Final Report of the Committee for the Review of Proposals to Ohio's Third Frontier Program, 2012-2013: Innovation Platform Program 2012

Committee for the Review of Proposals to Ohio's Third Frontier Program, 2012-2013
Aeronautics and Space Engineering Board
Division on Engineering and Physical Sciences
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This report has been reviewed in draft form by A. Thomas Young, Lockheed Martin Corporation (retired), in accordance with procedures approved by the Report Review Committee of the National Research Council. The purpose of this independent review is to provide candid and critical comments that will assist the institution in making its published report as sound as possible and to ensure that the report meets institutional standards for objectivity, evidence, and responsiveness to the study charge. The review comments and draft manuscript remain confidential to protect the integrity of the deliberative process.

Although Mr. Young provided many constructive comments and suggestions, he was not asked to endorse the conclusions or recommendations, nor did he see the final draft of the report before its release. Responsibility for the final content of this report rests entirely with the authoring committee and the institution.

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July 11, 2012

Christiane Schmenk
Director
Ohio Department of Development
77 S. High Street
Columbus, OH 43215-6130

Dear Ms. Schmenk:

This letter details the work and transmits the final report of the Committee for the Review of Proposals to Ohio's Third Frontier Program, 2012-2013, for proposals submitted to the 2012 Innovation Platform Program (IPP). This activity was supported by a contract from the Ohio Department of Development (ODOD) with the National Academy of Sciences and was performed under the auspices of the National Research Council's (NRC's) Aeronautics and Space Engineering Board (ASEB). The NRC is committed to providing elected leaders, policy makers, and the public with expert advice based on sound scientific evidence. For this study, the committee appointed to conduct the review was asked not only to exercise scientific judgment, but also to focus on commercial viability as a key consideration. This is the tenth year the NRC has reviewed proposals for the State of Ohio.

Program Objectives

As stated in the IPP's request for proposals (RFP), a major goal of the Ohio Third Frontier (OTF) is to "catalyze collaborations in technology commercialization, innovation, and product development between the State's colleges and universities and Ohio industry."[1] The specific purpose of the IPP is to "link the development and innovation capabilities and capacities of an already established Innovation Platform and all its resources… to specific late stage development and innovation needs of Ohio companies."[2] Critical to grasping the program's objectives is an understanding of what is meant by "Innovation Platform." The RFP defines an Innovation Platform 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.[3]

[1] Ohio Third Frontier Innovation Platform Program Fiscal Year 2012 Request for Proposals (RFP), available at http://www.thirdfrontier.com/Documents/FY2012OTFIPPRFP-Final.pdf, p. 5.
[2] Ohio Third Frontier Innovation Platform Program Fiscal Year 2012 Request for Proposals (RFP), p. 5.
[3] Ohio Third Frontier Innovation Platform Program Fiscal Year 2012 Request for Proposals (RFP), p. 5.

The RFP also outlines several key objectives of the program:

- To support existing Innovation Platforms at Ohio colleges, universities, or not-for-profit research institutions that will serve specifically defined near-term commercialization objectives of two or more Ohio for-profit companies;
- To support Innovation Platforms that will develop and launch new products, innovations, or services into the commercial market within three (3) to five (5) years of the Project start date;
- To kick-start the long-term, sustained use of the Innovation Platform by multiple Ohio industry partners.
- To support Innovation Platforms that will create wealth and employment opportunities within Ohio.[4]

Scope of Engagement

For the 2012 IPP, a total of 37 proposals were submitted, 35 of which passed an administrative review by ODOD and were evaluated by the committee. Proposals spanned the eight technology areas identified in the program's RFP: Advanced Materials (AM), Aeropropulsion Power Management (APM), Fuel Cells and Energy Storage (FCES), Medical Technology (MT), Software Applications for Business and Healthcare (SABH), Sensing and Automation Technologies (SAT), Situational Awareness and Surveillance Systems (SASS), and Solar Photovoltaics (PV) (see Table 1).

This report provides the committee's assessment of all of the received proposals. The committee recommends that the Third Frontier Commission (TFC) consider funding 6 of the 35 proposals; these 6 recommended proposals make a strong case that they would achieve the goals and purpose of the IPP. The total amount of state funds requested by the recommended proposals is $17,166,078.

Evaluation Methodology

Committee members were recruited based on their familiarity with the subject areas of the 35 proposals to be evaluated and for their experience with business practices, technology transfer, venture capital, and economic development. The committee is chaired by T.S. Sudarshan, president and CEO of Materials Modifications, Inc. The committee comprises a combination of working engineers, academics, and business executives; three members are also members of the National Academy of Engineering, and two members are members of the National Academy of Sciences. The committee roster appears on page v, and biographical sketches of the committee members can be found in Appendix E.

Based on criteria and proposal requirements specified in the RFP, ASEB staff developed an evaluation worksheet (see the section "Evaluation Criteria and Key Differentiators," below) to help guide the initial evaluation of the proposals. Because the IPP is a new program, ASEB staff also developed a definition sheet of critical terms and key criteria, again based on the RFP (see Appendix D). Committee members were then assigned 4 to 6 proposals each to evaluate. For each proposal, committee members were designated as primary or secondary reviewers for the purposes of guiding committee discussions at the first meeting. Each proposal was evaluated by at least three committee members before the committee's first meeting.

The committee held its first meeting on April 19-20, 2012. Early at this meeting, the committee heard a presentation from ODOD staff and held a discussion regarding the IPP's objectives, requirements, and criteria, seeking clarification from ODOD as needed. Following this discussion, the committee held a round of "triage"—each member was asked if, in their view, any of their assigned proposals clearly and critically failed to meet the requirements of the RFP. Further input was sought from the other committee

[4] Ohio Third Frontier Innovation Platform Program Fiscal Year 2012 Request for Proposals (RFP), p. 5-6.

members and, through consensus, the committee eliminated from further discussion those proposals deemed critically flawed. Following the triage round, primary and secondary reviewers used their initial evaluations to lead the rest of the committee in a discussion of the strengths and weaknesses of the remaining proposals. Because of their subjective nature, the evaluation worksheets were used only to guide discussions.

TABLE 1 Innovation Platform Program Proposal Technology Areas

Proposal	AM	APM	FCES	MT	SABH	SAT	SASS	PV
12-203				x		x		
12-204	x							
12-205		x						
12-206			x		x	x		x
12-207	x							
12-208			x					
12-209							x	
12-211	x			x				
12-213						x		
12-216	x							
12-218			x					
12-219					x			
12-220				x				
12-221	x		x					
12-224	x							
12-229	x							
12-230				x				
12-233	x		x			x		
12-238	x			x				
12-245				x				
12-246	x							
12-247				x				
12-249					x			
12-251				x				
12-254				x				
12-258				x				
12-265				x				
12-266			x					
12-269				x		x	x	
12-270	x	x	x					
12-276								x
12-277	x	x				x	x	x
12-282	x							
12-284				x				
12-287				x				
Total	13	3	7	14	3	6	3	3

NOTE: AM, Advanced Materials; APM, Aeropropulsion Power Management; FCES, Fuel Cells and Energy Storage; MT, Medical Technology; SABH, Software Applications for Business and Healthcare; SAT, Sensing and Automation Technologies; SASS, Situational Awareness and Surveillance Systems; and PV, Solar Photovoltaics.

Based on those discussions and through consensus, the committee selected 13 proposals for further examination at the committee's second and final meeting:

- 12-204: Advanced Materials for Additive Manufacturing Maturation (University of Dayton)
- 12-208: Innovation Platform: Distributed Energy Storage Systems (The Ohio State University)
- 12-209: Situational Awareness Integration, Visualization, Validation, Exploitation and Demonstration (SAIVVED) Commercialization Platform (University of Dayton)
- 12-216: New Concept Devices Based on Nanoscale Engineering of Polymer-Liquid Crystal Interface (Kent State University)
- 12-220: Commercialization of an Innovative Neuromodulation and Neurostimulation Technology Platform (Case Western Reserve University)
- 12-233: Electrochemical Innovation Platform: Advanced Materials for Energy Storage and Sensors (Ohio University)
- 12-245: Products to Improve Orthopaedic Patient Outcomes (PIOPO) (Cleveland Clinic)
- 12-247: Ophthalmic Imaging Center (Cleveland Clinic Foundation)
- 12-254: PET/MRI, a Next Generation Multi-Modal Molecular Imaging Technology Platform (The Ohio State University)
- 12-258: The OH-Alive Innovator Platform: A Process and Manufacturing Platform for Cell Therapy (Case Western Reserve University)
- 12-276: Innovation Platform for Solar Photovoltaics (University of Toledo)
- 12-277: Ohio Sensor and Semiconductor Innovation Platform (OSSIP) (The Ohio State University)
- 12-284: Ohio Platform for Tomorrow's Industrial Medical Imaging Systems and Equipment—OPTIMISE (Case Western Reserve University)

The committee also developed a list of follow-up questions that addressed areas of concern for each of these 13 proposals. These questions were sent to ODOD, who forwarded them to the lead applicants prior to the second meeting. Applicant teams were instructed to provide written answers approximately 2 weeks before the committee's second meeting. At the close of the first meeting, all committee members were asked to read each of the 13 proposals prior to the committee's second meeting.

The committee held its second meeting on May 30-June 1, 2012, and interviewed the applicant teams of the 13 proposals selected at the first meeting. Each applicant team was given 50 minutes to address additional questions from the committee. Each session was conducted in true "interview" format; no presentation materials were allowed. At the completion of the interviews, the committee held a final dialogue with ODOD staff regarding the performance of applicant teams on prior OTF grants, as well as further clarification on the requirements of the IPP. Following this dialogue, the committee received no additional input from ODOD regarding the proposals. The committee subsequently held an in-depth discussion on each of the 13 proposals and, through consensus, determined which proposals best satisfied the requirements of the RFP and their respective rank-order.

Evaluation Criteria and Key Differentiators

The IPP's RFP details the evaluation criteria to be utilized by the committee.[5] The evaluation worksheet generated by ASEB staff to guide the committee's initial evaluation of the proposals groups most of these criteria into five broad sections (see Appendix C). Below are several of the individual criteria from the worksheet, rewritten and paraphrased here as questions to illustrate their overall breadth:

[5] Ohio Third Frontier Innovation Platform Program Fiscal Year 2012 Request for Proposals (RFP), p. 20.

- *Technical Merit and Plan.* Can the technical challenges be met? Are the project goals and objectives realistic? How will these be met? Are there significant risk factors? Are all original and innovative technical objectives addressed? Are the concepts, approaches, or methods for achieving these objectives novel? Does the proposal include a plan for beyond the 3-year time period?
- *Commercialization Strategy.* Does the team understand the total resource requirements for achieving market entry and full commercialization, the type of knowledge that must be produced at the identified positioning stage, and who will likely be the funding providers for the market entry stage? What is the specific value proposition of the proposed approach, and what are the differentiating benefits associated with the proposed technology? Has the Innovation Platform already achieved at least proof of principle? What are the competitive advantages of the IPP's technologies or products over existing and alternative technologies? How closely matched is the project with the existing or emerging supply chain's capabilities?
- *Performance Goals.* Will the project have an impact on Ohio in three or more of the following areas: job creation; personal wealth; new sales of products; company creation or attraction; follow-on investment; talent recruitment; and enhanced Ohio, national, and/or international recognition? Does the proposal contain a realistic forecast of the economic impacts of the Innovation Platform (for 3 and 5 years after start of project)?
- *Experience and Qualifications.* Is leadership demonstrated in all critical phases, including research, intellectual property (IP) protection, regulatory compliance, product development, leveraging of additional funding, and commercialization? Does the applicant team have the relevant organizational experience to perform the technical and commercialization work involved?
- *Budget and Cost Share.* Is the budget justified in a detailed narrative with the appropriate forms? Is it adequate to meet proposal goals? Is the cost share necessary and reasonable? Is the cost share in the form of cash? Are letters of commitment provided, and are they sufficiently detailed, including an explanation of cost share commitment?

During the course of the study, the committee prepared an Overview Table (see Appendix A) to summarize how well each proposal satisfied the evaluation criteria in each of the above groups. On the chart, "E" and the color green indicate that the proposal *exceeds* the RFP requirements, "M" and the color yellow indicate that the proposal *meets* the RFP requirements, and "D" and the color red indicates that the proposal *does not meet* the RFP requirements. The committee stresses that understanding the context of these determinations is somewhat critical. In some cases, a relatively strong proposal may have "does not meet" grades in several areas due to a single problem that relates across each of the areas, whereas another proposal could have an equivalent number of areas with "does not meet" grades, yet be a much weaker proposal, due to the number of failures in the individual areas.

Recommendations

The committee recommends that the Third Frontier Commission consider funding six proposals that make a strong case for achieving the goals and purposes of the Innovation Platform Program (see Table 2). In terms of the evaluation criteria presented in the RFP, the strengths of these proposals far outweigh whatever weaknesses may be present. Detailed reviews of all 35 proposals appear in Appendix B. For the benefit of the TFC, the committee has rank-ordered the six proposals in terms of their relative merit and compliance with the RFP.

TABLE 2 Proposals Recommended for Funding Consideration

Rank	Proposal	Title (Lead Applicant)
1	12-247	Ophthalmic Imaging Center (OIC) (Cleveland Clinic Foundation)
2	12-216	New Concept Devices Based on Nanoscale Engineering of Polymer-Liquid Crystal Interface (Kent State University)
3	12-254	PET/MRI, a Next Generation Multi-Modal Molecular Imaging Technology Platform (The Ohio State University)
4	12-204	Advanced Materials for Additive Manufacturing Maturation (University of Dayton)
5	12-258	The OH-Alive Innovator Platform: A Process and Manufacturing platform for Cell Therapy (Case Western Reserve University)
6	12-245	Products to Improve Orthopaedic Patient Outcomes (PIOPO) (Cleveland Clinic)

The six proposals are summarized as follows:

1. *Ophthalmic Imaging Center (12-247)* seeks to develop and commercialize new ophthalmologic diagnostic and surgical instrumentation, compatible new surgical instruments, new contrast dyes, and automated software packages that will extend and enhance high-resolution optical coherence tomography (OCT) systems. Of particular importance is the development of an interoperative OCT platform where the surgical team will be able to use the enhanced power of OCT technology in the conduct of complicated ocular surgical procedures. The proposal represents an innovative, highly desired platform that is expected to provide significant value to patients along with strong commercial value to Ohio. The center's initial successes in launching an interoperative OCT system, along with the impressive leadership and experience within the Cole Eye Institute, significantly enhances the probability of technical and commercial success.

2. *New Concept Devices Based on Nanoscale Engineering of Polymer-Liquid Crystal Interface (12-216)* seeks to firm up an existing platform that is built around the Liquid Crystal Institute (LCI) at Kent State University and includes four local collaborators: Kent Displays, Inc. (KDI); AlphaMicron, Inc.; Crystal Diagnostics, Ltd.; and Akron Polymer Systems. The goal is to leverage the scientific prowess of LCI to resolve the existing technical issues of the polymer-liquid crystal interface, which in turn will help push the core products of the collaborators to the next level of commercial success. The committee has a fairly high level of confidence that there will be positive economic impact to Ohio. The proposal has a relatively clear path to near-term (3- to 5-year) economic impact, as well as significant longer-term market potential. An additional strength of the proposal is that the collaborators will benefit from essentially the same research, while not being direct competitors.

3. *PET/MRI, a Next Generation Multi-Modal Molecular Imaging Technology Platform (12-254)* will build upon the efforts that led to the market introduction of integrated positron emission tomography (PET)/magnetic resonance imaging (MRI) by Philips Cleveland to achieve rapid market growth and global adoption of PET/MRI-related products/services in the global healthcare community. The state-of-the-art time-of-flight integrated PET/MRI system has superior imaging quality relative to comparative systems currently on the market. The proposal team members know and clearly state the challenges they are facing, both technically and commercially, and are well prepared to address and overcome them. The team is very experienced, and the proposal leverages The Ohio State University's well established capabilities and capacities in the biomedical imaging arena to support the innovation goals and 3- to 5-year commercialization plans of the collaborator, Philips Healthcare, and committed partner, Cardinal

Health. These two partners have the technical and commercial experience, as well as strong incentive and commitment, to make the project a success. Moreover, the strong technical foundation of the proposal, the technology's potential for commercialization, and the in-place and planned resources for the program further bolster the proposal's prospects for success.

4. *Advanced Materials for Additive Manufacturing Maturation (12-204)* is directed at a relatively new method of producing polymeric structures, termed Additive Manufacturing (a process with some similarities to selective laser sintering). To date, these processes have usually involved prototype moldings to assess the part design for polymers used in various applications. This process is perceived as being cost-competitive and potentially much lower in cost compared to conventional injection molding where a low number of parts are required. The University of Dayton is the lead applicant, and collaborators include RP+M, PolyOne Corporation, GE Aviation, and Stratasys. The University of Dayton will develop specific composites for applications to be primarily directed at the aerospace industry in Ohio. The composite development at University of Dayton will be scaled up at PolyOne. The specific parts will be molded by RP+M using equipment developed and commercialized by Stratasys. The combination of partners offers the potential to develop an industry based in Ohio, initially in the aerospace industry but branching out to various other applications. The committee is satisfied with the applicant team's stated reliability and performance of the parts to be produced by this process. There is a high level of interest in this project from numerous potential industrial end-users. If successful, this project will have a substantial positive economic impact on the state of Ohio.

5. *OH-Alive Innovator Platform: A Process and Manufacturing Platform for Cell Therapy (12-258)* proposes to leverage the existing capabilities of the Cellular Therapies Integrated Service (CTIS), to establish a facility that will support accelerated commercialization of discovery by filling an important gap in the cellular therapy platform. Cell therapy is a quickly expanding field of medical applications using living cell material tailored to regenerate, restore, or rejuvenate the human body, and the market for cell therapy is rapidly growing with significant long-term potential for Ohio. Once complete, the OH-Alive Innovator Platform will assemble in one facility the capacity and expertise to support development of a cellular therapy from basic research to clinical trials and commercialization on an affordable, contract basis to researchers and biotechnology companies. The OH-Alive facility will assist in the development of appropriate protocols for producing and releasing cellular therapy materials for clinical trials that meet U.S. Food and Drug Administration expectations, scale to meet the volume requirements as clinical trials advance, shorten timelines for delivery of clinical material, and reduce total costs. Optimizing protocols early will substantially improve the commercialization process of moving therapies from the laboratory to the bedside. The technical plan is well thought out, and the team clearly understands the risks and mitigation strategy for the integration and stand-up of this facility. The team has the technical and management capacity to become a much more important player in the evolution of this technology and its potential paths to commercialization.

6. Products to Improve Orthopaedic Patient Outcomes (PIOPO) (12-245) aims to develop software and other tools to improve surgical accuracy in total shoulder and hip arthroplasty. This proposal includes the development of products designed to facilitate pre-surgical planning and improve accuracy of component placement during surgery. The applicant team has already made significant progress with most of the three objectives identified in the proposal, and the suite of technologies contained in the proposal has the potential to reduce the cost of orthopaedic surgery and dramatically improve patient outcomes. The deliverables, the plan for achieving the technical goals, and the timeline are all reasonable and well-outlined, and the applicant team has the requisite expertise to produce the products described in the proposal.

All of the remaining 29 proposals scored substantially lower than the 6 proposals listed above *when ranked against the criteria and requirements specified in the IPP's RFP*, and they are not recommended for consideration under the current year's program. This does not necessarily mean that the proposals lack merit or should not be funded as part of some other program sponsored by the TFC, the State of Ohio, or the federal government. For example, *Innovation Platform: Distributed Energy Storage Systems (12-208)* has a generally well thought out, ambitious, and achievable technical plan and promotes nearly all of the goals of the IPP. However, the committee is concerned with the lead applicant's traditional focus on the automotive (as opposed to utility) field and, more importantly, feels that the goals would not be met in the time required by the RFP, since the adoption rate of smart grid and community-scale systems will almost surely take longer than 3 to 5 years. Even with these shortfalls, the proposal is still quite strong, but ultimately does not fit within the program's requirements. The specific strengths and weaknesses of all the IPP proposals are included in the individual reviews in Appendix B.

The committee wishes to thank the State of Ohio for the opportunity to review these proposals and to provide its recommendations as to which of the proposals best meet the requirements set forth in the IPP's RFP.

Sincerely,

T.S. Sudarshan, *Chair*

cc: Michael H. Moloney, Director, Aeronautics and Space Engineering Board

Appendixes

A Overview Table
B Individual Summary Evaluations
C Evaluation Worksheet
D IPP Definitions, Goals, and Criteria
E Biographical Sketches of Committee Members

Appendix A
Overview Table

This table was prepared by the Committee for the Review of Proposals to Ohio's Third Frontier Program, 2012-2013 to summarize how well each proposal satisfied the evaluation criteria of the Request for Proposals (RFP) for the 2012 Ohio Third Frontier Innovation Platform Program.

