(3) Commercial products to be developed

*Material precursors:* Furans; fermentation derived organic acids; benzene, toluene and xylene (BTX) (plastic precursors)

*Value-added products for agribusiness* and food processing: Bio-surfactants, succinic acid, ethanol and biochar,

*Other co-products*: bio-lubricants; fatty alkanol amides and Fatty alcohols

(4) Commercial sustainability of the technology platform:

Sustainability will result from:

a. Multiple products
b. Multiple industry clients, and
c. Expanding markets

13-320

Ohio | Third Frontier
Innovation Creating Opportunity

# Innovation Platform Program

**2013 Request for Proposals**

## Letter of Intent

| | |
|---|---|
| **Lead Applicant Institution** | **Cleveland Clinic** |
| **Lead Applicant Contact Information** | **Name: Douglas Johnston, M.D.** |
| | **Title: Staff, Thoracic and Cardiovascular Surgery** |
| | **Phone Number: 216-444-5613** |
| | **Email: johnstd3@ccf.org** |
| **Project Title:** | **Interactive Visual Health Records Platform** |

| | | | |
|---|---|---|---|
| **Total Project Budget** | $ 6,541,802 | **Ohio Third Frontier Funds Requested** | $ 3,000,000 |

**Project Focus:**

- ☐ Advanced Materials (related to advanced polymers; ceramics; composites; carbon fibers and nanotubes; and, specialty metals and alloys)
- ☐ Aeropropulsion and Power Management
- ☐ Fuel Cells and Energy Storage
- ☐ Medical Technology (related to imaging; surgical instruments/equipment; implant devices; and, regenerative medicine)
- ☒ Software Applications for Business and Healthcare
- ☐ Sensing and Automation Technologies
- ☐ Situational Awareness and Surveillance Systems
- ☐ Solar Photovoltaics
- ☐ Agribusiness and Food Processing

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1) Describe the proposed technology platform. Please refer to the Request for Proposals Section 2.1 second paragraph for the definition of a technology platform.
2) Please list all committed industry clients and their anticipated cash cost share contribution.
3) Describe the commercial products that will be developed and enter the market within the 3-year timeframe of the Grant.
4) Describe how the platform will provide a sustainable pipeline of technologies for commercialization.

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**Exhibit A**
**Letter of Intent – Interactive Visual Health Records Platform**

1) The primary goal of the Interactive Visual Health Records (iVHR) platform is to provide a unique technology framework that will enable clinicians to improve the accuracy in patient acuity, delivering higher quality and efficiency of care and reducing the cost of healthcare.

   The Heart and Vascular Institute of the Cleveland Clinic, the largest and highest acuity cardiac program in the United States, has systematically examined the effect of medical record inefficiency and inaccuracy on patient care, outcomes and economic models. Over the past year, the Cleveland Clinic has developed a platform and technologies to evaluate and correct these inaccuracies and to present more meaningful and actionable data from the Electronic Medical Record (EMR) to providers.

   The Interactive Visual Health Records platform will provide a means to develop the enabling software applications and deployment capabilities for hospitals in the multi-billion dollar healthcare IT market.

2) iVHR, Inc., 10000 Cedar Avenue, MS #28, Cleveland, Ohio 44106
   Anticipated Cash Cost Share Contribution: $2,250,000

   Avantia, Inc., 9655 Sweet Valley Drive, #1, Valley View, Ohio 44125
   Anticipated Cash Cost Share Contribution: $750,000

3) The Interactive Visual Health Records platform will provide a next generation healthcare IT solution for hospitals, providing the following capabilities: (i.) advanced clinical decision support utilizing evidence-based predictive algorithms; (ii.) innovative visual representations of clinical data creation of actionable intelligence; (iii.) integration to existing commercially available EMRs for real-time decision support; and (iv.) performance analytics and consulting services to assist providers in improving patient care, thereby optimizing clinical processes and quantifying improved outcomes.

4) The Cleveland Clinic has a history of leadership in commercializing innovative products; the iVHR platform and its collaborators will provide the capability to extend across the healthcare IT market segments including outside the United States. The modular approach to the platform developed by the Cleveland Clinic's Heart and Vascular Institute allows for early market entrance in cardiac care with short-term targeted expansion in orthopedics and rheumatology specialties. The platform is poised to provide job creation in the Cleveland area by leveraging the pool of potential graduates of local universities and the diversity of IT expertise in Northeastern Ohio.

13-321

Ohio | Third Frontier
Innovation Creating Opportunity

# Innovation Platform Program

## 2013 Request for Proposals

## Letter of Intent

| | |
|---|---|
| **Lead Applicant Institution** | **Cleveland Clinic Foundation** |
| **Lead Applicant Contact Information** | **Name: Surafel Gebreselassie** |
| | **Title: Staff (Nephrology and Hypertension)** |
| | **Phone Number: 216-444-6768** |
| | **Email: GEBRESS@ccf.org** |
| **Project Title:** | Three-dimensional Electron Microscopy as a Diagnostic Test for Chronic Kidney Diseases |

| | | | |
|---|---|---|---|
| **Total Project Budget** | $ 6,000,000 | **Ohio Third Frontier Funds Requested** | $ 3,000,000 |

**Project Focus:**

- ☐ Advanced Materials (related to advanced polymers; ceramics; composites; carbon fibers and nanotubes; and, specialty metals and alloys)
- ☐ Aeropropulsion and Power Management
- ☐ Fuel Cells and Energy Storage
- ☒ Medical Technology (related to imaging; surgical instruments/equipment; implant devices; and, regenerative medicine)
- ☐ Software Applications for Business and Healthcare
- ☐ Sensing and Automation Technologies
- ☐ Situational Awareness and Surveillance Systems
- ☐ Solar Photovoltaics
- ☐ Agribusiness and Food Processing

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3) Describe the commercial products that will be developed and enter the market within the 3-year timeframe of the Grant.
4) Describe how the platform will provide a sustainable pipeline of technologies for commercialization.

**Technology Platform**

Chronic kidney disease (CKD) is a major health problem. In the US alone there are over 26 million adults with CKD. Although diabetes and hypertension are the leading causes of CKD in the US and often get the most attention, glomerulonephritis is increasingly being recognized and is the third most common cause of CKD in the US. Glomerulonephritis comprise of a wide variety of primary or secondary kidney diseases where the whole mark is inflammation of the glomerulous. It varies from a pure podocytopathy ( focal segmental glomerulosclerosis, minimal change disease, etc ) to rapidly progressive glomerulonephrits such as antibody mediated disease (Wegener's granulomatosis, anti-glomerular basement membrane disease) or the more common immune complex mediated disease (lupus nephritis, post infectious glomerulonephritis, membranoproliferative glomerulonephritis, etc) where affected patients can develop uremia within days to weeks without intervention.

Although there are recent advances in identification of biomarkers in glomerular diseases including efforts to have bio-repository and bio-banking of tissue and human blood and urine samples, kidney biopsy remains the gold standard in almost all of these diseases. On average about 150-200 native kidney biopsies are performed in the main campus of the Cleveland Clinic Foundation (CCF) but that number is substantially higher (>600 per year) when transplant (both indication and protocol) and outside biopsies are included. The department of nephrology and hypertension at Glickman Urological and Kidney Institute has a retrospective glomerular disease registry and a discarded frozen renal tissue registry.

The current method of evaluation of renal biopsy specimen using light microscopy, immune-fluorescence and particularly electron microscopy has its own pitfalls. In clinical practice it is often difficult to differentiate between a primary and secondary focal glomerular sclerosis in some patients. Often the degree of podocyte effacement on electron microscopy is employed to help make the distinctions which has treatment implications (steroid or calcineurin inhibitor therapy for primary FSGS versus angiotensine converting enzyme inhibitors (ACEI) or angiotensin receptor blockers (ARB) for secondary FSGS). Nodular glomerular sclerosis is another area where the overlap between the size and distribution of the substructures (amyloid versus fibrillary glomerulonephritis, for example) on electron microscopy could create diagnostic dilemma to mention a few.

Serial block face scanning EM is a new technology that provides large sets of electron microscopy images from tissue samples. Instead of imaging thin sections, as occurs in transmission EM, this system derives TEM-like images by scanning an electron beam across a sample surface and collecting the backscattered electrons. This utilizes a scanning electron microscope, but in place of a conventional SEM stage, samples are mounted in an "in-chamber" ultramicrotome (Gatan 3View system), which uses a diamond knife to remove thin layers from the tissue block after imaging. Automated cycles of imaging and cutting results in large sets of serial images providing both 3D information and/or very large fields of datasets. Images also lack many deficits of TEM serial sectioning, such as missing sections, sample warping due to compression during cutting, and uneven section thicknesses. Image datasets can be analyzed using open source software developed for confocal microscopy (ImageJ, Reconstruct), or more complex commercial 3D software (Imaris, Amira).

Recent application of rapid automated 3D-EM technology for ultrastructural analysis of biological samples in three dimensions has the potential to revolutionize the way we look at renal biopsy specimens. Currently 3D-EM is being utilized and developed for imaging neurons and neuronal networks, reconstructing of their synapses, understanding the biology of mitochondria etc. The Department of Neurosciences at CCF and Renovo Neural Inc have acquired the technology to do 3D-EM on a variety of biological samples. In collaboration with Renovo Neural Inc, we conducted a pilot study to investigate the utility of 3D-EM in selected glomerular diseases using human discarded tissue specimen from our discarded tissue registry. The pilot study generated sufficient preliminary data to demonstrate that 3D-EM offers several advantages and is superior to traditional EM in accurately diagnosing glomerulonephritis. Furthermore, 3D-EM has the potential to add to our understanding of glomerular diseases which could have treatment implications for millions of people worldwide who suffer from acute and chronic kidney disease as a result of glomerulonephritis.

**Committed Industry Clients**

**Renovo Neural Inc:** Renovo is partnering with Cleveland Clinic to develop and commercialize novel applications using the 3D-EM technology described here. In addition, we already established a working relationship with Renovo to conduct the 3D-EM pilot study. Renovo will contribute $1,500,000 over 3 years as a cost share.

**Image IQ:** Image IQ is a Cleveland Clinic spin-off with significant expertise in developing and commercializing software solutions for image analysis. Image IQ will contribute $300,000 over 3 years as a cost share.

**Commercial Products**

We expect to commercialize 3D-EM as a diagnostic test for chronic kidney diseases. This diagnostic test entails biopsy of patient samples which will be shipped to Renovo for 3D-EM processing, imaging and analysis. The data will then be interpreted by a board certified clinical pathologist. Current market reimbursement is $1400 per sample to conduct traditional (2-dimensional) EM. We expect to receive similar if not higher reimbursement for 3D-EM following demonstration of its accuracy and clinical significance over traditional EM.

**Sustainable Pipeline**

In addition to commercializing 3D-EM as a diagnostic test to meet and/or exceed the current requirements, we expect to generate a wealth of new information from these samples that will provide an opportunity to develop new diagnostic endpoints and intellectual property. Furthermore, the new information about pathogenesis of chronic kidney diseases may result in novel pathways for drug development for these diseases. In addition, the image analysis software provides a great opportunity for new intellectual property that can add significant perpetual licensing revenues.

13-322

Ohio | Third Frontier
Innovation Creating Opportunity

# Innovation Platform Program

## 2013 Request for Proposals

## Letter of Intent

| | |
|---|---|
| **Lead Applicant Institution** | **Health Foundation of Greater Cincinnati** |
| **Lead Applicant Contact Information** | **Name: Patricia O'Connor** |
| | **Title: Vice President** |
| | **Phone Number: 513-458-6600** |
| | **Email: oconnorp@healthfoundation.org** |
| **Project Title:** | Commercialization of Health Landscape Information Platform |

| | | | |
|---|---|---|---|
| **Total Project Budget** | $ 6,000,000 | **Ohio Third Frontier Funds Requested** | $ 3,000,000 |

**Project Focus:**

- ☐ Advanced Materials (related to advanced polymers; ceramics; composites; carbon fibers and nanotubes; and, specialty metals and alloys)
- ☐ Aeropropulsion and Power Management
- ☐ Fuel Cells and Energy Storage
- ☐ Medical Technology (related to imaging; surgical instruments/equipment; implant devices; and, regenerative medicine)
- ☒ Software Applications for Business and Healthcare
- ☐ Sensing and Automation Technologies
- ☐ Situational Awareness and Surveillance Systems
- ☐ Solar Photovoltaics
- ☐ Agribusiness and Food Processing

Please answer the following questions using no more than two additional pages. The Letter of Intent should address each question in order identifying each response. Do not include any trade secret information in this Letter of Intent.

1) Describe the proposed technology platform. Please refer to the Request for Proposals Section 2.1 second paragraph for the definition of a technology platform.
2) Please list all committed industry clients and their anticipated cash cost share contribution.
3) Describe the commercial products that will be developed and enter the market within the 3-year timeframe of the Grant.
4) Describe how the platform will provide a sustainable pipeline of technologies for commercialization.

The Health Foundation of Greater Cincinnati and its clients plan to submit a proposal for the commercialization of an existing HealthLandscape platform to address health care industry market needs in the areas of community health needs assessment, community health improvement, payment reform and environmental health and safety. These modules will be commercialized as platform tools used by clients and end users to build derivative works and product offerings that will be distributed to the broader domestic and global markets as product solutions.

### 1. Proposed Technology Platform

HealthLandscape is an existing suite of web-based mapping tools built on a shared core platform. It replaces time-consuming and technically challenging data acquisition and analyses. The HealthLandscape platform has been designed to enable additional customization and configuration by clients and end users. Such customizations become derivative works to be commercialized by the clients. The HealthLandscape platform consists of Common Tools (i.e. those usable in every HealthLandscape deployment) and Custom Tools (i.e. tools configurable by clients and end users). Examples of each are provided below:

"Common Tools" offer quick and easy user mapping and data visualization on standard geographic maps, for example, by zip code, address specific geo codes, and thematic data.

"Custom Tools" include:

- Community Needs Assessment Module, used to widely disseminate community data in an easy-to-use branded application
- Population Distribution Module, used to describe a population of interest by combining maps, multiple distribution and scatter plots
- Location Module, a searchable map showing characteristics of a location
- Service Area Explorer Module, used to create an interactive service map for multiple site locations by combining location data with counts and percent of clients/patients
- Site Explorer Module, used in a dashboard application to quickly summarize data for a location from multiple sources

The HealthLandscape platform contains unique technology capabilities and strengths through the suite of data visualizations tools that have been developed using a combination of industry standard, state-of-the-art Geographic Information System (GIS) applications, web-based file servers, and relational databases.

The Health Foundation of Greater Cincinnati has assembled the technical and commercialization talent, acquired the equipment and provided facilities to support the platform. With key industry partners GE Aviation, Cincinnati Children's Hospital Medical Center, The Christ Hospital and HealthBridge, the research and development activities of the Foundation will be commercialized to address the health industry's needs as defined by the clients and end users. The full proposal will demonstrate the job creation and business opportunities to build Ohio's health information supply chain that will have long term economic impact for Ohio.

### 2. Committed Industry Clients and Anticipated Cash Cost Share Contribution

| Client Company Name | Company Structure | 3 year Commitment |
|---|---|---|
| | | |
| Health Foundation of Greater Cincinnati | Non-profit | $1,500,000 |
| HealthBridge | Non-profit | $1,440,000 |
| GE Aviation (Gensuite) | For-profit | Under discussion |
| Cincinnati Children's Hospital MC Subsidiary | For-profit | Under discussion |
| The Christ Hospital Subsidiary | For-profit | Under discussion |
| American Academy of Family Physicians (AAFP) | Non-profit | Under discussion |
| BKD | For-profit | Under discussion |
| North Carolina Community Care Network | Non-profit | Under discussion |
| Kentucky Primary Care Association | Non-profit | Under discussion |
| Australia National University | For-profit | Under discussion |
| United Way of Greater Cincinnati | Non-profit | Under discussion |
| United Way of Kentucky | Non-profit | Under discussion |
| **Total Anticipated Cost Share** | | **$3,000,000-$4,000,000** |

## 3. Description of Commercial Products to be Developed and to Market within the Grant Period

**Community Health Needs Assessment (CHNA)**
This product will provide the information needed by 2,918 non-government and non-profit US hospitals to comply with a requirement of the 2010 Affordable Care Act. The CHNA is the ongoing process for a hospital to evaluate the health needs of a community, which facilitates a prioritization of strategies and interventions to address the needs. Data assessments performed will include health profile and data analysis of the county's population compiled with secondary data by zip code. The objective is to obtain a distribution of age, sex, household income, payer mix, etc., all of which help to create an understanding of the social and economic condition of the community.

**Community Health Improvement**
A community health improvement process uses community data to identify priority issues, develop and implement strategies for action, and monitor community progress toward improvement. A community health improvement process looks outside of the performance of an individual organization serving a specific segment of a community toward collective impact in improving community health. Collaboration with various health information organizations locally and statewide will drive the development of this product.

**Environmental Health and Safety (EHS)**
This product will collect, monitor and analyze information about the employee work and living environments for multiple facility sites owned and operated by a corporation. This may include ergonomics, obesity, diabetes, environmental or infectious exposures and other health issues that increase the company's health care costs and may place the company's employees at risk. In addition to evaluating sites, intervention strategies and tactics will be identified. GE Aviation will be the commercialization client for this product.

**Payment Reform**
Health Information Exchanges (HIE) have been set up across the US to transmit and manage data related to electronic health records. HIE extensive databases include claims, clinical information and patient outcomes. This creates the ability to analyze costs and quality outcomes at levels never before possible and monitor outcomes in real-time thereafter. Our HealthLandscape payment reform product will support payers and providers to design effective payment reform. This is feasible because the Cincinnati HIE can use its data about claims, clinical databases and quality improvement information to analyze costs and quality outcomes, meet federal meaningful use, payment reform and accountable care requirements. These tools are necessary to address the health care cost crisis and other communities are interested in leveraging our products on a fee for service basis. HealthBridge will be the commercialization client for this product.

## 4. How the Platform Will Provide a Sustainable Pipeline of Products for Commercialization

Since 2004, The Health Foundation of Greater Cincinnati has conducted groundbreaking research and development for 19 core modules that now comprise the HealthLandscape platform and are ready to be commercialized. The unique technology described above and the strategic relationships developed with industry, health providers, health provider member associations, global organizations, local, state and federal policy makers will enable Health Landscape to commercialize the platform and create addition modules.

The HealthLandscape platform is highly configurable via modest customization of existing modules. Distribution of specific commercial applications requires no further product research or development. As part of the proposed program, the focus of our proposal will be to increase growth through strategically chosen commercialization clients, most of whom will become our re-distribution channels into the marketplace, and by selected internal growth. We expect to sustain HealthLandscape through on-going licensing of web services and sales of further customization services.

13-323

Ohio | Third Frontier
Innovation Creating Opportunity

# Innovation Platform Program

## 2013 Request for Proposals

## Letter of Intent

| | |
|---|---|
| **Lead Applicant Institution** | **National Composite Center** |
| **Lead Applicant Contact Information** | **Name: Lisa A. Novelli** |
| | **Title: President & CEO** |
| | **Phone Number: 937-297-9447** |
| | **Email: lnovelli@compositecenter.org** |
| **Project Title:** | High Temperature Processing of Multifunctional Continuous Fibers |

| | | | |
|---|---|---|---|
| **Total Project Budget** | $ 6,000,000 | **Ohio Third Frontier Funds Requested** | $ 3,000,000 |

**Project Focus:**

- ☒ Advanced Materials (related to advanced polymers; ceramics; composites; carbon fibers and nanotubes; and, specialty metals and alloys)
- ☐ Aeropropulsion and Power Management
- ☐ Fuel Cells and Energy Storage
- ☐ Medical Technology (related to imaging; surgical instruments/equipment; implant devices; and, regenerative medicine)
- ☐ Software Applications for Business and Healthcare
- ☐ Sensing and Automation Technologies
- ☐ Situational Awareness and Surveillance Systems
- ☐ Solar Photovoltaics
- ☐ Agribusiness and Food Processing

Please answer the following questions using no more than two additional pages. The Letter of Intent should address each question in order identifying each response. Do not include any trade secret information in this Letter of Intent.

1) Describe the proposed technology platform. Please refer to the Request for Proposals Section 2.1 second paragraph for the definition of a technology platform.
2) Please list all committed industry clients and their anticipated cash cost share contribution.
3) Describe the commercial products that will be developed and enter the market within the 3-year timeframe of the Grant.
4) Describe how the platform will provide a sustainable pipeline of technologies for commercialization.

National Composites Center
2000 Composite Drive
Kettering, Ohio, USA
45420

21 December 2012

Ohio Development Services Agency
Office of Technology Investments, Attention: IPP
77 South High Street, 25th Floor
Columbus, OH 43215

*Via email to: IPP@development.ohio.gov*

**Subject: 2013 Innovation Platform Program Letter of Intent**

To Whom It May Concern:

Please accept this official notification from the National Composites Center (NCC) for our intent to submit a proposal in response to the above referenced program.

Lead Applicant: National Composites Center (NCC)
2000 Composite Drive, Kettering, Ohio 45420
Phone: 937-297-9447
Contact: Lisa Novelli
Email: Lnovelli@compositecenter.org

The focus of this project is related to Advanced Materials. The project title is: **"High Temperature Processing of Multifunctional Continuous Fibers".** The proposed technology platform encompasses common high temperature materials that can be utilized in a continuous fiber process in composite systems and structures for multiple industry applications.

The innovative platform providing a sustainable pipeline of technologies for commercialization involves the development of continuous fibers on a pilot scale to determine performance characteristics for specific end-use applications. The commercial products anticipated for development as an outcome of this project comprise a wide variety of industries and may include lighting, rebar, armor, ballistics, and workholding.

The committed industry clients for this project include GrafTech International, United Materials, and Adisco, Inc. End user support will be provided by ATK and other potential interested parties. $3 million in state funds is requested with a 1:1 cash match of $3 million provided by the industry clients as cost share contribution.

Ohio Development Services Agency
Office of Technology Investments, Attention: IPP
21 December 2012

We appreciate the opportunity to participate in this program. If you have any questions or require additional information, please feel free to contact me at +1.937.297.9447 or via email at lnovelli@compositecenter.org.

Sincere Regards,

Lisa Novelli
President and CEO

Attachment: Innovation Platform Program LOI Form

13-324

Ohio | Third Frontier
Innovation Creating Opportunity

# Innovation Platform Program

## 2013 Request for Proposals

## Letter of Intent

| | |
|---|---|
| Lead Applicant Institution | Cleveland Clinic Foundation |
| Lead Applicant Contact Information | Name: Marcie Reilly |
| | Title: Commercialization Officer |
| | Phone Number: 216-445-9039 |
| | Email: reillym2@ccf.org |
| Project Title: | Concussion Management and Prevention Program |

| | | | |
|---|---|---|---|
| Total Project Budget | $ 6 Million | Ohio Third Frontier Funds Requested | $ 3 Million |

**Project Focus:**

- ☐ Advanced Materials (related to advanced polymers; ceramics; composites; carbon fibers and nanotubes; and, specialty metals and alloys)
- ☐ Aeropropulsion and Power Management
- ☐ Fuel Cells and Energy Storage
- ☒ Medical Technology (related to imaging; surgical instruments/equipment; implant devices; and, regenerative medicine)
- ☒ Software Applications for Business and Healthcare
- ☒ Sensing and Automation Technologies
- ☐ Situational Awareness and Surveillance Systems
- ☐ Solar Photovoltaics
- ☐ Agribusiness and Food Processing

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1) Describe the proposed technology platform. Please refer to the Request for Proposals Section 2.1 second paragraph for the definition of a technology platform.
2) Please list all committed industry clients and their anticipated cash cost share contribution.
3) Describe the commercial products that will be developed and enter the market within the 3-year timeframe of the Grant.
4) Describe how the platform will provide a sustainable pipeline of technologies for commercialization.