Key	
E	Exceeds Requirements of the RFP
M	Meets Requirements of the RFP
D	Does Not Meet Requirements of the RFP

Proposal (Lead Applicant)		**Technical Merit and Plan**	**Commercialization Strategy**	**Performance Goals**	**Experience and Qualifications**	**Budget and Cost Share**	
Recommended							Rank
12-247	Ophthalmic Imaging Center (Cleveland Clinic Foundation)	**E**	**E**	**M**	**E**	**M**	1
12-216	New Concept Devises Based on Nanoscale Engineering of Polymer-Liquid Crystal Interface (Kent State University)	**E**	**E**	**M**	**E**	**M**	2
12-254	PET/MRI, a Next Generation Multi-Modal Molecular Imaging Technology Platform (The Ohio State University)	**E**	**M**	**E**	**E**	**M**	3
12-204	Advanced Materials for Additive Manufacturing Maturation (University of Dayton)	**E**	**E**	**M**	**M**	**M**	4
12-258	The OH-Alive Innovator Platform: A Process and Manufacturing Platform for Cell Therapy (Case Western Reserve University)	**M**	**M**	**M**	**E**	**M**	5
12-245	Products to Improve Orthopaedic Patient Outcomes (PIOPO) (Cleveland Clinic)	**M**	**M**	**M**	**E**	**M**	6
Not Recommended							Key Weaknesses
12-203	Non-Hermetic Micro Package Technology and Implant Sensor System Integration (Case Western Reserve University)	**D**	**D**	**D**	**D**	**D**	Weak technical plan; vague commercialization strategy and product portfolio; missing expertise on applicant team; discrepancy in the cost share in the letters of support
12-205	Expanding EWI's Innovation Platform for Aeropropulsion Manufacturing and Repair (Edison Welding Institute)	**D**	**D**	**D**	**M**	**D**	Flawed technical plan; limited probability of success; the proposed commercialization plan is weak; low probability of significant economic impacts

Proposal (Lead Applicant)		Technical Merit and Plan	Commercialization Strategy	Performance Goals	Experience and Qualifications	Budget and Cost Share	
12-206	Center for Control of Distributed Renewable Energy in Smart Grids and Critical Power Sites (The Ohio State University)	D	M	D	M	D	Existence of platform is questionable; low, not well-substantiated job creation; discrepancy in the cost share in the letters of support
12-207	Advanced Materials Solutions for Wear and Corrosion (University of Akron)	D	D	D	M	D	Platform does not yet exist
12-208	Innovation Platform: Distributed Energy Storage Systems (The Ohio State University)	D	D	D	D	M	Lead applicant does not have enough familiarity in the specific field; realization of goals will likely be outside the necessary 3 to 5 years
12-209	Situational Awareness Integration, Visualization, Validation, Exploitation and Demonstration (SAIVVED) Commercialization Platform (University of Dayton)	M	D	D	E	E	Plans to use UAV's without discussion of regulations; no consideration of public view of the system or the likely public resistance to adoption
12-211	Akron Functional Materials Center (University of Akron)	M	D	D	M	M	Questionable technical merit; commercialization strategy is unrealistic; potential market is limited; commercial success is unlikely
12-213	Advanced Control Systems (Cleveland State University)	D	D	M	M	M	Unconvincing technical merit; insufficient discussion of competition; insufficient discussion of likely difficulties with market penetration
12-218	Center for Motorsports Technology and Commerce (The Ohio State University)	D	D	D	D	D	Unconvincing technical merit; cost share is not consistent with RFP
12-219	Northeast Ohio Health-IT Innovation Platform (Case Western Reserve University)	D	D	M	M	M	Difficult to discern a true platform—proposal reads as three distinct projects with little commonality; vague commercialization strategy
12-220	Commercialization of an Innovative Neuromodulation and Neurostimulation Technology Platform (Case Western Reserve University)	E	M	M	D	M	Information pertaining to prior OTF awards and performance on those awards was not included in proposal, which is required by the RFP
12-221	Development of Novel Membranes for Advanced Energy Storage (University of Akron)	D	D	D	M	M	Insufficient technical details; insufficient commercial case for proposed technical solution; insufficient justification for economic impacts

Proposal (Lead Applicant)		Technical Merit and Plan	Commercialization Strategy	Performance Goals	Experience and Qualifications	Budget and Cost Share	
12-224	Transparent Conductive Film Manufacturing for Emerging Flexible Electronics Market (University of Akron)	D	M	M	E	M	Insufficient technical details; error in the technical plan
12-229	Center for Sustainable Polymer Products (University of Toledo)	D	D	D	M	M	Too early-stage
12-230	Breath Analysis Innovation and Commercialization Platform (Cleveland Clinic)	D	D	M	M	D	Questionable technical merit on the volatile organic compounds diagnostic technology; dubious benefits to Ohio job creation; budget and cost share section missing information; potential for exceeding 20% limit for indirect costs
12-233	Electrochemical Innovation Platform: Advanced Materials for Energy Storage and Sensors (Ohio University)	D	D	D	D	M	No significant synergy between projects; vague commercialization plan for one of the two products; untenable management plan
12-238	Manufacturing & Commercialization of Value-Added Orthopedic Products from Cheap Raw Materials (University of Toledo)	D	D	D	M	D	Weak technical plan; unclear whether products in proposal can seize adequate market share (due to existing competition); unrealistic commercialization timeframe; vague performance goals; contradictory budget information
12-246	Next-Generation Coating Technologies for Very-High Temperature Engine Components (University of Cincinnati)	D	D	D	D	D	Insufficient technical details; actual time to market is likely outside 3- to 5-year timeframe; insufficient budget
12-249	Healthcare Information Technology Transform Platform (Cleveland Clinic)	D	D	D	D	D	Questionable technical merit; unrealistic commercialization strategy; performance goals lacking in details; insufficient product commercialization expertise on applicant team; unclear whether and how iVHR will be able to sustain its cost-share commitment
12-251	The FLEX Scoring Catheter (University of Toledo)	D	D	D	M	D	Weak technical plan; vague and unrealistic commercialization strategy; performance goals are insufficient; inconsistent budget figures used throughout the proposal

Proposal (Lead Applicant)		Technical Merit and Plan	Commercialization Strategy	Performance Goals	Experience and Qualifications	Budget and Cost Share	
12-265	Novel Regenerative Therapies for Treatment of Cardiovascular Disease (Summa Health System)	**M**	**D**	**D**	**M**	**M**	No specific platform to achieve commercialization [within the timeframe required by the RFP]; weak commercialization strategy; commercialization performance goals are unclear
12-266	Grid Energy Storage Integration Platform for Industrial Power Quality Management (The Tech Belt Energy Innovation Center)	**D**	**D**	**D**	**D**	**D**	Commercialization plan is not well laid out; lacks critical data to support performance goals; elements of budget seem only to support the project indirectly
12-269	Integrated Regional Device Manufacturing (IRDM) (Lorain County Community College)	**D**	**D**	**D**	**D**	**D**	Platform does not yet exist; apparent lack of expertise to address the technical development of the products
12-270	Advancing Material Technologies in Ohio through Surface Engineering (Case Western Reserve University)	**D**	**D**	**D**	**M**	**M**	Proposal appears to be designed solely to enable equipment purchase; poor commercialization plan; lacks critical data to support performance goals, which are not well defined
12-276	Innovation Platform for Solar Photovoltaics (University of Toledo)	**M**	**D**	**D**	**M**	**M**	Serious concerns regarding likely execution and past performance of one of the collaborators; insufficient commercial justification, given the conditions of the present solar market
12-277	Ohio Sensor and Semiconductor Innovation Platform (OSSIP) (The Ohio State University)	**M**	**D**	**M**	**M**	**M**	Flawed commercialization strategy
12-282	Bio-Based Composites Innovation Platform (The Ohio State University)	**D**	**D**	**M**	**M**	**E**	Lacks critical technical data; vague commercialization plan
12-284	Ohio Platform for Tomorrow's Industrial Medical Imaging Systems and Equipment—OPTIMISE (Case Western Reserve University)	**D**	**M**	**M**	**E**	**M**	Cannot discern a platform
12-287	Integrated Patient Personal Care Center (Cleveland Clinic)	**D**	**D**	**D**	**M**	**M**	Unrealistic technical development and commercialization timelines; role of certain collaborators is unclear; dubious impact on revenue and job creation

Appendix B
Individual Summary Evaluations

Summary evaluations of the 35 proposals to the 2012 Ohio Third Frontier Innovation Platform Program (OTF IPP) are given below. Proposals were evaluated according to criteria given in the Request for Proposals (RFP).

Recommended		**Page**
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12-216	New Concept Devices Based on Nanoscale Engineering of Polymer-Liquid Crystal Interface (Kent State University)	17
12-254	PET/MRI, a Next Generation Multi-Modal Molecular Imaging Technology Platform (The Ohio State University)	20
12-204	Advanced Materials for Additive Manufacturing Maturation (University of Dayton)	23
12-258	The OH-Alive Innovator Platform: A Process and Manufacturing Platform for Cell Therapy (Case Western Reserve University)	26
12-245	Products to Improve Orthopaedic Patient Outcomes (PIOPO) (Cleveland Clinic)	29

Not Recommended		**Page**
12-203	Non-Hermetic Micro Package Technology and Implant Sensor System Integration (Case Western Reserve University)	32
12-205	Expanding EWI's Innovation Platform for Aeropropulsion Manufacturing and Repair (Edison Welding Institute)	35
12-206	Center for Control of Distributed Renewable Energy in Smart Grids and Critical Power Sites (The Ohio State University)	38
12-207	Advanced Materials Solutions for Wear and Corrosion (University of Akron)	40
12-208	Innovation Platform: Distributed Energy Storage Systems (The Ohio State University)	42
12-209	Situational Awareness Integration, Visualization, Validation, Exploitation and Demonstration (SAIVVED) Commercialization Platform (University of Dayton)	45
12-211	Akron Functional Materials Center (University of Akron)	48
12-213	Advanced Control Systems (Cleveland State University)	51
12-218	Center for Motorsports Technology and Commerce (The Ohio State University)	53
12-219	Northeast Ohio Health-IT Innovation Platform (Case Western Reserve University)	55
12-220	Commercialization of an Innovative Neuromodulation and Neurostimulation Technology Platform (Case Western Reserve University)	57
12-221	Development of Novel Membranes for Advanced Energy Storage (University of Akron)	60
12-224	Transparent Conductive Film Manufacturing for Emerging Flexible Electronics Market (University of Akron)	62

12-229	Center for Sustainable Polymer Products (University of Toledo)	65
12-230	Breath Analysis Innovation and Commercialization Platform (Cleveland Clinic)	68
12-233	Electrochemical Innovation Platform: Advanced Materials for Energy Storage and Sensors (Ohio University)	71
12-238	Manufacturing & Commercialization of Value-Added Orthopedic Products from Cheap Raw Materials (University of Toledo)	73
12-246	Next-Generation Coating Technologies for Very-High Temperature Engine Components (University of Cincinnati)	75
12-249	Healthcare Information Technology Transform Platform (Cleveland Clinic)	77
12-251	The FLEX Scoring Catheter (University of Toledo)	79
12-265	Novel Regenerative Therapies for Treatment of Cardiovascular Disease (Summa Health System)	82
12-266	Grid Energy Storage Integration Platform for Industrial Power Quality Management (The Tech Belt Energy Innovation Center)	84
12-269	Integrated Regional Device Manufacturing (IRDM) (Lorain County Community College)	86
12-270	Advancing Material Technologies in Ohio through Surface Engineering (Case Western Reserve University)	88
12-276	Innovation Platform for Solar Photovoltaics (University of Toledo)	90
12-277	Ohio Sensor and Semiconductor Innovation Platform (OSSIP) (The Ohio State University)	92
12-282	Bio-Based Composites Innovation Platform (The Ohio State University)	95
12-284	Ohio Platform for Tomorrow's Industrial Medical Imaging Systems and Equipment—OPTIMISE (Case Western Reserve University)	97
12-287	Integrated Patient Personal Care Center (Cleveland Clinic)	100

OTF IPP 12-247
Ophthalmic Imaging Center (OIC)
Cleveland Clinic Foundation

Proposal Summary

Proposed Budget		
	State Funds	Cost Share
Operating Funds	$2,999,709	$3,489,562
Capital Funds	$0	$0
Subtotal	$2,999,709	$3,489,562
TOTAL	$6,489,271	

This proposal seeks funds to develop and commercialize new ophthalmologic diagnostic and surgical instrumentation, compatible new surgical instruments, new contrast dyes, and automated software packages that will extend and enhance high-resolution optical coherence tomography (OCT) systems. Of particular importance is the development of an interoperative OCT platform where the surgical team will be able to use the enhanced power of OCT technology in the conduct of complicated ocular surgical procedures. OptoQuest and Image IQ are Ohio companies collaborating and providing cost share funds with the Cleveland Clinic's Ophthalmic Imaging Center (OIC). Additional Ohio companies involved include Avedro, Bioptigen, and Peregrine, as non-cost-sharing collaborators.

Detailed Review

- **Technical Merit and Plan**

The main goals of this proposal are to complete the development and bring to market integrated and innovative OCT instrumentation systems to diagnose defects in posterior eye microstructures and conduct surgical repair/reconstruction procedures. The objectives include four individual work streams that aim to (1) develop an interoperative OCT system for surgical procedures that includes multi-center clinical trials, develop a fully incorporated heads-up display system that will operate within the microscope, and create and integrate clinical standards and protocols; (2) develop OCT-compatible surgical instruments that require identification of appropriate materials; (3) identify and develop novel clinically acceptable contrast dyes; and (4) develop new automated analysis software that will integrate the heads-up display system with the interoperative OCT instrument. The technical merit is strong and the interdependencies of the work plan do not appear to significantly decrease the probability of technical success. The proposal exceeds the requirements of the RFP on Technical Merit and Plan.

- **Commercialization Strategy**

The commercialization strategy hinges on the experience of the Cleveland Clinic's OIC in assisting companies with commercialization of OCT devices. Successful commercialization will benefit from the identification of suitable OCT-compatible materials for designing and manufacturing new surgical instruments. This strategy, if successful, may result in the formation of a new company that could have strong intellectual property, market presence, and significant revenues. The development of the heads-up display and integrated software systems for interoperative OCT is also crucial, along with the selection of a preferred microscope system to complete the commercialization package. By themselves, these integrated devices and software may not offer strong commercialization value; rather, their value is in ensuring the viability of the OCT system. Finally, commercialization is highly dependent on developing an appropriate-quality system to enable U.S. Food and Drug Administration (FDA) 510(k) approval and successfully conducting and completing the commercialization clinical trials to support the Premarket Approval FDA submission. The proposal exceeds the requirements of the RFP on Commercialization Strategy.

- **Performance Goals**

The performance goals of this proposal seem reasonable, given the successful development, testing, and launch of the integrated, interdependent, interoperative OCT systems. The project is expected to launch seven product streams that have the potential to earn approximately $150 million and create approximately 43 jobs by the end of the third year. The goals to generate invention disclosures, patent filings, technology licenses, and platform technologies within the first 5 years are also reasonable, but obtaining $10 million per year in additional funds from grants and sponsored research contracts may be an unrealistic expectation. The proposal meets the requirements of the RFP on Performance Goals.

- **Experience and Qualifications**

The Cole Eye Institute at the Cleveland Clinic is an impressive organization of internationally recognized investigators. Their strong history of accomplishments and of attracting and sustaining large research funding is a good predictor of future success in executing the critical development and subsequent commercialization goals of this proposal. In addition, the OIC within the Cole Eye Institute is a strongly managed organization that focuses on hiring and retaining key thought leaders and provides the appropriate leadership and environment to create opportunities to develop and commercialize exciting medical advances in diagnostic and surgical procedures/systems. ImageIQ is an established imaging software development company. OptoQuest appears to be less well established, albeit well managed. The proposal exceeds the requirements of the RFP on Experience and Qualifications.

- **Budget and Cost Share**

The budget for the proposal is well organized and realistic. The Cleveland Clinic OIC will provide $2,419,692 in cash cost share. This includes funds to mitigate the 54.5 percent indirect cost rate down to the required 20 percent. Additional cost sharing of $613,870 and $456,000 by OptoQuest and ImageIQ, respectively, is well documented and supported by the accompanying letters. The proposal meets the requirements of the RFP on Budget and Cost Share.

Summary of Review and Recommendation

The proposal to develop and commercialize advanced OCT systems for diagnosing and surgically treating structural deformities of the eye is generally sound. It represents an innovative, highly desired platform that is expected to provide significant value to patients along with strong commercial value to Ohio. Interdependencies such as the identification and development of OCT-compatible surgical instruments and suitable contrast dyes should impact successful clinical trials and commercialization. The OIC's initial successes in launching an interoperative OCT system, along with the impressive leadership and experience within the Cole Eye Institute, significantly enhances the probability of technical and commercial success. The committee recommends that this proposal be considered for funds under the Ohio Third Frontier Innovation Platform Program.

OTF IPP 12-216
New Concept Devices Based on Nanoscale Engineering of Polymer-Liquid Crystal Interface
Kent State University

Proposal Summary

Proposed Budget		
	State Funds	Cost Share
Operating Funds	$3,000,000	$2,980,000
Capital Funds	$0	$20,000
Subtotal	$3,000,000	$3,000,000
TOTAL	$6,000,000	

This proposal seeks to firm up an existing platform that is built around the Liquid Crystal Institute (LCI) at Kent State University (KSU) and includes four local collaborators: Kent Displays, Inc. (KDI), AlphaMicron, Inc. (AMI), Crystal Diagnostics, Ltd. (CDx), and Akron Polymer Systems (APS). Two of the collaborators are housed in the KSU Centennial Research Park. The goal is to leverage the scientific prowess of LCI to resolve the existing technical issues of the polymer-liquid crystal (LC) interface, which in turn will help push the core products of the collaborators to the next level of commercial success within 3 to 5 years to achieve a growth of more than 100 percent.

Detailed Review

- **Technical Merit and Plan**

The main goal of this proposal is to enhance control of the interactions at the polymer-liquid crystal (LC) interface for liquid crystal device applications. KSU will utilize a multi-physics partial differential equation (PDE) solver package to model the various scenarios pertaining to the polymer-LC interfaces that will also benefit from an existing National Science Foundation (NSF) Partnership for Innovation (PFI) program grant. Three projects (involving a total of eight different tasks) are proposed, in which the resulting polymer-LC interfaces will be fine-tuned to enhance the capabilities of the collaborating companies to introduce new and/or enhanced products.

APS will develop new polymers for these applications. One of the projects involves writing tablets (the Boogie Board) where thinner line width and selective erasing capability are desired. The basic solution is envisioned as optimization of the polymer-LC interface to restrict stress-induced flow. A second project involves designing flexible visors for military eyewear suitable for use in both full sunlight and total darkness and that are not adversely affected by transient patterns that would otherwise cause haze and reduced optical clarity. A third application involves developing improved materials such as polyimides/surfactants for enhancing CDx pathogen detection technology. The rationale for KSU's involvement with these collaborating companies is compelling. The key to the issues at hand for the collaborators is lack of control of the interactions at the polymer-LC interface, which will be enhanced by KSU through its established innovation platform at the LCI, which will benefit from the NSF PFI grant. Additionally, KDI has received a National Institute of Standards and Technology (NIST) Technology Innovation Program (TIP) grant to help sustain synergistic areas in manufacturing. The collaboration will develop new materials and processes to overcome the technical problems. The proposers have contingency plans in place (involving carbon nanotube-based conductors and other hybrid formulations) in case they should be unable to exploit poly(3,4-ethylenedioxythiophene) (PEDOT)-based conductors. The team has a clear understanding of the steps required to achieve their goals as well as the potential risks they may have to overcome. The committee believes that the project has significant technical merit and a very high probability of success. The proposal exceeds the requirements of the RFP on Technical Merit and Plan.

- **Commercialization Strategy**

The committee believes that the commercialization strategy is reasonable for the companies and their products. KDI Boogie Board eWriter products (manufactured almost exclusively in Ohio) have already been exported to more than 25 countries; they seem to have a definite edge over competitive technologies such as the Wacom Inkling and the AceCad Digimemo. KDI is about to enter into some significant commercial relationships, including with major retailers, and is working to meet the $99 retail price target for the second generation release of the Boogie Board RIP. The KDI product compares rather favorably to paper and pen and is expected to have an increasingly larger customer acceptance once the technology can overcome the current limitations in the areas of line width, selective erase, and contrast. The product and channel development appears well established at each company. The value of having KSU's expertise in liquid crystal combined with APS's expertise in polymers to solve the noted problems is well detailed and a clear strength for the proposal. The success of the project can ensure a long-term competitive edge for the four collaborating partners.

The proposal has a good chance of successful completion of its goals. The size of each individual opportunity within the scope of this proposal appears small, but, collectively, they are somewhat larger. In written elaborations provided to the committee, it is clear that the AMI eyewear (with the U.S. Army and other special operations) and CDx's pathogen detection market opportunities are non-trivial. CDx plans to explore pathogen detection market opportunity in food during this project period, and there are numerous other market opportunities involving water, biodefense, agriculture, and clinical areas. The long-term economic benefit to the state of Ohio is reasonable and has a good chance of success. The proposal exceeds the requirements of the RFP on Commercialization Strategy.

- **Performance Goals**

The proposal's objectives and goals are reasonable and achievable. The technical solutions needed for the enhancement of the products appear to legitimately require new approaches (such as that to be contributed by LCI of KSU) to analyze and engineer the structure and material characteristics of the polymer-LC interfaces. All the commercialization partners have clearly identified products and market strategy, and all but CDx have already entered the marketplace with new, innovative products. KDI's Boogie Board and Boogie Board RIP are already on the market. Based on feedback, KDI believes that reducing line width and introducing selective erase can greatly expand its market beyond its present niche. Using funds from the IPP, this proposal will create six direct new private sector jobs with salaries over $45,000 and at least two jobs in the non-profit sector at more than $35,000 per year. These companies expect to increase sales by $10 million in 2013-2014, which will generate internal capital for further investments and create additional new Ohio jobs. The proposal meets the requirements of the RFP on Performance Goals.

- **Experience and Qualifications**

The KSU team provides highly qualified individuals with demonstrated prior track records, including more than 160 active patents with additional foreign patents and pending applications. The value of having KSU's LC expertise combined with APS's polymer expertise to solve the noted problems is well detailed and is a genuine strength. The platform is already established and has had prior collaboration experiences. The proposal exceeds the requirements of the RFP on Experience and Qualifications.