1) Describe the proposed technology platform. Please refer to the Request for Proposals Section 2.1 second paragraph for the definition of a technology platform.

The Concussion Management and Prevention Program combines multiple Cleveland Clinic product development and research activities into a comprehensive Platform for the detection, management and prevention of concussions and mild traumatic brain injuries (mTBI). The resulting technologies specifically address the existing gaps in concussion care and prevention, including building a database of quantitative impact data and corresponding injury that can be leveraged for the ongoing development of improved safety equipment to prevent future concussions/mTBI. The following Cleveland Clinic technologies are included in the Cleveland Clinic Concussion Management and Prevention Program:

- Concussion Management: Cleveland Clinic has developed tools to measure head impacts and assess cognitive function, including:
    - The Intelligent Mouthguard measures in-game impact dynamics in contact sports such as football, soccer, and boxing. Data from the mouthguard is used to measure head orientation, position, velocity and acceleration of impact. The data is used to identify athletes who have experienced potential injury from head accelerations, so those athletes can be evaluated further.
    - The Cleveland Clinic Concussion (C3) Assessment and Management System is used to quantify the multiple symptoms of concussions and mild traumatic brain injury (mTBI) on a single platform. The benefit of the technology is that it quantitatively assesses the combination of cognitive and motor functions, postural stability, and dynamic visual acuity.
- Concussion Prevention: Cleveland Clinic has developed new helmet designs that promise to reduce concussion rates, and state-of-the-art capabilities to test helmet performance.

2) Please list all committed industry clients and their anticipated cash cost share contribution.

Sportsguard Laboratories, Inc. – located in Kent, OH, specializes in custom mouthguards for athletes. Sportsguard will contribute cash cost share to support the development and commercial launch of the Intelligent Mouthguard product, including precise design to incorporate the sensors into the mouthguard chassis.

iComet Technologies, Inc. – located in Cleveland, OH, is focused on bringing the C3 product to market initially for sports applications, but subsequently for other clinical conditions. iComet will contribute cost share in the form of product testing to create a database of concussion recovery rates and establish the distribution network to roll-out C3 nationwide.

We estimate a combined cash cost share of $2.5 Million from our industry partners.

3) Describe the commercial products that will be developed and enter the market within the 3-year timeframe of the Grant.

- Concussion management –
    - Intelligent Mouthguard for high school, and college athletes
    - C3 concussion assessment app for high school, and college athletes

- C3 cognitive function assessment app for Parkinson's patients.

- Concussion protection –
  - Concussion protection helmets for football and military applications

4) Describe how the platform will provide a sustainable pipeline of technologies for commercialization

After the first wave of concussion assessment and management products achieves initial product sales in the fall of 2013 and wide spread Market Entry in the fall of 2014, the Concussion Management and Prevention Program will continue to deliver benefits to Ohio commercial Clients. Cleveland Clinic will be in a unique position to create a database correlating measured impacts with post injury cognitive function and recovery rates. This database will be the foundation for development of future concussion management and prevention products, such as even better performing helmets for football and military applications, and more accurate concussion management tools. Also, we will look to extend our product line to youth sports, which will require adjusting parameters from our high school and college products. Considering that there are more than 43 million youth, high school, and college athletes in the USA, and it estimated that as many as 3.8 million sports-related concussions occur each year, this is a very substantial market for our Lead Applicant and Clients to pursue.

13-325

Ohio | Third Frontier
Innovation Creating Opportunity

# Innovation Platform Program

## 2013 Request for Proposals

## Letter of Intent

| | |
|---|---|
| **Lead Applicant Institution** | **Wright State Applied Research Corporation** |
| **Lead Applicant Contact Information** | **Name: Jason Parker** |
| | **Title: Medical Physicist** |
| | **Phone Number: (937) 705-1016** |
| | **Email: jason.parker@wright.edu** |
| **Project Title:** | The Advanced Neuroplastic Imaging Center |

| | | | |
|---|---|---|---|
| **Total Project Budget** | $ 6,000,000 | **Ohio Third Frontier Funds Requested** | $ 3,000,000 |

**Project Focus:**

- ☐ Advanced Materials (related to advanced polymers; ceramics; composites; carbon fibers and nanotubes; and, specialty metals and alloys)
- ☐ Aeropropulsion and Power Management
- ☐ Fuel Cells and Energy Storage
- ☒ Medical Technology (related to imaging; surgical instruments/equipment; implant devices; and, regenerative medicine)
- ☐ Software Applications for Business and Healthcare
- ☐ Sensing and Automation Technologies
- ☐ Situational Awareness and Surveillance Systems
- ☐ Solar Photovoltaics
- ☐ Agribusiness and Food Processing

Please answer the following questions using no more than two additional pages. The Letter of Intent should address each question in order identifying each response. Do not include any trade secret information in this Letter of Intent.

1) Describe the proposed technology platform. Please refer to the Request for Proposals Section 2.1 second paragraph for the definition of a technology platform.
2) Please list all committed industry clients and their anticipated cash cost share contribution.
3) Describe the commercial products that will be developed and enter the market within the 3-year timeframe of the Grant.
4) Describe how the platform will provide a sustainable pipeline of technologies for commercialization.

# Wright State Applied Research Corporation
# Innovation Platform Program 2013 - Letter of Intent

1. Describe the proposed technology platform

Acquired brain injury (ABI) affects over 2.6 million people in the United States each year, and has an annual financial impact of over $130 billion on the US economy. In Ohio alone, there are over 50,000 ABI's each year, creating significant social and economic challenges for patients, families, healthcare providers, and the state as whole. Traditionally, the adult human brain has been considered a physiologically static organ, with development peaking during early childhood and stopping around the age of twenty-two. However, recent research has demonstrated that the human brain actively changes throughout life, influenced by evolving behaviors and environment, as well as in response to injury. When changing in response to injury, the brain has been shown to be capable of developing new neural pathways for processing, or shifting functions previously controlled by damaged tissue to undamaged or healthy regions. This remapping of brain function is referred to as neuroplasticity, and since its discovery has led to a paradigm shift in how we view recovery from ABI. The purpose of this proposal is to create an Advanced Neuroplastic Imaging Center (ANIC) in the new Neuroscience and Engineering Collaboration Building at WSU that will be a world-class, commercializable research program that leverages innovation platforms in cellular neuroscience and functional neuroimaging at WSU, to develop and translate new neuroplasticity therapies that accelerate the recovery from ABI (**Figure 1**). At the core of the facility will be a 3-Tesla GE MR scanner (model 750W) capable of supporting clinical studies of our products. We will leverage a strategic partnership with the Dayton-based **Clinical Trials Research Alliance** to conduct randomized controlled trials needed for FDA approvals. The clinical products will initially be translated into service offerings through our clinical partners **Premier Health Partners**, followed by worldwide commercialization through our for-profit partners **Advratech** and **daytaOhio**. This linkage of existing innovation platforms at an Ohio university with industry needs will lead to job creation and business opportunities and will have beneficial long-term economic impacts on the State of Ohio.

2. Please list all committed industry clients and their anticipated cash cost share contribution

A. Premier Health Partners - $500,000
B. Wright State University - $2,500,000
C. Advratech LLC
D. daytaOhio Holdings, Inc
E. Clinical Trials Research Alliance

3. Describe the commercial products that will be developed and enter the market within the 3-year timeframe of the Grant

Wright State University (WSU) is a leader in the development of new treatments for ABI based on neuroplasticity, with core areas of emphasis in task-induced, stimulation-induced, and drug-induced therapies. For example, a collaboration between the Wright State Research Institute and the U.S. Air Force Research Laboratory has developed a new MRI-compatible software system that enables patients to see the activity of specific areas of the brain on a monitor above their head during their MRI scan. While undergoing treatments, the patients engage in exercises that teach them how to stimulate and control the brain regions that have been damaged or injured. As a subset of the task-induced neuroplasticity methods, this new system stimulates the regrowth of damaged brain regions, and holds the promise of enabling patients to restore functions lost due to ABI. In another collaboration with the Air Force, Wright State has developed a new neuroplasticity therapy that uses pulsed magnetic fields applied non-invasively above the scalp, to directly induce brain activity in areas damaged by an ABI. By directly targeting groups of neurons damaged by ABI, this technique can stimulate the growth of new communication pathways that can *non-invasively* help restore lost functions. A final area of innovation at Wright State in the treatment of ABI has been the development of a new drug therapy utilizing two FDA-approved drugs (simvastatin, fluoxetine) that have been shown to increase neuroplasticity and the

growth of new blood vessels in the brain following ABI. The University holds a patent on this new therapy and is actively working to optimize dosing protocols using the drug combination.

4. Describe how the platform will provide a sustainable pipeline of technologies for commercialization

The ANIC will have six (6) planned product offerings and revenue-generating service lines that will ensure the long-term usage of our Innovation Platforms at the Neuroscience Institute and the Neuroscience and Medical Imaging Program, as well as the ANIC facilities that arise from this proposal (**Figure 7**). Each of our product lines and service lines will leverage existing equipment and talent at the ANIC to generate revenue that can maintain operations as well as contribute to the growth of the innovation platforms. The ANIC will be managed by the **ANIC Technical Director**, Jason Parker, who has nearly five (5) years of experience managing busy clinical and research MRI Service Lines. Due to the advanced nature of these product offerings, job growth is expected to be primarily in high-skilled, high-paying technology jobs, along with graduate student assistantships in science technology, engineering, and math (STEM), and internships for high-school and undergraduate students in the Dayton region. An overview of the six product and service lines offered at the ANIC are listed below. Revenue projections for each product and service line are given in Section VII.I.

- **Vendor Services and Clinical Trials** – We have previously leveraged our talent in advanced imaging to attract multi-million dollar NIH and DOD research grants and contracts by partnering with other researchers (see Section X. Experience and Qualifications), and this service offering is expected to be our initial revenue-generating mechanism, with expected revenue streams beginning in Year 2.

- **Product Sales** – Initial sales are expected to come from neurofeedback and TMS communication, visualization, and treatment planning software, are expected to begin in Year 4.

- **Venture Capital** – Gaining additional investment from venture and angel investors for continued product development and commercialization is planned for Year 4.

- **R&D Grants and Contracts** – The university and its collaborators are expected to access significant revenue through research grants and contracts that leverage the advanced imaging capabilities of the ANIC, and this expectation is justified by our past performance (Sections IX and X).

- **Software Licensing** – The software developed for real-time communication between MRI and fNIRS equipment, and the neurofeedback visualization environment will use proprietary algorithms developed at the ANIC in partnership with GE. We will seek to commercialize these capabilities through licensing arrangements starting in Year 3 of the Project Period.

- **Decision-support Imaging Database Access** – All subjects imaged at the ANIC will be asked to sign a consent form (IRB-approved) requested their data be de-identified and stored in the ANIC Imaging Repository. The AIR will grant access to this data to researchers and industry clients through subscription-based services. The eventual goal of the AIR will be to facilitate real-time clinical decision-making support by allowing clinical patient images to be compared to diagnostic data and images in the database.

13-326

Ohio | Third Frontier
Innovation Creating Opportunity

# Innovation Platform Program

## 2013 Request for Proposals

## Letter of Intent

| | | | |
|---|---|---|---|
| **Lead Applicant Institution** | The University of Toledo - Interprofessional Immersive Simulation Center | | |
| **Lead Applicant Contact Information** | **Name:** Brandon Cohen,JD | | |
| | **Title:** Director | | |
| | **Phone Number:** 419-530-6173 | | |
| | **Email:** brandon.cohen@utoledo.edu | | |
| **Project Title:** | Interprofessional Immersive Simulation Center | | |
| **Total Project Budget** | $ 6,000,000 | **Ohio Third Frontier Funds Requested** | $ 3,000,000 |
| **Project Focus:** | ☐ Advanced Materials (related to advanced polymers; ceramics; composites; carbon fibers and nanotubes; and, specialty metals and alloys) | ☒ Software Applications for Business and Healthcare | |
| | ☐ Aeropropulsion and Power Management | ☐ Sensing and Automation Technologies | |
| | ☐ Fuel Cells and Energy Storage | ☐ Situational Awareness and Surveillance Systems | |
| | ☒ Medical Technology (related to imaging; surgical instruments/equipment; implant devices; and, regenerative medicine) | ☐ Solar Photovoltaics | |
| | | ☐ Agribusiness and Food Processing | |

Please answer the following questions using no more than two additional pages. The Letter of Intent should address each question in order identifying each response. Do not include any trade secret information in this Letter of Intent. Please see attached pages

1) Describe the proposed technology platform. Please refer to the Request for Proposals Section 2.1 second paragraph for the definition of a technology platform.
2) Please list all committed industry clients and their anticipated cash cost share contribution.
3) Describe the commercial products that will be developed and enter the market within the 3-year timeframe of the Grant.
4) Describe how the platform will provide a sustainable pipeline of technologies for commercialization.

**1) Describe the proposed technology platform. Please refer to the Request for Proposals Section 2.1 second paragraph for the definition of a technology platform.**

The University of Toledo has created the Interprofessional Immersive Simulation Center (IISC), a $36 MM institutional investment, to create a transformative learning environment that positions UT and the Toledo community as national and global leaders in the education of health care professionals and the advancement of clinical practice. The IISC team, a multidisciplinary group of health professionals, has partnered with software developers, creating content modules for teaching health professionals with a specific goal of reducing critical medical errors thereby getting better patient outcomes and driving costs out of the healthcare system. IISC will be the only facility, worldwide, that engages in health care training using advanced simulation, live tissue and virtual reality in the same facility. And these training modalities are all driven by unique, varying and rapidly changing software platforms, with a specific emphasis on 3D delivery.

IISC is currently in prototype with over $1.5MM spent to build out an interim facility in the Collier Building on UT's Medical Campus. The technology team from UT's Center for Creative Instruction is actively engaged in the development process, and its track record of success can be seen through its McGraw-Hill Partnership with "Anatomy Revealed", a high grossing, multi-media learning platform that teaches students dissection using software on regular computers. Although not publicly available, this one software platform has generated millions of dollars in royalty revenue for the University of Toledo in its first 5 years of launch.

**2) Please list all committed industry clients and their anticipated cash cost share contribution.**

The following for profit enterprises have agreed in principle to provide the following cash matches for the program. We anticipate that others will be added and the dollar amounts will vary by the time the final proposal is submitted:

| | |
|---|---|
| Rocket Education | $500,000 |
| Homeward Health | $300,000 |
| IRISense | $500,000 |
| Eon Reality | $150,000 |
| Expandshare | $ 50,000 |

**3) Describe the commercial products that will be developed and enter the market within the 3-year timeframe of the Grant.**

**A. Design of new simulation training models:**

i. IISC has over 100 simulation programs that have been designed. Many of these simulations have not been developed past the conceptualization stage and need to be put into a simulation package (software). As an example, methods currently exist to train physicians on the procedure of performing a circumcision. IISC has designed a training model that would allow the clinician to receive procedure training in a non-clinical and safe environment, including live tissue training (cadaver), after practicing on computerized mannequins, modeled prosthetics and in virtual reality. The additional training and software assessment would guarantee degree of learning and verify practitioner ability prior to working on a patient. This could also include modifying/enhancing the current technical components of the human patient simulators already on the market to train new procedures such as central line placement as well as many other procedures.

ii. Many of these technologies could be commercialized, deployed and generating significant revenue within 1 year.

**B. 3D Simulation Curriculum Module Development**

i. A 3D web and simulation-based curriculum that will allow the learners to gain hands-on training with real clinical situations in the simulated environment. This would involve re-design of curriculum for multiple disciplines (Medical Students, Residents, Nursing Students, Physician Assistant Students, Nurse Practitioner Students, etc.) which can become the standard for teaching these disciplines throughout all Universities and Colleges.

ii. The curriculum could be deployed within 18 months.

**C. Health Care Safety & Efficiency Training Development:**

i. The IISC will be developing software for assessing the inefficiencies of current health care facility protocols/procedures and design hands-on simulation training programs that would focus on the safety and efficiency of health care delivery. The training program would use best practice standards to reinforce the individual and/or team skill level in communication, hand-over of care, and procedural competency. This training program would be used for initial training and then ongoing reassessment of competency levels.

ii. This system could be deployed within 1 year.

**D. New Medical/Surgical Products or Instruments**

i. The creation of a simulated environment to assist in the design, testing, and focus group evaluations of the product new medical and surgical products and instruments. Part of the simulated environment created would allow for assistance in the development of a staff education/training module once the product is approved and goes to market.

ii. This technology could be deployed within 1 year.

E. New Multi-Media Learning Platforms, driven by Health Care and STEM Education

i. Rocket Education (RockEd) will be significantly involved in creating some initial commercial products within the IISC platform. RockEd will be a leader for developing and distributing visual educational content modules to schools and edutainment venues. The company will produce (develop) and acquire content that can be used for educational purposes in hospitals, schools, museums, science centers, zoos, etc. The company will develop visual learning modules which feature 5 points of learning per module, along with fun facts, a glossary, and a visual of the subject material (i.e. the heart, spine, a dinosaur). The modules can be formatted to be accessible on various types of software (different learning management systems (LMS)) and various types of hardware, such as regular or 3-D projectors.

**4) Describe how the platform will provide a sustainable pipeline of technologies for Commercialization.**

RockEd, as well as the other named commercial partners and unnamed third parties, will create commercial products within the IISC platform. RockEd will be a leader for developing and distributing visual educational content modules to schools and edutainment venues that provide for learner assessment and immediate feedback to the educator. The company will produce (develop) and acquire content that can be used for educational purposes in hospitals, schools, museums, science centers, zoos, etc. The company will develop visual learning modules which feature various points of learning per module, along with fun facts, a glossary, and a visual of the subject material (i.e. the heart, the spine, a dinosaur). The modules can be formatted to be accessible on various types of software (different learning management systems (LMS)) and various types of hardware, such as regular or 3-D projectors. Most of the software learning modules created will be pulled out of IISC and commercialized, utilizing private funding rather than institution funding.

13-327

CASE WESTERN RESERVE UNIVERSITY
COLLEGE OF ARTS AND SCIENCES

Michael A. Martens
Associate Professor
Department of Physics
Rockefeller Building
Case Western Reserve University
10900 Euclid Avenue
Cleveland, Ohio 44106-7079
Michael.Martens@case.edu
216-368-4123

Ohio | Third Frontier
Innovation Creating Opportunity

# Innovation Platform Program

## 2013 Request for Proposals

## Letter of Intent

| | |
|---|---|
| **Lead Applicant Institution** | **Case Western Reserve University (CWRU)** |
| **Lead Applicant Contact Information** | **Name: Michael A. Martens** |
| | **Title: Associate Professor, Department of Physics** |
| | **Phone Number: 216-368-4123** |
| | **Email: Michael.Martens@case.edu** |
| **Project Title:** | **Ohio Platform for Tomorrow's Industrial Medical Imaging Systems and Equipment (OPTIMISE)** |

| | | | |
|---|---|---|---|
| **Total Project Budget** | **$ 6.0M** | **Ohio Third Frontier Funds Requested** | **$3.0M** |

**Project Focus:**

- ☐ Advanced Materials (related to advanced polymers; ceramics; composites; carbon fibers and nanotubes; and, specialty metals and alloys)
- ☐ Aeropropulsion and Power Management
- ☐ Fuel Cells and Energy Storage
- ✓ Medical Technology (related to imaging; surgical instruments/equipment; implant devices; and, regenerative medicine)
- ☐ Software Applications for Business and Healthcare
- ☐ Sensing and Automation Technologies
- ☐ Situational Awareness and Surveillance Systems
- ☐ Solar Photovoltaics
- ☐ Agribusiness and Food Processing

**Proposed Technology Platform:**
The OTF Innovation Platform Ohio Platform for Tomorrow's Industrial Medical Imaging Systems and Equipment (OPTIMISE) resides in the area of **Medical Technology related to imaging and with connections to surgical instruments/equipment, implant devices, and regenerative medicine**. OPTIMISE is proposed by the medical imaging group in the Physics Department of CWRU. OPTIMISE arose out of a 30-year history of success in developing exceptional research strength and an established Innovation Platform in the design, optimization, and prototyping of imaging hardware for Ohio's medical imaging industry sector. The established Platform has outstanding access to equipment and facilities, unique hardware modeling capability, computational talent in the areas of electromagnetic, thermal, and structural optimization software, and in analysis techniques for the design of products with direct application to medical imaging and therapy industries. OPTIMISE has a remarkable long-standing engagement – perhaps unmatched even on an international scale – with a large number of industrial partners, and a distinguished record in creating intellectual property and in research commercialization of innovative products.

The background of our group effort in innovation and commercialization - **the design and development of pioneering hardware for medical imaging systems** – lies in the many years of successful research and industrial collaboration referenced above. We began by creating and prototyping the first actively shielded MRI coil sets for Cleveland MRI industry in the 1980's. We went on to significant designing, prototyping, patenting, publishing, and graduating of PhD's who have joined the Ohio workforce, most frequently at the dozen or so imaging companies with which we have collaborated over the years. In parallel development, the establishment of a CWRU physics graduate program in entrepreneurship more than ten years ago has benefited OPTIMISE in establishing new industry and growing the business workforce. In the past year, OPTIMISE has been in various stages of *individual* proposing, planning and collaboration with the following imaging clients (in alphabetical order): AllTech, GE, Hyper Tech, Philips, Quality Electrodynamics (QED), Toshiba Medical Research Institute USA, Inc., and ViewRay. There have been contacts with additional clients, such as Thermo Fisher, for synergistic applications of the optimized modeling tools. This large number of business connections promises that an OTF investment enabling OPTIMISE to reach a critical mass will lead to a sustainable commercialization pipeline.

**Committed Industry Clients and anticipated cost share contribution:**

*Primary partners for IPP proposal:* Hyper Tech Research (Columbus, OH), Quality Electrodynamics (Mayfield Village OH) – this may be expanded to more partners.

*Potential Ohio Industrial Collaborators in alphabetical order:* AllTech Medical Systems America (Solon OH), GE HealthCare (Aurora OH), Philips Medical Systems (Highland Heights OH), Toshiba Medical Research Institute USA (Mayfield Village OH), and ViewRay Inc. (Oakwood Village OH).

The primary partners are committed to provide cost-share equal to or greater than the request of $3M (tentatively, equal to or greater than $1.5M provided by each client). Additional clients have indicated a strong interest in primary partnership as well, with the exciting possibility, as noted, of expanding the number of primary partners and the commercial products to be developed. The cost-share allocations may be reapportioned accordingly.

**Commercial Products that will be developed include the following:**

**MRI Main Magnets** As a setting for the first commercial product, MRI has become an indispensable imaging commodity due to its superior soft tissue contrast and the absence of ionizing radiation. It is estimated that more than half a million MRI scans are performed everyday all around the world. With an increasing demand in new application areas and new machine designs for extremity imaging, the MRI industry market is expected to reach $7.4 billion by 2015.

Almost all of the MRI magnets over the field strength of 0.35T are made of superconducting wires that rely on liquid helium baths to achieve and maintain the necessary low temperatures. Traditional 1.5T and 3T full-body systems require 2000 to 3000 liters to fill the reservoir and cool the magnet down. With a threefold increase in

helium price over the last 10 years and nearly a 7% annual increase in the MRI market, a drive towards helium-free MRI magnet design is at the forefront of the hardware research. The superior critical current density characteristic of magnesium diboride ($MgB_2$) in the 10-15K temperature range has made it a good candidate for conduction cooled magnet design. Since the superconducting properties of $MgB_2$ were discovered in 2001, Hyper Tech has been on the forefront of inventing practical manufacturing methods of making wire from this powdery material. Over a two-year span of research, and in response to the above market forces, OPTIMISE, along with its industrial partner Hyper Tech Research, has taken the initiative to simulate and optimize the designs of $MgB_2$-based superconducting magnets for low to high field (0.35T-3T) MRI systems. In one embodiment, Hyper Tech is partnering with CWRU OPTIMISE to focus on **modeling, designing, building and testing a complete $MgB_2$ split magnet system** that will address the challenge of cost effective helium free, conduction cooled, dry magnet design and tackle the ever increasing interventional and image guided multimodal MRI market.

**Breast Imaging Coils** The NIH National Institute of Cancer predicts that 226,870 new cases of female breast cancer diagnosis and 39,510 of breast cancer related deaths will have occurred in the US this year (2012). The role and clinical acceptance of breast magnetic resonance imaging (MRI) has grown rapidly in the past decade, particularly as a cancer screening tool and as a means to evaluate the extent of disease in newly diagnosed breast cancer. MRI has been utilized for the detection and diagnosis of breast cancer, even in its earliest stages. Although MRI demonstrates a high sensitivity for cancer detection, no imaging modality exists that has 100% specificity for a cancer diagnosis. Therefore, a biopsy is required when a suspect lesion is detected. In some cases, a so called "second look", based upon the MRI results, will permit biopsy targeting by sonography. However, MRI guided biopsy is currently the only viable method for MRI-detected lesions that lack a definitive sonographic correlate. Thus, beginning January 2012, the American College of Radiology (ACR) requires MRI centers to provide MR Guided Biopsies in order to receive accreditation for breast scanning. (Without accreditation these centers cannot receive CMS reimbursement for breast scans.) With this new requirement the hospital facilities in USA would have to upgrade their existing breast coil system to meet the ACR guideline. Quality Electrodynamics (QED), a leading RF coil manufacturer and an OPTIMISE partner, will work together with OPTIMISE to design and commercialize comprehensive **state-of-the art, multi-channel MR breast imaging and biopsy (BIB) systems** that provides enhanced biopsy access for both grid-and-post and pillar stereotactic needle guidance. These BIB systems will be compatible with MR OEM platforms at 1.5 and 3T, and will support a retail pricing structure of less than 50% of the current commercial solutions.

**Sustainable Pipeline of Technologies for Commercialization:**

The purpose of the OPTIMISE Proposal is to take its established capability, robust industrial network, and past success of the CWRU medical imaging physics group and stimulate a new level of late-stage development and innovation needs of Ohio companies. The new level would be to turn OPTIMISE from individual, smaller scale efforts over longer time periods into a **large scale of multiple commercial partnerships with accelerated time schedules**. OPTIMISE would certainly stimulate collaboration with industry, scale up near-term commercialization which includes growing the business of major Ohio suppliers to the collaborators, and grow to a critical scale to sustain far-term synergism. The OTF grant would provide operational funds and equipment for the established OPTIMISE Platform to scale up the number of partnerships to six or more Ohio for-profit companies (who have already made their interest known, see above.) It is proposed that multiple commercial market entries would be accomplished within the IPP time period. It is further proposed that a clear business plan would be created for a self-sustaining IPP with no further OTF investment. The research group's design and development knowledge would thereby be taken to the high level accepted and approved by a new and significantly larger market in which there is already a strong and rich history of achievement.

The potential pipeline of products desired by our primary partners beyond the IPP program to sustain the program are: Specialty $MgB_2$ 1.5T background magnet for breast imaging, specialty MRI background magnet for orthopedic imaging and for dedicated neonatal scanners, dedicated RF coils for neonates and pediatric patients, and RF coils for hybrid systems including PET/MRI and RT/MRI developments. Other potential clients are interested in: RF coils with higher signal to noise ratio, lower manufacturing cost gradient coils, and improved gradient coil design for reduced acoustic noise.

13-328

Ohio | Third Frontier
Innovation Creating Opportunity

# Innovation Platform Program

## 2013 Request for Proposals

## Letter of Intent

| | |
|---|---|
| **Lead Applicant Institution** | **Innovative Plastics and Molding, Inc.** |
| **Lead Applicant Contact Information** | **Name: Robert C. Joyce 6632 Maple wood Suite 311 Sylvania, Ohio 43560** |
| | **Title: President** |
| | **Phone Number: 419-346-8728** |
| | **Email: rjoyce07@buckeye-express.com** |
| **Project Title:** | *"Cellulose Fiber Thermoplastic Compound Pellets for the Transportation Industry"* |

| | | | |
|---|---|---|---|
| **Total Project Budget** | $2,500,000 | **Ohio Third Frontier Funds Requested** | $1,250,000 |

**Project Focus:**

X Advanced Materials (related to advanced polymers; ceramics; composites; carbon fibers and nanotubes; and, specialty metals and alloys)

Software Applications for Business and Healthcare

Aeropropulsion and Power Management

Sensing and Automation Technologies

Fuel Cells and Energy Storage

Situational Awareness and Surveillance Systems

Medical Technology (related to imaging; surgical instruments/equipment; implant devices; and, regenerative medicine)

Solar Photovoltaics

Agribusiness and Food Processing

Please answer the following questions using no more than two additional pages. The Letter of Intent should address each question in order identifying each response. Do not include any trade secret information in this Letter of Intent.

1) Describe the proposed technology platform. Please refer to the Request for Proposals Section 2.1 second paragraph for the definition of a technology platform.

2) Please list all committed industry clients and their anticipated cash cost share contribution.
3) Describe the commercial products that will be developed and enter the market within the 3-year timeframe of the Grant.
4) Describe how the platform will provide a sustainable pipeline of technologies for commercialization.

The automobiles, aerospace and truck manufacturers that have end products in the transportation industry have been investigating the use of various biomass additives in thermoplastics for years. They are interested in utilizing a thermoplastic biopolymer in instrument panels, seat parts, rear cargo shelves, storage shelves, and the like to help reduce the carbon footprint; moreover, utilize sustainable resources. The existing biopolymer applications, which are very few, are hidden. These biopolymers are expensive and underperform, having poor physical properties like impact and unforgiving processing characteristics like odor. An inventive alloy composition is being proposed that includes a sustainable resource *"Cellulose Fiber Thermoplastic Compound Pellets for the Transportation Industry"*. Initial tests that were performed with the cellulose and thermoplastic polyolefin resin utilizing U.S. Patent 7,994,241 revealed an alloy composition with superior heat resistance, high flexural modulus with low specific gravity. The research objective would be to produce an advanced material while optimizing the thermal and mechanical properties of the cellulose and thermoplastic polyolefin compound for part production.

More specifically, within the 3 year term of the grant, there are two areas of project concentration, to produce an improved biopolymer material technology. The two advanced materials will include an advanced biopolymer material with better strength and heat resistance for under hood applications and a biopolymer compound with better ductility and flow for applications that require head impact. Each of these requirements will require different loadings of cellulose in the thermoplastic with additional ingredients for the compound. In addition, after testing and characterization, part production and further testing must be completed to industry specification. These tests could take up an additional 6-12 months after completion of compound.

The commercial value of the advanced material technology will be attractive because of the performance characteristics and cost equation. With improved material performance, manufacturers can reduce product mass by 10 to 20%, specifically, lowering the weight of the part by making it thinner. A thinner part with cellulose will cool quickly compared to 100% plastic, achieving faster cycle time, promoting lower energy costs. Furthermore, the processors who mold transportation products will like a bio material with improved thermal resistance to recycle without fear of burning after a single use. This new material composition will cost approximately $1.20 to $1.30 per lb., versus the competition cost at $1.40 to $1.50 per lb..
In approximately 2-3 years, Innovative Plastics and Molding, Inc. plans to capture 10% market share or 90 million lbs. per year , creating 75 jobs.

Not included in the above statistics for the advanced material biopolymer compound is applications for military vehicles, such as doors, consoles, and seats, which is believed to be a sizable market. The government is pursuing technology to help reduce weight in vehicles and has requested that bio preferred products need to be utilized where ever possible. Innovative Plastics and Molding, Inc. is presently working with PTAC in Northwest Ohio to introduce new biopolymers to the government. The company is the first biopolymer company in Ohio to have an approved USDA bio preferred thermoplastic intermediate resin. The company will continue to work with PTAC in Northwest Ohio to pursue opportunities to help bring molding and assembly jobs to Northwest Ohio.

Furthermore, it is also anticipated that other industries will benefit, like processors who are thermo formers, injection molders, tooling companies and raw material suppliers. The local community college in Northwest Ohio can help with training to support operations, manufacturing and production personnel. We anticipate that since this technology was developed in the U.S. there will be a considerable amount of advanced biopolymer compound, as well as, product exported oversees; furthermore, creating more jobs.

Lead applicant Robert Joyce, President of Innovative Plastics and Molding, Inc. located in Northwest Ohio will be responsible for Ohio Third Frontier Innovation Platform program. The companies customers that include Amplas Compounding, and IVP Plastics with associated letters from clients the following comments; We are very interested in continuing to explore and expand products that the market has termed "Green". Those products include those that are reusable, recyclable, compostable, biodegradable, or are made from renewable resources. The current compostable offerings or those made from renewable resources that we have investigated have some market and application limitations. The major hurdles to finding a suitable offering to our customers are low heat deflection strength, low melt strength, high cost of finished part due to lower stiffness of the substrate. I expect that adding your FibreTuff material will reinforce the base polymer and provide improvements in the polymers stiffness, melt strength, and allow for a thinner stronger part resulting in a lower cost finished product.....utilizing US patent 7,994,241for compliance in molding sheet/films and containers.

A list of potential industry clients that will consider cost sharing include customers in the automotive, Tier two suppliers located in Ohio and in Michigan. There is also private funding available for cost sharing from industry veterans who have also been selected to participate in the company operation.

13-329

Ohio | Third Frontier
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# Innovation Platform Program

## 2013 Request for Proposals

## Letter of Intent

| | | | |
|---|---|---|---|
| **Lead Applicant Institution** | **University of Dayton Research Institute** | | |
| | **Name: Larrell Walters** | | |
| | **Title: Sensor Systems Division Head** | | |
| | **Phone Number: 937-239-5717** | | |
| | **Email: Larrell.Walters@udri.udayton.edu** | | |
| **Project Title:** | **Trusted Situational Awareness** | | |
| **Total Project Budget** | $ 2,200,000 | **Ohio Third Frontier Funds Requested** | $ 1,100,000 |
| **Project Focus:** | ☐ Advanced Materials (related to advanced polymers; ceramics; composites; carbon fibers and nanotubes; and, specialty metals and alloys) | ☐ Software Applications for Business and Healthcare | |
| | ☐ Aeropropulsion and Power Management | ☐ Sensing and Automation Technologies | |
| | ☐ Fuel Cells and Energy Storage | ☒ Situational Awareness and Surveillance Systems | |
| | ☐ Medical Technology (related to imaging; surgical instruments/equipment; implant devices; and, regenerative medicine) | ☐ Solar Photovoltaics | |
| | | ☐ Agribusiness and Food Processing | |

Please answer the following questions using no more than two additional pages. The Letter of Intent should address each question in order identifying each response. Do not include any trade secret information in this Letter of Intent.

1) Describe the proposed technology platform. Please refer to the Request for Proposals Section 2.1 second paragraph for the definition of a technology platform.
2) Please list all committed industry clients and their anticipated cash cost share contribution.
3) Describe the commercial products that will be developed and enter the market within the 3-year timeframe of the Grant.
4) Describe how the platform will provide a sustainable pipeline of technologies for commercialization.

***1)***

***2) Describe the proposed technology platform.***

The proposed Technology Platform consists of the State of Ohio funded Wright Center of Innovation, the Institute for the development and Commercialization of Advanced Sensor Technology, and the State of Ohio funded Ohio Academic Research Cluster for Layered Sensing. These University of Dayton led entities form a nationally unique capability in the area of situational awareness.

***3) Please list all committed industry clients and their anticipated cash cost share contribution.***

The industrial clients participating in the IPP are shown in Table 1.

Table 1. For-profit IPP Collaborators

| Industrial Client | Role | Location | Anticipated Cost Share |
|---|---|---|---|
| Woolpert | OEM | Beavercreek, Ohio | $800,000 |
| Raber-Hughes Technologies | Cyber component | Dayton, Ohio | $150,000 |

Woolpert, the nation's largest privately owned Geographic Information Systems company will be that OEM that takes the Situational awareness product to market. Raber-Hughes Technologies will provide the cyber component that ensures the product has trusted situational awareness

***4) Describe the commercial products that will be developed and enter the market within the 3-year timeframe of the Grant.***

The commercial product is a trusted situational awareness system that can be utilized by first responders, law enforcement, border protection, college campuses, schools, ports, and malls. The product will be developed and marketed in less than 24 months. This market is expected to be in excess of $50 billion/per year by 2018. The value of a cyber-hardened system insures that the information collected is authentic and thus actionable and of evidentiary value. Recently Microsoft and New York City have teamed to develop a situational awareness product for New York that Microsoft will market to larger entities, giving some of the profits back to New York City. While Microsoft will focus on larger cities, Woolpert will focus on medium size cities like Dayton, Ohio and applications such as malls and schools. The Dayton, Ohio police department will utilize the system, providing instrumental feedback for product improvements.

***5) Describe how the platform will provide a sustainable pipeline of technologies for commercialization.***

Once the trusted situational awareness system has been developed, it will create at IDCAST a capability to incorporate sensors from companies all over the nation. These companies will come to Ohio and have their sensors tested and incorporated in to this operational trusted situational awareness systems, because it is nearly impossible for an individual sensor company to get their products incorporated into a situational awareness system

13-330

Ohio | Third Frontier
Innovation Creating Opportunity

# Innovation Platform Program

## 2013 Request for Proposals

## Letter of Intent

| | |
|---|---|
| **Lead Applicant Institution** | **Kent State University** |
| **Lead Applicant Contact Information** | **Name: J.T. Gleeson** |
| | **Title: Professor and Chairperson, Department of Physics** |
| | **Phone Number: 330 672 2246** |
| | **Email: jgleeson@kent.edu** |
| **Project Title:** | Electrodynochromatic Materials |

| | | | |
|---|---|---|---|
| **Total Project Budget** | $ 2,8000,000 | **Ohio Third Frontier Funds Requested** | $ 1,400,000 |

**Project Focus:**

- ☒ Advanced Materials (related to advanced polymers; ceramics; composites; carbon fibers and nanotubes; and, specialty metals and alloys)
- ☐ Aeropropulsion and Power Management
- ☐ Fuel Cells and Energy Storage
- ☐ Medical Technology (related to imaging; surgical instruments/equipment; implant devices; and, regenerative medicine)
- ☐ Software Applications for Business and Healthcare
- ☐ Sensing and Automation Technologies
- ☐ Situational Awareness and Surveillance Systems
- ☐ Solar Photovoltaics
- ☐ Agribusiness and Food Processing

Please answer the following questions using no more than two additional pages. The Letter of Intent should address each question in order identifying each response. Do not include any trade secret information in this Letter of Intent.

1) Describe the proposed technology platform. Please refer to the Request for Proposals Section 2.1 second paragraph for the definition of a technology platform.
2) Please list all committed industry clients and their anticipated cash cost share contribution.
3) Describe the commercial products that will be developed and enter the market within the 3-year timeframe of the Grant.
4) Describe how the platform will provide a sustainable pipeline of technologies for commercialization.

KENT STATE
UNIVERSITY

December 21, 2012

Ohio Development Services Agency
Office of Technology Investments
77 South High St, 25th Floor
Columbus, OH 43125

To whom it may concern,

We are pleased to submit this Letter of Intent to apply for the FY 2013 Innovation Platform Program of the Ohio Third Frontier. The project title, Electrodynochromatic Materials refers to a proposal having Project Focus on Advanced Materials.

1) The proposed technology platform is a new class of liquid crystal materials will be developed which can provide multiple functions within a single layer film. Currently, the commercial systems are either absorptive, reflective or scattering. However, in many cases, there is a need to be able to provide multiple functions using the same system. Electrodynochromic material is capable of operating in two modes within the same system. In this program we will develop and optimize the material and implement it in the state of art flexible film.
2) The committed industry clients are AlphaMicron, Inc (contribution 0.8M$), AlphaMirror Inc. (contribution 0.2M$). Kent State University will contribute cost share amounting to 0.4M$.
3) Commercial products that will be developed include autodimming glass for automotive application, and visors for head mounted displays.
4) This material is compatible with current materials used for a variety of liquid crystal based applications. It enhances the system to provide a novel capability currently not offered by these materials. As such, it is expected that the material will be able to be used in a wide range of applications ranging from eyewear for medical use, to windows for avionic application.

Sincerely yours

GLEESON, JAMES

Digitally signed by GLEESON, JAMES
DN: cn=GLEESON, JAMES, o=Kent State University, ou=Department of Physics, email=jgleeson@kent.edu, c=US
Date: 2012.12.21 10:37:22 -05'00'

J.T. Gleeson
Professor and Chairperson

**Department of Physics**
P.O. Box 5190 • Kent, Ohio 44242-0001
330-672-2246 • Fax: 330-672-2959 • http://www.kent.edu/cas/physics/

13-331

Ohio | Third Frontier
Innovation Creating Opportunity

# Innovation Platform Program

## 2013 Request for Proposals

## Letter of Intent

| | |
|---|---|
| **Lead Applicant Institution** | Bowling Green State University |
| **Lead Applicant Contact Information** | **Name:** Felix N. Castellano<br>**Title:** Director / Professor<br>**Phone Number:** 419 372-7513<br>**Email:** castell@bgsu.edu |
| **Project Title:** | Photoactivatable Consumer Cleaning Products |

| | | | |
|---|---|---|---|
| **Total Project Budget** | $6,000,000 | **Ohio Third Frontier Funds Requested** | $3,000,000 |

**Project Focus:**

- ■ Advanced Materials (related to advanced polymers; ceramics; composites; carbon fibers and nanotubes; and, specialty metals and alloys)
- ☐ Aeropropulsion and Power Management
- ☐ Fuel Cells and Energy Storage
- ☐ Medical Technology (related to imaging; surgical instruments/equipment; implant devices; and, regenerative medicine)
- ☐ Software Applications for Business and Healthcare
- ☐ Sensing and Automation Technologies
- ☐ Situational Awareness and Surveillance Systems
- ■ Solar Photovoltaics
- ☐ Agribusiness and Food Processing

Please answer the following questions using no more than two additional pages. The Letter of Intent should address each question in order identifying each response. Do not include any trade secret information in this Letter of Intent.

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3) Describe the commercial products that will be developed and enter the market within the 3-year timeframe of the Grant.
4) Describe how the platform will provide a sustainable pipeline of technologies for commercialization.

December 19, 2012

Ohio Department of Development
Technology and Innovation Division
77 South High Street, 25th Floor
Columbus, OH 43215
E-mail: IPP@development.ohio.gov

**Subject: 2013 Ohio Third Frontier IPP LOI**

To Whom It May Concern:

Please accept this letter of intent from Bowling Green State University for the Ohio Third Frontier Innovation Platform Program, whose relevant information follows:

| | |
|---|---|
| **Lead Applicant Name:** | Bowling Green State University<br>Sponsored Programs and Research<br>106 University Hall<br>Phone: (419) 372-2481<br>Bowling Green, Ohio 43403-0230 |
| **Contact Person:** | Prof. Felix N. Castellano<br>Center for Photochemical Sciences<br>Phone: (419) 372-7513<br>E-mail: castell@bgsu.edu |
| **Proposed Project Title:** | Photoactivatible Consumer Cleaning Products |
| **Estimated Funds Requested:** | $3,000,000 |
| **Collaborators:** | Procter and Gamble and its subsidiaries |
| **Technology Subject Matter:** | Advanced Materials and Solar Energy Utilization |

**Summary of the Proposed Project**

The Center for Photochemical Sciences at Bowling Green State University will aid Procter and Gamble in the development of household consumer cleaning agents activated through visible light excitation. Some of the materials to be developed are targeted exclusively for outdoor use and will be activated with terrestrial solar photons. This collaborative effort will ultimately lead to advanced formulations poised for short-term introduction into the marketplace and will likely penetrate into every market where cleaning products are utilized.

13-332

Ohio | Third Frontier
Innovation Creating Opportunity

# Innovation Platform Program

## 2013 Request for Proposals

## Letter of Intent

| | |
|---|---|
| **Lead Applicant Institution** | **Cleveland State University** |
| **Lead Applicant Contact Information** | **Name: Jerzy T. Sawicki, PhD** |
| | **Title: Interim Vice President for Research and Graduate Studies** |
| | **Phone Number: 216.687.9364** |
| | **Email: j.sawicki@csuohio.edu** |
| **Project Title:** | Center for Biomaterials Characterization and Innovation |

| | | | |
|---|---|---|---|
| **Total Project Budget** | $ 6,000,000 | **Ohio Third Frontier Funds Requested** | $ 3,000,000 |

**Project Focus:**

- X Advanced Materials (related to advanced polymers; ceramics; composites; carbon fibers and nanotubes; and, specialty metals and alloys)
- ☐ Aeropropulsion and Power Management
- ☐ Fuel Cells and Energy Storage
- ☐ Medical Technology (related to imaging; surgical instruments/equipment; implant devices; and, regenerative medicine)
- ☐ Software Applications for Business and Healthcare
- ☐ Sensing and Automation Technologies
- ☐ Situational Awareness and Surveillance Systems
- ☐ Solar Photovoltaics
- ☐ Agribusiness and Food Processing

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4) Describe how the platform will provide a sustainable pipeline of technologies for commercialization.

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THE CENTER FOR BIOMATERIALS CHARACTERIZATION AND INNOVATION

## 1. The Technology Platform

Cleveland State University (CSU) is establishing the Center for Biomaterials Characterization and Innovation (CBCI) to promote and support Ohio's advanced materials industry in research, development, and commercialization related to a growing bioscience market. The proposed Innovation Platform builds on existing CSU strengths to leverage synergies between the CBCI and commercialization capabilities of a broad range of companies in Northeast Ohio. Specifically, the CBCI will support Ohio industry through: 1) the characterization of advanced material surfaces and functionality; 2) characterization of protein stability and interaction with materials; and 3) application benchmarking and data generation to support end user evaluation and adoption. These state-of-the-art capabilities contribute to a world-class Innovation Platform that will directly enable the near and long-term commercialization of new products in an important growth market for Northeast Ohio. As an Innovation Platform, the CBCI offers unique intellectual capital, technological capabilities, equipment, and facilities across the College of Sciences and Health Professions and the Fenn College of Engineering at CSU, which boast a strong track record in life science research and development.

## 2. Industry Clients

The CBCI is actively engaging new clients from across Northeast Ohio, which is home to a vibrant biomaterials and bioscience industry that includes hundreds of locations and supports more than 21,000 jobs (BioOhio, http://www.bioohio.com/pdfs/growthreport12.aspx). One client, Momentive Performance Materials Quartz, expects to contribute cost share of approximately $750,000.