- **Budget and Cost Share**

The budget and cost share are both reasonable and realistic. The letters of commitment are compelling and sufficiently detailed; they are well aligned with chance of successful completion of the goals. Immediate economic benefit to the state of Ohio is modest, but the proposal has a high chance of success. The proposal meets the requirements of the RFP on Budget and Cost Share.

Summary of Review and Recommendation

In this proposal, the collaborators have products that are either on the market and need minor technical advancements or are nearing commercialization. The committee has a fairly high level of confidence that there will be positive economic impact to Ohio. The proposal has a relatively clear path to near-term (3- to 5-year) economic impact, as well as significant longer-term market potential. An additional strength of the proposal is that the collaborators will benefit from essentially the same research while not being direct competitors. The committee recommends that this proposal be considered for funds under the Ohio Third Frontier Innovation Platform Program.

OTF IPP 12-254
PET/MRI, a Next Generation Multi-Modal Molecular Imaging Technology Platform
The Ohio State University

Proposal Summary

Proposed Budget		
	State Funds	Cost Share
Operating Funds	$2,000,000	$2,681,690
Capital Funds	$1,000,000	$345,000
Subtotal	$3,000,000	$3,026,690
TOTAL	$6,026,690	

Philips' Ingenuity time-of-flight (TOF) positron emission tomography (PET)/magnetic resonance imaging (MRI) system, a state-of-the-art integrated PET and MRI product, received FDA marketing approval in November 2011. PET/MRI is a new imaging modality that enables a combined patient imaging examination that yields information about both MRI soft-tissue morphological imaging (detailed visualization of internal structures) and PET functional imaging (functional processes in the body). A 2006 OTF Biomedical Research Commercialization Program (BRCP) project award entitled "WCI-BMI Part II" was granted to The Ohio State University (OSU) and Philips Healthcare to engineer, develop, and manufacture Philips' Ingenuity TOF PET/MRI. For receipt of the BRCP award, Philips agreed to do the project in Cleveland and thus moved it from California. In the past 7 years, Cardinal Health also moved its Nuclear Pharmacy Business from California to Dublin, Ohio. While the earlier efforts enabled the desired goal to bring a PET/MRI product to the global market, the product (and technology) needs further and rapid improvements to reach its full potential in market share and global opportunity. The proposal's overall goal is to build upon the efforts that led to the market introduction of PET/MRI by Philips Cleveland, with many supportive efforts from the Ohio Imaging Research and Innovation (OIRAIN) partners, and achieve rapid market growth and global adoption of PET/MRI-related products/services in the global healthcare community.

The Wright Center of Innovation in Biomedical Imaging (WCI-BMI) at The Ohio State University is the lead applicant for the project. Philips Healthcare is a collaborator, and Cardinal Health's Division of Pharmacy Services is a committed partner.

Detailed Review

- **Technical Merit and Plan**

The technology challenges that will be addressed by the PET/MRI Innovation Platform include PET reconstruction methodologies to enable quantitative and high resolution capabilities; PET time-of-flight acquisition methodologies to enable fast and innovative applications; MRI approaches for attenuation correction and rapid tissue segmentation; fast and real-time imaging approaches for simultaneous PET/MRI acquisition; and targeted imaging pharmaceuticals: multi-modal, PET/MRI enabling, or enabled by PET/MRI and based on ^{124}I, ^{18}F, and ^{68}GA or ^{11}C.

The in-place and planned resources for this program are extensive: several dedicated 3-Tesla (3T) MRI Philips instruments, a TOF PET/CT (computed tomography) system with plans to upgrade it for PET, the embedding of a Philips Healthcare reconstruction/development team at the WCI-BMI, a facility designed for the fast installation and de-installation of major imaging devices to facilitate rapid product development and support for regulatory approval of innovative imaging technologies, and involvement of and ready access to top-quality PET/MRI and imaging pharmaceuticals experts and planned GMP (good manufacturing practices) facilities. The proposal team combines a long history of development and successful commercialization in the PET and MRI arena (Philips) and an in-depth understanding of radiopharmaceuticals for imaging (Cardinal Health) with significant resources and expertise at the WCI-BMI. The proposal team members know and clearly state the challenges they are facing and what

technology, stepwise efforts, and equipment are needed to achieve the desired technological deliverables. The proposal exceeds the requirements of the RFP on Technical Merit and Plan.

- **Commercialization Strategy**

The applicants are well aware of the challenges related to the speed of market penetration for a new medical technology and what is needed to get it accepted and used by patients, physicians, healthcare systems, healthcare insurers, healthcare benefit providers, and regulatory mandates. The proposal team is well prepared to address and overcome these challenges because its goals focus on making its imaging system coupled to the use of safe and effective imaging pharmaceuticals that are easily used for clinically important applications and are both time and cost-effective. Likewise, a combined PET/MRI system satisfies an unmet need by providing a faster timeline to diagnosis and treatment and by reducing patient discomfort related to undergoing two separate, relatively stressful, scanning procedures.

Important to note is that Philips is in a head-to-head race with Siemens, which in June 2011 received FDA approval for its PET/MRI system and has direct access to imaging pharmaceuticals from its PETNET division in marketing and delivering PET/MRI to the global marketplace. Siemens recently deployed a PET/MRI instrument that conducts simultaneous PET and MRI imaging, while the Philips instrument sequentially acquires PET and MRI scans. The Philips instrument is expected to provide superior image reconstruction, but Siemens's simultaneous imaging system may, in fact, be significantly more patient friendly, resulting in less initial market penetration of the Philips system. In spite of this concern, Philips has an opportunity to establish itself as the market leader with market share potential above 50 percent. General Electric and Toshiba are the two other global imaging technology companies that are developing PET/MRI systems, but their regulatory approval appears to be in the distant future. Thus, getting to market sooner rather than later is a critical issue for Philips. In addition, by partnering with Philips to produce imaging pharmaceuticals for Philips's PET/MRI system, Cardinal Health has a considerable opportunity to develop and offer new longer-half-life imaging radiopharmaceuticals (for example, [^{124}I]-labeled tracers) for the rapidly growing PET/MRI imaging market, as well as to centralize its manufacture of imaging pharmaceuticals—a major employment and profitability advantage for Ohio. With regard to customer readiness, Philips already has a total of more than 10 PET/MRI systems on order or installed, and the market projection further indicates that around 20 to 30 PET/MRI systems will be purchased in 2012. In addition, the market projection on utilization of PET-based and PET-related imaging pharmaceuticals predicts a nearly 10-fold increase until 2018. Taken together, these market research reports confirm that the growth is being driven by a medical need for advanced imaging in the targeted applications.

The committee has some minor concerns about how the project team will compete against Siemens, which has a significant first-mover advantage, and suggests that Philips and Cardinal need to make every effort to speed up both their application development and commercialization efforts by increasing the amount of financial and human resources support dedicated to the project either from their companies or from federal grants. In addition, and as soon as possible, Philips ought to consider implementing a public relations program to highlight the competitive advantages of its PET/MRI approach versus Siemens's PET/MRI system and develop and implement its training programs for physicians, technologists, physicists, and service engineers to use, manage, quality assure, and maintain PET/MRI systems. However, failure to adopt these suggestions does not preclude the proposal from meeting the requirements of the RFP on Commercialization Strategy. The proposal meets the requirements of the RFP on Commercialization Strategy.

- **Performance Goals**

The economic and job creation projections are based on the combination of market research predictions and market patterns; Philips Healthcare and Cardinal Health's strong global sales forces; their prior experience and success in technical innovation and commercialization efforts of relevant imaging programs; and their long-term resources, financial, and manpower commitments. The committee believes the performance goals to be realistic and achievable. In addition, the ongoing operation and success of the platform will provide training for the physicians, technologists, physicists, and service engineers to use, manage, quality assure, and maintain PET/MRI systems, as well as build on the Cleveland-Columbus corridor's strong international reputation as a biomedical imaging center. The proposal exceeds the requirements of the RFP on Performance Goals.

- **Experience and Qualifications**

The leaders of the project from OSU/WCI-BMI, Philips, and Cardinal Health are very experienced in their areas, committed to the project, have access to deep resources (Philips and Cardinal Health), and will be able to commercialize the innovations from this effort. In addition, the resources available at OSU/WCI-BMI are in place and supplemental resources needed for this project will be easily added. Philips has also performed very well on prior OTF grants. The proposal exceeds the requirements of the RFP on Experience and Qualifications.

- **Budget and Cost Share**

The ratio of cost share to state funds from the IPP is slightly greater than 1:1, which shows the commitment of Philips to the project. 33% of state funds ($1 million) will be used for the purchase of capital equipment related mainly to the addition of ^{124}I capabilities (solid target production) to the academic-industry Molecular Imaging Agent Research and Production Facility at OSU. These facilities—near the WCI-BMI—support Cardinal Health GMP, OSU GMP, and OSU non-GMP molecular imaging agent facilities and have access to two cyclotrons, as well as to expansion of the PET/MRI capabilities, resources to update related data storage, analytical workstations, and visualization capabilities at the WCI-BMI. Indirect costs will be covered by 15.5% of operating expenses from state funds. Philips's cash cost share is $1,995,000. Via the RFP stipulations, OSU is matching the difference between the allowable 20% indirect rate and the established institutional indirect rate of 52.5% as a match consisting of $502,000 for the proposal. There is no budgeted cost share from Cardinal Health, but it was agreed beforehand that Cardinal Health would not submit a financial match budget for the project to ease accounting documentation because the company is investing $5 million in the production facility at Kinnear Road. The proposal meets the requirements of the RFP on Budget and Cost Share.

<u>Summary of Review and Recommendation</u>

The strength of this proposal is that it leverages OSU's well-established capabilities and capacities in the biomedical imaging arena to support the innovation goals and 3- to 5-year commercialization plans of Philips Healthcare and Cardinal Health. These two global healthcare powerhouses need to expand for competitive reasons the markets for their imaging offerings globally and have the technical and commercial experience, as well as strong incentive and commitment, to make the project a success. Moreover, the strong technical foundation of the proposal and the technology's potential for commercialization further bolster the proposal's prospects for success. The committee recommends that this proposal be considered for funds under the Ohio Third Frontier Innovation Platform Program.

OTF IPP 12-204
Advanced Materials for Additive Manufacturing Maturation
University of Dayton

Proposal Summary

Proposed Budget		
	State Funds	Cost Share
Operating Funds	$2,699,050	$3,371,513
Capital Funds	$300,000	$0
Subtotal	$2,999,050	$3,371,513
TOTAL	$6,370,563	

This project is directed at a relatively new method of producing polymeric structures termed "Additive Manufacturing" (a process with some similarities to selective laser sintering). To date, these processes have usually involved prototype moldings to assess the part design for polymers used in various applications. This process is perceived as being cost competitive and potentially much lower in cost compared to conventional injection molding where a low number of parts are required. This is due to the very high cost of injection molds where a limited production will yield a very high cost per part because of the mold investment. The University of Dayton is the lead applicant, and collaborators include RP+M, PolyOne Corporation, GE Aviation, and Stratasys. The University of Dayton will develop specific composites for applications to be primarily directed at the aerospace industry in the state of Ohio. The composite development at the University of Dayton will be scaled up at PolyOne. The specific parts will be molded by RP+M using equipment developed and commercialized by Stratasys.

Detailed Review

- **Technical Merit and Plan**

This proposal is designed to demonstrate a relatively new concept in producing thermoplastic composite parts. It is particularly relevant to applications where relatively few parts are required. The specific example chosen for demonstration of the commercial promise of the process is the aerospace industry. Commercial and military aircraft have a large number of diverse parts per aircraft, but a limited number of aircraft are produced. As such, there are a lot of different parts but with low numbers of specific parts required. This situation leads to a very high cost per part because of the very expensive tooling required for each injection-molded part. The process noted (additive deposition molding) involves the deposition of a thermoplastic by an extrusion head computer controlled in both the horizontal and vertical direction to build up the specific part. The process allows for production of very complex parts one at a time. It can handle many polymers, including high-performance engineering polymers such as polyetherimide, which is proposed. The development of specific composites capable of employing this process and meeting application requirements could provide real benefits, including strength, stiffness, and reliability in application end-use.

The proposal does not address the reliability or performance of this process to produce parts compared to the conventional injection molding process; for example, whether the parts proposed are to be utilized in critical applications where failure could be catastrophic. If so, the reliability and performance aspects need primary attention. The committee asked about this matter during its second meeting, and the applicant team indicated that the parts produced are not used in structurally critical parts, and the process delivers acceptable performance.

The process appears to be uniquely relevant for thermoplastic part production where a relatively small number of parts are required. This proposal will be taking this technology to a higher level. The primary use of this process currently is for modeling and prototype applications. The ability to use the process for the production of parts for the aerospace industry would be a significant step forward for the technology. The proposal exceeds the requirements of the RFP on Technical Merit and Plan.

- **Commercialization Strategy**

The commercial area primarily involves the aerospace industry (for example, Boeing, GE Aviation, Lockheed Martin, and Northrop Grumman) for commercial and military aircraft applications. The University of Dayton will be involved with composite and nanocomposite development for the components to be produced by additive manufacturers. PolyOne will scale-up the production of the desired composites for customers. The process and equipment is produced by Stratasys (a Minnesota-based company). The proposed commercial plan is reasonable, with a significant number of major customers, composite development (University of Dayton), composite production (PolyOne), and part production (RP+M) all based in Ohio, which will assure supply chain continuity from development to commercialization.

The committee notes that the military is supportive of processes similar to this for production of aircraft and other military parts. The Department of Defense (DOD) has recently asked for proposals for additive manufacturing for military parts. The proposal indicates that the members of this proposal have also submitted a proposal in response to this recent government solicitation. Furthermore, the proposal includes letters of support from potential customers, including Honda, Lockheed Martin, and Northrop Grumman, clearly indicating a high level of industrial interest beyond the collaborators in the project. The proposal exceeds the requirements of the RFP on Commercialization Strategy.

- **Performance Goals**

The proof of principle for this proposal has been well demonstrated. The overall performance goals are achievable. While the direction of the project is toward aerospace applications, this process could favorably compete with injection molding in a number of other commercial applications where structural performance is not critical. If the aerospace industry can successfully demonstrate the feasibility of this process for their applications, it would open the door for many other industries. The projected sales and jobs added appear reasonable with the successful completion of the project—85 jobs and $50 million in sales at the end of 5 years. The proposal meets the requirements of the RFP on Performance Goals.

- **Experience and Qualifications**

The combination of partners, companies, fabricators, and customers all offer the experience and qualifications to successfully conduct this project. The supply chain from product development through commercial utilization is clearly defined with key personnel and skills described. The proposal meets the requirements of the RFP on Experience and Qualifications.

- **Budget and Cost Share**

The overall budget appears reasonable relative to the proposed scope of the project. The cost share from RP+M and Stratasys is reasonable, but the values from GE Aviation appear low relative to the advantage they would derive from successful completion of the project. This lower level of commitment was explained at the committee's second meeting and relates to the high commitment from GE on the DOD proposal also being submitted by this team. Ultimately, the committee is convinced that GE is committed to the project. The proposal meets the requirements of the RFP on Budget and Cost Share.

Summary of Review and Recommendation

This project is proposing to advance the technology of the fused deposition molding process to higher performance applications employing engineering polymers and composites. The combination of partners offers the potential to develop an industry based in Ohio, initially in the aerospace industry but branching out to various other applications. The committee is satisfied with the applicant team's stated reliability and performance of the parts to be produced by this process. There is a high level of interest in this project from numerous potential industrial end-users. If successful, this project will have a substantial positive economic impact on the state of Ohio. The committee recommends that this proposal be considered for funds under the Ohio Third Frontier Innovation Platform Program.

OTF IPP 12-258
OH-Alive Innovator Platform: A Process and Manufacturing Platform for Cell Therapy
Case Western Reserve University

Proposal Summary

Proposed Budget		
	State Funds	Cost Share
Operating Funds	$1,855,661	$1,799.166
Capital Funds	$548,214	$604,709
Subtotal	$2,403,875	$2,403,875
TOTAL	$4,807,750	

The OH-Alive Innovator Platform proposes to leverage the existing capabilities of the Cellular Therapies Integrated Service (CTIS), managed by the National Center for Regenerative Medicine (NCRM), to establish a facility that will support accelerated commercialization of discovery by filling an important gap in the cellular therapy platform. Once complete, the OH-Alive Innovator Platform will assemble in one facility the capacity and expertise to support development of a cellular therapy from basic research to clinical trials and commercialization on an affordable, contract basis to researchers and biotechnology companies. The lead organization is Case Western Reserve University. The collaborators are the Cleveland Clinic, Athersys, Inc., BioEnterprise, BioOhio, BioSpherix, Nanofiber Solutions, Renovo Neural, Inc., and TECAN.

Cell therapy is an expanding field of medical applications using living cell material tailored to regenerate, restore, or rejuvenate the human body. Case Western investigators and their collaborators have been active in the discovery, development, and implementation of stem cell therapies. However, moving potential therapies from discovery to clinical use has been impeded by the time, costs, and volume constraints of current cell culture processes. The FDA requires controlled manufacturing conditions for early-phase clinical material used to study safety and efficacy—requirements that become even more stringent as the trials advance. The goal of OH-Alive is to establish a facility to assist in the development of appropriate protocols for producing and releasing cellular therapy materials for clinical trials that meet FDA expectations, scale to meet the volume requirements as clinical trials advance, shorten timelines for delivery of clinical material, and reduce total costs. Optimizing protocols early will substantially improve the commercialization process of moving therapies from the laboratory to the bedside.

The goal of the proposed OH-Alive facility is to serve as a translational science facility, while adhering to good manufacturing practices (GMP) regulations and guidelines as it produces material suitable for human use throughout the clinical trials process.

Detailed Review

- **Technical Merit and Plan**

The plan proposes to add the ability for process optimization (new cell culture protocols) and automated cell culture scale-up (generation of specific high throughput data confirming the desired final state of the cell product) to the existing CTIS capacity for small-scale defined cell therapy isolation and manual culture processes.

OH-Alive proposes to acquire state-of-the-market (1) robotic and incubator equipment to automate evaluation of multiple protocol parameters in order to optimize production of material with desired characteristics, and (2) analytical equipment for verification of cell type and performance. Funding will also be used to employ administrative, technical, and regulatory personnel, as well as to cover expenses associated with developing the identified proof-of-concept studies. The new physical capacity will be integrated into existing CTIS competency in FDA consultancy, Investigational New Drug (IND) filing support, intellectual property filing, and compliance matters involving Institutional Review Board filings.

The integrated facility will include (1) the BioSpherix Xvivo system, for optimizing cell culture conditions, and Process Analytical Technology (PAT) and (2) robotic equipment for liquid handling (TECAN) to facilitate process optimization, using good laboratory practices (GLP) state-of-the-art analytical equipment for assessing processes and developing release criteria and documentation systems to meet FDA GMP requirements. Collaborator BioSpherix will provide a fully developed, GMP-compliant 3-module Xvivo suite for the OH-Alive platform's use. The Xvivo system has fully insulated, environmentally controlled incubators and cell handling areas, integrated with a comprehensive cell PAT.

The team has worked with commercial partners to develop a custom-designed hardware configuration, optimized for process optimization with multiple concurrent users and projects. This system is based on TECAN's liquid handling robotics, with its embedded culture and environmental control and deep manipulative power, combined with extremely powerful endpoint analysis based on a combination of a large-scale quantitative [real-time] polymerase chain reaction (QPCR) (OpenArray Platform, Applied Biosystems) and high-content imaging (Thermo Arrayscan VT1, Renovo Neura). TECAN has committed to developing a functioning software module that allows an accommodating user interface in setting up experimental parameters for this unique system.

The technical plan is well thought out and the team clearly understands the risks and mitigation strategy for the integration and stand-up of this facility. The proposal meets the requirements of the RFP on Technical Merit and Plan.

- **Commercialization Strategy**

It is anticipated that platform implementation will take 1 year (installing and testing the equipment and systems and incorporating and leveraging specific expertise from Ohio-based academic investigators and the for-profit partners to develop the optimized cell manufacturing methods).

Once the platform is satisfactorily implemented, the OH-Alive team expects to complete a total of 15 individual pilot demonstrator projects by year three, of which seven lead projects were identified and discussed for relevance in the proposal. An additional eight demonstrator project selections will be based on responses to a request for proposals issued at the time of platform implementation by the OH-Alive steering board. Each selected project will be allocated $40,000 to cover supply and evaluation costs, and each principal investigator (PI) will be asked to embed one part- or full-time employee (FTE; typically Ph.D.-level) toward the conductance of the process optimization. PIs also will be expected to leverage other project support as their project operates within OH-Alive. The budget includes the potential for allocating an additional $20,000 to any of the demonstration projects in years two and three, based on commercial merit and immediate potential for a clinical trial.

Ultimately, the economic and health impacts will derive from the projects selected, but these impacts are well beyond the timeframe of the grant. In fact, the product being developed is the OH-Alive facility itself. It will be a pay-for-service GMP facility, which could directly generate revenue and create jobs for Ohio within the project timeframe. The proposed business model is that of a university-based, commercial-style Contract Research Organization (CRO)-type business model in the cellular therapy space. The demonstration projects will each have their own value proposition, with clear potential follow-on jobs and wealth for Ohio.

CROs are not usually big revenue and intellectual property (IP) generators, but cell therapy is at such a very exciting time that this proposal is well positioned to not only help accelerate technologies developed by university and new venture based investigators, as described in the proposal, but also to potentially attract big pharmaceutical companies to this platform. Consideration of a CRO-type model will also

require reconsideration of management, go-to-market, and IP strategy for developing and enhancing a sustainable competitive advantage for an Ohio value chain.