## 3. Commercial Products

The CBCI and its clients will develop and launch new products within the three-year project period, including advanced materials used in the development, manufacturing, and delivery of therapeutic proteins. Other products that may be commercialized through the CBCI include: biosensors and biomarkers, materials for targeted drug delivery, materials for implants and regenerative medicine applications, and materials used in biopharmaceutical manufacturing.

## 4. Sustainable Pipeline of Technologies

The CBCI is designed to respond to the needs of Ohio's advanced materials industry, and to reinforce Ohio's leadership position in this industry by facilitating access to new, high growth markets. The specified areas of expertise for the CBCI are core industry needs, where access to the CBCI's state-of-the-art instrumentation, biomaterials expertise, and resources for collaborative R&D will support these companies in generating critical application data needed to drive the commercialization of novel materials for bioscience applications.

13-333

# Innovation Platform Program

**2013 Request for Proposals**

## Letter of Intent

| | | |
|---|---|---|
| **Lead Applicant Institution** | | The Ohio State University |
| **Lead Applicant Contact Information** | **Name:** | Robert J. Davis |
| | **Title:** | Director, Nanotech West Lab |
| | **Phone Number:** | 614.292.7309 |
| | **Email:** | Davis.2316@osu.edu |
| **Project Title:** | | The Ohio Sensor and Semiconductor Innovation Platform (OSSIP) |

| | | | | |
|---|---|---|---|---|
| **Total Project Budget** | $ $5,800,000 | **Ohio Third Frontier Funds Requested** | $ $2,900,000 | |

**Project Focus:**

- ☐ Advanced Materials (related to advanced polymers; ceramics; composites; carbon fibers and nanotubes; and, specialty metals and alloys)
- ☐ Aeropropulsion and Power Management
- ☐ Fuel Cells and Energy Storage
- ☐ Medical Technology (related to imaging; surgical instruments/equipment; implant devices; and, regenerative medicine)
- ☐ Software Applications for Business and Healthcare
- ■ Sensing and Automation Technologies
- ☐ Situational Awareness and Surveillance Systems
- ☐ Solar Photovoltaics
- ☐ Agribusiness and Food Processing

Please answer the following questions using no more than two additional pages. The Letter of Intent should address each question in order identifying each response. Do not include any trade secret information in this Letter of Intent.

1) Describe the proposed technology platform. Please refer to the Request for Proposals Section 2.1 second paragraph for the definition of a technology platform.
2) Please list all committed industry clients and their anticipated cash cost share contribution.
3) Describe the commercial products that will be developed and enter the market within the 3-year timeframe of the Grant.
4) Describe how the platform will provide a sustainable pipeline of technologies for commercialization.

**The Ohio Sensor and Semiconductor Innovation Platform (OSSIP)**

Letter of Intent

PI: Robert J. Davis, Ph.D.
Nanotech West Lab, The Ohio State University
Suite 100
1381 Kinnear Road
Columbus OH 43212
davis.2316@osu.edu / 614.292.7309

**1. Description**

The Ohio Sensor and Semiconductor Innovation Platform, or OSSIP, will be centered at the established Ohio State Nanotech West (NTW) Lab, which has a 10 year track record of providing micro- and nanofabrication capabilities to both academic and non-academic organizations. Nanotech West currently represents an investment of ~$20M in capital and infrastructure, and as a testament to its success in serving industry clients approximately 40% of its billed usage per month is from industry.

Currently, engineering staff at NTW is sufficient to install, repair, and maintain equipment and train users in safe operations; a very limited amount of service work for users is available as a result. At Ohio State, OSSIP will fund 3-4 Engineering staff positions that will be created specifically to assist Ohio companies in semiconductor technology, primarily but not necessarily restricted to sensor fabrication, packaging, and test. OSSIP will also invest in a small amount of capital equipment, targeted towards electronic packaging and testing, at Nanotech West.

**2. Industry Clients**

Known collaborators at this time include the industrial clients below:

**L-3 / Cincinnati Electronics**, Mason OH – estimated cost share $1.2M
**Syntonics LLC.**, Columbus OH – estimated cost share $300k
**Srico Inc.**, Columbus OH – estimated cost share $300k

**3. New Products**

New products will span a range of sensor and semiconductor materials and applications. For L-3, the targeted products are high-definition (HD), small pixel (~10 microns) mid-wave infrared (MWIR) and short-wave infrared (SWIR) focal plane arrays. Since the submission of a similar proposal in the FY12 IP competition, the customer

base for this technology is now much better defined. Using Nanotech West, the Syntonics Columbus Research Center has recently demonstrated a prototype of a Passive Wireless Sensing (PaWS) device, based on surface acoustic wave (SAW) technology, intended for extreme environments such as jet engine monitoring; OSSIP will help Syntonics solve significant fabrication, packaging, and reliability issues in this technology and accelerate its time to market. For Srico, OSSIP personnel will directly assist the company in solving fabrication issues with a variety of high-speed electro-optic modulators (EOMs).

**4. Sustainability**

As a Lab, Nanotech West at Ohio State is already a sustainable, growing operation. For OSSIP, sustainability of the 3-4 engineering positions past the initial three-year program will be the key point. At its current staffing level, Nanotech West routinely turns down fee-for-service work (fabrication design, process, and test) due to the highest priority of equipment uptime. We anticipate that these engineering positions will continue by serving these requests; to serve the current industrial collaborators and more; and be directly funded on new research and development awards, especially from Federal sources.

13-334

Ohio | Third Frontier
Innovation Creating Opportunity

# Innovation Platform Program

## 2013 Request for Proposals

## Letter of Intent

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|---|---|
| **Lead Applicant Institution** | **Ohio State University** |
| **Lead Applicant Contact Information** | **Name: William Marras** |
| | **Title: Professor** |
| | **Phone Number: 614-292-6670** |
| | **Email: marras.1@osu.edu** |
| **Project Title:** | Commercialization of Metal Oxide Composite Manufacturing for Advanced Energy Conversion and Storage |

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|---|---|---|---|
| **Total Project Budget** | $2,300,000 for 3 years | **Ohio Third Frontier Funds Requested** | $1,150,000 for 3 years |

**Project Focus:**

- ☐ Advanced Materials (related to advanced polymers; ceramics; composites; carbon fibers and nanotubes; and, specialty metals and alloys)
- ☐ Aeropropulsion and Power Management
- ☐ Fuel Cells and Energy Storage
- ☒ Medical Technology (related to imaging; surgical instruments/equipment; implant devices; and, regenerative medicine)
- ☒ Software Applications for Business and Healthcare
- ☐ Sensing and Automation Technologies
- ☐ Situational Awareness and Surveillance Systems
- ☐ Solar Photovoltaics
- ☐ Agribusiness and Food Processing

Please answer the following questions using no more than two additional pages. The Letter of Intent should address each question in order identifying each response. Do not include any trade secret information in this Letter of Intent.

**1. Describe the proposed technology platform.**

Spine Research Institute, developed by Dr. William Marras of The Ohio State University, is a platform technology that conducts an analysis of an individual's spinal condition and provides feedback for successful treatment. The analysis is based off of past medical history, MRI, CAT scan, and other pertinent test results that show target problem areas in the patient's spine. This information is then used to decide upon a plan of action for the patient that is forecasted to produce the best results.

The analysis of different options for the patient is based on test results involving models that have been used in the laboratory. This would include testing of certain materials and structural designs in different body types and areas of an individual. The consequences and projected results would then be able to be known and addressed. This will give a much higher success rate in the surgery and care of individuals with lower back problems.

The individual's test results and information will be sent to the personalized Spine Research Institute to be analyzed and a report of recommended plans of actions for the patient will be established. Results showing problems with certain implementations will be mentioned and a recommendation to avoid that form of care will be given.

Current treatments for lower back problems are based on physician experience and intuition, causing a much lower than desired success rate. This service would provide much more clearly defined results and projections that would enhance the success rate for the care of such patients. Recommended care on an individual basis, as opposed to general diagnostic, leads to a higher success rate for patient care.

The market for this service consists of physicians with work focused in the care and treatment of lower back pain and material science companies that create devices that may be used in the treatment of lower back pain and injuries. The results of the assessment can provide important feedback for both the physicians and engineers.

**2. Please list all the committed industry clients and their anticipated cash cost share contribution.**

The institute intends to leverage existing relationships and support to match the state's funding for this project. The anticipated cost share amounts are as follows:

- Honda - $500,000
- Cardinal Health - $500,000
- Nationwide - $150,000

**3. Describe the commercial products that will be developed and enter the market within the 3-year timeframe of the grant.**

Two primary products, with strong commercial potential, that can be produced from Dr. Marras's technology portfolio are the Lower Lumbar Monitor and modeling software. Both of these technologies work hand in hand to create a comprehensive lower back diagnostic system and can be sold separately to chronicle back movement.

The Lower Lumbar Monitor is a backpack that is worn by the user and mimics the movement of the user's spine through their full range of motion. While the user is executing a prescribed set of motions, the sensors in the back monitor are collecting crucial elements that include range of motion, acceleration around an axis, and stress levels to evaluate the health of the user's lower back. This information has already been sold to existing customers to include Honda and other industrial partners.

The heart of Dr. Marras's IP portfolio lies in his modeling technology. Developed over the course of a decade, the modeling is a culmination of data from a variety of sources to include CT, MRI, LLM, and electrical signals to the muscle to accurately portray stress levels upon the back. The stress levels are color coded on screen based upon the data received. Each part of the lower back is depicted with a quantifiable stress level to include disks, vertebrae, muscle, tendons, and ligaments.

**4. Describe how the platform will provide a sustainable pipeline of technologies for commercialization.**

This technology is a platform from which at least two products can be successfully commercialized in multiple applications. The applications/markets are the following:

- Correctly quantify, identify, and locate back problems for patients.
- Evaluate surgical procedures for their success.
- Evaluate progress for recovery from back injuries.
- Provide an accurate platform for surgeons to pre-plan their surgeries prior to entering the patient.
- Provide a virtual testing ground for medical hardware manufacturers to test their devices under load.

In addition to the above opportunities, the technology could be adapted and scaled to other parts of the body as well as veterinary medicine. In fact, the Spine Institute within The Ohio State University is being established jointly between the College of Engineering, College of Medicine, and College of Veterinary Medicine.

13-335

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# Letter of Intent

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|---|---|
| Lead Applicant Institution | Ohio University |
| Lead Applicant Contact Information | Name: Gerardine (Gerri) G. Botte, PhD |
| | Title: Russ Professor, Director- Center for Electrochemical Engineering Research |
| | Phone Number: (740) 593-9670 |
| | Email: botte@ohio.edu |
| Project Title: | Electrochemical Innovation Platform: Advanced Materials for Energy Storage |

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|---|---|---|---|
| Total Project Budget | $ 4,470,000 | Ohio Third Frontier Funds Requested | $ 2,226,000 |

**Project Focus:**

- ☐ Advanced Materials (related to advanced polymers; ceramics; composites; carbon fibers and nanotubes; and, specialty metals and alloys)
- ☐ Aeropropulsion and Power Management
- ☒ Fuel Cells and Energy Storage
- ☐ Medical Technology (related to imaging; surgical instruments/equipment; implant devices; and, regenerative medicine)
- ☐ Software Applications for Business and Healthcare
- ☐ Sensing and Automation Technologies
- ☐ Situational Awareness and Surveillance Systems
- ☐ Solar Photovoltaics
- ☐ Agribusiness and Food Processing

Please answer the following questions using no more than two additional pages. The Letter of Intent should address each question in order identifying each response. Do not include any trade secret information in this Letter of Intent.

1) Describe the proposed technology platform. Please refer to the Request for Proposals Section 2.1 second paragraph for the definition of a technology platform.
2) Please list all committed industry clients and their anticipated cash cost share contribution.
3) Describe the commercial products that will be developed and enter the market within the 3-year timeframe of the Grant.
4) Describe how the platform will provide a sustainable pipeline of technologies for commercialization.

1. Technology Platform

The Innovation Platform, Center for Electrochemical Engineering Research (CEER) at Ohio University, was established with an initial investment from the State of Ohio through the Ohio Third Frontier Program, Wright Project. The Center for Electrochemical Engineering Research (CEER) is devoted to developing solutions to global problems through an electrochemical approach. CEER is dedicated to entrepreneurial electrochemical research, innovation, education, and to economic growth. CEER emphasizes a collaborative and interdisciplinary approach to these goals. CEER establishes partnerships with companies to support commercialization of technologies leveraging electrochemical expertise, and over $4 million in state-of-the-art facilities and infrastructure. Ohio University has a history of successful Open Innovation partnerships with Industry. CEER, working closely with its sponsored research and technology transfer offices, has developed creative solutions to enable successful partnerships with industry. CEER currently has nine granted patents and twenty-seven pending patent applications in the areas of energy storage and conversion, advanced materials, recovery of critical metals, water remediation, hydrogen production, and sensors. The Innovation Platform Program (IPP) proposed here will initially emphasize the commercialization of applications for which Intellectual Property (IP) has been developed and proven at bench scale and in prototypes at CEER. This IPP will focus on implementing technologies that will enable recycling and refurbishment of advanced materials for energy storage applications.

2. Industry Clients

This IPP project will catalyze the commercialization of CEER's platform of technologies including bench scale processes and prototypes. CEER will collaborate with ***BASF in Elyria and Beachwood, Ohio,*** to develop a revolutionary battery cathode metal recycling process to reduce the cost of high purity high purity metals required for the manufacturing of lithium ion batteries, and with ***Toxco Inc. in Lancaster, Ohio***, to enhance battery recycling and refurbishment for stationary and vehicles applications. The total anticipated cash cost share from the industrial clients is $1,125,000 in three years.

3. Commercial Products

Within the 3-year timeframe, the team will leverage the expertise and resources of the clients: Toxco, Inc. (the most diverse battery recycling company in the world) and BASF (the world's largest chemical company that has made automotive battery materials a global strategic priority), to provide recycled high purity materials that can be used in Nickel Metal Hydride Batteries, and Lithium ion Batteries, respectively.

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OHIO UNIVERSITY

4. Sustainable Pipeline of Technologies for Commercialization

OHIO CEER will serve as a platform for technologies that will support the State of Ohio's position as a leader in advanced materials. Through the licensing of technologies created at the Center, CEER will create intellectual property that will ensure Ohio sustains its competitive advantage in the fields of advanced materials, and clean energy. CEER currently has nine granted patents and twenty-seven pending patent applications in the areas of energy storage and conversion, advanced materials, recovery of critical metals, water remediation, hydrogen production, and sensors. To accelerate and sustain its pipeline of technologies, CEER, the Innovation Platform, will capitalize on the establishment of a National Science Foundation Industry/University Cooperative Research Center among other industry/university partnerships.

13-336

# Innovation Platform Program

## 2013 Request for Proposals

## Letter of Intent

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|---|---|
| **Lead Applicant Institution** | **Case Western Reserve University** |
| **Lead Applicant Contact Information** | **Name: Norbert Avril, MD** |
| | **Title: Professor of Radiology** |
| | **Phone Number: (216) 286-3210** |
| | **Email: Norbert.Avril@case.edu** |
| **Project Title:** | PET Imaging using Novel Biomarkers: Clinical Validation and Commercialization |

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|---|---|---|---|
| **Total Project Budget** | $ 7,000,000 | **Ohio Third Frontier Funds Requested** | $ 3,000,000 |

**Project Focus:**

- ☐ Advanced Materials (related to advanced polymers; ceramics; composites; carbon fibers and nanotubes; and, specialty metals and alloys)
- ☐ Aeropropulsion and Power Management
- ☐ Fuel Cells and Energy Storage
- X Medical Technology (related to imaging; surgical instruments/equipment; implant devices; and, regenerative medicine)
- ☐ Software Applications for Business and Healthcare
- ☐ Sensing and Automation Technologies
- ☐ Situational Awareness and Surveillance Systems
- ☐ Solar Photovoltaics
- ☐ Agribusiness and Food Processing

Please answer the following questions using no more than two additional pages. The Letter of Intent should address each question in order identifying each response. Do not include any trade secret information in this Letter of Intent.

1) Describe the proposed technology platform. Please refer to the Request for Proposals Section 2.1 second paragraph for the definition of a technology platform.

The Lead Applicant Institution operates a radio-pharmaceutical research facility with an on-site cyclotron and a radio-chemical synthesis laboratory established in 1985 along with the first Positron Emission Tomography (PET) scanner in the State of Ohio. We have a strong track record of innovative developments in the field of PET biomarkers exemplified by a number of "first-in-human" PET imaging studies.

PETNET is a subsidiary of SIEMENS, which commercially produces PET biomarkers, predominately a radiolabeled glucose analogue for human PET/CT imaging. PETNET is operating internationally with currently three radiopharmaceutical manufacturing sites in the State of Ohio. We were one the first collaborators with PETNET more than 10 years ago with a production, dispensing and distribution

facility located on site of Case Medical Center. From there, PETNET has produced and shipped PET biomarkers to the entire northeast Ohio area and beyond, as far as Pittsburgh, PA and Detroit, MI.

Recently, the FDA has implemented new regulations effective on December 13, 2012 to govern clinical research regarding PET biomarkers. The new regulations now require that any PET biomarker used for clinical research must be produced in compliance with Current Good Manufacture Practice (cGMP).To comply with these new regulations, Case Medical Center needs to upgrade the requisite radiochemistry infrastructure as well as place necessary expertise and personnel. Our strong collaboration with PETNET can help us in different ways: 1) Build-out of a cGMP-certified radiopharmaceutical facility; 2) Experience and expertise with the regulatory framework; 3) Strong partner for commercialization of new PET biomarkers; 4) An international network of distribution and supply infrastructures; 5) Platform to attract and produce locally new radiopharmaceuticals being developed by 3rd party I.P. holder to the state of Ohio.

There is strong clinical need to develop and commercialize new PET biomarkers. We plan to develop, evaluate, and validate novel PET biomarkers, which would subsequently be commercialized by PETNET. Specifically, Case Medical Center will conduct appropriate clinical trials which are required for FDA approval and commercialization. We have the necessary infrastructure in place such as a strong clinical trials unit, radiation safety, the latest imaging equipment including 4 PET/CT scanners and the first clinical PET/MRI in the State of Ohio. In addition, PETNET will relocate part of its research and PET biomarker development and commercialization to Case Medical Center in Cleveland, Ohio.

To summarize, we propose a new Technology Platform, a **Clinical PET-Biomarker Research Program**, for which we request OTF funds to establish with our commercial partners. We have identified novel PET biomarkers with great promise to be clinically useful for a wide range of medical applications. This includes detection/diagnosis, staging/follow-up, (radiation) therapy planning as well as prognosis and post-treatment assessment. Moreover, these novel PET biomarkers will assist in personalized and individually tailored treatment stratifications, which is widely regarded as a major challenge for medicine in the 21st century.

2) Please list all committed industry clients and their anticipated cash cost share contribution.

PETNET: $1,500,000 in cash for construction and decommissioning of old cyclotron and space. $2,000,000 "in-kind" cost share contribution for new high performance Cyclotron and $800,000 in advanced Chemistry and Quality Control equipment for new biomarker production.

ImageIQ: $115,000 in cash and $200,000 "in-kind" coast share contribution.

3) Describe the commercial products that will be developed and enter the market within the 3-year timeframe of the Grant.

There is a portfolio of highly promising novel PET biomarkers, which have been identified. These will be further developed, clinically evaluated, and validated for routine human use to enable commercialization and marketing.

These novel PET biomarkers require a set of toolkit for post-imaging image processing including quantitative data analysis to enable commercialization.

4) Describe how the platform will provide a sustainable pipeline of technologies for commercialization

The **Clinical PET-Biomarker Research Program** will serve as a new technology platform, which will enable the identification of new disease-specific targets. We will have an infrastructure to develop new PET biomarkers for these targets. In addition, PETNET/Siemens have their own pipeline of PET biomarkers, which will be further developed and evaluated by us and others to ensure a continuous flow of new disease-specific PET biomarkers into the validation and commercialization process. Furthermore, our own successful program will open us to other PET biomarkers developed elsewhere for similar further development.

13-337

Wexner Medical Center

**Jianjie Ma, Ph.D.**
Professor and Karl P. Klassen Chair in Thoracic Surgery
Director, Division of Surgical and Biomedical Sciences
Investigator, Davis Heart & Lung Research Institute
378 Biomedical Research Tower
460 West 12th Avenue
Columbus, OH 43210
(614) 292-2426
jianjie.ma@osumc.edu

December 20, 2012

Andrew Hanson
Office of Technology Investments
Ohio Development Services Agency
(614) 466-0270
IPP@development.ohio.gov

Dear Dr. Andrew Hanson:

This letter is to express our intent to submit an application to the Innovation Platform Program (IPP) of the Ohio Third Frontier effort. The Ohio State University Wexner Medical Center (OSUWMC) will submit an application to the IPP to expand a center of excellence on "Organ Preservation for Transplantation".

This program will build on the existing Comprehensive Transplant Center in the Department of Surgery at OSUWMC under the guidance of its director, Dr. Robert S. Higgins. This application will also benefit greatly from the support of the Dorothy M. Davis Heart and Lung Research Institute at the OSUWMC, and the Director of the Institute, Dr. Peter Mohler. These program leaders are dedicated to translational research efforts to produce proof-of-concept studies on organ preservation as part of this application.

A major goal of this application is to assist in the commercialization of organ preservation products in development at TRIM-edicine, a privately held biotechnology company that is resident in Ohio, located at the TechColumbus Center. TRIM-edicine was founded by Dr. Jianjie Ma, the Karl P. Klassen Chair of Thoracic Surgery at the OSUWMC, and has exclusive license to regenerative medicine technologies in the area of organ preservation. The commercialization effort at TRIM-edicine is headed by Dr. Gene Wang, a seasoned expert in many aspects of pharmaceutical development and clinical trial management. This collaborative multidisciplinary team of experts will be tasked with an effort to commercialize a novel protein named MG53 for use as a preservative for multiple organs, deceased donor procurement during harvesting and transport before the organs for transplantation purposes.

Organ transplantation is among one of the most extraordinary, health care technologies in the world and is a last resort therapy to treat patients with end-organ failure of the heart, lung, liver, and kidney. Since the initial introduction of organ transplantation with the first kidney transplant in 1954, the development and expansion of this technology to serve more than 115,000 patients who await life-enhancing or life-saving transplants in the United States, has created extraordinary successes which are limited in part by the lack of suitable organs from deceased donors. With nearly 30,000 annual procedures in the United States such procedures have become an important and invaluable intervention in our modern healthcare programs. Despite the increasing numbers of these procedures performed every year, there is a growing waiting list of patients who are eligible for transplants but the number of suitable

donor organs fall far short of the demand. Increasing the number of organs that are available for transplant to address this unmet medical need could be addressed by improving the preservation and/or protecting donated organs so that more of them will remain viable for use in transplant procedures. Many organs that are donated for transplant cannot be used in recipients as there is a very narrow time window during which the organ must be harvested, transported and then transplanted into the recipient. Specialized transport conditions, including specific solutions used to bathe the organ during preservation and cold ischemia can increase the lifespan of an organ outside of the body. This approach is passive and may not actively repair the ischemic damage to the cells of the organ during the time of ischemia or during hypothermic transport of the organ.

An active agent to reduce ischemic damage to organs during transport will represent a technology that would enhance the protection of existing donors and potentially resuscitate marginal organs which could then be transplanted. TRIM-edicine is developing such an agent, recombinant human MG53 protein (rhMG53), as an excellent candidate for an adjuvant to add to organ transport solutions to extend the useful life of organs before transplant surgery. This application will present extensive evidence for the efficacy of rhMG53 in limiting ischemic damage to the heart, lung and kidneys in animal models, providing the justification for the use of rhMG53 in organ preservation.

There are significant advantages to the use of rhMG53 here, including the potential that it could be considered a medical device, which would greatly simplify the regulatory path for the commercialization of rhMG53. Development of rhMG53 in a joint effort between TRIM-edicine at OSUWMC will create an excellent economic opportunity in Ohio and pave the way to further products relating to the use of rhMG53 in a number of different disease states.

Our application will also present a clear developmental plan for the use of rhMG53 in organ preservation that should lead to the commercialization of rhMG53 within three years of funding of this application. The OSWMC is dedicated to pursing this project, as evidenced by the involvement of several members of the Medical Center leadership, including Dr. Steven Gabbe (CEO of the Wexner Medical Center), Dr. Charles Lockwood (Dean of the College of Medicine), Brian Cummings (Vice President for Technology Commercialization) and Dr. Christopher Ellison (Chair of Surgery), in this development effort.

We all look forward to this opportunity to expand our program at OSUMC and address this critical unmet medical need and to benefit the economy of the State of Ohio.


Robert Higgins

Director,
Comprehensive Transplant Center
Ohio State University
Robert.Higgins@osumc.edu

Jianjie Ma

Director,
Surgical & Biomedical Sciences

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Peter Mohler

Director,
Davis Heart and Lung
Research Institute
Peter.Mohler@osumc.edu

13-338

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# Innovation Platform Program

## 2013 Request for Proposals

## Letter of Intent

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|---|---|
| **Lead Applicant Institution** | **Cleveland State University** |
| **Lead Applicant Contact Information** | **Name: Jerzy T. Sawicki, PhD** |
| | **Title: Interim Vice President for Research and Graduate Studies** |
| | **Phone Number: 216.687.9364** |
| | **Email: j.sawicki@csuohio.edu** |
| **Project Title:** | Center for Biomaterials Characterization and Innovation |

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|---|---|---|---|
| **Total Project Budget** | $ 6,000,000 | **Ohio Third Frontier Funds Requested** | $ 3,000,000 |

**Project Focus:**

- X Advanced Materials (related to advanced polymers; ceramics; composites; carbon fibers and nanotubes; and, specialty metals and alloys)
- ☐ Aeropropulsion and Power Management
- ☐ Fuel Cells and Energy Storage
- ☐ Medical Technology (related to imaging; surgical instruments/equipment; implant devices; and, regenerative medicine)
- ☐ Software Applications for Business and Healthcare
- ☐ Sensing and Automation Technologies
- ☐ Situational Awareness and Surveillance Systems
- ☐ Solar Photovoltaics
- ☐ Agribusiness and Food Processing

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1) Describe the proposed technology platform. Please refer to the Request for Proposals Section 2.1 second paragraph for the definition of a technology platform.
2) Please list all committed industry clients and their anticipated cash cost share contribution.
3) Describe the commercial products that will be developed and enter the market within the 3-year timeframe of the Grant.
4) Describe how the platform will provide a sustainable pipeline of technologies for commercialization.

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## THE CENTER FOR BIOMATERIALS CHARACTERIZATION AND INNOVATION

### 1. The Technology Platform

Cleveland State University (CSU) is establishing the Center for Biomaterials Characterization and Innovation (CBCI) to promote and support Ohio's advanced materials industry in research, development, and commercialization related to a growing bioscience market. The proposed Innovation Platform builds on existing CSU strengths to leverage synergies between the CBCI and commercialization capabilities of a broad range of companies in Northeast Ohio. Specifically, the CBCI will support Ohio industry through: 1) the characterization of advanced material surfaces and functionality; 2) characterization of protein stability and interaction with materials; and 3) application benchmarking and data generation to support end user evaluation and adoption. These state-of-the-art capabilities contribute to a world-class Innovation Platform that will directly enable the near and long-term commercialization of new products in an important growth market for Northeast Ohio. As an Innovation Platform, the CBCI offers unique intellectual capital, technological capabilities, equipment, and facilities across the College of Sciences and Health Professions and the Fenn College of Engineering at CSU, which boast a strong track record in life science research and development.

### 2. Industry Clients

The CBCI is actively engaging new clients from across Northeast Ohio, which is home to a vibrant biomaterials and bioscience industry that includes hundreds of locations and supports more than 21,000 jobs (BioOhio, http://www.bioohio.com/pdfs/growthreport12.aspx). One client, Momentive Performance Materials Quartz, expects to contribute cost share of approximately $750,000.

### 3. Commercial Products

The CBCI and its clients will develop and launch new products within the three-year project period, including advanced materials used in the development, manufacturing, and delivery of therapeutic proteins. Other products that may be commercialized through the CBCI include: biosensors and biomarkers, materials for targeted drug delivery, materials for implants and regenerative medicine applications, and materials used in biopharmaceutical manufacturing.

### 4. Sustainable Pipeline of Technologies

The CBCI is designed to respond to the needs of Ohio's advanced materials industry, and to reinforce Ohio's leadership position in this industry by facilitating access to new, high growth markets. The specified areas of expertise for the CBCI are core industry needs, where access to the CBCI's state-of-the-art instrumentation, biomaterials expertise, and resources for collaborative R&D will support these companies in generating critical application data needed to drive the commercialization of novel materials for bioscience applications.

13-339

Ohio | Third Frontier
Innovation Creating Opportunity

# Innovation Platform Program

## 2013 Request for Proposals

## Letter of Intent

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|---|---|
| **Lead Applicant Institution** | **Wright State University** |
| **Lead Applicant Contact Information** | **Name: Ellen Reinsch Friese** |
| | **Title: Assistant Vice President for Research** |
| | **Phone Number: 937-775-2425** |
| | **Email: rsp@wright.edu** |
| **Project Title:** | Semantic Technology Platform for Big Data Analytics Involving Mobile, Social, and Sensor Data |

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|---|---|---|---|
| **Total Project Budget** | $ 2,000,000 | **Ohio Third Frontier Funds Requested** | $ 1,000,000 |

**Project Focus:**

- ☐ Advanced Materials (related to advanced polymers; ceramics; composites; carbon fibers and nanotubes; and, specialty metals and alloys)
- ☐ Aeropropulsion and Power Management
- ☐ Fuel Cells and Energy Storage
- ☐ Medical Technology (related to imaging; surgical instruments/equipment; implant devices; and, regenerative medicine)
- ☒ Software Applications for Business and Healthcare
- ☐ Sensing and Automation Technologies
- ☐ Situational Awareness and Surveillance Systems
- ☐ Solar Photovoltaics
- ☐ Agribusiness and Food Processing

Please answer the following questions using no more than two additional pages. The Letter of Intent should address each question in order identifying each response. Do not include any trade secret information in this Letter of Intent.

1) Describe the proposed technology platform. Please refer to the Request for Proposals Section 2.1 second paragraph for the definition of a technology platform.
2) Please list all committed industry clients and their anticipated cash cost share contribution.
3) Describe the commercial products that will be developed and enter the market within the 3-year timeframe of the Grant.
4) Describe how the platform will provide a sustainable pipeline of technologies for commercialization.

12/20/12

**RE: 2013 Innovation Platform Program Letter of Intent**

**Semantic Technology Platform for Big Data Analytics involving Mobile, Social and Sensor Data**

We are submitting this Letter of Intent to the Ohio Third Frontier 2013 Innovation Platform Program on behalf of Kno.e.sis - The Ohio Center of Excellence in Knowledge-enabled Computing, at Wright State University. Kno.e.sis is multidisciplinary by design and addresses significant challenges in domains such health care and life sciences, defense, and intelligence. It consists of the largest academic research groups in Semantic Web (which drives Web 3.0) in the US. Kno.e.sis was founded and is directed by Dr. Amit Sheth, the LexisNexis Ohio Eminent Scholar.

Dr. Sheth's extensive industry, entrepreneurial, and academic background has been instrumental to the conduct of the research and subsequent development of technologies with significant market relevance. Kno.e.sis consists of 13 labs, approximately 100 multidisciplinary researchers, including 15 faculty members from four colleges within the university, and approximately 50 PhD students with an increasing number of MS and BS students from Computer Science, Cognitive Science, Biomedicine, and Health Informatics. This is matched by access to worldclass resources.

1) Kno.e.sis is one of Ohio's Centers of Excellence in BioHealth Innovation, which researches, develops, and applies semantic and knowledge-enabled techniques as well as advances in traditional Web, Social Web, Sensor Web, Mobile, Services, and Cloud Computing to health care and life sciences, social engagement and development, defense and intelligence and other applications. Currently, Kno.e.sis has a variety of projects, which are in the later stages of development with great potential for commercialization within various marketplaces. Two technologies with immediate potential are kHealth and Twitris. Together they form a comprehensive Semantic Application Development Platform that provides unique capabilities in exploiting big data analytics for traditional enterprise and Web, as well as social and sensor data. The kHealth technology provides the ability to use low cost sensors, smartphones, and intelligent processing for decision making. It is currently in the trial stages for use in health applications, but the technology can be used in many other markets. The Twitris technology is among the most comprehensive system for social media analytics. Both projects will be further addressed in 3.

2) Our team is currently in discussions with several industry clients who will be commercialization partners for the variety of products developed by the Kno.e.sis team and in collaboration with industry partners. We are in the process of securing their commitments and will have them completed when our proposal is submitted on February 13, 2013.

3) kHealth is a knowledge-enabled Web 3.0 application development framework with the ability to create Health 3.0 applications. KHealth integrates data from passive and active sensing, which includes both machine and human sensors, with background knowledge from domain ontologies, semantic reasoning, and state of the art mobile communication and computing environments to help people make decisions to improve health, wellness, and fitness. Besides disease specific clinical applications (current use cases are in cardiology and allergy/asthma), the technology and platform has applications in environmental monitoring, disaster rescue and recovery, and Army/Marine battlefield situational awareness. Presently, kHealth based applications and products are positioned to enter into the

marketplace within the next twelve to eighteen months.

Twitris has the widest functional capability to analyze social content along spatio-temporal-thematic, people-content-network, and emotion-sentiment-intention dimensions. Understanding these comprehensive dimensions of data is a key to unlocking the true potential of social media. This is especially true for monetization of social media. Understanding an underlying intent can tell us if a user is expressing a transactional (potentially for buying a product) intent, seeking information, or just sharing information. Sentiment is perhaps the most sought after type of analysis of social data. Currently, it is the primary basis of social media analysis to predict whether a product or a movie will succeed, who is more likely to win an election, or to attempt to identify a consumer interest and hence use it for targeting the advertising. It is the only system we know that uses Semantic Web techniques and technologies for deeper and higher quality analysis. A patent application has been published, and is awaiting further action.

The Twitris commercialization plan is to first transfer its current research system into a separate licensable version with enhancements necessary to build a commercial version of the software and validating technology with respect to initial market targets. Initial customer engagement (e.g. Disney/ABC) for market definition has already started. We target initial penetration into the media and political sectors (administrations and polling institutions) in the Fall of 2013, followed by marketing (brand awareness and protection) once sufficient market acceptance in the initial sectors affords product distinction in the branding/marketing sectors.

4) Kno.e.sis is a world-class center; based on 5-year impact, we share the 3rd position in North America and 7th position in the world among all universities in the area of World Wide Web. It has extensive industry collaborations with the very best Web/Internet/Technology companies, as attested by gifts and challenge grants from Microsoft, IBM, Google and HP. The center is well funded by competitive grants from major federal (including NIH, NSF, AFOSR, AFRL), state, and industry sources that will continue to help us maintain a robust research program that results in transferable technologies. Revenues from commercialization will also largely be reinvested into this research, creating a sustainable ecosystem covering all facets, including: research and work force training, technology development and transfer, and commercialization.

The Kno.e.sis focus on semantic web research and development is the platform that will develop the next generation of products that exploit mobile, social, and sensor ecosystems. These represent the fastest growing data sets for the foreseeable future. Kno.e.sis' strong research and technology development program has given it a significant competitive advantage in big data computational solutions for mobile, social and sensor data.

13-340

Ohio | Third Frontier
Innovation Creating Opportunity

# Innovation Platform Program

## 2013 Request for Proposals

## Letter of Intent

| | |
|---|---|
| **Lead Applicant Institution** | **Case Western Reserve University** |
| **Lead Applicant Contact Information** | **Name: Liming Dai, Ph.D.** |
| | **Title: Kent Hale Smith Professor** |
| | **Address: 10900 Euclid Ave Cleveland, OH 44106** |
| | **Phone Number: 216-368-4176** |
| | **Email: liming.dai@case.edu** |
| **Project Title:** | Center for Advanced Nanocomposites |

| | | | |
|---|---|---|---|
| **Total Project Budget** | $ 6,000,000 | **Ohio Third Frontier Funds Requested** | $ 3,000,000 |

**Project Focus:**

- ☒ Advanced Materials (related to advanced polymers; ceramics; composites; carbon fibers and nanotubes; and, specialty metals and alloys)
- ☐ Aeropropulsion and Power Management
- ☐ Fuel Cells and Energy Storage
- ☐ Medical Technology (related to imaging; surgical instruments/equipment; implant devices; and, regenerative medicine)
- ☐ Software Applications for Business and Healthcare
- ☐ Sensing and Automation Technologies
- ☐ Situational Awareness and Surveillance Systems
- ☐ Solar Photovoltaics
- ☐ Agribusiness and Food Processing

Please answer the following questions using no more than two additional pages. The Letter of Intent should address each question in order identifying each response. Do not include any trade secret information in this Letter of Intent.

1) **Describe the proposed technology platform. Please refer to the Request for Proposals Section 2.1 second paragraph for the definition of a technology platform.**

In 2011, Case Western Reserve University was awarded a Department of Defense Multidisciplinary University Research Initiative (MURI) grant to bring unrivaled qualities found in one- and two-dimensional nanomaterials into three dimensions. The existing MURI technology foundation builds upon the resources of multiple universities, industries, and national labs, and has established a platform at CWRU that is working to produce new materials for a host of uses.

Through this technology development platform, CWRU has established a notable record of accomplishments and pioneering achievements in research and development. Leveraging the existing expertise, intellectual properties, and resources of the previously funded MURI capabilities, CWRU and its industry clients in this proposed Ohio Third Frontier project will exploit innovative multi-path syntheses and assembly strategies to fabricate advanced nanocomposites that exhibit excellent thermal, electrical, and mechanical properties in all three dimensions for a wide range of applications. Some of these applications include new materials for energy conversion and storage, thermal management, fire retardant products, potential high-performance nano/microscale integrated devices, multifunctional materials for aerospace systems, and biomedical devices, to name a few.

The objective of this proposal is to establish a world-class Center for Advanced Nanocomposites (**CAN**) that creates a significant economic impact for Ohio. CAN will provide industrial client partners with the state-of-the-art facilities and expertise for the development and characterization of advanced nanocomposites. Through the unique collaboration defined by the Ohio Third Frontier Innovation Platform Program, CAN will also help our industrial partners conduct product and market development by quickly transitioning intellectual property generated from research taking place inside the university.

2) **Please list all committed industry clients and their anticipated cash cost share contribution.**

Case Western Reserve University will serve as the Lead Applicant, and will host the Innovation Platform on its campus in Cleveland, Ohio. At this time, CWRU has teamed with Momentive Performance Materials in Strongsville, and PolyOne Corporation in Avon Lake.

| Client Name | Location | Anticipated Cost Share |
|---|---|---|
| Momentive Performance Materials | Strongsville, Ohio | $750,000 |
| PolyOne Corporation | Avon Lake, Ohio | $750,000 |

CWRU intends to attract additional clients and end users in order to expand the potential for economic development and product market entry that will result from an investment of Third Frontier funding. As Lead Applicant, CWRU acknowledges that it is ultimately responsible for maintaining the proposed cost share ratio for the duration of the project period as delineated by the policies of the Ohio Department of Development.

**3) Describe the commercial products that will be developed and enter the market within the 3-year timeframe of the Grant.**

Through the proposed project, CWRU and the project team will create a unique technology development and commercialization vehicle that is unrivaled in Northeast Ohio. Among the commercial products that can be developed in the course of collaboration with CAN, the following application areas have been specifically targeted by the project team.

- Nanocomposites for Energy Applications
- Nanocomposites for Electrical Applications
- Nanocomposites for Thermal Applications (For Example: Thermally conductive resin systems for use in cooling personal computers, LED lighting systems, etc.)
- Nanocomposites for Bio Applications (For Example: Catheter formulations for use in medical applications, lead free Radiopaque compounds for minimally invasive surgery, and lead freed Radiopaque compounds for use in medical equipment such as X-Ray machines and CT scanning machines, nanoparticles for biomedical imaging and targeted drug delivery)

**4) Describe how the platform will provide a sustainable pipeline of technologies for commercialization.**

A single material component often cannot meet demanding application needs. The development of composite materials possessing properties characteristic of the constituent components with synergetic effects has long been exploited as an effective approach towards advanced nanocomposite materials. With recent significant advances in nanoscience and nanotechnology, the research and development of advanced nanocomposites offers numerous opportunities for innovative product development through advanced materials design, processing, and characterization.

As an Innovation Platform, CAN will provide the necessary facilities, equipment, and expertise to support industry clients in the technical drive to product commercialization. By building on the capabilities and capacity of CWRU's existing MURI platform, industry clients will have the opportunity to develop and characterize advanced nanocomposite products using state-of-the-art tools and techniques. Support by the Third Frontier Innovation Platform Program will allow CWRU and its industry clients to collaborate like never before in the advancement of nanocomposite products for a range of commercial applications.

13-341

# Innovation Platform Program

## 2013 Request for Proposals

## Letter of Intent

| | |
|---|---|
| **Lead Applicant Institution** | **Cleveland Clinic** |
| **Lead Applicant Contact Information** | **Name: Dr. George Muschler** |
| | **Title: Professor of Orthopaedic Surgery, Vice Chairman, Orthopaedic and Rheumatologic Institute, Vice Chairman, Department of Biomedical Engineering** |
| | **Phone Number: 216-403-5646** |
| | **Email: muschlg@ccf.org** |
| **Project Title:** | Development and Commercialization of a Cellular Imaging, Analysis and Processing Tool for Application in Regenerative Medicine |

| | | | |
|---|---|---|---|
| **Total Project Budget** | $ 3.45 million | **Ohio Third Frontier Funds Requested** | $ 1.7 million |

**Project Focus:**

- ☐ Advanced Materials (related to advanced polymers; ceramics; composites; carbon fibers and nanotubes; and, specialty metals and alloys)
- ☐ Aeropropulsion and Power Management
- ☐ Fuel Cells and Energy Storage
- ☒ Medical Technology (related to imaging; surgical instruments/equipment; implant devices; and, regenerative medicine)
- ☒ Software Applications for Business and Healthcare
- ☐ Sensing and Automation Technologies
- ☐ Situational Awareness and Surveillance Systems
- ☐ Solar Photovoltaics
- ☐ Agribusiness and Food Processing

Please answer the following questions using no more than two additional pages. The Letter of Intent should address each question in order identifying each response. Do not include any trade secret information in this Letter of Intent.

1) Describe the proposed technology platform. Please refer to the Request for Proposals Section 2.1 second paragraph for the definition of a technology platform.
2) Please list all committed industry clients and their anticipated cash cost share contribution.
3) Describe the commercial products that will be developed and enter the market within the 3-year timeframe of the Grant.
4) Describe how the platform will provide a sustainable pipeline of technologies for commercialization.

1) **Describe the proposed technology platform.**

Cell-based regenerative medicine has been widely touted as the "next frontier" in the treatment of human disease and injury. However, there is a critical need for a cost-effective means of rapid preparation of therapeutic cells for research and clinical use. Manufacture and regulatory approval of cell-based products is expensive, labor-intensive and not standardized. Progress in the field has been impeded by cost-, labor- and infrastructure-intensive manual methods of cell culture, selection, characterization, and *in vitro* cell expansion. This is exacerbated by a dearth of purification and quality control systems and standards for release criteria suitable to support the needs of scaled-up "in-house" manufacturing. Even the best manual methods often yield highly variable end products, making it difficult to provide the robust audit trail of safety and efficacy needed to streamline the regulatory path from R&D to FDA approval.

Smart Cellector™ 3.0 will represent an automated platform that combines two core functional features: Quantitative imaging and image analysis capabilities (i.e. Colonyze™ - a patented Cleveland Clinic technology) and precision robotic tools for cell manipulation and processing (i.e. Smart Syringe™ a patented Parker Hannifin technology).

Integration of these two technology platforms enables the creation of an integrated automated manufacturing platform that will dramatically improve the quality and reliability of current and future cell therapy products, reduce cost, reduce waste, improve documentation, improve the safety of current and future cell therapy products, and accelerate the availability of personalized cell therapy strategies using a patient's own cells.
This proposal fulfills several major goals of the Ohio Third Frontier Biomedical Program (OTFBP) by:

- Advancing standards for characterizing and processing cells for clinical regenerative therapies.
- Creation of new jobs in Ohio.
- Leverage resources and filling technical needs of several clients, including Ohio-based companies and institutions.
- Completion of technical validation necessary for regulatory approval (FDA, ISO, GMP, CLIA)
- Demonstrating *market readiness*, and strategically positioning in a broad base of cell therapy applications.

**2) Please list all committed industry clients and their anticipated cash cost share contribution.**

Partners - This proposal is being led by Cleveland Clinic (CC) and includes two committed Ohio partners: Parker Hannifin Corp. (PHC), and eehscience, LLC (Columbus, OH).

Extended Collaborators - We expect to include several Ohio based partners as collaborators involved in beta-testing and validation, including Ohio State University, Case, University of Cincinnati, Athersys, Inc., the Cleveland Cord Blood Center, and Image IQ. We also expect to include one or more organizations outside of Ohio as collaborators involved in beta-testing and validation, including: Massachusetts Institute of Technology (MIT) and ISTO Technologies, Inc.

Cost Share - Cost Share will be provided primarily by Cleveland Clinic ($1,000,000 and Parker Hannifin Corporation ($750,000). PHC will manufacture three Smart Cellector prototypes (2.0, 2.1 and 3.0). Prototypes 2.0 and 2.1 will be used to validate the capabilities of the platform technology through in house and beta-testing collaborations. They will also be utilized to engage in fee-for-service offerings to potential customers. The experience in fabricating and using prototypes 2.0 and 2.1 will also be used to refine the design and manufacturing of the first commercial prototype for external sales (Smart Cellector 3.0). EehScience will serve as an enabling commercial partner and will not contribute towards cost share.

**3) Describe the commercial products that will be developed and enter the market in the 3 yr period of the Grant.**

The work in this proposal will result in the design and validation of an integrated modular component product that can be used alone or in combination to fill critical gaps in the area of stem cell and progenitor cell research, clinical diagnostics, quality control in cell therapy, process development and fully scaled cell manufacturing.

Colonyze™ Imaging and Image Analysis System enables "real time" "in line "quantitative assay and characterization of living cell populations (human or animal) *in vitro*. The output of Colonyze™ also provides precise information regarding the identity as well as location of individual cells or groups of cells (i.e. colonies) within a given cell sample. Characterization may be accomplished using native optical properties alone (i.e. no extrinsic chemicals or reagents) or any of a number of vital (i.e. live cell) markers as well as conventional staining of fixed or non-viable cell samples. Brightfield, fluorescence or IR imaging can be performed. The analysis tools in Colonyze™ provide a versatile platform that can be readily customized by the user to be specific for unique cell types or markers using defined parameters. The Colonyze™ module represents a separately marketable "stand alone" analytical tool that can be used to characterize cell populations for purposes related to basic research, quality control in manufacturing, or clinical diagnostic services.