The committee would like to see this broader CRO-style vision explored and adopted as a means to significantly increase the economic impact during the 3- to 5-year evaluation period of this grant evaluation period. The committee believes that although the near-term business model and market plans need improvement, the proposal meets the requirements of the RFP on Commercialization Strategy.

- **Performance Goals**

The overall objectives of the project are well articulated and feasible, and the deliverables are clearly defined. The end result will be a significant enhancement of an already strong technical platform, with significant long-term economic and health value. The proposal aims to employ eight people by year five and spin out the platform into a for-profit entity with an average employee salary of $82,000. In addition, the applicants expect revenue to increase from $600,000 in year three to $1 million in year five. The capabilities of the OH-Alive platform, combined with the growing cell therapy market, mean that this platform has a high probability for sustainable success over the long term. The technical goals are clearly linked to long-term competitive success. The proposal meets the requirements of the RFP on Performance Goals.

- **Experience and Qualifications**

The PI, Dr. Stanton Gerson of Case Western Reserve University, his colleagues, and the collaborators are well qualified to lead, manage, and deliver on the project. In particular, the collaborators have a strong stake in the success of the project. Moreover, the NCRM has a solid record of receiving grant awards over the past decade and has grown its capabilities in that time. Through the NCRM and the many industrial partners, the applicant team has considerable resources—financial and intellectual—to overcome technical challenges and enhance the chances of successful commercialization. The proposal exceeds the requirements of the RFP on Experience and Qualifications.

- **Budget and Cost Share**

The budget appears to be well thought out, with careful articulation in the budget narrative. The cost share is 1:1, with approximately three quarters of the requested state funds being directed towards operating funds, and the remaining amount going toward equipment purchases for the establishment of a dedicated small-scale molecular/cell biology laboratory. The proposal meets the requirements of the RFP on Budget and Cost Share.

Summary of Review and Recommendation

The cell therapy market is rapidly growing and has significant long-term potential for Ohio. The team has the technical and management capacity to become a much more important player in the evolution of this technology and its potential paths to commercialization. While clearly established, the platform remains relatively early in its development, and achieving its near-term potential will require a focused commercial business model. The committee believes that the applicant team has the expertise and wherewithal to improve the business model. Once the commercialization strategy is focused and more specific commercial performance goals are established, the platform will be well poised to achieve commercial success. The committee recommends that this proposal be considered for funds under the Ohio Third Frontier Innovation Platform Program.

OTF IPP 12-245
Products to Improve Orthopaedic Patient Outcomes (PIOPO)
Cleveland Clinic

Proposal Summary

Proposed Budget		
	State Funds	Cost Share
Operating Funds	$2,433,444	$2,800,575
Capital Funds	$330,000	$0
Subtotal	$2,763,444	$2,800,575
TOTAL	$5,564,019	

This proposal aims to develop software and other tools to improve surgical accuracy in total shoulder and hip arthroplasty. This proposal includes the development of products designed to facilitate pre-surgical planning and improve accuracy of component placement during surgery. The launch of eight new products is projected to result in $15 million in revenue by year three and more than $50 million in revenue and 55 new jobs by year five. Some of the funds will be used to purchase two StereoLithography (SLA) machines dedicated to product development (located at Astro Manufacturing and Design, owned by Cleveland Clinic). The lead applicant is the Cleveland Clinic, with collaborators Custom Orthopaedic Solutions (COS), Astro Manufacturing and Design, and ImageIQ, Inc.

Detailed Review

- **Technical Merit and Plan**

This proposal has three objectives with specific deliverables:

1. *Market entry of orthopaedic accuracy products*: Deliverables include bringing orthopaedic accuracy products that can be used to plan and execute total joint replacement surgery to market (includes OrthoVis software, RealBones, SmartBones, Intelligent Reusable Instruments [IRIs]) and executing distribution agreements with orthopaedic companies.
2. *Provide surgeon training*: Deliverables include establishing a surgeon training suite adjacent to Cleveland Clinic's existing cadaver laboratory to train Cleveland Clinic faculty and students as well as outside trainees, and sign agreements with American Academy of Orthopaedic Surgeons (AAOS) and Current Concepts in Joint Replacement (CCJR) for surgeon training products.
3. *Produce tools to strengthen research and development (R&D)*: Deliverables include releasing the OrthoVisR&D software and the ImageRegister service.

The team has already made significant progress with most of these products (the osteotomy patient-specific instruments are not as far in development as the other products). In addition, the suite of technologies contained in the proposal has the potential to dramatically improve patient outcomes in orthopaedic surgery. The deliverables, the plan for achieving the technical goals, and the timeline are all reasonable and well outlined. The proposal meets the requirements of the RFP on Technical Merit and Plan.

- **Commercialization Strategy**

The funds requested through the IPP program will be in large part directed to commercialization of the products in the proposal and to gain regulatory approval thereof. These products are considered class 1 or class 2 devices and, thus, can move through the FDA in an expedited manner, generally with an FDA 510(k) clearance. Although the timeline for each product being ready for the market may be overly optimistic, the committee feels that market readiness will occur within the timeframe of the project. The proposal team intends to stage the roll-out of the accuracy products; they believe that the SmartBones, the IRIs, and the surgical plan (created by the team using OrthoVis software) form the group of products that

will be completed and generate revenues first. The committee notes a few potential concerns: (1) software development time can be highly variable and difficult to predict, and, subsequently, the time to market entry for those products that require software development and testing may also be hard to predict, (2) the proposal does not specify its strategy for providing customer support and training for OrthoVis, (3) it is not clear who will market all of the products. COS will sell the OrthoVis software and the RealBones and SmartBones models through non-exclusive distribution agreements with orthopaedic companies. The letters from the end-users clearly demonstrate that there is interest in the products being developed, which is a strength of the proposal. The committee notes an additional strength: the products used for training and research, including RealBones and the OrthoR&D software (which combines OrthoVis with the ImageRegister and Image Tracker software components), do not need FDA approval and can be marketed as soon as development is complete, providing the applicants an opportunity for shorter-term revenue streams while the FDA approvals are pending. Even with the minor potential concerns, the committee believes that this proposal meets the requirements of the RFP on Commercialization Strategy.

- **Performance Goals**

The sections of the proposal describing the deliverables and the plan for achieving these goals are clear and well written. The projected uses for the state funds are reasonable and will include major capital acquisitions that will strengthen the capabilities of both the Cleveland Clinic and Astro Manufacturing. The projected job creation number for year three is reasonable and demonstrates a good return on the state investment (35 jobs created). The expected penetration into the market is perhaps overly optimistic, and, thus, the projected revenues at all time points and job creation numbers at year five are high, but the committee nevertheless believes that the team will be successful in creating both jobs and revenue. Further, the team believes that there will be increased international recognition to the Cleveland Clinic and the State of Ohio as a result of this project. Since there are competitors for some of the proposed products, it would be helpful to know the annual revenues for those companies (for example, Materialise and ACRM) since it is logical that the projected revenues for the proposed products could, at best, be a fraction of these in the early years. The proposal meets the requirements in the RFP on Performance Goals.

- **Experience and Qualifications**

Members of this team have received prior funding from the State of Ohio and have been collaborating on the development of several of these proposed products since 2009. The lead investigators are well known for their work in the arena of improving patient outcomes through increased accuracy during joint replacement surgery and have completed several clinical trials. Thus, they have demonstrated their expertise and management ability. The proposal exceeds the RFP on experience and qualifications.

- **Budget and Cost Share**

The budget includes funds to purchase two StereoLithography (SLA) machines using state funds. However, the proposal discusses that one SLA machine will be purchased, and the revenue generated from products sold will be used to expand the SLA capability. Although cost share for one collaborator (Astro) is vague and not completely delineated in the proposal, it was clarified in the interview at the committee's second meeting. The overall cost share is slightly greater than that required by the RFP. This proposal meets the requirements of the RFP for Budget and Cost Share.

Summary of Review and Recommendation

The products in this proposal have the potential to reduce the cost of surgery and improve patient outcomes after total shoulder and hip replacement surgery. The team has the requisite expertise to produce the products described in the proposal, and the performance goals are well defined and achievable. There are some minor concerns about the proposal's commercialization strategy, but the committee notes that these concerns are not substantial enough to preclude the proposal from meeting the requirements of the RFP. It is the hope of the committee that the applicant team can address these concerns to enhance its return on investment of state funds. The committee recommends that this proposal be considered for funds under the Ohio Third Frontier Innovation Platform Program.

OTF IPP 12-203
Non-Hermetic Micro Package Technology and Implant Sensor System Integration
Case Western Reserve University

Proposal Summary

Proposed Budget		
	State Funds	Cost Share
Operating Funds	$1,031,200	$1,052,032
Capital Funds	$0	$0
Subtotal	$1,031,200	$1,052,032
TOTAL	$2,083,232	

The project proposes the development and launch of micro-electro-mechanical system (MEMS) based products with non-hermetic packaging technology. Hermetic packaging may cause reliability and stability issues with MEMS devices, which may be addressed through non-hermetic packages. This will be a joint venture between Case Western Reserve University (CWRU); Expert System Applications, Inc.; and Medi MEMS, Inc. The target application space is medical monitoring and therapeutic microsystems. The project seeks to leverage the multiple patents of Dr. Ko, the lead investigator and program manager at CRWU, and the MEMS packaging technology available at CWRU and the SMART Center at Lorain County Community College. The project aims to create 133 new jobs over a 4-year period. Potential clients of the products are Neuros Medical, Inc.; Valtronic Technologies (USA), Inc.; the QiG Group; NDI Medical, LLC; and Medtronic, Inc. Medi MEMS and Expert System Applications will provide cost share and are formal collaborators with CWRU on the proposal.

Detailed Review

- **Technical Merit and Plan**

Application of non-hermetic packaging to MEMS is only desirable if hermetic packaging reduces the performance and increases failure rates of the MEMS device. Due to the multiple moving parts in MEMS devices, non-hermetic packaging is a viable option for meeting the performance considerations if it can be demonstrated to be comparable to hermetic packaging. The performance baseline with hermetic packaging and the comparable performance changes with non-hermetic packages need to be clearly demonstrated. The current proposal does not make a valid case for non-hermetic packaging. The technical aspects hinge on three hypotheses. The first, regarding non-hermetic package development, is vague and lacks technical details with clear performance metrics besides the saline test; the second, regarding multi-layer coating, needs substantiation; and the third, regarding mechanical flexibility with a combination of rigid and malleable sub-layers, is counterintuitive unless the composition matrix is also discussed. The technical plan needs to address the reliability specifications for medical packages as detailed by existing Joint Electron Devices Engineering Council specifications. The proposal is very minimal on technical details pertinent to the requirements of the RFP. The applicant's National Institutes of Health Exploratory/Developmental Research Grant Award (R21) lasts until December 2013 and will need to be completed before this project can take off. The data from the R21 award has been indicated by the proposers as the basis of the current proposal; hence, technical merit of the proposal is weak. The proposal does not meet the requirements of the RFP on Technical Merit and Plan.

- **Commercialization Strategy**

The commercialization strategy is in three phases. The first phase is focused on late-stage research and development. The second phase is market entry of the prototype products. The third phase is market position for medical device technology packaging. The commercialization strategy is very weak. The strategy is also vague, lacking specific details on what attributes of the value proposition offered by the technology will be leveraged. Focus can be brought into the commercialization strategy if the product portfolio is better defined, which can only happen once the technical plan is rearticulated. It is unclear if a

full utility patent has been filed by the lead applicant via CWRU. The applicant will retain the right to use the patent owned by CWRU. New patents will be jointly owned by Medi MEMS and CWRU. As the potential product line is unclear, the future follow-on intellectual property (IP) is difficult to determine. The publications cited of Dr. Ko are primarily from the 1980s and 1990s, with only one in 2009. The IP protection based on the patent technology may be a cause for concern. All five (QiG, Neuros, Valtronic, NDI Medical, Medtronic) of the potential end-users' letters state that they will be interested in using the non-hermetic micropackage technology when it is proven to be practical for use, substantiating that the technology is still in the early stage of research and that its proof of concept has not been demonstrated. CWRU has not licensed the technology to Medi MEMS, which weakens the proposal from the commercialization standpoint. In addition, it is unclear whether Expert System Applications and Medi MEMS are truly different entities. They have the same street address, which indicates that effectively there are not two commercial partners for commercializing the technology. The support letters are also questionable: two letters from Dr. Ngo (Expert System Applications, Inc.) mention two different cost-share amounts, and most of these letters refer to CWRU as a "company" in their letters. The proposal does not meet the requirements of the RFP on Commercialization Strategy.

- **Performance Goals**

There are two project goals: the first is to build a non-hermetic micropackage platform to commercialize the technology developed at CWRU, and the second is to build a platform to provide services in medical sensor design and implant system integration. These are very broad, high-level goals; the details provided to substantiate the execution of the goals are insufficient.

Three phases have been identified for commercialization, but the key metrics for success or failure need to be defined. The experiments detailed in the proposal are focused on testing three hypotheses, which indicates to the committee that the technology is still too early in its research and development to be suitable for the IPP funding mechanism. Clear articulation of the experimental metrics and the performance goals are absent. The performance goals are estimates lacking specific details, the basic assumptions required, clear success/failure criteria, and performance evaluation criteria for each metric. Furthermore, the committee was unable to determine how the applicants arrived at their job creation figures, which do not seem to add up. The proposal does not meet the requirements of the RFP on Performance Goals.

- **Experience and Qualifications**

The team consists of Dr. Ko, the technologist who is responsible as the technical director of the project; Dr. Frank Ngo, the cofounder and chairman of Expert System Applications and the cofounder of Medi MEMS, who will be responsible for further fund raising and designing the path toward commercialization of the technology; Mrs. Virginia Ngo, also cofounder of Expert System Applications and the CFO of Medi MEMS, bringing expertise in the areas of accounting and business operations. The team lacks the services of a commercialization expert in the MEMS packaging field to help with market penetration. The design rules that govern MEMS packaging and its associated lab-to-market transition have some unique characteristics that are different from standard semiconductor packaging; hence, for the current application it would be critical to have a semiconductor packaging expert with knowledge of medical micro devices who will be able to assist with the transition of this academic technology into the product space. The proposal does not meet the requirements of the RFP on Experience and Qualifications.

- **Budget and Cost Share**

The state funds requested for the entire project is $1,031,200 and the cost share is $1,052,032, it is 1:1 cost share. No capital equipment is requested by the entities. The assumption is that the facilities in CWRU and the Loraine County Community College SMART Center would support this activity. State funds for all entities are requested for personnel support, purchased services, supplies, and travel, with equal amounts requested through state funds as well as through the cost share. Medi MEMS has a total cost share of $319,200 and state funds requested of $446,200. Expert System Applications, which seems to be the parent entity from which Medi MEMS was started, has a cost share of $124,800 with state funds of $54,000. The costs associated with personnel have been indicated, but the correlation of the personnel to the corporate entities is missing. The budget, in general, appears reasonable for the effort. There is a discrepancy in the cost share in the support letters; as a result, the proposal does not meet the requirements of the RFP on Budget and Cost Share.

Summary of Review and Recommendation

The project proposes the development of non-hermetic packing technology for medical and therapeutic devices. The technical details of the performance of the non-hermetic package are insufficient to merit its research and development. The proposers need to clearly show a list of specifications and associated performance attributes to substantiate the core premise of the proposal, which is that non-hermetic packaging performs better than hermetic packaging technologies for medical MEMS. Details on animal studies and regulatory aspects are missing. These are critical for commercialization. The commercialization strategy is weak. Leveraging the Ohio supply chain is addressed as a big picture, but details are lacking, and the job creation numbers do not seem to add up. The committee does not recommend that this proposal be considered for funds under the Ohio Third Frontier Innovation Platform Program.

OTF IPP 12-205
Expanding EWI's Innovation Platform for Aeropropulsion Manufacturing and Repair
Edison Welding Institute

Proposal Summary

Proposed Budget		
	State Funds	Cost Share
Operating Funds	$1,402,584	$1,842,696
Capital Funds	$0	$0
Subtotal	$1,402,584	$1,842,696
TOTAL	$3,245,280	

This project proposes that some members of the Additive Manufacturing Consortium (AMC) develop an "Advanced Metal AM In-Process Quality Assurance Technology." The additive manufacturing (AM) process the applicant team will pursue uses a laser or electron beam to melt successive layers of metal to build a part. Edison Welding Institute leads the project, with collaborators GE Aviation; Goodrich Corporation (Goodrich Aerospace); Morris Technologies; Sigma Labs, Inc. (B6 Sigma); CONCEPT Laser GmbH; Applied Optimization; and FLIR Systems Inc., Commercial Systems. In the initial task, Edison would contract with Concept Laser for a new laser and powder bed. The Concept Laser control system would then be augmented with cameras to increase the number of variables for the quality control system. AMC members B6 Sigma and Applied Optimization would then define a group of experiments and, from data developed during the experiments, attempt to develop an analytical model with tolerance bands for each of the variables. Finally, parts would be produced for consortium members GE Aviation and Goodrich Aerospace for final evaluations.

Detailed Review

- **Technical Merit and Plan**

Additive manufacturing is a very important emerging manufacturing process. Edison Welding Institute, as the lead member of the proposal, attempts to bring some members of the AMC together to develop an "In-Process Quality Control System" for the additive material manufacturing process. The value statement for this effort is that it would be a significant step in decreasing the cost of implementation of the additive material process. AMC members B6 Sigma and Applied Optimization would then define a test program and develop an analytical model with tolerance bands for part production. However, the addition of two cameras to the set variables currently measured by the Concept Laser control system project do constitute a complete set of process variables; therefore, the technical plan is flawed from the start.

While the proposal's layout of tasks is well defined and logical, developing in-process quality control for these types of processes has shown very limited success. In fact, this project depends on the investigators' preconceived idea of what important variables that control quality of the process are known; other variables exist that may be very important and are not included. A key issue is the z-axis properties of the manufactured part, and also the final porosity of the part, of which neither are usually completely acceptable from this process. These two issues are not addressed in the proposal, yet deserve careful attention. The proposal does not meet the requirements of the RFP on Technical Merit and Plan.

- **Commercialization Strategy**

The commercialization discussed in the proposal is extremely weak. B6 Sigma would be one, but not the only, company to commercialize the In-Process Quality Control System for the AM process. The fact (as stated in the proposal) that almost all of the commercial AM powder bed machines are closed architecture makes the commercialization of the output of this proposal very difficult. For example, even if a successful In-Process Quality Control System were developed for the Concept Laser Powder Bed AM

system, it would in all likelihood not translate to other AM machines. Task definition is logically laid out and starts from building the sensors, using the sensors and a quality data acquisition program to develop the quality control system. Design of experiments is utilized to determine the tolerance level required for the variables. The final task is to manufacture aerospace propulsion parts for GE and Goodrich. The proposal does not meet the requirements of the RFP on Commercialization Strategy.

- **Performance Goals**

Performance goals of the proposal are based on the utilization of AM, not on the basis of the In-Process Quality Control System. For example, Morris Technologies already has a very large capital investment in its existing 22 closed-architecture AM machines; therefore, even if the proposed development of the In-Process Quality Control System for the Concept Laser additive manufacturing were successful, an additional large capital investment would be required before any benefit could be derived. In addition, as discussed in the technical review above, there are doubts that the plan will actually produce the expected results. The economic benefit of this proposal is doubtful and, at best, very long term compared to those claimed in the proposal. The proposal does not meet the requirements of the RFP on Performance Goals.

- **Experience and Qualifications**

The members of the AMC in this proposal consist of a group of for-profit companies that are all involved in the high-tech material business. Morris Technology currently has 21 AM machines and is a leading manufacturer of AM parts. In addition, Concept Laser has developed a powder-bed laser AM machine that has a control system for some process variables. B6 Sigma and Applied Optimization also have general experience in quality control systems. The members of the AMC that are involved in the proposal have extensive experience in the process control. However, the planned technology integration will likely require additional resources beyond the team's expertise. The proposal meets the requirements of the RFP on Experience and Qualifications.

- **Budget and Cost Share**

The total ratio of member cost share to state costs is greater than 1:1. Different members of the consortium involved in this proposal would provide different cost shares. Edison Welding Institute's cost share is made up of overhead cost in excess of the 20 percent allowed by the state. GE Aviation and Goodrich Aerospace would provide most of the cost share by testing hardware produced during the program. The project budget states that none of the project funds will go toward capital expenditures, but that Concept Laser will receive nearly $900,000 in state funds for supplies. However, examination of the letter of support from Concept Laser reveals that these funds are to enable the delivery and set up of an AM machine. No discussion of ownership of the machine at the end of the program is provided by the proposal. In addition, the proposal's budget narrative calls some of the cost-share "in-kind," which runs counter to the requirements of the RFP. The proposal does not meet the requirements of the RFP on Budget and Cost Share.

Summary of Review and Recommendation

The additive manufacturing process is a very important, emerging manufacturing process. The development of an In-Process Quality Control System would greatly simplify the adaption of process to many applications. The members of the Additive Manufacturing Consortium involved in the proposal have a great deal of expertise in materials processing, quality control systems, and additive manufacturing. However, the program described in this proposal is flawed, the probability of success is very limited, and the proposed commercialization of the In-Process Quality Control System is very weak. In addition, the probability of a significant economic impact of this program in a 3- to 5-year timeframe is

very low. Therefore, the committee does not recommend that this proposal be considered for funds under the Ohio Third Frontier Innovation Platform Program.

OTF IPP 12-206
Center for Control of Distributed Renewable Energy in Smart Grids and Critical Power Sites
The Ohio State University

Proposal Summary

Proposed Budget		
	State Funds	Cost Share
Operating Funds	$2,416,096	$2,316,096
Capital Funds	$0	$100,000
Subtotal	$2,416,096	$2,416,096
TOTAL	$4,832,192	

The proposed Center for Control of Distributed Renewable Energy in Smart Grids and Critical Power Sites seeks to extend The Ohio State University's (OSU's) Green Energy Innovative Software application through collaboration with BPL Global, which is developing the software platform and commercialization of the solution, to create a semi-holistic solution. This is to be done in conjunction with Ashlawn, which provides a vanadium redox flow battery solution; Emerson-Liebert, providing uninterruptible power supply (UPS) technology; and American Electric Power (AEP), a local utility providing electric distribution feeder data. Together, the team proposes to create a scalable, cost-optimizing control system for a 10,000 node-network electric grid that demonstrates grid stability and reliability with a high penetration of distributed energy resources (DER), managing various DER assets, including flow batteries, UPS systems, solar, wind, fuel cells, and others. The technical solution begins by focusing on a predictive, automatic generation control system that integrates DER solutions at the edge of the distribution network (neighborhood level).

Detailed Review

- **Technical Merit and Plan**

The need for controlling the balance of generation and load in microgrids and power grids on a second–by-second basis is appropriately recognized as an important need. The proposal leverages OSU's Green Energy Innovative Software Platform to address the problem of integration of green energy sources in microgrids, power grids, and critical power sites for commercialization of scalable cost-optimizing control software. The specific features and capabilities of this existing platform, however, are not explained thoroughly, leading to questions as to whether this project truly begins with a platform, as defined in the RFP. More detail with regard to how the first iteration of a predictive, automatic generation control (AGC) system focused on DER resources will build on the existing capability would strengthen the proposal. Goals and objectives are well addressed in the proposal; however, few of the goals and objectives are to be supported with very specific, measurable parameters. The proposal meets the requirements of the RFP on Technical Merit and Plan.

- **Commercialization Strategy**

This project brings together a leading university with an established technical capability in the field of green energy. The proposal clearly identifies and explains the market opportunity and key entry points; however, there is very little information that describes the differentiation of the proposed method, versus the many other commercial solutions either currently offered or under development. The project is well defined with a logical plan to achieve commercialization at some level. The predicted market penetration for the planned software product may be understated, bringing into question the potential value in an investment in this approach. The proposal meets the requirements of the RFP on Commercialization Strategy.

- **Performance Goals**

Performance goals for the proposed program could use some additional clarification. There is no clearly described link between the envisioned products and the platform upon which they are to be built. The proposal calls out a key advantage in achieving Level A Metrics wherein parts of the proposed software control technology solution functionality will be licensed amongst collaborators; this does not necessarily lend confidence to a commercial pathway, but instead only provides an intramural "market." The proposal also suggests that a version of the software elements will be made available to the market, but does not provide any detail as to what this product may include. The magnitude of the overall job creation contemplated by this proposal is weak, given the investment, and not well substantiated. The proposal does not meet the requirements of the RFP on Performance Goals.

- **Experience and Qualifications**

The team appears to be well qualified to execute the work plan presented in this proposal, and the management plan provides sufficient detail regarding the control and execution of programmatic activities. Further definition regarding the roles of the various participants and the nature of their interaction would add clarity to the proposal. The proposal meets the requirements of the RFP on Experience and Qualifications.

- **Budget and Cost Share**

The overall budget appears to be ample in meeting the objectives of the proposed effort. The cost share called out in the proposal is in the form of cash. However, there is a critical flaw in the proposal: the Emerson letter of support calls out a cost share of $60,000, but the budget forms and overall budget account for an Emerson contribution of $84,000, leaving a shortfall of $24,000 with regard to the 1:1 cost share requirement specified in the RFP. The proposal does not meet the requirements of the RFP on Budget and Cost Share.

Summary of Review and Recommendation

The proposed effort seems to meet a significant need in creating a scalable, cost-optimizing control system for a 10,000 node-network electric grid that demonstrates grid stability and reliability with a high penetration of DER, managing various DER assets. The proposed effort brings together a strong team to collaborate on these critically important system pieces. However, there is significant uncertainty as to whether the project leverages an existing platform as defined by the RFP. Additional definition concerning performance goals and the interaction of team participants would further strengthen this proposal. In addition, a more clearly described pathway describing how the proposed project builds upon elements of the existing capability would be helpful. The proposal contains a critical flaw in that it falls short of the requirement for a 1:1 cost share match to program dollars. The committee does not recommend that this proposal be considered for funds under the Ohio Third Frontier Innovation Platform Program.

OTF IPP 12-207
Advanced Materials Solutions for Wear and Corrosion
University of Akron

Proposal Summary

Proposed Budget		
	State Funds	Cost Share
Operating Funds	$2,177,551	$3,388,139
Capital Funds	$815,227	$0
Subtotal	$2,992,778	$3,388,139
TOTAL	$6,380,917	

The proposal seeks to establish an advanced wear and corrosion center for evaluating surface-related improvements through surface coatings. Three different technologies are proposed: a nanocomposite coating for bearings, a corrosion-resistant coating for oil and gas drilling tubes, and a coating for electrodes for biomedical sensing. The University of Akron is the lead applicant of the proposal with the following collaborators: Timken Company, ASB Industries, and Orbital Research, Inc.

Detailed Review

- **Technical Merit and Plan**

The proposed center at the University of Akron provides a means for corrosion testing of coatings to evaluate various coatings for three different and diverse applications. The proposal is based on the development of innovative coatings. The establishment of a platform seems to be the goal of this proposal, rather than building up an existing platform. Prior data is not provided for any of the technologies to help in assessing the maturity of the different coatings proposed. Three separate and extremely diverse technical projects have been selected to participate in the proposed platform. Details on the biomedical coatings are sketchy and speculative at best. The representation of information is not coherent. The technology that demonstrates the most commercial promise is the biomedical coatings, and the proposers could pursue developing a new proposal for a future competition based solely on this area, assuming sufficient evidence can be provided regarding the actual existence of a platform and a multitude of partners that want to partner in that effort and are committed to Ohio.

Ultimately, because the platform necessary for this proposal is not yet available and is to be created during the course of the 3 years of proposed work, the proposal does not meet the requirements of the RFP on Technical Merit and Plan.

- **Commercialization Strategy**

The commercialization strategy is not convincing and is overly optimistic, considering that none of the coatings technologies have been proven or produced at the pilot level. The question of costs and the barriers to entry due to existing coating technologies are also not addressed in two of the technologies associated—coating of oil and gas tubes and electrodes for sensing in garments. In terms of market penetration and getting a product to market, the technology that shows most promise is the biomedical coatings. An in-depth market survey and associated competitor market share would need to be presented if the team were to submit a proposal in the future. Furthermore, the proposal's approach to commercialization includes the creation of at least two new companies. The committee notes that it is typically the case that start-ups have greater difficulty surviving if they are not well capitalized, but there was no discussion within the proposal of how these new companies will be capitalized or funded in a sustainable manner. The proposal does not meet the requirements of the RFP on Commercialization Strategy.

- **Performance Goals**

The objective of this proposal is to create a corrosion center to evaluate surface-engineered products. The ability to reduce the cost of corrosion and wear and to improve the life of components is always valuable to produce improved efficiencies as well as to reduce maintenance and to prolong replacement. Because the collaborative platform does not currently exist but is expected to be created during the course of the program, the goals of the program would not be achieved as specified in the RFP. The proposal does not meet the requirements of the RFP on Performance Goals.

- **Experience and Qualifications**

All the partners in this proposal are well qualified to do the work and will definitely be able to achieve the individual objectives proposed. The team organization is acceptable. The metrics for success or failure need improved articulation for better execution. The prior experience the collaborators have in the different technologies would be valuable in the creation of successful products. The proposal meets the requirements of the RFP on Experience and Qualifications.

- **Budget and Cost Share**

The proposal has a well-matched budget with major cost share coming from the University of Akron and its collaborators, primarily in the form of salaries. However, approximately 30 percent of the funding will go toward creating a major component of the platform; however. the RFP clearly states that the innovation platforms must already be in place. The numerous activities detailed in this proposal will limit any one technology or process from becoming completely successful—further funds will be needed in significant measure beyond the levels proposed under this program. However, the proposal fails to adequately discuss likely avenues of additional funding. While the proposal meets the program's requirements for cost share matching, it does not meet the overall requirements of the RFP on Budget and Cost Share.

Summary of Review and Recommendation

This proposal targets multiple technical applications areas to develop an innovation platform. However, the program's RFP clearly states that innovation platforms must already exist. The committee suggests that the team reevaluate its approach and possibly focus on its most promising application—the biomedical coatings. If the applicant can show that this area is in fact an established platform, then it could submit a stronger proposal in a future competition, provided the partners are committed to creating jobs within Ohio. In view of the proposal not meeting the primary condition of the existence of a platform, the committee does not recommend that this proposal be considered for funds under the Ohio Third Frontier Innovation Platform Program.

OTF IPP 12-208
Innovation Platform: Distributed Energy Storage Systems
The Ohio State University

Proposal Summary

Proposed Budget		
	State Funds	Cost Share
Operating Funds	$2,230,000	$1,929,283
Capital Funds	$520,000	$850,000
Subtotal	$2,750,000	$2,779,283
TOTAL	$5,529,283	

The Ohio State University Center for Automotive Research (OSU-CAR) is proposing to expand their innovation platform to support a broader penetration of Distributed Energy Storage Systems (DESS) by building on two existing investments. This will be achieved through deployment and demonstration of modular battery systems, and associated power management and software integration products. OSU-CAR is the lead organization, and the collaborators include Beckett Energy Systems and BPL Global, both with Ohio locations. The jobs creation goal is 120 jobs in 3 years and 365 jobs in 5 years. It is anticipated that future use of these investments will serve various Ohio-based needs.

Detailed Review

- **Technical Merit and Plan**

The technical plan is generally well thought out, ambitious, and achievable. However, the proposal would be strengthened with tighter focus, prioritization of activities, and further discussion of commercialization markets, the primary driver for the technical plan. The plan follows well the Ohio commercialization model of testing, engineering, demonstration, and validation in a relevant environment. Attention is clearly focused primarily on technologies that support BPL Global and Beckett Energy's products (although markets are not clearly defined in the proposal) and that will assist Beckett's move into community-scale grid markets with the required 3-phase power outputs. BPL Global is using this program for a live test of its software integration platform. Testing the challenges of integration into a working environment will help to develop solutions to problems not predictable in a laboratory environment. In addition, it will give confidence to the utilities that are the prime market for these products, and it will give working experience with these products early on in the commercial adoption stage as a demonstration site. These are opportunities to develop industry standards based around a particular product or to allow the customer opportunities to voice comments in an informal manner.

However, the committee has some concerns with the overall technical plan, stemming from OSU-CAR's traditional focus on automotive issues. The proposal aims to commercialize battery storage for utility applications, but automotive requirements are significantly different than utility and community-scale needs, and the proposal fails to make a convincing case that the team can handle the difference. The proposal does not meet the requirements of the RFP on Technical Merit and Plan.

- **Commercialization Strategy**

The weakest part of the proposal is the lack of specific commercialization and go-to-market strategies. The general market can likely support small and midsized niche players, but key facts are not provided, including who the customer is, what the value proposition is, who the competitors (or potential competitors in each niche) are, and what the path to market is. The proposal does not fully address the barriers to market entry and lacks information concerning the development of new intellectual property (IP) and the treatment or protection of IP amongst the team. The proposal does address the market need for these products, but little detail concerning Beckett's or BPL Global's specific impact on markets is addressed. Beckett is very experienced and well positioned in the 120/240 volt markets, but the

commercial 3-phase markets are somewhat different and have end-users who do not necessarily have the same technical requirements in their domain. While BPL Global does have experience in the utility domain, it is not the dominant collaborator in the proposal. The proposal does not meet the requirements of the RFP on Commercialization Strategy.

- **Performance Goals**

The proposal's performance goals are consistent with the objectives of the IPP in terms of jobs and economic impact. The equipment and experience gained by OSU-CAR will have lasting value in demonstrating and improving end-of-grid storage and software integration. This is an emerging market that will need substantial future product validation and integration testing for entry into the existing larger power infrastructure. It is well known that the transitions to what is commonly called a "smart grid" will take 20 to 50 years, and energy storage will be the key connection point for grid stability and support to baseline generation.

The proposal promotes nearly all of the goals of the IPP, including further cluster investments due to Beckett's impact on the Ohio supply chain. In addition, further educational and training opportunities will be created from the proposed activities. Beckett and BPL Global are addressing emerging opportunities for grid integration components and end products insertion into an aging utilities infrastructure that will be transformed by the bi-direction communication controls systems being developed by the collaborators.

The proposal aims to create 120 jobs in 3 years and 365 jobs in 5 years, which would be reasonable, but the adoption rate of smart grid and community-scale systems is outside the control of the participants and will probably take longer than 3 to 5 years. With market penetration likely to slip, the goals will simply not be met in the time specified in the RFP. The proposal does not meet the requirements of the RFP on Performance Goals.

- **Experience and Qualifications**

The staff from each of the three organizations are very appropriate to the project, but the committee has a concern relating to the general focus of OSU-CAR on automotive problems. The commercial partners are highly experienced in the customer requirements, codes, regulations, nuances, and technical details of integration into their proposed end markets, although Beckett is not experienced with utility markets. The lead organization, OSU-CAR, is automotive-focused, but the commercial products are industrial and distributed power generation. The crossover to a consideration of the emerging impact of all electric cars on grid stress has the capability to solve both the supply and demand problems associated with end-of-grid point performance, but a clear plan to address those issues and conflicts is not stated in the plan. The proposal does not meet the requirements of the RFP on Experience and Qualifications.

- **Budget and Cost Share**

The proposal's budget is consistent with the IPP guidelines, leveraging private and state funds for operating costs and capital, to a cost share ratio of 1:1. Of note is Beckett's $1,740,000 cost share, which is nearly 3:1, showing major commercial commitment to this project. The proposal meets the requirements of the RFP on Budget and Cost Share.

Summary of Review and Recommendation

The proposal has a generally well thought out technical plan, solid cost share, and much of the experience required to complete its tasks. However, the committee believes that the lead applicant does not have enough familiarity in industrial and distributed power generation, which greatly undermines the quality of the proposal. Overall, the proposal would be stronger with tighter focus, prioritization of activities, and further discussion of commercialization markets. The committee does not recommend that this proposal be considered for funds under the Ohio Third Frontier Innovation Platform Program.

OTF IPP 12-209
Situational Awareness Integration, Visualization, Validation, Exploitation and Demonstration (SAIVVED) Commercialization Platform
University of Dayton

Proposal Summary

Proposed Budget		
	State Funds	Cost Share
Operating Funds	$2,500,000	$3,519,550
Capital Funds	$500,000	$290,200
Subtotal	$3,000,000	$3,809,750
TOTAL	$6,809,750	

The ability to generate vast quantities of real-time and near-time sensor and imagery surveillance data vastly exceeds the ability to convert that data into actionable information and then into decisions and appropriate response in a timely and cost-effective manner. This is a particularly urgent challenge for military applications, with strong opportunity in homeland security, police, and emergency response applications. The market for what is referred to as "integrated situational awareness (SA) systems" is dominated by large systems integrators with proprietary systems focused primarily on military markets. This proprietary market has been difficult to enter for smaller integrators and firms developing SA products and components. Customers are looking for demonstrated technologies as part of a complete systems solution, not individual, standalone products.

The proposed project builds on an existing SA capability to make available an open architecture hardware-in-the-loop situational awareness platform, where companies developing SA products can, with the help of the Innovation Platform Institute for the Development and Commercialization of Advanced Sensor Technology (IDCAST), have their technologies evaluated, certified, and integrated into fully operational SA systems in order to increase consumer confidence and interest. This platform is referred to in the proposal as the Situational Awareness Integration, Visualization, Validation, Exploitation and Demonstration (SAIVVED) Commercialization Platform.

The proposal's lead applicant is the University of Dayton. Collaborators include Persistent Surveillance Systems (PSS), Woolpert, Greenlight Optics, Defense Research Associates, Air Force Research Laboratory (AFRL), and the City of Dayton.

Detailed Review

- **Technical Merit and Plan**

IDCAST brings a wealth of resources to enable success on this effort with vast experience in developing plug-and-play open architectures, developing and implementing algorithms, and developing systems that enable SA functions to be performed in real time through hardware acceleration technologies. IDCAST will also be collaborating with the Air Force Research Laboratory's Sensors Directorate (AFRL/RY) to develop standards for evaluating, testing, and certifying the performance of SA products, with the goal of utilizing these standards to evaluate and certify SA products and technologies. Despite the strong demonstrated partnership with AFRL/RY, the committee is concerned with the timing of this defense/commercial translation of standards and certification standards. A slow translation may delay finalization of the suite of commercial standards and testing procedures for the evaluation of SA products and technologies. However, delay in this deliverable should not significantly impact either the technical or commercialization success over the 3- to 5-year review project period.

The plan is to work with two Ohio-based SA integrators with existing solutions to build a platform that can be used for testing and evaluation of multiple products and solutions—Woolpert and Persistent Surveillance Systems (PSS). The critical technology for success of this effort is the ability to adapt the

sensor interoperability plug-and-play capability developed by IDCAST/UDRI for the Army Research Laboratory and the Defense Intelligence Agency under the Terra Harvest7 Open Source Environment (THOSE) program for use with SAIVVED. The core of THOSE has been developed, and perhaps the most important enhancement to THOSE planned for this program will be developing the capability for remote management. Once finalized, both the Woolpert United Views System and the PSS IView2 system will be able to be marketed as a complete SA solution and foundation components of the hardware in the loop test bed.

Once the test bed is complete, the team will integrate the SA products from Defense Research Associates (Vigilant Sensor System) and Greenlight Optics (second generation GLOCAT 1200mm F4 Lens) into the system, and employ the laboratory-validated system and SA products into a real world operational environment in Dayton, Ohio, for the Dayton Police Department.

The applicant team has demonstrated a clear understanding of the steps required to achieve their goals as well as the potential risks they may have to manage. The roles of each of the team members are well defined. The committee is concerned that this platform is excessively deployment-focused and would like to see a more explicit research and innovation component designed into the project. The committee believes that the proposal meets the requirements of the RFP on Technical Merit and Plan.

- **Commercialization Strategy**

The primary markets identified are medium and large city police departments. The only customer interaction discussed in detail is with the demonstration partner in Dayton, but the industry partners have existing networks of police (and other) clients. As such, the industry partners have primary commercialization responsibility, while the SAIVVED platform becomes a critical asset in the SA collaborators' go-to-market and product development strategies. The committee has some concern that the proposal is too much of a marketing platform for two private firms, with limited payback to SAIVVED despite the very high value it provides. In addition, state and local budget constraints and declining federal pass-through funding raised some concerns that sales projections might be at risk.

One key element of the SA strategy is the use of unmanned air vehicles (UAVs) to gather imaging data. However, the use of UAVs in an urban environment such as Dayton, in close proximity to Wright-Patterson Air Force Base (WPAFB), would generate substantial regulatory concerns from the Federal Aviation Administration and WPAFB that are not addressed in the proposal.

SAIVVED's own sustainability is based on a fee-for-service model, as well as a platform for continued IP development. In response to questions concerning privacy concerns, the SAIVVED team provided a very strong discussion of the legal concerns and the plans for internal controls and management. However, they did not address the political risk inherent in rolling out a system with such concerns about the potential for abuse and invasion of privacy. The Dayton Police did not express any such concerns, and the City Manager provided an enthusiastic letter of support. Other urban areas have deployed SA systems (if less comprehensive) that are being used across the United States. If the deployment of other systems with privacy concerns is any predictor, the politics of deployment will vary significantly from state to state and city to city, but had the potential to be a serious risk to deployment.

There are a variety of niche players and competitors in the SA market space, but the integrated SAIVVED platform, combined with operational deployment by the Dayton Police and active integration with Air Force SA activities and programs, appears to offer a unique competitive strength for the collaborators as well as a translation partner for accelerated commercialization of new sensor and SA solutions. The team is confident that their smaller market, lower cost, open architecture strategy will have a sustainable competitive advantage against the large integrators that have been active in the SA space. However, in an

environment of tightening federal budgets, the committee remains concerned about the competitive responses of the large integrators as markets such as large city police departments are proven by such entities as SAIVVED.

A final concern is the accessibility of WPAFB sensor and other IP to a commercialization effort by the proposing team. It is not clear in the proposal that the Air Force technology and data to be used in this system would remain accessible in a commercialization venture, as opposed to a military deployment.

Based on these concerns, the proposal does not meet the requirements of the RFP on Commercialization Strategy.

- **Performance Goals**

The overall objectives of the project are well articulated, and deliverables are clearly defined. Technical goals are clearly linked to competitive success. Level A, B, and C metrics are well articulated, and the job creation, sales, and other economic impact estimates appear reasonable, based on the commercialization strategy. Three- and five-year projections are presented for each team member, but in aggregate by year three, the proposal projects net new job creation of 31 and annual industry collaborator sales of about $4.3 million. By year five, these projections grow to net new jobs of 69 and annual sales of nearly $9 million. However, the concerns expressed about the commercialization strategy above raise similar concerns about the economic impact estimates. The proposal does not meet the requirements of the RFP on Performance Goals.