*Smart Syringe™* provides the means of precisely controlling the collection, removal or transplantation of cells from any population characterized using defined coordinates provided by Colonyze™ analysis.

Smart Cellector™ 3.0 will represent the modular combination of Colonyze™ and Smart Syringe™ into one integrated unit, including controllers and software tools. Smart Cellector™ provides the user with the capability of both characterizing the cells and colonies in a given cell sample, and the capacity to design and implement rigorous automated processing to select or remove cells for analysis or as part of a cell processing strategy designed to select a cell or cells with specific biological properties. These Smart Cellector™ systems and ancillary modules will also define a plurality of customized disposable materials and service requirements that represent additional products and sales opportunities.

The Smart Cellector™4.0 will be designed to provide the capacity to add further modules, such as placement in a rigorous Smart Cellector™ Environment Control Chamber and/or integration with Smart Cellector™ Automated Material Handling Systems. These modules provide a "hands free" control system to enable Smart Cellector™4.0 to serve as the central processing unit in a scalable and versatile fully automated system of cell manufacturing. These systems enable rigorous certification applicable to ISO, GMP, GLP, CLIA and other applicable regulatory standards.

**4) Describe how the platform will provide a sustainable pipeline of technologies for commercialization.**

The Gantt chart below outlines the product development and commercialization timeline over the three-year proposal.

The initial prototype (Smart Cellector™ 1.0) was developed and tested in 2012. Using this prototype we have defined conditions in which human cells cultured on conventional tissue culture surfaces can be efficiently and safely selected and transplanted using the automated Smart Syringe™ from a source plate to a recipient location, and go on to grow as a purified and rigorously characterized population. This feasibility testing was accomplished using physically discontinuous Colonyze™ unit and Smart Cellector™ with manual transfer of cells between Colonyze™ imaging and "Cellection."

The next stage of development in 2013 will create a prototype that integrates Colonyze™ and Smart Cellector™ into a single automated platform. Cleveland Clinic, Parker Hannifin, and eehScience anticipate the prototype (Smart Cellector 2.0) to be ready by Q3 2013. This process is currently leveraged by collaboration with the Cleveland Cord Blood Center under an existing OTF award in which Colonyze™ is being applied to the analysis and clinically relevant quality assessment of human hematopoietic stem cell (HSC) colonies. This experience builds upon prior experience using Colonyze™ approaches to characterize native human connective tissue progenitors (hCTPs) and culture expanded human mesenchymal stem cells (hMSCs).

Fee-for-service contracting has already been established using Colonyze™ alone to assay human CTPs in samples of from bone marrow or fat. We expect to offer fee-for-service contracts using Smart Cellector ™2.0 for CTPs and hematopietic stem cells (HSCs) from marrow or umbilical cord blood by Q3 2013, followed by fee-for-service for cartilage-derived stem cells and engineered skin substitutes as additional capacity is added by Smart Cellector™ 2.1 and 2.2.

The first commercial device for external sale, Smart Cellector™3.0, is expected to be launched in Q1 2015. The fully scalable and versatile Smart Cellector™4.0 should be deployable by Q1 2016.

| | 2012 | 2013 | | | | 2014 | | | | 2015 | | | | 2016 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Development Plan** | | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 |
| Smart Cellector™ 1.0 | | | | | | | | | | | | | | | |
| Smart Cellector™ 2.0 | | | | | | | | | | | | | | | |
| Smart Cellector™ 2.1 | | | | | | | | | | | | | | | |
| Smart Cellector™ 3.0 | | | | | | | | | | | | | | | |
| Smart Cellector™ 4.0 | | | | | | | | | | | | | | | |
| **Fee for service analysis** | | | | | | | | | | | | | | | |
| Bone marrow or fat-derived CTPs or MSCs | | | | | | | | | | | | | | | |
| Umbilical cord or marrow-derived HSCs | | | | | | | | | | | | | | | |
| Cartilage progenitors | | | | | | | | | | | | | | | |
| Skin progenitors | | | | | | | | | | | | | | | |
| **Product sales** | | | | | | | | | | | | | | | |
| Smart Cellector™ 3.0 | | | | | | | | | | | | | | | |
| Smart Cellector™ 4.0 | | | | | | | | | | | | | | | |

13-342

Ohio | Third Frontier
Innovation Creating Opportunity

# Innovation Platform Program

## 2013 Request for Proposals

## Letter of Intent

| | |
|---|---|
| **Lead Applicant Institution** | **The University of Akron** |
| **Lead Applicant Contact Information** | **Name: J. Alexis De Abreu-García** |
| | **Title: Professor and Chair, Electrical and Computer Engineering Department** |
| | **Phone Number: (330) 972-6709** |
| | **Email: alexis4@uakron.edu** |
| **Project Title:** | Smart Sensor System Design, Development, and Commercialization |

| | | | |
|---|---|---|---|
| **Total Project Budget** | $ 4,200,000 | **Ohio Third Frontier Funds Requested** | $ 2,100,000 |

**Project Focus:**

- ☐ Advanced Materials (related to advanced polymers; ceramics; composites; carbon fibers and nanotubes; and, specialty metals and alloys)
- ☐ Aeropropulsion and Power Management
- ☐ Fuel Cells and Energy Storage
- ☐ Medical Technology (related to imaging; surgical instruments/equipment; implant devices; and, regenerative medicine)
- ☐ Software Applications for Business and Healthcare
- ☒ Sensing and Automation Technologies
- ☐ Situational Awareness and Surveillance Systems
- ☐ Solar Photovoltaics
- ☐ Agribusiness and Food Processing

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2) Please list all committed industry clients and their anticipated cash cost share contribution.
3) Describe the commercial products that will be developed and enter the market within the 3-year timeframe of the Grant.
4) Describe how the platform will provide a sustainable pipeline of technologies for commercialization.

Project Title: Smart Sensor System Design, Development, and Commercialization.

1) Describe the proposed technology platform.

The Department of Electrical and Computer Engineering at the University of Akron has a unique Innovation Platform Technology in the sensors area. Through the Wright Center for Sensor Systems Technology partnership at the University of Akron (WCSSE-UA), which is part of the Center for Advanced Vehicles and Energy Systems (CAVES), the researchers in the College of Engineering are in partnership with nearly a dozen for-profit companies for the development of novel sensors which will create jobs and lead to long-term commercial benefits. Currently, personnel from ADI Wind, BASF, EBO, Orbital Research, and R.W. Beckett are collaborating with WCSSE-UA personnel to shorten the time-to-market of a number of new sensors, ranging from high temperature ASICs to flow sensors to flame detention sensors to flexible embedded sensors. Some of the unique technology capabilities include wireless sensors, networked sensors, sensors with embedded computing, virtual sensors, energy harvesting sensors, high temperature sensors, optical sensors, fluid sensors, flow sensors, stress-strain sensors, corrosion sensors, health-monitoring and other physical sensors. These sensor technologies are widely applicable to a number of Ohio industries. Some unique facilities include a 150kW dynamometer for testing motors, generators, and power electronic drive sensors, a high temperature electronics lab for testing integrated circuits at high temperatures, a real-time computing lab for the development of improved embedded capabilities including virtual sensors, a tribology lab for testing bearing and seal sensors, an optical strain analysis lab for developing sensors that determine the deformation of structures, a battery lab for testing battery pack monitoring sensors and management systems, a microwave lab for developing wireless communication capabilities, an alternative energy lab for developing sensors for use in green technologies, a number of corrosion facilities for developing corrosion sensors, and access to a clean room in the Timken Engineered Surfaces Center. Through these facilities, researchers in the College of Engineering have established a long term track record of helping industries in the commercialization of new products, including the creation of new technology, intellectual property, and jobs.

2) List all committed industry clients and their anticipated cash cost share contribution.

Committed industry clients are Therm-O-Disc, Inc. | Emerson, located in Mansfield, OH, and Bendix Commercial Vehicle Systems located in Elyria, OH. Therm-O-Disc's anticipated cost share contribution for this program is $1,200,000 Dollars over the 3 year program period. The University of Akron and Bendix Commercial Vehicle Systems commit to proportionately share the cost share balance of $900,000 Dollars.

Therm-O-Disc, headquartered in Mansfield, Ohio, is a leading supplier of temperature, flow, and pressure sensors across multiple global markets including appliances, HVAC, automotive, data center monitoring, and other commercial industries. Therm-O-Disc's broad product line includes: bimetal disc thermostats, Microtemp® thermal cutoffs (also known as thermal fuses or thermal links), thermistor probes, and special purpose temperature controls. Therm-O-Disc is the world's largest producer of bi-metal disc controls and has thousands of configurations available for specific design requirements. More recently, this family of sensors has expanded to include smart sensors for temperature, flow, and pressure, including wireless connectivity. Therm-O-Disc is a business unit of Emerson, a diversified global manufacturing and technology company. Therm-O-Disc's $1,200,000 Dollars cost share contribution to this program is a testament to their intent to continue to invest heavily in the commercial development of smart sensor products.

Bendix Commercial Vehicle Systems, a member of the Knorr-Bremse Group, develops and supplies leading-edge active safety technologies, air brake charging, and control systems and components under

the Bendix® brand name for medium- and heavy-duty trucks, tractors, trailers, buses, and other commercial vehicles throughout North America. Bendix, employing more than 2,000 people, delivers solutions for improved vehicle performance, safety, and overall operating cost.

Bendix Commercial Vehicle Systems, headquartered in Elyria, Ohio, has the vision to become the leading worldwide supplier of active vehicle safety systems within the commercial vehicle industry.

3) Describe the commercial products that will be developed and enter the market within the 3-year timeframe of the Grant.

The objective of the Therm-O-Disc project is to develop sensors and systems supporting pipeline integrity management, corrosion and environment monitoring, and power measurement. The sensors will incorporate wireless communication technology to enable remote monitoring and reporting. These sensors will target the needs of the natural gas pipeline industry and industrial facility energy management.

The objective of the Bendix Commercial Vehicles project is to develop an electronic system to monitor the health condition of the brake system in trucks and report to the central control unit. The brake sensor and associated hardware and software pieces would need to be integrated with other possible sensors used in the brake system to provide a complete sensor package.

4) Describe how the platform will provide a sustainable pipeline of technologies for commercialization.

Sensing real physical data is an ubiquitous activity. To improve competitiveness, industries are realizing that obtaining more data from their manufacturing processes will allow them to improve production efficiency by understanding how their processes are behaving. More and more sensors are being added to everyday use devices to improve their performance. There is an increasing need to place wireless sensors throughout our infrastructure to monitor the status of roads, bridges, buildings, pipelines, and the power grid. All industries are realizing that they must add sensors to their production lines and products in order to reduce energy usage and remain competitive. The sensor technology and knowledge developed through WCSSE-UA will be utilized for the sponsoring companies, but once a capability has been created, other industries will then engage the university for the development of similar sensors. Through this ongoing interaction, new sensors will be created, old sensors will be repurposed, and previously developed sensors will be licensed or modified for new applications. Companies will continue to utilize and sell these new products, as well as create jobs needed in their manufacture. Researchers in the College of Engineering at the University of Akron are dedicated to the success of these sensor technologies, and to the success of the Ohio industries engaged as partners.

13-343

**Hansen, Andrew**

**From:** Clovis Linkous [calinkous@ysu.edu]
**Sent:** Friday, December 21, 2012 11:31 AM
**To:** OhioThirdFrontierRFP
**Cc:** Michael Hripko
**Subject:** 2013 Innovation Platform Program Letter of Intent

Dear Mr. Hansen,

Please consider this as a letter of intent in application to the Ohio Innovation Platform Program. I intend on submitting a proposal on the subject of Solid Oxide Fuel Cells and its implementation toward the conversion of biogas found in Ohio's landfills to electrical power. The collaborating companies are NexTech in Lewis Center and Rolls Royce in Stark. Feel free to e-mail back (calinkous@ysu.edu) or call (321-536-3329) if you have questions.

Very truly yours,

Clovis A. Linkous, Ph.D.
STEM College professor
Youngstown State University

13-344

# Innovation Platform Program

## 2013 Request for Proposals

## Letter of Intent

| | |
|---|---|
| **Lead Applicant Institution** | The Ohio State University |
| **Lead Applicant Contact Information** | **Name:** Dennis Hall |
| | **Title:** Interim Director, OBIC (The Ohio Bioproducts Innovation Center) |
| | **Phone Number:** (614) 292-4188 |
| | **Email:** hall.16@osu.edu |
| **Project Title:** | Bio-Based Composites Innovation Platform |

| | | | |
|---|---|---|---|
| **Total Project Budget** | $6,000,000 | **Ohio Third Frontier Funds Requested** | $3,000,000 |

**Project Focus:**

- ☒ Advanced Materials (related to advanced polymers; ceramics; composites; carbon fibers and nanotubes; and, specialty metals and alloys)
- ☐ Aeropropulsion and Power Management
- ☐ Fuel Cells and Energy Storage
- ☐ Medical Technology (related to imaging; surgical instruments/equipment; implant devices; and, regenerative medicine)
- ☐ Software Applications for Business and Healthcare
- ☐ Sensing and Automation Technologies
- ☐ Situational Awareness and Surveillance Systems
- ☐ Solar Photovoltaics
- ☒ Agribusiness and Food Processing

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2) Please list all committed industry clients and their anticipated cash cost share contribution.
3) Describe the commercial products that will be developed and enter the market within the 3-year timeframe of the Grant.
4) Describe how the platform will provide a sustainable pipeline of technologies for commercialization.

152 Howlett Hall
2001 Fyffe Ct.
Columbus OH 43210-1066
Phone 614-292-2922
FAX 614-247-4739

# Letter of Intent: Response to Questions

**Project Title:** Bio-Based Composites Innovation Platform
**Lead Applicant:** The Ohio State University (OBIC)
**Contact:** Denny Hall, Interim Director of OBIC
(614) 292-4188
hall.16@osu.edu

**1) Describe the proposed technology platform. Please refer to the Request for Proposals Section 2.1 second paragraph for the definition of a technology platform.**

The anchoring technology behind the OBIC Bio-Based Composites Innovation Platform (BBCIP) is the result of a prior Ohio Third Frontier Wright Project - Commercialization of *Bio-based and Nano-tailored Composites for Industrial Application*, awarded March 2009. This breakthrough technology allows for a drop-in replacement of new composite materials that combine the benefits of superior performance, renewable content, light-weighting, improved end-of life options, and improved wear of extrusion tools and dies (reduced abrasion), all with at least 10% cost savings compared to synthetic fibers.

The use of sustainable, bio-based materials in polymeric compounds is expected to grow by 30-40% per year for the next decade. The BBCIP proposes to address this large and growing demand for bio-based composites and ensure that Ohio takes its rightful place as a major player in this emerging industry.

**2) Please list all committed industry clients and their anticipated cash cost share contribution.**

For this Innovation Platform Program proposal, the BBCIP will be partnering with at least three unrelated industrial collaborators to pull this technology into the market with an impressive array of products. Current collaborators include:

- GDC is anticipated to commit approximately $900K in cost share.
- BioBent is anticipated to commit approximately $600K in cost share.
- Engineering Mechanics Corporation of Columbus is anticipated to commit approximately $180K in cost share.
- Other OBIC Alliance Members are also anticipated to participate and provide cost share.

**3) Describe the commercial products that will be developed and enter the market within the 3-year timeframe of the Grant.**

To date, the Bio-Based Composites Innovation Platform (BBCIP) has demonstrated advanced natural fibers with high aspect ratios and high strength ranging from processed bast to nano-sized fibers. When blended into a variety of plastic resins, the processed fiber composites (a) enhance the physical, mechanical, acoustic, thermal, and electrical properties, (b) provide special functionality, and (c) lower the cost, reduce the weight, and promote ease of processing compared to other common performance fibers such as glass.

The BBCIP is taking a portfolio approach, and has developed a deep pipeline of near-term through long term products. The first products to market within the 3-year timeframe of the grant will focus on bast-fiber composites using existing formulations and production methods, and will include replacement of aluminum and glass fiber reinforced structural members for light-weighting and cost savings in the automotive, consumer, and building materials markets. Meanwhile, the BBCIP's other natural fibers (such as soy hulls, soy protein, miscanthus, etc), various resins (including bio-based resins), and additional forming processes will be developed, which will then support the roll-out of an expanded number of drop-in replacements for performance products in our industrial partners' existing product lines.

**4) Describe how the platform will provide a sustainable pipeline of technologies for commercialization.**

The Bio-Based Composites Innovation Platform (BBCIP) is market focused, and driven by a large and growing cluster of Committed End Users and bio-based composites development companies. These new and emerging bio-based composite technologies and processes provide a unique competitive advantage for Ohio. The proposed BBCIP will link Ohio assets in advanced natural fiber technologies, and application development expertise. The funding will help make Ohio first to market with revolutionary new performance fibers and provide new business for Ohio's composite manufacturers while propelling our Ohio manufacturing supply chain into the role of the world's leading suppliers of bio-based composite materials, bio-based raw materials, and processing equipment.

13-345

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# Innovation Platform Program

## 2013 Request for Proposals

## Letter of Intent

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|---|---|
| **Lead Applicant Institution** | **Cleveland Clinic** |
| **Lead Applicant Contact Information** | **Name: Raed A. Dweik** |
| | **Title:** Director, Pulmonary Vascular Program |
| | **Phone Number: 216-445-5763** |
| | **Email: dweikr@ccf.org** |
| **Project Title:** | Breath Analysis Innovation and Commercialization Platform |

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|---|---|---|---|
| **Total Project Budget** | $ 6 Million | **Ohio Third Frontier Funds Requested** | $ 3 Million |

**Project Focus:**

- ☐ Advanced Materials (related to advanced polymers; ceramics; composites; carbon fibers and nanotubes; and, specialty metals and alloys)
- ☐ Aeropropulsion and Power Management
- ☐ Fuel Cells and Energy Storage
- ☒ Medical Technology (related to imaging; surgical instruments/equipment; implant devices; and, regenerative medicine)
- ☐ Software Applications for Business and Healthcare
- ☐ Sensing and Automation Technologies
- ☐ Situational Awareness and Surveillance Systems
- ☐ Solar Photovoltaics
- ☐ Agribusiness and Food Processing

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1) Describe the proposed technology platform. Please refer to the Request for Proposals Section 2.1 second paragraph for the definition of a technology platform.
2) Please list all committed industry clients and their anticipated cash cost share contribution.
3) Describe the commercial products that will be developed and enter the market within the 3-year timeframe of the Grant.
4) Describe how the platform will provide a sustainable pipeline of technologies for commercialization.

**1- The proposed technology:**

With each breath we exhale, thousands of molecules are expelled. Each individual has a "breath-print" that can tell a lot about the state of his or her health. Breath analysis is rapidly evolving as the new frontier in medical testing. The end of the 20th century and the beginning of the 21st century have witnessed a revolution in our understanding of the constituents of exhaled breath and the development of the field of breath analysis and testing. Thanks to major breakthroughs in new technologies – infrared, electrochemical, cemiluminescence – and the availability of mass spectrometers, the field of breath analysis has made considerable advances in the 21st century. Several methods are now in clinical use or nearly ready to enter that arena. Advancement in this field demands close collaboration between constituents: engineers and technical experts seeking clinical applications for emerging device technologies; medical experts facing the clinical challenges of diagnosis and monitoring; and players in the industrial and commercial arena who are able to successfully manufacture and market the final product. The goal of the proposed Breath Analysis Innovation and
Commercialization Platform is the establishment and nurturing of these important collaborations to ensure the establishment of Ohio as the international leader in breath analysis.
As pioneers in breath analysis, our team has been involved in the field since its modern inception. The breath analysis laboratory at the Cleveland Clinic continues to produce cutting edge research and draws on the strengths of the Departments of Pulmonary and Critical Care Medicine in the Respiratory Institute and Pathobiology in the Lerner Research Institute. Clinical and biological exhaled breath markers as predictors of treatment response are being tested in lung disease like lung cancer, asthma and pulmonary hypertension, as well as diseases beyond the lung including liver disease, renal failure, diabetes, and infections, among others. The goal of establishing the Breath Analysis Innovation and Commercialization Platform is to accelerate the transfer of technology to our industry partners.

**2- Committed industry:**

Makel Engineering: Requested state funds: $1,365,048, cost share 1,338,224
Syft technologies: Requested state funds: $484,020, cost share 553,248

**3- Commercial Products:**

**Product 1 from area 1: Asthma NO monitor**

**Product 2 from area 1: Physiology monitors ($CO_2$, $O_2$)**

**Product 1 from area 2: Breath test for alcoholic liver disease**

**Product 2 from area 2: Breath test for dialysis**

**Product 3 from area 2: Breath test for heart failure**

**4- Sustainable pipeline:**

The Platform will focus on the commercialization of recently developed sensors by building them into clinically useful and commercially viable products. The Platform will mobilize and focus the clinical and commercial resources needed to demonstrate the clinical utility and ensure commercial viability and success for market entry of breath analysis products based on the existing technology previously

developed with our partners. The Platform will lead to $27M in revenue in year 5, with 47 jobs created in our Ohio collaborators. This will help advance the Clinic's mission by allowing us to continue to provide world class care for all our patients and also pave the way for advances in personalized care for each individual patient based on his or her own unique breath print. More importantly, the Breath Analysis
Innovation and Commercialization Platform will also help establish and consolidate Ohio as an international clinical and commercial hub in this rapidly emerging field.

13-346

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# Innovation Platform Program

## 2013 Request for Proposals

## Letter of Intent

| | |
|---|---|
| **Lead Applicant Institution** | **The Ohio State University** |
| **Lead Applicant Contact Information** | **Name: Longya Xu** |
| | **Title: Professor** |
| | **Phone Number: 614-292-6119** |
| | **Email: xu.12@osu.edu** |
| **Project Title:** | Advanced Integration and Management of Electrical Power and Propulsion Systems |

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|---|---|---|---|
| **Total Project Budget** | $ 3,000,000 | **Ohio Third Frontier Funds Requested** | $1,500,000 |

**Project Focus:**

- ☐ Advanced Materials (related to advanced polymers; ceramics; composites; carbon fibers and nanotubes; and, specialty metals and alloys)
- ☒ Aeropropulsion and Power Management
- ☐ Fuel Cells and Energy Storage
- ☐ Medical Technology (related to imaging; surgical instruments/equipment; implant devices; and, regenerative medicine)
- ☐ Software Applications for Business and Healthcare
- ☐ Sensing and Automation Technologies
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4) Describe how the platform will provide a sustainable pipeline of technologies for commercialization.

## 1) Describe the proposed technology platform. Please refer to the Request for Proposals Section 2.1 second paragraph for the definition of a technology platform.

This project is based on the existing power electronics and electric machine research capabilities at The Ohio State University (OSU). The goal is to further enhance the research facility and operation to support multiple applications that include advanced integration and management of propulsion and power systems for airplanes, hybrid electric propulsion systems for Unmanned Aerial Vehicles (UAVs), power supplies and battery chargers for Shale gas drilling systems, traction drive and auxiliary power supply for hybrid and electric vehicles, as well as the interface for renewable energy sources such as wind and solar.