- **Experience and Qualifications**

The principal investigator is a leading expert, and he and his colleagues are well qualified to lead, manage, and deliver on the project. The industry partners clearly understand the target markets and already have existing clients that can be leveraged. The strong senior commitment of police personnel to the citywide deployment and operation of the platform provides invaluable real-world validation that cannot be duplicated in any laboratory. Moreover, the collaboration with the AFRL on evaluation and standards will greatly benefit the delivery and quality of the program. The proposal exceeds the requirements of the RFP on Experience and Qualifications.

- **Budget and Cost Share**

The budget appears to be well thought out, with careful articulation in the budget narrative. The cost share exceeds the 1:1 match requirement. The committee especially notes the significant match contribution from AFRL and the Dayton Police, indicating their strong commitment to the project. The proposal exceeds the requirements of the RFP on Budget and Cost Share.

Summary of Review and Recommendation

The defense and commercial SA market is rapidly growing and has long term potential for Ohio. The team has the technical and management capacity to become a much more significant player in the evolution of this technology and its potential paths to commercialization. The IDCAST platform builds upon a strong set of academic, industry, and Air Force assets. The market and commercialization risks raised above give the committee significant concerns about the successful completion of the proposed program. The proposal would be significantly strengthened if these concerns were addressed before submission to a future round of the program. The committee does not recommend that this proposal be considered for funds under the Ohio Third Frontier Innovation Platform Program.

OTF IPP 12-211
Akron Functional Materials Center
University of Akron

Proposal Summary

Proposed Budget		
	State Funds	Cost Share
Operating Funds	$ 2,925,000	$ 3,003,596
Capital Funds	$ 75,000	$ 0
Subtotal	$ 3,000,000	$ 3,003,596
TOTAL	$ 6,003,596	

This proposal seeks funding for additional projects at a Center of Excellence known as the Akron Functional Materials Center (AFMC), a Center of Expertise founded in 2010 through a joint initiative between the University of Akron and the Austen Bioinnovation Institute in Akron (ABIA) that focuses on new polymeric materials for biomaterials, energy, and sustainability. Additional funding of $3 million is requested for two new AFMC initiatives that are projected to generate more than 28 jobs and $51 million in annual revenues at the end of the 5-year project period:

1. In collaboration with PolyOne, the AFMC proposes to identify, formulate, and develop opacitant additives for radiopaque thermoplastic elastomersm and similarly,
2. In collaboration with Ohio Willow Wood Company, the AFMC proposes to develop a prosthetic system that enhances comfort (by optimizing the thermal properties of liner and socket polymer composites).

Detailed Review

- **Technical Merit and Plan**

This proposal is directed at two different projects related to the development of improved biomaterials for existing applications. One initiative is to develop improved radiopaque catheters to provide improved observation of catheter insertion into the patient during diagnosis and/or for therapy. Although combinatorial methods may support improved material development, the committee believes that other predictive methods of experimental design protocol could be equally (or, perhaps even better) suited to optimize this composition. The applicability of combinatorial testing to the second initiative (improved liner thermal conductivity) is even less apparent. First, as sweating is the main problem, a continuous liner does not allow evaporative cooling of the resultant perspiration. It would appear that a porous liner may be more desirable as it could allow wicking of the perspiration and the resultant evaporative cooling.

The second initiative in collaboration with Ohio Willow Wood focuses on improving the thermal conductivity of the liner support for prosthetic devices that contacts the patient's skin by incorporating conductive fillers (e.g., nanotubes or pyrolytic graphite). The role of the AFMC is primarily directed at the use of high-throughput combinatorial testing to optimize the composite structures for both applications. While incorporating conductive fillers may improve the thermal conductivity, it will not allow perspiration to be removed—with little or no change in skin irritation. The proposal thus appears to be attacking the wrong problem. The project is largely focused on combinatorial testing to design optimum composites for the proposed applications. To solve both problems, combinatorial methods may work, but other predictive methods or experimental design protocol could be equally or more effective. The committee believes this proposal puts too much emphasis on combinatorial testing without regard for other well-proven optimization methods. In the case of the liner, it may be solving the wrong problem (thermal conductivity instead of removal of perspiration). While it may be misdirected, the proposal meets the requirements of the RFP on Technical Merit and Plan.

- **Commercialization Strategy**

The recent acquisition of GLS Corporation (specializing in soft elastomers) and New England Urethanes should improve PolyOne's ability to commercialize improved radiopaque catheters. In addition, Ohio Willow Wood appears to be commercial in this area and should be able to commercialize improved materials in these applications. A more critical issue is the likelihood of achieving the proposed employment (more than 28 new jobs) and economic impact (more than $51 million in annual revenues) in the State of Ohio in 5 years. The committee sees such commercial success as very unlikely for products in these applications. Accordingly, the proposal does not meet the requirements of the RFP on Commercialization Strategy.

- **Performance Goals**

The projected impact for these projects would be reasonable for consideration of support; however, the market opportunities are somewhat limited as these would be highly specialized products for relatively small applications. In addition, the committee believes the impact that combinatorial testing can have in driving a solution to these technical problems is somewhat overstated. Predictive methods and experimental design methods are usually preferred over combinatorial or high throughput methodologies for these kinds of applications. Combinatorial methodology is better suited for synthesis (catalyst screening) and drug design (biological testing) where predictive methods or experimental design formats cannot handle the multiple—and often random—unproductive variables. The proposal does not meet the requirements of the RFP on Performance Goals.

- **Experience and Qualifications**

As principal investigator, Dr. Becker is well qualified to conduct high throughput testing. Similarly, the two commercial collaborators appear to be capable of scaling up and commercializing promising developments in this area. The proposal meets the requirements of the RFP on Experience and Qualifications.

- **Budget and Cost Share**

The ratio of cost share to state funds is 1:1; 98 percent of state funds will be used to pay operational expenses, including personnel, supplies, and various other direct and indirect project costs. The cost share is necessary and appears to be reasonable, with more than half of the cost share funds ($1,543,191) from the University of Akron. The balance of the proposed cost share is confirmed in commitment letters from the AFMC ($762,510), PolyOne ($359,895), and Ohio Willow Wood ($338,000). The proposal meets the requirements of the RFP on Budget and Cost Share.

Summary of Review and Recommendation

With the many challenges related to the use of combinatorial testing to drive the development of polymer additives for commercial use, the probability that either of the products derived from the effort will have a significant industry and economic impact within 3 to 5 years is very low. Significant amounts of time, effort, and money have already been spent on product development for the selected applications; however, the risk factors stated in the proposal are too general and do not take into account that most previous efforts have either failed outright or have not yet delivered on even the limited commercial results promised.

The proposal essentially presents a scenario where combinatorial testing will yield a commercial success without a great deal of substantiation of the technical and commercial aspects of the proposal. Moreover, the committee believes that the potential applications and revenue generation for the platform and resultant products are very limited. Simply stated, the committee sees this as the wrong method being used to optimize polymer additives for flexible polymers to be used in the wrong applications (that is, design of optimal thermal properties of prosthetic devices). Therefore, the committee does not recommend that this proposal be considered for funds under the Ohio Third Frontier Innovation Platform Program.

OTF IPP 12-213
Advanced Control Systems
Cleveland State University

Proposal Summary

Proposed Budget		
	State Funds	Cost Share
Operating Funds	$1,346,122	$1,236,980
Capital Funds	$115,000	$230,000
Subtotal	$1,461,122	$1,466,980
TOTAL	$2,928,102	

This project proposes to take the next step to commercialize the disturbance decoupling control (DDC) industrial platform developed at Cleveland State University (CSU) in the hopes of replacing the 80-year-old technology called proportional-integral-derivative (PID), which currently dominates the field. CSU developed the DDC technology over the past two decades, and the DDC platform has the potential to bridge the gap between existing technologies to make high-performance control easy to use. The key intent of the proposed platform is to stimulate "significant, industry-defined and directed opportunities through the development and commercialization of new products and innovations" in the Sensing and Automation Technology space. CSU will collaborate with two Ohio companies, UniControl, Inc., and PolyOne Corporation, which have an interest in the DDC platform. A third collaboration is proposed with Northeast Ohio's Manufacturing Advocacy and Growth Network (MAGNET), whose main role is to assist CSU in identifying other non-profit and for-profit entities that have an interest in the platform and its outcomes.

Detailed Review

- **Technical Merit and Plan**

The applicants have identified areas in need of improvement for existing controls and automation technology. From the information provided by the applicants, the committee is not convinced that the control system proposed would replace the PID systems currently in operation. The proposal should have acknowledged the presence of many other technologies such as state space and observer technologies, among others. The proposal should have also included acknowledgement of PID tuning algorithms and methodologies, which have greatly improved performance of untuned PID systems. The proposal does not meet the requirements of the RFP on Technical Merit and Plan.

- **Commercialization Strategy**

The lead applicant proposes to research and develop commercialization solutions through an advanced control system for use in a wide variety of commercial and industrial processes and machineries. The proposal states that the platform as a whole is at the Growth and Sustainability Phase. Thus, no further technical development is needed to make the platform market ready. The commercialization strategy consists of the execution of the growth strategy, which is to utilize advanced control algorithms in a variety of applications. This will be facilitated through the industrial collaborators UniControl and PolyOne. CSU proposes to use the requested funding to provide the capacity to support the commercialization of projects for the individual collaborators and to develop a plan to market these capabilities to other industries beyond those that are represented in the proposed project. The collaboration with MAGNET will assist the lead applicant, CSU, to identify other non-profit and for-profit entities that have an interest in the platform and its outcomes. MAGNET will also assist collaborating companies in identifying, accessing, and applying monitoring resources in the public and private sector that can support their projects. The companies identified for implementation are in areas where control problems can be significant and where tight controls of processes are critical. However, the commercialization plan should have acknowledged the competition from other technologies listed above

and the difficulties likely to be encountered in market penetration. The proposal does not meet the requirements of the RFP on Commercialization Strategy.

- **Performance Goals**

The proposal states that, if successful, the proposed platform has the potential for a number of economic impacts on the State of Ohio. For CSU, there is the potential for enhanced national and international recognition that can lead to additional sources of funding opportunities and collaborations. In addition, the education of future control engineers involved with this project can enhance Ohio's competitive edge. The two industry collaborators also forecast a number of quantitative impacts that will have a direct benefit for Ohio. These include the potential to create a total of 27 to 30 new jobs and a projected greater than 4 percent increase in revenues. The proposal meets the requirements of the RFP on Performance Goals.

- **Experience and Qualifications**

The lead applicant considers the proposed project to be original and not an extension of or related to any previous OTF projects. However, the two industry collaborators have received funding in the past from the State of Ohio. The works for both of the previously funded projects are directly related to the proposed project. A major outcome of the grant that PolyOne Corporation received from the Innovation Loan Program was the creation of 10 jobs and the retention of 567 positions in Avon Lake, Ohio. The ODOD Energizing Career grant that UniControl Inc. received will be used to train 12 existing UniControl employees in the same biomass control system that will be partially funded from the proposed IPP grant. The applicants from both academia and industry have significant experience in the proposed topic. There is also sufficient expertise in management and commercialization among the applicants. The proposal meets the requirements of the RFP on Experience and Qualifications.

- **Budget and Cost Share**

The ratio of cost share to state funds is 1:1. Approximately 8 percent of state funds will be used for purchase of capital equipment. For the most part, the project's budget is sufficiently detailed and informative, and the cost share is reasonable with sufficiently detailed letters of commitment letter. Cost share will be provided by the lead application and two of the three collaborators. The CSU cost share includes two items: (1) graduate student tuition and fees for all five assistants and (2) unrecovered indirect costs. The cost share from PolyOne will be in the form of operating costs (personnel/fringe, raw materials, and travel) and capital funds (machinery/equipment). However, there is no mention in the budget narrative as to the details regarding the capital equipment that is being provided by collaborator PolyOne. This is a minor oversight that must be corrected if the applicant team submits a proposal in the future. The cost share from UniControl will be in the form of personnel/fringe for operating funds and equipment (laboratory tools, electronic breadboards, integrated circuits, and microprocessors) for capital funds. The proposal meets the requirements of the RFP on Budget and Cost Share.

<u>Summary of Review and Recommendation</u>

The applicants have identified areas in need of improvement for existing controls and automation technology. In addition, the companies identified for implementation are in areas where control problems can be significant and where tight controls of processes are critical. However, the committee was not convinced that the control system proposed would replace the PID systems currently in operation. The applicants should have acknowledged the presence of competition from many other technologies and the difficulties encountered in market penetration. The committee does not recommend that this proposal be considered for funds under the Ohio Third Frontier Innovation Platform Program.

OTF IPP 12-218
Center for Motorsports Technology and Commerce
The Ohio State University

Proposal Summary

Proposed Budget		
	State Funds	Cost Share
Operating Funds	$1,126,000	$322,250
Capital Funds	$1,874,000	$3,000,000
Subtotal	$3,000,000	$3,322,250
TOTAL	$6,322,250	

The Ohio State University (OSU) and its partners intend to develop a motorsports venue, including infrastructure for electric drive capability, and a small fleet of electric race vehicles, and thus foster growth in the electric drivetrain area. OSU has partnered with CAR Technologies, LLC, Arshot Investment/Cooper Park Re-development, Columbus Electric Motorsports, Mustang Advanced Engineering, and A123, with support from the U.S. Auto Club (USAC).

Detailed Review

- **Technical Merit and Plan**

The proposal addresses the need for a venue serving electric racing and claims as an objective the development of an electric racing industry cluster in Ohio. This is a high-profile opportunity for Ohio. The experience of OSU is acknowledged in the battery drive landspeed records, and the support from USAC is an appropriate sanctioning organization. However, previous collaborative efforts by the proposal team, which would evidence a strong platform on which to build, are missing. The team should partner with multiple industrial original equipment manufacturers (OEMs) to be successful in its objective to catalyze an electric racing industry in Ohio. The proposal has formally targeted the field of innovation in energy storage, but the technical plan is unclear as to how the team will specifically tackle this area. Specific technical targets are not set out in the proposal. Specific innovations in battery technology or electric drive systems are not the focus of the proposal. The proposal does not meet the requirements of the RFP on Technical Merit and Plan.

- **Commercialization Strategy**

The commercialization strategy, like much of the proposal, consists of numerous tables outlining the relevant contributions of each partner. The tables assign a metric and briefly address each topic, as called for in the RFP, listed by each partner. Justification for each assigned metric is not explained beyond the rough sketch given in the tables. This approach results in insufficient detail and ambiguity regarding the metrics listed. This is especially true for the commercialization strategy. Among many examples of ambiguity, a single example in the commercialization strategy is where time and investment is listed as high. This could be meant as a high level of investment, or it could be long time period required, or both. This approach does not provide sufficient detail to convince the committee that a unified viable commercialization strategy would ensue with this project. The proposal does not meet the requirements of the RFP on Commercialization Strategy.

- **Performance Goals**

Some performance goals are not well laid out. Nebulous commitments regarding the number of participating vehicles built do not quantify the performance goals or milestones with accuracy. Commitments should be made for a minimum amount of vehicles rather than a maximum of vehicles. Goals such as “making Ohio the birthplace of electric racing” are not goals that can be well quantified. The proposal does address metrics in job creation, new sales of products, and follow-on investment;

however, insufficient detail is given for each metric. Due to the ambiguity in the goals and missing specifics on how the innovation cluster spurs such growth, the proposal does not meet the requirements of the RFP on Performance Goals.

- **Experience and Qualifications**

The lead applicant and partners are qualified for performing research and development of the proposed project. They have excellent experience in electric motorsports and in electric drive vehicles. However, the project management plan only outlines the experience of the lead applicant and partners and leaves serious concerns for the management of the project as a whole and for the commercialization of the proposed project. Due to this lack of a coherent management plan, the proposal does not meet the requirements of the RFP on Experience and Qualifications.

- **Budget and Cost Share**

The budget of the proposed project is heavily one sided, and the cost share is largely met by a single partner supplying the cost share through a building and facilities donation. This is not a cash contribution, as required by the RFP. Other listed contributions also do not meet the cost share requirement. Aside from the issues with cash contributions, the building and most facilities in the proposed project are multiuse; therefore, it is unclear that the cost share will go to meeting the innovation objective. Furthermore, the battery development partner has a $280,000 commitment but is not listed in the cost share budget forms, nor is it included in the budget narrative. Another $277,000 in cost share by the dynamometer developer is also not accounted for in the budget documents. The proposal does not meet the requirements of the RFP on Budget and Cost Share.

Summary of Review and Recommendation

While the proposed project has potential for high public visibility, the committee finds that the technical merit of the proposed project is not convincing as an innovation in energy storage, as called for by the RFP. The outputs are unclear, and the cost share and budget documents do not meet the requirements of the RFP. The proposed project is one that could be considered for a pure development project, but it misses the mark with respect to developing technical innovation in fuel cells or energy storage. The committee does not recommend that this proposal be considered for funds under the Ohio Third Frontier Innovation Platform Program.

OTF IPP 12-219
Northeast Ohio Health-IT Innovation Platform
Case Western Reserve University

Proposal Summary

Proposed Budget		
	State Funds	Cost Share
Operating Funds	$4,627,534	$4,630,391
Capital Funds	$0	$0
Subtotal	$4,627,534	$4,630,391
TOTAL	$9,257,925	

This proposal seeks funding to establish a Health-IT Innovation Platform with three collaborators:

1. The Explorys project will develop novel approaches to provide predictive modeling and time-series analysis of clinical data.
2. The BioInVision project will develop a cloud-based administrative Health IT software project (Core Science Lab in the Cloud, or CSLIC) to serve university and commercial core science facilities generating molecular and imaging data.
3. The NeoProteomics project will integrate advanced next generation gene and protein data generated by the biotech and pharmaceutical industries.

The Case Western Reserve University (CWRU) group will provide innovations in informatics for each of these commercial projects. Innovations common to each project include development of Natural Language Processing capabilities (for example, translating computer data to human language) and BIG DATA Ontologies (for example, common definitions for Health IT). Additional developments will pertain to web- and cloud-based data management and analysis strategies to optimize overall research activity, drugs and diagnostics, and clinical prediction and decision making.

Detailed Review

- **Technical Merit and Plan**

The proposal requests funds to establish a platform based on the capabilities of the CRWU group, which will focus on strengthening its curriculum and its research on the technical areas of the proposal. Although the CLSIC does have the required platform-based component, it is not clear that the projects do, making it difficult for the committee to discern a true platform that meets the requirements of the IPP RFP. Even if the committee were to accept the existence of a platform, the committee had difficulties understanding the correlation of the three projects and partners involved and the use of a particular platform being leveraged. Instead, the proposal reads as three distinct projects, of which the only commonality was the use of CWRU as a resource. Each project has its own merit, but judged as a whole, the technical plans do not leverage any one specific technology. The BioInvision technical plan does comply with the platform-based requirement of having its base on a piloted technology, but the other two components of the proposal are more research based. Another technical issue that deviates from the RFP's objectives is the nature of the products for Explorys, which are described as added functionality to an existing product. The proposal does not meet the requirements of the RFP on the Technical Merit and Plan.

- **Commercialization Strategy**

The proposal describes three different and distinct set of deliverables, one for each collaborator. The commercialization path for Explorys is clear because the company has customers, and the products described are additional features to an existing product. The BioInvision commercialization path could use greater detail, especially in defining the size of the market (market segmentation, current alternatives) and explaining why the market would buy its product, the resources required to penetrate the market, and how it would sustain its competitive advantage. The NeoProteomics commercialization path is less defined due to the early nature of its product. Furthermore, only a few of the other companies (and there are many) that are developing or have products that address the problems listed are included in the proposal. The proposal does a good job of explaining how it would handle the produced intellectual property (IP), which can be very difficult given the various external patents, and the current licensing and IP ownership of previous work that may potentially interfere with the resulting products. The proposal does not meet the requirements of the RFP on Commercialization Strategy.

- **Performance Goals**

The proposal anticipates achieving the creation of a combined 50 high-salary jobs by year five for all collaborators. Considering the issues cited in the preceding evaluation of the proposal's commercialization strategy, the committee finds this claim somewhat dubious, but notes that there is a potential for job creation nevertheless. The proposal meets the requirements of the RFP on Performance Goals.

- **Experience and Qualifications**

All the collaborators involved in the project (CWRU, Explorys, BioInvision, and NeoProteomics) have demonstrated expertise in their specific areas. Explorys has grown significantly since it spun off from the Cleveland Clinic, having raised close to $15 million in venture capital. BioInvision, a recent spinoff from CWRU, has commercialized its high-resolution imaging technology that allows preclinical researchers to see the exact location of single cells and displays the information in a three dimensional reconstruction of a mouse. The proposal meets the requirements of the RFP on Experience and Qualifications.

- **Budget and Cost Share**

The cost share is 1:1, while indirect costs represent 7.6 percent of the requested OTF grant. The budget narrative is specific and, in general, well done. The costs presented in the budget seem reasonable. The proposal meets the requirements of the RFP on Budget and Cost Share.

Summary of Review and Recommendation

The proposal does not clearly articulate how the three collaborators leverage an intellectual platform, leaving the committee with a belief that these are three separate projects, each with its own merits and challenges, that cannot be evaluated together. The committee does not recommend that this proposal be considered for funds under the Ohio Third Frontier Innovation Platform Program.