Power electronic converters, electric machines, and associated control systems have gradually become integral parts of all types of modern energy systems. In the last several years, related activities at OSU have received strong support from the State of Ohio. A Center for High Performance Power Electronics (CHPPE) has recently been established with the support from the Wright Project program. An earlier Wright Project at OSU for plug-in hybrid electric vehicles also has a strong power electronics component. With this project, the industry and university team hopes to ramp up the effort on UAV and Shale gas related products. The planned activities on aerial vehicles are complimentary with GE Aviation's effort on engine thermal and power management, which is in collaboration with University of Cincinnati and also supported by Ohio Third Frontier.

## 2) Please list all committed industry clients and their anticipated cash cost share contribution.

**General Electric Aviation**
Cost share: $750,000

**IAP Research, INC**
Cost share: To be decided

**AMETEK Solidstate Controls LLC**
Cost share: $100,000

The above numbers indicate the interest from industry partners but not a commitment. The partner's commitment to propose and to cost share is pending formal business approval.

## 3) Describe the commercial products that will be developed and enter the market within the 3-year timeframe of the Grant.

High power density and high temperature converter for airplane engine control: There is a strong demand on advanced engine control and power system management for aerial vehicles. The planned high power density and high temperature power converter is one of the key components for the advanced control and management systems. Because of the high demand, near term products are expected.

Next generation Low Pressure Spool generator: with the advanced power electronics circuits and control, the next generation LP generator would become the essential part of the hybrid electric drive of UAVs. This effort will be supported by GE Aviation and IAP.

Uninterrupted Power Supply (UPS) and Chargers: these units are the critical subsystems of Shale gas drilling systems. AMETEK is currently supplying these components to Shale gas industry. Upgrade with the technology from this project can make the products more competitive in the market.

## 4) Describe how the platform will provide a sustainable pipeline of technologies for commercialization.

The platform has strong focuses on wide bandgap power device based circuits and real-time simulation of complex power electric and power system systems. For near term products, with the simulation and test capabilities, the platform can provide technical support in terms of design optimization, control strategy study, and prototype testing. For the long term, the research on new circuit topologies and associated controls will bring in upgrade of existing products as well as brand new products especially for the hybrid electric drives of UAVs.

13-347

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# Innovation Platform Program

## 2013 Request for Proposals

## Letter of Intent

| | |
|---|---|
| Lead Applicant Institution | Ohio State University - Center for Automotive Research |
| Lead Applicant Contact Information | Name: Giorgio Rizzoni<br>Title: Professor and CAR Director<br>Phone Number: 614 688-3856<br>Email: rizzoni.1@osu.edu |
| Project Title: | Development of CNG/LNG Fuel & Energy Storage Systems for Medium & Heavy Duty Vehicles |
| Total Project Budget | $ 6,000,000 |
| Ohio Third Frontier Funds Requested | $ 3,000,000 |
| Project Focus: | ☐ Advanced Materials (related to advanced polymers; ceramics; composites; carbon fibers and nanotubes; and, specialty metals and alloys)<br>☐ Aeropropulsion and Power Management<br>☑ Fuel Cells and Energy Storage<br>☐ Medical Technology (related to imaging; surgical instruments/equipment; implant devices; and, regenerative medicine)<br>☐ Software Applications for Business and Healthcare<br>☐ Sensing and Automation Technologies<br>☐ Situational Awareness and Surveillance Systems<br>☐ Solar Photovoltaics<br>☐ Agribusiness and Food Processing |

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4) Describe how the platform will provide a sustainable pipeline of technologies for commercialization.

**Ohio Third Frontier 2013 Innovation Platform Program Letter of Intent**
**Development of CNG/LNG Fuel & Energy Storage Systems for Medium & Heavy Duty Vehicles**
**By the Ohio State University Center for Automotive Research**

## 1. Proposed Technology Platform

There is a strong current focus on breaking our dependency on foreign fuels. Additionally, all sectors of the transportation market are looking for relief from the high costs of petroleum, the fuel that drives over 90% of the vehicles in the US. Natural Gas (NG) has recently been found in several large shale deposits here in the US that could, by several credible estimates, bring our country to energy independence within a decade. Energy independence alone makes Compressed Natural Gas (CNG) and Liquefied Natural Gas (LNG) attractive as fuels for use in the medium and heavy duty vehicle market, the place where studies have shown NG to be the most economically attractive. NG is additionally attractive to the vehicle owner because gaseous fuels are half the price of their petroleum based counterparts. Finally, NG is desirable to Ohio because this state has huge NG reserves. At present, there are relatively few OEM or aftermarket vehicles to choose from that can use CNG/LNG as a fuel. There is also a fledgling industry that produces conversion kits for trucks but the primary market is expected to be with new vehicles. One of the primary elements in a vehicle that can burn CNG or LNG is the energy storage and fuel distribution system, which stores the gaseous fuel and provides the fuel to the engine at the proper temperature and pressure for combustion.

The goal of this project is to link the existing Technology Platform at the Ohio State University Center for Automotive Research (CAR), with two client companies involved with fuel and energy storage systems for CNG/LNG vehicles. CAR resources and know-how will be used to help these client companies develop fuel system products within the performance period of this grant, allowing Ohio to become a leader in this emerging market. Current fuel and energy storage systems for CNG & LNG vehicles consist of a hodgepodge of parts and pieces that are available from a variety of manufacturers. There has not yet been a focused effort to develop comprehensive CNG and LNG fuel systems for medium and heavy duty vehicles that focuses on overall systems optimization from the vehicle level.

CAR has developed an international reputation for leading the effort in sustainable transportation. Specifically, the Technology Platform at CAR that is relevant to this proposal consists of:

- Design engineers and researchers with extensive experience in the automotive arena with a focus on energy storage, vehicle energy management, fluid flow, controls, and system optimization;
- Design tools for vehicle simulation and optimization;
- A proven ability to innovate in this automotive arena;
- Fabrication and prototyping capability for automotive technologies; and,
- Testing capabilities, including a unique heavy duty dynamometer facility that the Third Frontier helped to establish.

## 2. List of Committed Industry Clients

The following are the clients that are currently committed to this project with the estimated cost share each will contribute.

| Participant | Cost Share |
|---|---|
| Ohio State University – Center for Automotive Research | $ 350,000 |
| Worthington Cylinder | $2,500,000 |
| Trilogy Engineered Solutions | $ 150,000 |

**3. Commercial Products to be Developed**

The principle products to be developed will be a CNG fuel system for a medium duty delivery vehicle and an LNG fuel system for a heavy duty over the road vehicle. This will include the construction of computer based design tools for developing CNG and LNG fuel systems, as well as the design and prototyping of CNG and LNG systems for particular vehicles. These fuel systems will be installed in typical vehicles, tested, and then EPA certified in CAR's unique heavy duty dynamometer facility. At the end of the grant period, these two fuel systems will be ready for manufacture. Specifically, the following tasks will be accomplished during the 3 year performance period:

- Market analysis to determine all the products that are available for CNG & LNG fuel systems;
- Vehicle simulations to determine desirable CNG & LNG fuel system characteristics;
- Analysis of codes and standards;
- Fuel system design for CNG & LNG systems including new innovations in design to improve system performance and reduce manufacturing costs;
- Development of a design tool for CNG & LNG fuel system design;
- Construction of prototype CNG & LNG fuel systems;
- Installation of CNG & LNG fuel systems on appropriate vehicles;
- Dynamometer testing to determine performance characteristics;
- Design revision and retesting to meet project objectives;
- Confirmation that design characteristics have been achieved;
- EPA certification of fuel systems; and,
- Set up manufacturing facilities to produce the fuel systems.

**4. How the IPP Provides a Sustainable Pipeline of Technologies for Commercialization**

This funding program would link existing resources and capabilities at CAR with two Ohio-based client companies to produce tools for CNG and LNG fuel system design, and would then prototype and test two actual energy storage and fuel systems for medium and heavy duty vehicles. At the conclusion of the grant, these fuel systems would be ready for mass production. But more importantly, this grant will have leapfrogged these companies into being market leaders in CNG/LNG fuel systems, enabling them to develop a long string of products including:

- CNG fuel systems for light duty and heavy duty vehicles, as well as additional medium duty vehicles not included in this grant;
- LNG fuel systems for light and medium duty vehicles, as well as additional heavy duty vehicles not included in this grant; and,
- Fuel systems for new engines that are optimized for CNG & LNG that are now being developed.

Thus the IPP will successfully link the strong existing capabilities at CAR with client Ohio-based companies that want to move into the CNG/LNG fuel system space. The IPP will leverage resources already invested at CAR by the Third Frontier to allow these companies to develop rapidly and take the lead in the developing market place for alternative fueled vehicles. The IPP funding will provide key resources that will unlock the development of a long string of CNG/LNG energy storage and fuel system products and innovations, and will catapult the client companies into market-leading roles in an industry forecasted for rapid growth and job creation.

13-348

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# Innovation Platform Program

## 2013 Request for Proposals

## Letter of Intent

| | |
|---|---|
| **Lead Applicant Institution** | **The Ohio State University Center for Automotive Research (OSU-CAR)** |
| **Lead Applicant Contact Information** | **Name: Dr. Giorgio Rizzoni** |
| | **Title: Professor, Director, Center for Automotive Research** |
| | **Phone Number: 614-688-3856** |
| | **Email: rizzoni.1@osu.edu** |
| **Project Title:** | Micro CHP Fuel Cell Generator |

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|---|---|---|---|
| **Total Project Budget** | $ 6,000,000 | **Ohio Third Frontier Funds Requested** | $ 3,000,000 |

**Project Focus:**

- ☐ Advanced Materials (related to advanced polymers; ceramics; composites; carbon fibers and nanotubes; and, specialty metals and alloys)
- ☐ Aeropropulsion and Power Management
- ■ Fuel Cells and Energy Storage
- ☐ Medical Technology (related to imaging; surgical instruments/equipment; implant devices; and, regenerative medicine)
- ☐ Software Applications for Business and Healthcare
- ☐ Sensing and Automation Technologies
- ☐ Situational Awareness and Surveillance Systems
- ☐ Solar Photovoltaics
- ☐ Agribusiness and Food Processing

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4) Describe how the platform will provide a sustainable pipeline of technologies for commercialization.

**1) Describe the proposed technology platform. Please refer to the Request for Proposals Section 2.1 second paragraph for the definition of a technology platform.**

*The Ohio State University - Center for Automotive Research (OSU-CAR) is the "Innovation Platform."* OSU-CAR is a powerful economic development partner to the State of Ohio and an experienced business and technology incubator with specialized skills, equipment and facilities that directly support research, product validation, and product commercialization activities in the areas of: advanced energy storage and fuel cell systems (for propulsion and grid applications); power electronics (for propulsion and grid application); advanced powertrains (hybrid, electric, alternative fuels); advanced sensors and controls (for propulsion and grid applications); and system integration. OSU-CAR has been the recipient of two significant investments related to vehicle electrification and to advanced energy storage through two OTF Wright Project Programs, in 2009 and 2010, focusing on commercial vehicle electrification and on advanced energy storage, respectively. The investment made by the OTF in these programs has been leveraged through significant interactions with industry partners that include two industry consortia: i) the CAR Industrial Consortium, focusing on automotive propulsion and intelligent vehicle research with the participation of some 15 companies, including Chrysler, Ford, GM and Honda; and ii) the SMART@CAR Consortium, focusing on plug-in vehicle-grid interaction and on distributed energy storage, with the participation of some 12 companies including AEP, FirstEnergy, Dayton Power and Light and PJM. Further OSU-CAR has recently launched a third consortium with focus on natural gas technology, GasWorks. Today, OSU-CAR is responsible for over $8M in external research, development and demonstration funding, with a significant fraction of the total coming from private sector partners. The result of the investments made in CAR-OSU by The Ohio State University, the Ohio Third Frontier Program, and by its industry partners is an Innovation Platform that has demonstrated the ability to support a broad range of technology development projects ranging from fundamental research to technology commercialization and company spin-out. OSU-CAR was recognized with the 2011 TechColumbus Innovation Award for *Outstanding Technology Team.* This proposal leverages OSU-CAR capabilities to support the development of fuel cell based combined heat and power solutions for residential and commercial electric power generation from natural gas. OSU-CAR has ten-year experience in the development of fuel cell system integration technologies, and is well position to extend its technology development services in support of the utility and back-up power industries.

**2) Please list all committed industry clients and their anticipated cash cost share contribution.**

The two industry clients are: 1) BluWatt Energy Systems, LLC – a newly formed tech startup - with an 8,000 ft2 engineering and test facilities with 15 employees planned in Columbus Ohio having new systems IP and technology that advance solid oxide fuel cell use in a Natural Gas micro CHP generator; and 2) NexTech Materials as a world-leader in the development and manufacture of high performance complex oxides for the solid oxide fuel cell (SOFC) and catalysis markets. NexTech's oxide materials synthesis and ceramic component manufacturing facilities have expanded to include a dedicated pilot facility for the manufacture of SOFCs and electrochemical sensor products in its 56,000 ft2 (5,000 m2) facility in Lewis Center, Ohio. The two clients will contribute a supermajority of the cost share, in the amount of $2.5M, with OSU-CAR contributing $0.5M.

**3. Describe the commercial products that will be developed and enter the market within the 3-year timeframe of the Grant.**

The commercial product associated with this project is a 6 kW residential fuel cell generator that incorporates electricity, hot water, and backup power in a device that replaces a conventional Natural Gas water heater in a home with an addressable US market of $47B with a 5% adoption rate.

*Background:* The electric power industry is seeking solutions to generate electric power from low cost, clean, and abundant Natural Gas. By 2025 the EIA predicts that 35% of the US supply of Natural Gas will come from newly tapped shale deposits, of which Ohio is well positioned to capitalize of its share. Even modern turbine with combined steam heat recovery power generation plants have the disadvantage of converting only 45% of the available energy from Natural Gas in end user electric power, losing 55% in heat and transmission losses. An emerging technology using micro Combined Heat and Power (uCHP)

Solid Oxide Fuel Cells (SOFC) is capable of transforming Natural Gas into electric power in a residential home utilizing more than 80% of the fuel for heat and electric power. This is accomplished by converting the fuel and oxygen from air in a solid-state electro-chemical process using a SOFC and not a combustion process that burns the fuel.

*Market:* By looking at the addressable market in the United States four factors were considered – electricity price, natural gas price, state-by-state usage of each on average, and availability of RECs. In this analysis it was concluded that the addressable market for this product is a $47B assuming a 5% adoption rate among users willing to enter into a fixed cost energy service agreement lease with $0 down, $0 additional cost per month; only the savings in energy and RECs is required to fund the product giving users access to emergency power at no cost. The uCHP generator will provide the following advantages to the typical end users:

(1) Lowers energy costs by 50% using uCHP ($720/year savings for an average home)
(2) Provides backup emergency power to homeowners during blackouts, and
(3) Eligible for Renewable Energy Credits ($670/year for an average home)
(4) Utilizes Natural Gas less prone to interruption during severe weather

*Technology:* This proposal leverages the long history that Ohio has with advanced work on Solid Oxide Fuel Cell technology as part of the OFCC leveraging NexTech Materials SOFC cell and stack capability. To commercialize this capability in the near term, BluWatt LLC has developed a design that can take advantage of existing SOFC technology having 20k hours of durability (2 years life) and extend that to the needed 10 years (100k hours) by using BluWatt's proprietary "Tiered Master-Slave-Slave Controls Architecture" dividing the 6 kW fuel cell into three parts that are alternated in and out of operation.

*Demonstration:* While the primary market is residential uCHP, BluWatt LLC is developing a go-to-market strategy that first matures the technology in controlled application on military bases (TARDEC, Fort Bragg, WPAFB) to gain experience while simultaneously addressing the US DOD initiative for autonomous power on military bases called "Net Zero". OSU-CAR will be the integration site for these first units with an ongoing demonstration being maintained at OSU-CAR for software and system integration development.

**4. Describe how the platform will provide a sustainable pipeline of technologies for commercialization.**

OSU-CAR has already demonstrated the ability to translate OTF investments into a sustainable enterprise. For example, facilities developed with funds from a 2009 OTF-WPP grant have spawned a significant stream of engineering services for the commercial vehicle industry that is currently supporting commercial technology development for medium and heavy-duty vehicles with clients such as Vanner, Parker-Hannifin, Cummins, Hendrickson. The facilities developed as a result of the 2010 OTF-WPP grant, in collaboration with CAR Technologies LLC, have similarly generated a broad range of engineering services related to energy storage, ranging from testing, characterization and validation programs for new battery technologies to battery system integration and ancillary technology development in power electronics, management systems, and software services, with clients such as A123 Systems, Magna eCAR, Bombardier, TE Connectivity and Vanner. The proposed program will extend these capabilities and will create a new range of technology commercialization and validation services for clients in the utility and backup power generation markets.

13-349

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# Innovation Platform Program

## 2013 Request for Proposals

## Letter of Intent

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|---|---|
| **Lead Applicant Institution** | **The Cleveland Clinic Foundation** |
| **Lead Applicant Contact Information** | **Name: Jon Heavey, MD MBA** |
| | **Title: Director, Business Development** |
| | **Phone Number: (216) 445-2476** |
| | **Email: heaveyj@ccf.org** |
| **Project Title:** | Advanced Surgical Products Platform and Manufacturing Factory |

| | | | |
|---|---|---|---|
| **Total Project Budget** | $ 6,000,000 | **Ohio Third Frontier Funds Requested** | $ 3,000,000 |

**Project Focus:**

- ☐ Advanced Materials (related to advanced polymers; ceramics; composites; carbon-fibers and nanotubes; and, specialty metals and alloys)
- ☐ Aeropropulsion and Power Management
- ☐ Fuel Cells and Energy Storage
- ☒ Medical Technology (related to imaging; surgical instruments/equipment; implant devices; and, regenerative medicine)
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This initiative was prompted through collaborative discussions with three industry clients: a multi-national manufacturing company with established factories in Ohio, a multi-national medical device distributor with channels throughout Ohio, and an emerging advanced product design company headquartered in Ohio. Together, the clients engaged with Cleveland Clinic Innovations to propose a joint collaboration to translate an extensive IP platform of surgical products and cardiovascular technologies.

Yokowo Co Ltd. is a multinational corporation headquartered in Japan with manufacturing plants in Japan, China, Thailand, and Columbus, Ohio. Yokowo has expressed a specific interest in establishing a new manufacturing facility in Cleveland to capitalize on the proximity to leading Cleveland Clinic clinical researchers and to launch its proprietary cardiovascular technologies in the U.S. market. The manufacturing focus will initially revolve around state-of-the-art pressure sensing coronary guide wires and interventional cardiology devices that expand on its existing OEM product line. This is anticipated to be the first product offering within the 3 year deliverable timeline.

Guided Interventions brings an industry experienced management team to focus on the development of next generation proprietary interventional products. Guided Intervention is collaborating with the U.S. Department of Veterans Affairs' Advanced Platform Technology center for micro-electromechanical systems (MEMs) in Cleveland at Case Western Reserve University, as well as the SMART Center at Lorain Community College. Guided Interventions will continue to harvest technologies from Cleveland Clinic clinical researchers to maintain a robust platform pipeline of cardiovascular technologies.

With $7.6 billion in 2011 revenues, Boston Scientific Corporation is one of the world's largest medical device manufacturing companies. The company generates approximately $2.5 billion in annual revenues from the sale of interventional cardiology devices, including coronary stents, balloons and accessory products like guide catheters. However, the company remains a secondary competitor with its guide wire franchise. Over the course of several meetings with the Cleveland Clinic Innovations team, Boston Scientific has expressed strong interest in advancing its current product line offerings to compete with the market leader, Abbott Vascular.

The Cleveland Clinic has long been ranked as one of the nation's leading healthcare providers by U.S. News and World Report. In 2011 alone, the Clinic performed nearly 11,000 procedures for patients with simple and complex ischemic heart disease. This unique experience positions Cleveland Clinic clinicians as ideal candidates for providing critical insights into new device solutions to enable faster, safer and more efficacious outcomes. It is anticipated industry client partners will provide $1.5M in cost-share with Cleveland Clinic contributing $1.5M in matching funds.

The worldwide market for interventional cardiovascular devices generates approximately $20 billion in annual revenues and is growing at a rapid pace due to continued technological advances that improve patient care. Additionally, favorable demographic trends and globalization of the medical device market continue to drive market growth. The applicant and client collaborators have identified opportunities to capitalize on these trends, leveraging the critical need for close proximity of leading clinicians, engineering teams, and a manufacturing site to forge a multinational corporate collaboration in Cleveland, Ohio.

13-350

Ohio | Third Frontier
Innovation Creating Opportunity

# Innovation Platform Program

## 2013 Request for Proposals

## Letter of Intent

| | |
|---|---|
| **Lead Applicant Institution** | The Ohio State University - Center for Automotive Research (CAR) |
| **Lead Applicant Contact Information** | **Name:** Dr. Giorgio Rizzoni |
| | **Title:** Professor; Director, Center for Automotive Research |
| | **Phone Number:** 614-688-3856 |
| | **Email:** rizzoni.1@osu.edu |
| **Project Title:** | Energy Storage Device Innovation Center (ESDIC) |

| | | | |
|---|---|---|---|
| **Total Project Budget** | $4,800,000 | **Ohio Third Frontier Funds Requested** | $2,400,000 |

**Project Focus:**

- ☐ Advanced Materials (related to advanced polymers; ceramics; composites; carbon fibers and nanotubes; and, specialty metals and alloys)
- ☐ Aeropropulsion and Power Management
- ■ Fuel Cells and Energy Storage
- ☐ Medical Technology (related to imaging; surgical instruments/equipment; implant devices; and, regenerative medicine)
- ☐ Software Applications for Business and Healthcare
- ☐ Sensing and Automation Technologies
- ☐ Situational Awareness and Surveillance Systems
- ☐ Solar Photovoltaics
- ☐ Agribusiness and Food Processing

Please answer the following questions using no more than two additional pages. The Letter of Intent should address each question in order identifying each response. Do not include any trade secret information in this Letter of Intent.

1) Describe the proposed technology platform. Please refer to the Request for Proposals Section 2.1 second paragraph for the definition of a technology platform.
2) Please list all committed industry clients and their anticipated cash cost share contribution.
3) Describe the commercial products that will be developed and enter the market within the 3-year timeframe of the Grant.
4) Describe how the platform will provide a sustainable pipeline of technologies for commercialization.