OTF IPP 12-220
Commercialization of an Innovative Neuromodulation and Neurostimulation Technology Platform
Case Western Reserve University

Proposal Summary

Proposed Budget		
	State Funds	Cost Share
Operating Funds	$3,000,000	$3,000,000
Capital Funds	$0	$0
Subtotal	$3,000,000	$3,000,000
TOTAL	$6,000,000	

This proposal seeks funds to develop and conduct commercialization clinical trials to support U.S. Food and Drug Administration (FDA) approval and marketing of two Neuromodulation Neurostimulation devices based on the developed OMNISTIM™ System "platform product" of implantable devices that encompass multiple stimulation targets and sensor technology. One application (Omnistim UE) will restore hand and arm functions to patients with upper extremity paralysis due to spinal cord injury or stroke. The other application (Omnistim AP) will provide relief of phantom limb pain in post amputation patients. Both of these applications use the same platform components. The lead applicant is Case Western Reserve University, and the formal collaborators on this proposal include SPR Therapeutics and NDI Medical. NeuroPro Systems is a new medical device company that will be formed as part of this Neuromodulation and Neurostimulation Technology (NNT) Platform Program.

Detailed Review

- **Technical Merit and Plan**

The main goal of this proposal is to transfer manufacturing of the Omnistim devices from the research laboratories to NDI Medical (manufacturer of record). NDI Medical will establish GMP (good manufacturing processes)-compliant manufacturing protocols and develop documentation for FDA approval of the investigational device exemption (IDE). Upon approval of the IDE, NDI Medical will conduct the final commercialization clinical trials and submit the necessary regulatory documents for full FDA pre-market approval (PMA) for device commercialization. Details pertaining to any clinical studies regarding the suitability of the Omnistim technology need to be presented.

A new medical device company, NeuroPro, will be formed as part of the NNT platform, specifically to market the Omnistim UE device. The Omnistim AP device will be marketed by SPR Medical. The NNT platform that provides the rationale, basic research, technology, and practical manufacturing strategy utilizes a modular, scalable, and interchangeable system of components that enhance the feasibility of this platform technology. This includes power modules, network cables, neurostimulator and biopotential recording modules, and stimulating and recording electrodes. These components, with modifications, are shared by the Omnistim UE and Omnistim AP devices. In addition, the modular strategy supports additional upgradeable components as new research and clinical developments evolve. The proposal exceeds the requirements of the RFP on Technical Merit and Plan.

- **Commercialization Strategy**

Commercialization of the Omnistim UE and Omnistim AP devices is highly dependent on successful commercialization clinical studies, submission of relevant regulatory documents, and subsequent FDA approval. Funding is already in place to support the commercialization clinical studies, and the applicants expect to launch the devices by the end of the third year. The timing for conducting and completing the commercialization clinical studies following approval of the IDE will support initial sales of the Omnistim AP devices within the appropriate 3- to 5-year timeframe. NNT's ability to achieve market entry, sustain a viable value proposition, and support the growth of high paying jobs in Ohio appears well

substantiated in the proposal. The proposal meets the requirements of the RFP on Commercialization Strategy.

- **Performance Goals**

By year five, NeuroPro's sales of the Omnistim UE device are expected to grow to approximately 400 units per year. This is based on the assumption that the Omnistim UE system is, indeed, ready to enter the market by year two of the proposal's performance plans. Annual sales of the Omnistim AP device are predicted to approach 2,500 units by year five. The Omnistim UE and Omnistim AP devices are predicted to enjoy a large market share (0.93 percent and 0.46 percent, respectively) by year five with strong revenue performance. The patient populations suffering from upper extremity paralysis or amputation-driven phantom pain appear to support the potential sales growth of the devices, but it is not clear if NNT's market penetration predictions are realistic. Evaluation of the product by lead medical device companies that operate in the neuro-stimulation market is an important performance goal that should be addressed.

By year five or six, approximately 95 new jobs with an average salary of $110,000 are expected. Assuming achievement of market penetration as described above, this performance goal seems realistic and obtainable. The proposal meets the requirements of the RFP on Performance Goals.

- **Experience and Qualifications**

The Cleveland Functional Electrical Stimulation Center (CFESC) at CWRU appears to be an outstanding organization with the appropriate infrastructure necessary to successfully drive research and development of NNT's medical devices. The research facilities and manufacturing capabilities in CFESC and NDI, respectively, are more than adequate to support the commercialization goals of the IPP proposal. The leadership for this project, including Dr. Peckham, Mr. Thorpe, Ms. Bennett, Mr. Strother, and Mr. Stultz, is an experienced and well-qualified team.

Since 2003, the applicants have received approximately $17.9 million in prior OTF awards to develop and commercialize related neurostimulation and neuromodulation devices. However, the proposal fails to disclose the receipt of and performance resulting from those prior OTF awards. Due to this nondisclosure, the proposal does not meet the requirements of the RFP on Experience and Qualifications.

- **Budget and Cost Share**

The budget for this proposal is well organized and realistic. CWRU will provide $2,481,538 in cash cost share. The federally negotiated indirect cost level of 57 percent will be reduced to the required 20 percent through cost sharing. Additional cost sharing of $356,370 and $171,092 by NDI Medical and SPR Therapeutics, respectively, is well documented and supported by the accompanying letters. The proposal meets the requirements of the RFP on Budget and Cost Share.

Summary of Review and Recommendation

The OMNISTIM™ System platform of implantable devices is well positioned to positively impact the unmet medical needs of paralysis and amputee patients while providing an economical growth engine for the State of Ohio. However, Section 3.3.9 of the IPP RFP clearly states that disclosure of performance on prior OTF awards is required.[6]

[6] Ohio Third Frontier Innovation Platform Program Fiscal Year 2012 Request for Proposals (RFP), available at http://www.thirdfrontier.com/Documents/FY2012OTFIPPRFP-Final.pdf, p. 15.

Because the team did not include any information regarding its previous OTF grants in the proposal, the proposal does not meet the requirements of the RFP. Fully understanding any applicant team's prior performance is critical to the committee's deliberations. However, the committee encourages the applicant team to resubmit a revised proposal to the next OTF RFP cycle. The committee does not recommend that this proposal be considered for funds under the Ohio Third Frontier Innovation Platform Program.

OTF IPP 12-221
Development of Novel Membranes for Advanced Energy Storage
University of Akron

Proposal Summary

Proposed Budget		
	State Funds	Cost Share
Operating Funds	$2,598,392	$2,752,066
Capital Funds	$138,964	$0
Subtotal	$2,737,356	$2,752,066
TOTAL	$5,489,422	

The objective of this proposal is to develop new, lower cost polymer membranes for vanadium redox flow batteries using the Innovative Membrane Manufacturing Platform at the University of Akron. The lead applicant is the University of Akron, with Ashlawn Energy, Akron Polymer Systems (APS), and InnoVentures, Inc., as collaborators. The University of Akron will use its Innovative Membrane Manufacturing Platform and lead the team to achieve the goal of producing commercially marketable membranes for vanadium redox flow batteries; Ashlawn will manufacture the batteries; InnoVentures will supply critical components for the Ashlawn battery stacks; and Akron Polymer Systems currently has a near-commercial material ready for fabrication into membranes and demonstration in a vanadium redox flow battery.

Detailed Review

- **Technical Merit and Plan**

The technical plan is described in sufficient detail. The proposers correctly note that the energy storage markets are large and growing. However, the cost reduction of the membrane that the proposers intend represents only a very small fraction of the total cost of the redox flow batteries and, even if successful, will not likely go far enough to achieve the ultimate desired cost for such batteries with regard to their successful commercial use. The proposal would be strengthened by including a list of desired and measurable membrane properties to support the technical activities, a list of performance targets, and a plan for achieving each of these performance targets to assess the probability of success of the proposed efforts. More information should have been provided concerning the long-term use of the platform. The proposal does not meet the requirements of the RFP on Technical Merit and Plan.

- **Commercialization Strategy**

The proposal falls short of making a convincing case for either the competitive benefits of Ashlawn's battery systems over all other solutions or other opportunities beyond the Ashlawn battery for implementation of these polymer solutions. This brings the strength of the overall commercialization strategy into question. Because there are many entrants to the energy storage field, the proposal would be strengthened by providing more information concerning the competitive advantage that the proposed new polymer technology provides over other materials. The connection with Akron Polymer Systems is somewhat unclear with regard to the overall commercialization strategy. The proposal would benefit from more definition of the contribution of APS in the roll-out of commercial product. The committee understands that this new polymer may also be used in fuel cells and thus may find much wider market applicability than just the vanadium redox flow batteries. The proposal would be stronger if this fact was emphasized and if a commercial partner was brought in to support this case. The proposal does not meet the requirements of the RFP on Commercialization Strategy.

- **Performance Goals**

While the proposal discusses job creation within the State of Ohio, there is no evidence provided to justify the large number of jobs claimed. Some discussion relative to the connection between jobs and revenues would be helpful, at a minimum. The proposal is also silent on personal wealth creation, an important parameter associated with the RFP. As previously discussed, other than the Ashlawn opportunity, the proposal does not suggest other avenues for commercialization of these polymer systems. Despite the fact that this proposal is otherwise strong on its discussion of business creation/growth and follow-on investment, critical flaws exist in supporting the rationale associated with key performance goals for the program. The proposal therefore does not meet the requirements of the RFP on Performance Goals.

- **Experience and Qualifications**

The lead applicant has assembled a capable team having significant experience in the development of polymers for electrochemical systems. Professor Weiss's deep background and experience in developing similar polymer systems adds significant credibility to the probability of achieving the proposed tasks. Furthermore, the facilities available at the University of Akron are materially important to the success of the project. The proposal could be further strengthened by providing more detail in the management plan concerning the methodology to be used in addressing program objectives. The proposal meets the requirements of the RFP on Experience and Qualifications.

- **Budget and Cost Share**

The budget is provided in adequate detail, and the cost share meets the OTF 1:1 ratio required for this RFP. The cost share for the proposal is in the form of cash. The commitment letters are sufficiently detailed, and the collaborators appear sufficiently committed to support the proposed effort. The proposal meets the requirements of the RFP on Budget and Cost Share.

Summary of Review and Recommendation

There is a significant need to make large-scale energy storage systems affordable. In this regard, the proposers intend to reduce the cost of the ion exchange membrane used in vanadium redox flow batteries. The proposers have assembled a capable team and are addressing important classes of materials to help in reducing the overall cost of such a system. However, even if successful, this cost reduction will likely not be sufficient to achieve the ultimate desired cost for such batteries for their successful commercialization since the bulk of the cost is in the reactants themselves rather than strictly the cost of the electrochemical cells. There are many areas described above where the applicant team could strengthen their proposal for a future submission. The committee does not recommend that this proposal be considered for funds under the Ohio Third Frontier Innovation Platform Program.

OTF IPP 12-224
Transparent Conductive Film Manufacturing for Emerging Flexible Electronics Market
University of Akron

Proposal Summary

Proposed Budget		
	State Funds	Cost Share
Operating Funds	$2,706,925	$2,980,889
Capital Funds	$292,000	$20,000
Subtotal	$2,998,925	$3,000,889
TOTAL	$5,999,814	

This proposal seeks to build upon an existing platform that includes the University of Akron and two supply chain collaborators, Akron Polymer Systems (APS) and Kent Displays, Inc. (KDI). The project goal is to design transparent conductive and flexible (TCF) films by leveraging an innovative roll-to-roll (R2R) hybrid pilot-scale machine developed by the University of Akron through a previously funded Wright Center of Innovation program.

Detailed Review

- **Technical Merit and Plan**

The goal of this proposal is to create alternative transparent, conductive, and flexible (TCF) surfaces to replace indium tin oxide (ITO) for use in more demanding display applications. There is an emerging need to improve flexibility in these applications; in addition, the limited supply of indium is also of major concern. The objective of the proposal is to further TCF through optimization of the material composition. The University of Akron has developed a solution to this need using an R2R hybrid pilot-scale machine. The proposal focuses on a unique method of embedding electrospun nanofibers in or on a polymer matrix. Optimization will involve varying fiber diameter, coverage, and network geometry. In general, increasing fiber diameter and coverage are expected to improve conductivity but reduce transparency of the film. The proposal has not addressed issues pertaining to the conductivity requirements and the water barrier properties required for the more demanding flexible displays. In addition, the issue of adhesion between the electrospun fibers and the matrix cannot be ignored for what has been proposed and might end up becoming a serious technical limitation. A number of other approaches are being considered, but these have not yet been able to replace ITO. This proposal seeks to use composites in the electrospun nanofiber format; however, it does not provide information about how their process might yield superior properties over the thin-film approach.

The overall proposal is good and appears to have unlimited commercial opportunity. However, there are several serious errors or omissions in the proposal. First, the comparison on flexural toughness is made to ITO coated films. The more realistic comparison should be to films of the candidate nanofiber (namely, poly(3,4-ethylenedioxythiophene) poly(styrenesulfonate)—PEDOT:PSS—and its more electrically conductive composites). If the nanofiber process works, there is no reason not to just use films of the chosen material. They could be more conductive, provide a more uniform surface, provide an easier (and lower cost) process, and be appropriate for all the applications where this proposed system could be employed. There also is an error in the description of PEDOT on page 11. As noted, "To overcome the inherent low solubility of the highly conductive polymers (PEDOT), they are dispersed with a polyelectrolyte such as poly(styrene sulfonate). However, this dispersant is insulating, leading to a reduction in contact between the conductive PEDOT domains." This is incorrect. PEDOT is at best a semiconductive polymer (undoped) as are all the other conjugated polymers. Conductivity only results with dopant addition, such as in acids. PSS poly(styrene sulfonic acid) is the dopant for PEDOT, and addition leads to a 10^4 to 10^6 increase in the conductivity. The proposal does not meet the requirements of the RFP on Technical Merit and Plan.

- **Commercialization Strategy**

The proposal addresses a large need for the emerging future in flexible electronics/devices. The commercialization strategy has the following components: APS will provide novel transparent high-performance resins and photocurable monomers, which will be integrated by the University of Akron into the hybrid process using its multi-nozzle electrospinning platform to produce flexible transparent conductive hybrid films. KDI will then integrate these materials into flexible displays. The University of Akron plans to spin off a manufacturing company to produce these transparent conductive films. This partnership and extension of the capabilities of transparent conductive coatings is expected to result in an Ohio-based supply chain for emerging flexible electronics. The strategy has defined areas where KDI can potentially use this technology. The committee believes that this commercialization strategy is appropriate. The proposal meets the requirements of the RFP on Commercialization Strategy.

- **Performance Goals**

If the proposal can succeed in moving the field even slightly, it would be a rather successful program. Further use of active matrix organic light-emitting diodes (AMOLEDs) will depend on additional innovation to further reduce power consumption and improve response times as well as resolutions. These performance factors are a function of the processing temperature of the driving electronics. AMOLEDs have a thin-film transistor (TFT) array structure on a transparent substrate. Higher TFT deposition temperatures, in principle, can dramatically improve the electrical efficiency of the display. Flexible substrate materials instead of glass will definitely open up newer possibilities for product design and enable lower-cost roll-to-roll fabrication. The total 2014 available market for key KDI product Boogie Board Rip is projected to be $145 million. To meet an expected 5 to 10 percent penetration in the accessible market, KDI is already investing in a second generation manufacturing line. A third generation line capable of large sizes may be realized using KDI internal funds generated from revenue growth. This will be contingent on the market feedback for Boogie Boards that have been shipped already to China, Japan, and Western Europe. The potential growth in jobs may include five high-end engineering jobs for the entire manufacturing line and 10-15 manufacturing jobs for back end completion of the displays. The proposal meets the requirements of the RFP on Performance Goals.

- **Experience and Qualifications**

The University of Akron is home to the Institute of Polymer Science and Engineering, the Department of Polymer Engineering, the Department of Polymer Science, the National Polymer Innovation Center, the Akron Global Polymer Academy, and the Akron Polymer Training Center. Its many accomplished researchers in the field can contribute to the success of this project. The platform is in existence and has had prior work experience. The University of Akron will more likely leverage the capabilities of the platform in the future through other and newer federally funded research and development from agencies such as the National Science Foundation (NSF) and the National Institute of Standards and Technology (NIST). The proposal exceeds the requirements of the RFP on Experience and Qualifications.

- **Budget and Cost Share**

The budget and cost share is both detailed and reasonable. Cost share provided by the University of Akron includes salary, tuition of graduate students, and equipment user fees, while that of KDI includes overhead, salaries, and equipment. The proposal meets the requirements of the RFP on Budget and Cost Share.

Summary of Review and Recommendation

The proposal does not meet the requirements of the RFP on Technical Merit and Plan as described above. If the proposal were to be resubmitted in a future year, the technical aspects of the proposal will need to be addressed more fully. It would be prudent to extend comparison beyond ITO-coated films to include films of PEDOT:PSS and their more electrically conductive composites. Inclusion of market feedback data for KDI products that have been shipped to China, Japan, and Western Europe is also strongly encouraged. The committee does not recommend that this proposal be considered for funds under the Ohio Third Frontier Innovation Platform Program.

OTF IPP 12-229
Center for Sustainable Polymer Products
University of Toledo

Proposal Summary

Proposed Budget		
	State Funds	Cost Share
Operating Funds	$1,800,572	$2,593,839
Capital Funds	$935,000	$145,000
Subtotal	$2,735,572	$2,738,839
TOTAL	$5,474,411	

This proposal is primarily seeking funding to form a Center for Sustainable Polymer Products. The technical part of the proposal consists of several longer-range projects in the concept stage to be investigated at the University of Toledo. The proposal is based on a search for bio-derived polymers and products to replace "non-sustainable" petrochemical derived sources. One project will involve replacing bisphenol A (BPA) polycarbonate with furan-based diols to ultimately be used in ring opening polymerization. A second project involves the use of naturally occurring unsaturated compounds that exhibit high oxygen reactivity for oxygen scavengers for polyethylene terephthalate (PET) bottle applications. A third project is to develop a terephthalic acid process from bio-derived p-xylene. A primary collaborator for this study is PolyOne. PolyOne's initial investigation will be to scale-up the ring opening polymerization process for BPA polycarbonate and relevant composites/nanocomposites to be formed during a reactive extrusion polymerization process. Other collaborators include Amcor Rigid Plastics and Hirzel Canning Co., which are involved in various aspects of the above noted research and development program, and the Center for Innovative Food Technology.

Detailed Review

- **Technical Merit and Plan**

This proposal is directed at the desire to replace synthetic polymers based on petrochemical sources with more sustainable natural product-based chemistry. The technical plan addresses several potential areas of interest.

The University of Toledo projects are at the very early stage of development. These projects have not achieved proof of principle, as required by the RFP. With the bio-derived furan diol, it does not appear that sufficient polycarbonate has been synthesized to determine the property profile. If so, it should have been noted in the proposal. Literally hundreds of different polycarbonate structures have been noted in the patent and open literature, but very few approach BPA polycarbonate in desired cost and properties. To claim that this specific polycarbonate could be competitive without providing supporting data is not a valid assumption. The oxygen scavenger concept also does not appear to be reduced to practice; again, no data are provided. Blending with PET would require temperatures of 280 ºC or higher, and the oxygen sensitivity would require a nitrogen blanketing process.

The PolyOne contribution of ring opening polymerization via reactive extrusion polymerization of BPA polycarbonate (including composites) is more likely to be achieved and could have success. PolyOne has demonstrated such a process for nylon 6 and relevant composites.

The overall proposal is still in the concept stage and does not achieve the proof of principle desired in this RFP. The proposal does not meet the requirements of the RFP on Technical Merit and Plan.

- **Commercialization Strategy**

The basic problem is that the projects proposed for study at the University of Toledo are concepts and have not achieved the proof of principle. In order to even consider a commercialization strategy, one would need to have data to compare with the technology to be replaced. These projects are at the concept stage and need to be reduced to practice before commercialization can be realistically discussed.

The PolyOne ring opening polymerization of bisphenol polycarbonate (cyclic oligomer) via reactive extrusion polymerization has prior literature verification and technically a good chance of success. It is the one element of this project that can be considered viable for potential commercialization. The time to scale up monomers, develop a polymerization process, and develop a commercially viable business in a well-established commercial market would not allow the bio-based furan diol polycarbonate to have any impact in the next 5 years. The PolyOne project could have economic impact; however, in about 3 years if the project received significant PolyOne commitment. The proposal does not meet the requirements of the RFP on Commercialization Strategy.

- **Performance Goals**

As stated above, the time to scale-up monomers, develop a polymerization process, and develop a commercially viable business in a well-established commercial market would not allow the bio-based furan diol polycarbonate to have any impact in the next 5 years. The PolyOne project could have economic impact, however, in about 3 years if the project received additional, significant PolyOne commitment. It is unrealistic to expect any commercial impact from the University of Toledo bio-related polycarbonate project in the next 5 years as it is only in the concept stage with very limited chances of commercial viability. The proposal does not meet the requirements of the RFP on Performance Goals.

- **Experience and Qualifications**

The PolyOne technical lead (J. Golba) has outstanding experience in polymer processing and reactive extrusion polymerization. The PolyOne project on ring opening polymerization of BPA polycarbonate via reactive melt extrusion polymerization would thus have a high chance of technical success.

The technical lead for the project (Maria Coleman, University of Toledo) is also highly qualified in various polymer science areas (nanocomposites, membrane separation). The area of chemistry of sustainable resources, however, is a relatively new area for the technical lead, and the proposal is therefore more at the concept stage than ready for commercial consideration. The proposal indicates that an advisory board will also be utilized to review technical/commercial progress, which is appropriate. The proposal meets the requirements of the RFP on Experience and Qualifications.

- **Budget and Cost Share**

The overall budget appears reasonable, with a significant amount of the budget proposed to upgrade the equipment to conduct the research program and establish the proposed center. The cost share noted for PolyOne for the contract (greater than $1 million) is significant, and the commitment letter from PolyOne appears strong. The proposal meets the requirements of the RFP on Budget and Cost Share.