**1) Describe the proposed technology platform. Please refer to the Request for Proposals Section 2.1 second paragraph for the definition of a technology platform.**

> *"... an Innovation Platform is defined as an already existing capacity that incorporates unique technology capabilities and strengths, talent, equipment, facilities, engaged industry partners, a track record of research commercialization and innovation, intellectual property, and other resources in a particular technology area that collectively can serve as a vehicle for significant, industry-defined and directed opportunities through the development and commercialization of new products and innovations."*

**The Ohio State University – Center for Automotive Research (OSU-CAR) is the "Innovation Platform."** OSU-CAR is a powerful economic development partner to the State of Ohio and an experienced business and technology incubator with specialized skills, equipment and facilities that directly support research, product validation, and product commercialization activities in the areas of: advanced energy storage and fuel cell systems (for propulsion and grid applications); power electronics (for propulsion and grid application); advanced powertrains (hybrid, electric, alternative fuels); advanced sensors and controls (for propulsion and grid applications); and advanced fueling/charging systems (hybrid, electric, alternative fuels). OSU-CAR has been the recipient of two significant investments related to vehicle electrification and to advanced energy storage through two OTF Wright Project Programs, in 2009 and 2010, focusing on commercial vehicle electrification and on advanced energy storage, respectively. The investment made by the OTF in these programs has been leveraged through significant interactions with industry partners that include two industry consortia: i) the CAR Industrial Consortium, focusing on automotive propulsion and intelligent vehicle research with the participation of some 15 companies, including Chrysler, Ford, GM and Honda; and ii) the SMART@CAR Consortium, focusing on plug-in vehicle-grid interaction and on distributed energy storage, with the participation of some 12 companies including AEP, FirstEnergy, Dayton Power and Light and PJM. Today, OSU-CAR is responsible for over $8M in external research, development and demonstration funding, with a significant fraction of the total coming from private sector partners. The result of the investments made in CAR-OSU by The Ohio State University, the Ohio Third Frontier Program, and by its industry partners is an Innovation Platform that has demonstrated the ability to support a broad range of technology development projects ranging from fundamental research to technology commercialization and company spin-out. OSU-CAR was recognized with the 2011 TechColumbus Innovation Award for *Outstanding Technology Team.* This proposal leverages OSU-CAR capabilities to support the development of integrated energy storage solutions for the passenger vehicle, commercial and specialty vehicle, commercial/ industrial equipment, military, marine, utility, telecommunications, and aerospace markets.

**2) Please list all committed industry clients and their anticipated cash cost share contribution.**

The full list of committed industry clients cannot all be fully disclosed "by name" due to pending final non-disclosure, IP sharing and collaborative agreements, however, the core collaborators include: **CAR Technologies LLC** – a leading Ohio-based energy storage research and engineering company; **Advanced Battery Concepts**, an Ohio-based battery research and manufacturing company, and; an

Ohio-based power electronics systems manufacturing company. In aggregate, the project collaborators are committed to provide a supermajority of the cash cost share contribution – some $2.4 million – and have documented Ohio Third Frontier experience successfully committing to and delivering cash cost share at this level in previous grant activities.

**3. Describe the commercial products that will be developed and enter the market within the 3-year timeframe of the Grant.**

The commercial products include

1. novel energy storage devices and configurations (manufacturing);
2. battery management systems, energy storage equalization and controls (manufacturing);
3. grid-tied energy storage systems (manufacturing);
4. energy storage component design, engineering, prototyping, and low-volume assembly (services);
5. micro-grid integration, simulation and communication controls (manufacturing and services).

These commercial products will address needs in the passenger vehicle, commercial and specialty vehicle, commercial/ industrial equipment, military, marine, utility, telecommunications, and aerospace markets within the 3-year timeframe of the Grant and beyond.

**4. Describe how the platform will provide a sustainable pipeline of technologies for commercialization.**

OSU-CAR has already demonstrated the ability to translate OTF investments into a sustainable enterprise. For example, facilities developed with funds from a 2009 OTF-WPP grant have spawned a significant stream of engineering services for the commercial vehicle industry that is currently supporting commercial technology development for medium and heavy-duty vehicles with clients such as Vanner, Parker-Hannifin, Cummins, Hendrickson. The facilities developed as a result of the 2010 OTF-WPP grant, in collaboration with CAR Technologies LLC, have similarly generated a broad range of engineering services related to energy storage, ranging from testing, characterization and validation programs for new battery technologies to battery system integration and ancillary technology development in power electronics, management systems, and software services. The proposed program will further strengthen these capabilities and will create a new range of technology commercialization and validation services for a broad range of clients, including the passenger vehicle, commercial and specialty vehicle, commercial/ industrial equipment, military, marine, utility, telecommunications, and aerospace markets.

In short, the Technology Platform will be in a position to act as an extension of the technology development and advanced manufacturing functions of a number of commercial entities – as well as being able to create new technology (circuits, components, controls) that may be licensed to enable new products. The underlying "Innovation Platform" is expert at developing industry collaborations and pre-competitive research to maintain IP creation momentum and new opportunity.

13-351

Ohio | Third Frontier
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# Innovation Platform Program

## 2013 Request for Proposals

## Letter of Intent

| | |
|---|---|
| **Lead Applicant Institution** | **The Ohio State University** |
| **Lead Applicant Contact Information** | **Name: John L. Volakis** |
| | **Title: Professor and Director of ElectroScience Laboratory at The Ohio State University** |
| | **Phone Number: 614 292 5846** |
| | **Email: Volakis.1@osu.edu** |
| **Project Title:** | Textile-based body-worn medical sensors for lung fluid detection |

| | | | |
|---|---|---|---|
| **Total Project Budget** | $ 1.5 M | **Ohio Third Frontier Funds Requested** | $ 1.5 M |

**Project Focus:**

- ☐ Advanced Materials (related to advanced polymers; ceramics; composites; carbon fibers and nanotubes; and, specialty metals and alloys)
- ☐ Aeropropulsion and Power Management
- ☐ Fuel Cells and Energy Storage
- ☒ Medical Technology (related to imaging; surgical instruments/equipment; implant devices; and, regenerative medicine)
- ☐ Software Applications for Business and Healthcare
- ☐ Sensing and Automation Technologies
- ☐ Situational Awareness and Surveillance Systems
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4) Describe how the platform will provide a sustainable pipeline of technologies for commercialization.

**Department of Electrical and Computer Engineering**

Email: volakis@ece.osu.edu

ElectroScience Laboratory
1320 Kinnear Road
Columbus, OH 43212

Phone 614-292-7981
Fax 614-292-7297

21 December 2012

Re: 2013 Innovation Platform Program Letter of Intent

Office of Technology Investments
Ohio Third Frontier
Ohio Development Services Agency

Through this innovation platform, the **ElectroScience Lab at The Ohio State University** will collaborate with **Avery Dennison Corp.** and **RNET Technologies Inc.** to commercialize novel textile-based radio frequency (RF) medical sensors. This unique textile-based technology will allow for unobtrusive installation of sensors and communication devices into clothes in a fashionable and carefree manner.

The proposed sensors employ two unique technologies developed at Ohio State: (1) body-worn unobtrusive antennas and radio frequency circuits using electronic textile fabrication and packaging processes; (2) wearable deep-tissue sensing systems for deep *in-vivo* monitoring and imaging of internal organs. The subject electronic textiles are fabricated by invisibly integrating conductive and flexible metal-polymer fibers (e-fibers) into the garment to form wearable RF antennas, sensors, and circuits. Prototypes of these devices have already been fabricated at Ohio State and experimentally validated for their excellent RF performance. Their performance has been demonstrated to be comparable to their traditional rigid counterparts. Importantly, the proposed functionalized electronic textiles are washable, and can be worn while working, sleeping or exercising. Therefore, this technology provides for unprecedented reliability, wearable comfortableness and ease of installation. Notably, it has attracted much attention from the academia and media. For example, we have been invited to present this research at major conferences and in journal publications. Also the technology has been reported in New York Times: (http://www.nytimes.com/2011/10/25/science/25shirt.html?ref=technology&_r=0) and IEEE (http://theinstitute.ieee.org/people/profiles/john-volakis-uncharted-waters). Ohio State has a patent on this e-fiber wearable RF technology.

The textile-based sensors are preferred over current health monitoring devices that are bulky, expensive, and mostly single function 'closed' systems. Specifically, the proposed sensors are (1) naturally conformal onto the body, providing reliable contact between the sensor and body, and (2) comfortable to wear due to their inconspicuous integration into the garments. Both advantages are critical for enabling long-term, reliable monitoring of patients to enable early detection and diagnosis. Indeed, a study by a Finnish research group noted that only 40% of patients continued to wear health monitoring sensors after their initial introduction. Of this group, <50% wore the sensors on a continuous basis, and a large percentage felt that such sensors were not trustworthy. It was concluded that only flexible and small wearable sensors (implantable or epidermal) placed on the clothes offer a reliable solution, thus avoiding patient non-compliance.

Under the IPP program, over the next 3 years we propose a collaborative effort among Ohio State, Avery Dennison and RNET focused on commercializing a lung sensing system with integrated capability for medical sensing, data processing, and wireless communication. The major system components include a medical sensor, a wearable antenna and user-friendly software to communicate with point-of-care centers through smart PDA devices or WiFi ports. A deep-tissue medical sensor will be used to monitor and image lung fluids (a well-known forewarning for heart failure). The proposed sensor is composed of textile-based parallel electrodes and utilizes the fringe field between electrodes to detect deep tissue properties. The RF signal can penetrate deep into the tissue depending on the sensor's size. This is a unique feature not available in any state-of-art sensors. The sensed signals are post-processed to extract the lung's dielectric properties in a

manner independent of the patient's muscle and fat layers. In other words, the same lung sensor can be calibrated for different body types and still provide for reliable lung information. This capability is based on a unique procedure developed at Ohio State.

The strong collaboration among the lead applicant and two industry clients is based on complementary experience, expertise, and mutual interests in medical sensing/communication areas. In particular, Ohio State will focus on the design and fabrication of the textile-based sensors and textile communication devices. RNET will develop the communication software to translate the received RF response for interpretation at point-of-care centers. RNET has already worked with Ohio State to develop an Android-based application for a wearable temperature sensor. The software for this application will be adapted for processing similar data from the lung sensor. Avery Dennison will lead sensor packaging and system integration for consumer needs. In addition, Avery Dennison will commercialize and bring sensors to the market. The patient studies will be carried out in the medical centers at the Ohio State and Wright State Universities, targeting elderly and people-at-risk.

The proposed budget for this IPP effort will be for approximately $3M. Of this amount, $1.5M will be requested from the State of Ohio. The remaining amount will be given in cash to support testing, development and commercialization at the Avery Dennison and RNET facilities.

The transformative nature of this IPP is based on the premise that carefree wireless connectivity to body-worn medical sensors is a transformative technology to enable virtual point-of-care health centers. Therefore, a series of textile-based medical sensors are needed and customized for different internal organs in various physical forms. Those sensors can be individually fabricated as small band-aids, wrist-bands or alternatively integrated within the entire garment to simultaneously detect all vital human signals. The obtained data can then be encrypted, transferred, and decrypted at physician sites (point-of care-centers) for *in-situ* but off-site monitoring. That is, the proposed technology will promote a new, low-cost methodology for early prognosis of medical conditions for people-at-risk, allowing them to live at home rather than in nursing homes and hospitals.

Sincerely,

John L. Volakis
Roy and Lois Chope Chair Professor
Director, ElectroScience Laboratory

13-352

Ohio | Third Frontier
Innovation Creating Opportunity

# Innovation Platform Program

## 2013 Request for Proposals

## Letter of Intent

| | |
|---|---|
| **Lead Applicant Institution** | **Wright State Applied Research Corporation** |
| **Lead Applicant Contact Information** | **Name: Mark Wysong** |
| | **Title: Director** |
| | **Phone Number: (937) 705-1082** |
| | **Email: mark.wysong@wright.edu** |
| **Project Title:** | The Advanced Neuroplastic Imaging Center |

| | | | |
|---|---|---|---|
| **Total Project Budget** | $ 6,000,000 | **Ohio Third Frontier Funds Requested** | $ 3,000,000 |

**Project Focus:**

- ☐ Advanced Materials (related to advanced polymers; ceramics; composites; carbon fibers and nanotubes; and, specialty metals and alloys)
- ☐ Aeropropulsion and Power Management
- ☐ Fuel Cells and Energy Storage
- ☐ Medical Technology (related to imaging; surgical instruments/equipment; implant devices; and, regenerative medicine)
- ☒ Software Applications for Business and Healthcare
- ☐ Sensing and Automation Technologies
- ☐ Situational Awareness and Surveillance Systems
- ☐ Solar Photovoltaics
- ☐ Agribusiness and Food Processing

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2) Please list all committed industry clients and their anticipated cash cost share contribution.
3) Describe the commercial products that will be developed and enter the market within the 3-year timeframe of the Grant.
4) Describe how the platform will provide a sustainable pipeline of technologies for commercialization.

# Wright State Applied Research Corporation
# Innovation Platform Program 2013 - Letter of Intent

## 1. Describe the proposed technology platform

The WSRI SSA Program provides a single service for a defined set of customers. With the adoption and expansion of electronic health records (EHRs), opportunities to begin automation of healthcare administration activities are expanding. As such, the SSA launched a program to attain health records electronically, eliminating the need to send mail requests for hard copies of patient health records. This change offers many benefits including:

a) Reduction in time to as little as 48 hours to make a disability claims determination by the SSA (currently can take up to three years)
b) Reduction in time from providers in copying medical records (estimated time savings of between 30 minutes and three hours per file)
c) Elimination of costs associated with mailing and materials
d) Reduced opportunity for human error

As a part of this program, the SSA allowed Health Information Exchanges (HIEs) to support the transfer of medical records from pilot provider offices to the SSA. The HIE developed under this contract is now live in production and provide the following to the SSA and the provider community:

a) Receipt of a request from SSA of a need for a patient's record
b) Send confirmation of receipt to SSA
c) Search master patient index (MPI) for identified disability applicant
    i. Return appropriate response to SSA
    ii. Patient not found (PNF)
    iii. No electronic record found (NERF)
    iv. C32 continuity of care document (CCD)

In return for providing a C32, the SSA remunerates WSRI with a $15 fee. No remuneration is provided for PNFs or NERFs. The WSRI SSA HIE services a single EHR which is athenahealth, athenaClinicals and other associated athenahealth product suites. To execute this work, WSRI will provide the following:

a) Development of a C32 CCD template aligned to the standards of the SSA which is the document transmitted to SSA and the trigger for payment of the $15 fee
b) Development, testing, and production deployment of a Master Patient Index (MPI) which is used to match the patient request for EHR information from the SSA
c) Development, testing, and production deployment of the CONNECT Gateway software
d) Testing with the NwHIN and ONC
e) On-boarding with the ONC
f) Development and execution of necessary legal documents including information sharing agreements
g) Development, testing, and production deployment of an adapter to the athenahealth electronic health records suite of software as a service (SaaS) application intended to extract, transform, and load EHR data to the C32 required format
h) Operation of a live production system for the exchange of healthcare records with SSA

**2. Please list all committed industry clients and their anticipated cash cost share contribution**

a) Wright State Applied Research Corporation - $600,000
b) JTEC Consulting - $2,400,000

**3. Describe the commercial products that will be developed and enter the market within the 3-year timeframe of the Grant**

The WSRI SSA HIE will be built to extract data from the athenahealth product suite. The exchange will extract data, transform the data and store it within the WSRI SSA HIE. The WSRI SSA HIE will then pull data from the MPI and the facilities list to construct a C32 CCD with the data obtained from the WSRI HIE adapter. Once all data is pulled together in the C32, the document is sent to SSA.

**4. Describe how the platform will provide a sustainable pipeline of technologies for commercialization**

At the conclusion of this program, WSRI will have established four distinct lines of revenue. These revenue streams include:

- **Health Information Exchange Sales** - The ability to sell access to the National Exchange
- **SSA Transaction Sales** - Sustainable revenue stream based on the exchange of CCDs to the SSA
- **Health Information Exchange Consultative Services** - Consultative services based on the implementation of HIE capability and data cleansing activities
- **Software Licensing** - Licensing access to the health information exchange.

13-353

Ohio | Third Frontier
Innovation Creating Opportunity

# Innovation Platform Program

## 2013 Request for Proposals

## Letter of Intent

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|---|---|
| **Lead Applicant Institution** | **The University of Toledo** |
| **Lead Applicant Contact Information** | **Name: Abdollah A. Afjeh** |
| | **Title: Professor and Chair** |
| | **Phone Number: 419.530.8210** |
| | **Email: aafjeh@utoledo.edu** |
| **Project Title:** | Out of Autoclave Technology Platform for Low Cost Composite Materials Manufacturing with Application to Wind Turbine Blade Fabrication |

| | | | |
|---|---|---|---|
| **Total Project Budget** | $ 2,000,000 | **Ohio Third Frontier Funds Requested** | $ 1,000,000 |

**Project Focus:**

- ☒ Advanced Materials (related to advanced polymers; ceramics; composites; carbon fibers and nanotubes; and, specialty metals and alloys)
- ☐ Aeropropulsion and Power Management
- ☐ Fuel Cells and Energy Storage
- ☐ Medical Technology (related to imaging; surgical instruments/equipment; implant devices; and, regenerative medicine)
- ☐ Software Applications for Business and Healthcare
- ☐ Sensing and Automation Technologies
- ☐ Situational Awareness and Surveillance Systems
- ☐ Solar Photovoltaics
- ☐ Agribusiness and Food Processing

Please answer the following questions using no more than two additional pages. The Letter of Intent should address each question in order identifying each response. Do not include any trade secret information in this Letter of Intent.

1) Describe the proposed technology platform. Please refer to the Request for Proposals Section 2.1 second paragraph for the definition of a technology platform.
2) Please list all committed industry clients and their anticipated cash cost share contribution.
3) Describe the commercial products that will be developed and enter the market within the 3-year timeframe of the Grant.
4) Describe how the platform will provide a sustainable pipeline of technologies for commercialization.

**1) Describe the proposed technology platform. Please refer to the Request for Proposals Section 2.1 second paragraph for the definition of a technology platform.**

The University of Toledo will partner with Owens Corning Composite Materials and NASA to develop commercial products launched from Owens Corning Platform Technology. Owens Corning's Composite Solutions Business (CSB) is a global leader in composite materials and delivers world-class technology and products. Owens Corning Composite Solutions Business has grown to nearly $2 billion and employs 7,100 people in 15 countries and has over 30 manufacturing facilities across Europe, America and Asia.

Owens Corning High-Performance Reinforcements is a product platform featuring ShieldStrand®, XStrand®, FliteStrand®, and WindStrand® high-strength reinforcement products developed for the ballistic, industrial, aerospace, and wind energy markets. WindStrand® is the Owens Corning trademark for high-performance reinforcements for wind energy.

The University of Toledo in partnership with Owens Corning seeks to commercialize NASA Langley Research Center's patented technology for Out of Autoclave Wind Turbine Blade Manufacturing Method. The technology is aimed at producing a more cost-effective wind turbine blade. The technology involves an assembly to support the fabrication of composite laminate materials during roll press processing as an alternative to hand tooling and autoclave processing. The simplified process involves room temperature processing and produces parts with quality close to those processed under high-temperature and high-pressure environments. NASA Langley's patented technology enables roll-pressing the material lay-up into a gently contoured wind turbine blades. The room temperature technology offers an additional advantage, potential to enable blade manufacturing and repair in the field, thus reducing the blade's transportation cost to the installation site.

In addition, the proposed process is anticipated to produce significantly less product-to-product variation and scrap rate and, ultimately, reduce cost and improve productivity to meet the needed increased capacity for manufacturing wind turbine blades.

**2) Please list all committed industry clients and their anticipated cash cost share contribution.**

Owens Corning - $500,000

**3) Describe the commercial products that will be developed and enter the market within the 3-year timeframe of the Grant.**

Lower cost, locally manufactured wind blades and composite laminate materials for downstream commercial products in infrastructure such as bridges, and buildings and in aircraft, marine vessels and structures.

**4) Describe how the platform will provide a sustainable pipeline of technologies for commercialization.**

Applications include lower cost, locally manufactured wind turbine blades. The U.S. Department of Energy (DOE) policy requires attaining 20% of U.S. electricity production from wind by 2030. The total output of currently installed wind power is 25 GW and it needs to grow to a projected amount of 305 GW by 2030 to meet the 20/2030 U.S. energy policy. With rapid, sustained growth in global use of wind turbines, the global demand to produce renewable energy will be much larger and thus the market for wind turbine blades is expected to remain strong for more than a decade. The proposed project builds on Ohio's advanced materials manufacturing strength, promoting the wind turbine manufacturing supply chain in Ohio by creating and maintaining jobs that will produce long-term, sustained economic development in Ohio.

Owens Corning glass fiber materials can be found in over 40,000 end-use applications within seven primary markets: power and energy, housing, water distribution, industrial, transportation, consumer and aerospace/military. Such products are manufactured and sold worldwide. The company has a network of over 33 manufacturing plants worldwide. Hence, the proposed platform provides a sustainable pipeline of technologies for commercialization.

13-354

# Innovation Platform Program

## 2013 Request for Proposals

## Letter of Intent

| | |
|---|---|
| **Lead Applicant Institution** | **Cleveland Clinic** |
| **Lead Applicant Contact Information** | **Name: Thomas J Graham MD** |
| | **Title: Vice Chairman of Orthopedics** |
| | **Phone Number: 216-630-1121** |
| | **Email: graham@ccf.org and or warrenw@ccf.org** |
| **Project Title:** | Enhanced lower extremity fixation methods |

| | | | |
|---|---|---|---|
| **Total Project Budget** | $ 6 million | **Ohio Third Frontier Funds Requested** | $ 3 million |

**Project Focus:**

- ☐ Advanced Materials (related to advanced polymers; ceramics; composites; carbon fibers and nanotubes; and, specialty metals and alloys)
- ☐ Aeropropulsion and Power Management
- ☐ Fuel Cells and Energy Storage
- ☒ Medical Technology (related to imaging; surgical instruments/equipment; implant devices; and, regenerative medicine)
- ☐ Software Applications for Business and Healthcare
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1.

Our technology development goals are to: 1) elect the most desirable general plate platforms to match the specific anatomic areas for which the implants are intended, and 2) determine the optimal screw morphology to match the plate designs. The development and validation methods described in this proposal integrate clinical and preclinical testing and evaluation techniques into a powerful tool for device development and validation that is very cost effective. We have demonstrated this integrated model of device development through the successful commercialization of existing extremity devices. These methods will serve as a common development and validation pathway for all of the new clinical applications in this proposal. Our Collaborator, i360Medical, an Ireland-based device development firm, with its North American headquarters in Cleveland, is considered among the world's most proficient and experienced concerns in orthopedic device design, development, prototyping, testing, regulatory approval and marketing.

2.

Company one is the largest development company in orthopedics with offices in 4 states one of which is Ohio . The company will provide the engineering and development responsibilities est cost of 1.7 million

Company two is the number three distribution company in orthopedics in the small joint orthopedics will be providing the distribution and marketing of the products developed 1.3 million

3.

This project will lead to significant economic development in Ohio as we commercializes a portfolio of ten products across our three major extremity platform areas:

| | **Platform Area** | | |
|---|---|---|---|
| | **Wrist** | **Hand** | **Elbow** |
| Products | Volar Plating<br>Plate Extensions<br>Radial Ulnar Neck | Small Joint Arthrodesis<br>IM Tubular Bone Fixation<br>CMC implants<br>Hand Plating System | Olecranon Osteotomy<br>Modular Wave Plating<br>Proximal Ulnar Plate |

We project that sales of these products will produce revenue of more than a $3 million in the 3rd year of the project, growing rapidly to approximately $40 million by the 5th year. These sales will support employment growth at IPPC, leading to 35 new jobs in Ohio within 5 years. Our comnpany can be a first mover with its suite of breakthrough technologies and will establish a capability to consistently bring new upper extremity technology to market well into the future.

4.

There is a unique set of variables conspiring to fuel growth in the orthopedic implant market for the foreseeable future. On one hand, an aging national population is supplemented by a young, active group who seek technically-advanced treatments for their traumatic injuries. On the other, patients suffering disorders like osteoporosis, or the skeletal manifestations of obesity and diabetes, continue to increase in number. Whether it is the low-energy fracture in the post-menopausal female or the high-energy injury in

the adolescent skateboarder, football player or vehicular trauma victim, an increasing number of these injuries have been treated by open reduction and internal fixation (ORIF) with plate and screw constructs or other implants in the last decade.