Summary of Review and Recommendation

This proposal is directed at projects at the University of Toledo that are at the concept stage and not properly reduced to practice to consider any commercialization strategy or plans. This proposal would be more suited toward the stated goal in the first several sentences of the abstract, which clearly notes that the proposal seeks funds to form a Center for Sustainable Polymer Products to create the economic/academic structure to ultimately yield commercially viable technology. They are not at the stage to presently consider the commercialization of any specific technologies. However, the committee does not believe the proposal meets the proof of principle requirement. The committee does not recommend that this proposal be considered for funds under the Ohio Third Frontier Innovation Platform Program.

OTF IPP 12-230
Breath Analysis Innovation and Commercialization Platform
Cleveland Clinic

Proposal Summary

Proposed Budget		
	State Funds	Cost Share
Operating Funds	$2,733,198	$3,016,911
Capital Funds	$250,000	$412,344
Subtotal	$2,983,198	$3,429,255
TOTAL	$6,412,453	

The Breath Analysis Laboratory, an innovation platform at the Cleveland Clinic, proposes to create a company to work with instrument builders to develop breath analysis equipment for new medical diagnostics methods that it is developing. The Cleveland Clinic and collaborators Makel Engineering, Inc., and SYFT Technologies, Inc., propose to develop instrumentation to monitor nitric oxide (NO) and volatile organic compounds (VOC) in breath and to demonstrate efficacy in clinical trials for U.S. Food and Drug Administration (FDA) approval. The Porter Instrument Division of Parker Hannifin in Ohio has expressed an interest in the possibility of manufacturing and marketing this instrumentation, although this company is not a collaborator on the proposal.

Detailed Review

The proposal contains two separate elements: (1) monitoring of NO in breath for diagnostics and treatment of asthma and of CO_2/O_2 in breath for tracking physiologic activity and (2) monitoring of VOC in breath for multiple possible diagnostic targets.

- **Technical Merit and Plan**

The Cleveland Clinic has a well-developed platform for breath analysis research and development from exploratory research through formal clinical trials. It is a world leader in developing this field. NO monitoring is well developed and ready to go into clinical trials for asthma. While pictures of the NO microsensor device are shown, there is no data on prototype performance, which would strengthen this section of the proposal.

Selected ion flow tube mass spectrometry (SIFT-MS) monitoring of VOCs has not yet been clearly demonstrated to be a useful medical diagnostic; more early-stage research at Cleveland Clinic is required and is part of the proposed work. The validation of the biomarkers for the VOC effort is still at the fundamental research stage. There are no specific clinical trials completed that clearly validate and establish clinical standards for the use of VOCs as breath analysis devices. The details pertaining to the suitability of the technology as a point-of-care platform are insufficient.

Because the NO diagnostic technology is much further developed than the VOC diagnostic technology, the committee split its evaluation of the proposal's technical merit and plan between these two technologies:

1. The NO diagnostic exceeds the RFP requirements for Technical Merit and Plan.
2. The VOC diagnostic does not meet the RFP requirements for Technical Merit and Plan.

- **Commercialization Strategy**

The commercial collaborators in developing the instrumentation are the natural entities to produce and market the instrumentation; they have the knowledge and part of the intellectual property (IP). However, Makel is a small company in Chico, California, and SYFT is based in New Zealand, so they provide no

prospect for employment in Ohio. Parker Hannifin has been proposed to produce the instrumentation and already does so for other products developed at the Cleveland Clinic. It is clearly capable, while neither Makel nor SYFT could be considered internationally competitive in this regard. However, Parker Hannifin has no official involvement to date and no claim to the IP. The applicants present two products pertaining to small molecule monitoring (NO and CO_2/O_2) and three pertaining to VOC monitoring. The NO-monitoring devices have a better chance of commercialization and market entry. The applicants should build an Ohio-centric team and focus their efforts on the NO devices. Given the tenuous connection of the project to Ohio industry, the proposal does not meet the RFP requirements on Commercialization Strategy.

- **Performance Goals**

The performance goals are articulated reasonably well for the first product area, the NO monitors. These goals are the following:

(a) Conduct in-office clinical trials at Cleveland Clinic,
(b) Conduct in-home clinical trials,
(c) Prepare pre-FDA documentation,
(d) Refine product design based on results of trials,
(e) Establish Ohio-based supply chain for key components of system (sensor, PCBs, assembly services), and
(f) Transition to OEM health care equipment suppliers.

The performance goals are not well articulated for the second product area. It would be useful to see performance metrics for development, along with go/no-go decision milestones and contingencies for each development stage (in vivo to clinical testing, field testing, etc.). The proposal meets the requirements of the RFP on Performance Goals.

- **Experience and Qualifications**

The Cleveland Clinic is a world leader in the development of medical diagnostics and therapies and is clearly well qualified to develop and exploit breath analysis as an important diagnostic and health monitoring technique. Makel is a small California company that has been working closely with the Cleveland Clinic. Makel is an experienced developer and producer of sensors for military applications. SYFT is a New Zealand company that has been working closely with the Cleveland Clinic and has produced and marketed its instrumentation worldwide for some time. Parker Hannifin, if and when involved, would provide excellent production and marketing capability based in Ohio. In the absence of its involvement currently, the delivery of jobs and economic productivity in Ohio is uncertain. The proposal meets the requirements of the RFP on Experience and Qualifications.

- **Budget and Cost Share**

The overall budget and cost share numbers are acceptable; however, some items are not described sufficiently. The large “other direct costs” state funds to SYFT include money for rent and other items that are considered indirect costs in the United States and may well exceed the 20 percent limit for indirect costs. The cost-matching equipment dollars in both the Cleveland Clinic and SYFT budgets, $206,172, are described for SYFT as a single instrument delivered by SYFT to the Cleveland Clinic at no cost. The money is distributed over 3 years, and an identical amount mysteriously appears on the Cleveland Clinic budget as cost match funds each year. It is unclear when the equipment is to be delivered and if it will be in time to be used during the grant period. Given the lack of detail, the proposal does not meet the requirements of the RFP on Budget and Cost Share.

Summary of Review and Recommendation

Exhaled breath analysis appears to be a promising new analytical technique for health care that could become widely applicable. The work on sensors for NO appears ready to commercialize. The CO_2/O_2 sensing of physiologic activity needs to be carefully compared to alternative systems before proceeding. The SIFT-MS tracking of exhaled VOCs is in an early exploratory stage and will require significantly more work before commercial development can be undertaken. Development of the VOC technology is not sufficiently mature to meet the requirements of the RFP. Although the proposal is promising and interesting, the committee does not recommend that this proposal be considered for funds under the Ohio Third Frontier Innovation Platform Program.

OTF IPP 12-233
Electrochemical Innovation Platform: Advanced Materials for Energy Storage and Sensors
Ohio University

Proposal Summary

Proposed Budget		
	State Funds	Cost Share
Operating Funds	$2,186,129	$2,110,226
Capital Funds	$200,000	$276,476
Subtotal	$2,386,129	$2,386,702
TOTAL	$4,772,831	

Ohio University proposes to use its Electrochemical Innovation Platform to transition two technologies to commercial products. The first is a metal recycling process for used battery cathodes to cost-effectively recover high-purity metals for use in new lithium ion batteries; this work will be done in collaboration with BASF Corporation. The second is the development of a low-cost, high-accuracy urea sensor for diesel emission control; this work will be done in collaboration with E3 Clean Technologies, Inc.

Detailed Review

- **Technical Merit and Plan**

The metal recycling part of the proposal has merit for reducing the cost of cobalt that is used in lithium-ion battery cathodes. BASF has developed a new cathode material that will significantly reduce the overall battery cost. The metals will be leached from future used-battery cathodes using BASF's Inductively Coupled Plasma Process and then recovered as pure metals using Ohio University's Sacrificial Reductant Electrowinning technology. However, it is not clear what the strategic rationale is behind the inclusion of the urea sensor development in this proposal. There does not seem to be significant synergy between the two efforts in the proposal. The technical merit of the proposal would be much better if the two foci of metals recycling and selective catalytic reduction (SCR) sensor development were separated with two appropriate for-profit collaborators. The proposal does not meet the requirements of the RFP on Technical Merit and Plan.

- **Commercialization Strategy**

The commercialization of the metal recycling technology will be achieved through BASF, who is already committed to investing large amounts of funds into the area of battery materials over the next 5 years. A portion of this investment will focus on reducing battery cost through the recycling of spent battery cathodes. The commercialization strategy for the metal recycling process is well described in the proposal. The urea sensor development part of the proposal is only vaguely outlined, with no original equipment manufacturer involvement. Thus, the proposal does not meet the requirements of the RFP on Commercialization Strategy.

- **Performance Goals**

The proposal requires much development of the urea sensor, and the BASF involvement in this part of the proposal is only linked to their interest in evaluating the economics of the pathway enabled by the urea sensor. Competition of alternative pathways is not identified. The quality of the proposal is less than desirable, as clear milestones and go/no-go decision points are not defined in the original proposal. Milestones subsequently submitted to the committee at its second meeting were still inadequate on the urea sensor development side. Because the proposal includes two completely separate commercialization directions, the project management plan is untenable as outlined, which draws into serious question the validity of the proposed economic impacts for the state. The proposal does not meet the requirements of the RFP on Performance Goals.

- **Experience and Qualifications**

The lead applicant, Ohio University, and the main collaborator, BASF, are highly qualified and experienced. They are well suited to carry out the proposed efforts on metal recycling. However, the urea sensor development effort, while qualified on the technical side, lacks significant experience in commercialization. Therefore, the proposal does not meet the requirements of the RFP on Experience and Qualifications.

- **Budget and Cost Share**

The cost share by the lead applicant, Ohio University, and the main collaborator, BASF, is adequate and meets the required 1:1 ratio. BASF contributes the bulk of the cost share and does not require any state funds. This could potentially be seen as BASF subsidizing the urea sensor development, but despite this, the committee believes that the proposal meets the requirements of the RFP on Budget and Cost Share.

Summary of Review and Recommendation

The proposal targets the important area of metals recycling of advanced batteries and identifies that a critical portion of that recycling is the use of a urea sensor. Ohio University has partnered with a strong corporate partner that is very supportive. However, the top level metals recycling process and alternative pathways thereof are not well laid out in the original proposal nor in the subsequent follow-on documents submitted in response to committee questions. A secondary direction is also laid out by the proposal targeting commercialization of a urea sensor for selective catalytic reduction in diesel engines, but the competition in this area is not acknowledged. The committee does not recommend that this proposal be considered for funds under the Ohio Third Frontier Innovation Platform Program.

OTF IPP 12-238
Manufacturing & Commercialization of Value-Added Orthopedic Products from Cheap Raw Materials
University of Toledo

Proposal Summary

Proposed Budget		
	State Funds	Cost Share
Operating Funds	$1,476,637	$705,811
Capital Funds	$102,380	$873,206
Subtotal	$1,579,017	$1,579,017
TOTAL	$3,158,034	

This proposal seeks to build on existing expertise in the manufacturing of biodegradable calcium materials and marketing of orthopaedic implants to create and market two new products for spine applications: a flowable cement for injection and a solid granular form for general bone graft applications. One collaborator (Osteo Synergy) has a business model of creating value-added products from poultry waste. They will partner with the University of Toledo in determining whether eggshells can be used as a source of calcium hydroxide ($Ca(OH)_2$) for these biodegradable materials. Other collaborators include X-Spine, a manufacturer of orthopaedic implants and bone graft materials made from allograft, and Osseon Therapeutics, Inc., a manufacturer of cement injection devices. Spinal Ventures, LLC is also listed as a collaborator. The proposed projects are projected to result in eight new jobs by year three, and 50 by year eight in the state of Ohio. Further, they project revenues from these projects to be over $50 million by year eight.

Detailed Review

- **Technical Merit and Plan**

The proposal is divided into three projects: manufacturing calcium hydroxide from egg shells (Osteo Synergy and UT), manufacturing of monetite-based injectable orthopaedic cements (UT, Spinal Ventures and Osseon), and manufacturing of monetite-based granules (UT, Osteo Syergy and X-Spine). The team at the University of Toledo has previously studied calcium phosphate (CaP) material formulations for orthopaedic applications using commercially pure $Ca(OH)_2$, but wishes to perform more tests and compare this formulation to cement made from the eggshell-derived material. It is not clear what changes will be made to the technical plan if the cement from the eggshell-derived material is found to be inferior to the materials made from the chemical-grade raw material or whether the facilities that are planned at Osteo Synergy might, therefore, not be needed. In addition, the technical plan contains several inconsistencies and is missing information, making it difficult to fully understand. For example, it is unclear whether rats or mice will be used for the in vivo studies, how the 48 animals will be divided into 3 groups of 9 animals per group for 3 timepoints, or if the same tests will be performed for the in vitro and in vivo testing of the granules, as are planned for the injectable formulation. Due to incomplete information contained within this section, the proposal does not meet the requirements of the RFP on Technical Merit and Plan.

- **Commercialization Strategy**

The proposed research is designed to provide the necessary data to be able to achieve regulatory certification (CE in Europe and 510(k) in the United States) of both the injectable and granular formulations of the material. The applications for certification are projected to be submitted at the end of year two and the beginning of year three. Thus, by the end of the 3-year project period, it is not estimated that either of the material formulations will be ready for commercialization. However, once market approval has been obtained, the collaborators have established sales and marketing expertise in spinal implants, and this expertise is a strength of the proposal. No revenues are projected for the 3-year target,

and although revenues from the products are projected at the 8-year target, the 5-year timepoint is not mentioned, which is a requirement of the RFP. Although the market for these types of materials exists, it is unclear what percentage of this market can be expected from the proposed products, when many other companies are already selling comparable materials. The proposal does not meet the requirements of the RFP on Commercialization Strategy.

- **Performance Goals**

Although the proposal does demonstrate that this work could have a significant impact on job creation and new sales of products by year eight, the impact at year three is limited and the impact at year five is not discussed. One of the collaborators has moved to Ohio, and another is considering it, so this project has met the requirements for company and talent recruitment. However, the realistic forecast for the 5-year mark is not available in the proposal, and, thus, this proposal does not meet the requirements of the RFP on Performance Goals.

- **Experience and Qualifications**

The principal investigator, his colleagues, and the collaborators are well qualified to lead, manage, and deliver on the project. In particular, the collaborators have a strong stake in the success of the project. The proposal meets the requirements of the RFP on Experience and Qualifications.

- **Budget and Cost Share**

The cost share meets the 1:1 match requirement, but some details are unclear. State funds of $320,193 are requested for a microCT machine that is estimated to cost $360,000. The budget detail lists a total request of $102,380 in state funds for equipment, with a commitment of $16,800 in cost share from one collaborator for equipment. A request for $320,193 is included in the budget for state funds to cover the costs of personnel for the lead institution. Thus, it appears that the budget pages and the budget description are contradictory. Furthermore, additional equipment is outlined in the technical plan as being required for the proposed studies (crushers, filters, bakers, etc.), and it is not clear where that money would come from. A letter from one collaborator detailing the commitment for cost share is missing, while another is included twice. Due to the inability to fully evaluate the requested budget, this proposal does not meet the requirements of the RFP on Budget and Cost Share.

Summary of Review and Recommendation

The experience of the team in novel materials and orthopaedics is significant and is the biggest strength of this proposal. However, there are many sections of this proposal that do not meet the requirements of the RFP. Critical information is missing, and there are several inconsistencies that make the proposal difficult to evaluate. While the market for resorbable materials in orthopaedics exists and is getting larger, there is considerable competition from products already approved and on the market. The technical plan for the project indicates clearly that commercialization will not begin by year three, and although some projections are made for year eight, the committee cannot evaluate the potential of these products in year five. Therefore, the committee does not recommend that this proposal be considered for funds under the Ohio Third Frontier Innovation Platform Program.

OTF IPP 12-246
Next-Generation Coating Technologies for Very-High Temperature Engine Components
University of Cincinnati

Proposal Summary

This proposal aims to use ceramic matrix composites in engine components with an environmental barrier coating. The lead applicant is the University of Cincinnati, and the collaborators on this project are GE Aviation and Ellison Technologies. The proposal emphasizes the setting up of a facility to make these coatings and test them on coupons.

Proposed Budget		
	State Funds	Cost Share
Operating Funds	$0	$2,719,302
Capital Funds	$3,000,000	$280,698
Subtotal	$3,000,000	$3,000,000
TOTAL	$6,000,000	

Detailed Review

- **Technical Merit and Plan**

The proposal aims to develop the next generation of materials in the form of ceramic matrix composites formed with Silicon Carbide (SiC) fibers in an SiC matrix. The primary goal is to set up a facility at the University of Cincinnati for depositing environmental barrier coatings. It is not clear what the composition of the coating will be and what parameters will ensure a successful coating. It is also not clear which rare-earth materials are to be replaced or eliminated. Without this information, the durability of the coating at elevated temperatures would be a serious concern. As the platform is non-existent and is to be created during the course of 3 years, the proposal does not meet the requirements of the RFP on Technical Merit and Plan.

- **Commercialization Strategy**

The ability of GE to use these coatings on ceramic matrix composites on the next generation of engines is a positive aspect of this proposal. However, the gestation time for these coatings and substrates to be qualified, scaled up to manufacturing, and implemented in real engines with Federal Aviation Administration (FAA) approval will easily exceed the 3- to 5-year timeframe of the IPP. There are no other specific products cited as end uses for these coatings or for these composites with strong commercial entities or end-users who are partners in this proposal. This is an extremely ambitious proposal that will not be able to develop any significant use of this technology within the 5-year timeframe. The proposal does not meet the requirements of the RFP on Commercialization Strategy.

- **Performance Goals**

The proposal can create a new line of composites for use in jet engines. However, because of the extremely research-oriented nature of the proposal, it is very difficult to predict the generation of any personal wealth or improved commercial benefit to Ohio. Qualification of new materials and processes and components can take decades through the regulatory systems, and, therefore, the committee feels that this proposal does not meet the requirements of the RFP on Performance Goals.

- **Experience and Qualifications**

The qualifications of the team are reasonable. The industrial partners are well qualified to handle the subject matter of this proposal. However, there is no coating expert listed on the proposal; this is planned

as a new hire. Furthermore, the principal investigator (PI) and the assistant PI are qualified neither in ceramic matrix composites nor in coatings. The PI is an expert on exoskeletons. The proposal does not meet the requirements of the RFP on Experience and Qualifications.

- **Budget and Cost Share**

All of the money proposed goes to creating the facility. There is minimal match from the university and most of the match is from GE. One of the participants neither receives nor provides any cost share, so it is not clear what their commitment is to the overall success of the program. In the committee's view, it is highly unlikely that the proposed budget will be sufficient to bring a commercially useable product to the market within 3 to 5 years. The proposal does not meet the requirements of the RFP on Budget and Cost Share.

Summary of Review and Recommendation

The proposal addresses an important need in the area of advanced materials for the next generation of jet engines. However, the lack of specifics related to the coatings, the type of rare-earth materials to be replaced, and the durability of these coatings are concerns to the committee. The proposed approach to commercialization is weak and restricted to GE, which poses an extraordinarily high risk to the selection of this program. In addition, there is no assurance of the jobs being created in Ohio by GE as a part of the funding requirements from this solicitation. The platform needed for the execution of this program does not exist and is planned to be created during this program, which does not meet the requirements of the RFP. The long gestation times associated with developing materials, processes, and technologies for flight certification through regulatory bodies will need significantly more funding than what has been sought through this proposal. The committee does not recommend that this proposal be considered for funds under the Ohio Third Frontier Innovation Platform Program.

OTF IPP 12-249
Healthcare Information Technology Transform Platform
Cleveland Clinic

Proposal Summary

Proposed Budget		
	State Funds	Cost Share
Operating Funds	$1,933,786	$2,153,154
Capital Funds	$0	$0
Subtotal	$1,933,786	$2,153,154
TOTAL	$4,086,940	

The proposal intends to develop a new type of electronic medical record (EMR) called iVHR that will be marketed as an improvement over current EMR models by improving usability through an intuitive graphical user interface. The proposal intends to extend the existing iVHR platform already in portions of Cleveland Clinic and allow discrete data storage in the EMR so that clinicians can focus on patient care. The proposal intends to use the funds requested to implement the EMR data layer solution that allows the system to access multiple EMRs. Cleveland Clinic will work with industry partners iVHR, Inc. (which is both a company and an EMR technology platform) and Avantia.

Detailed Review

- **Technical Merit and Plan**

The technical plan does a very good job of stating the problem iVHR is trying to solve. Similarly, the plan presents a high-level overview of the components needed to develop a solution. However, the proposal does not clearly present novel approaches that could lead to overcoming the difficulties of interfacing with the various systems with which iVHR must interact, a capability that is stated as key to adoption of iVHR. Additionally, the proposal does not address what technical challenges may come up from moving the current application from a Cleveland Clinic implementation to commercial application. The proposal does not meet the requirements of the RFP on Technical Merit and Plan.

- **Commercialization Strategy**

The commercial strategy describes a pilot at the Cleveland Clinic Heart and Vascular Institute as a way to demonstrate to potential clients the value of iVHR, but it does not address any issues and rights that would be required to negotiate with EPIC before commercializing what is effectively a modification or add-in to their product. The proposal also acknowledges the lengthy sales cycle at hospitals and clinics, but assumes this cycle will be shortened with the Cleveland Clinic pilot. Although having an installation at the Cleveland Clinic will serve as a good demonstration reference point, the committee believes it is insufficient to complete commercialization within the timeline requirements for this RFP. Moreover, the proposal does not describe how the project will proceed with effort required beyond sales, including implementation requirements, training, technical support, and maintenance. In addition, little information is supplied to support market acceptance of the idea of price-for-performance pricing. Similarly, the committee believes insufficient data is presented to validate the size of the available market opportunity. The proposal language is confusing, referring to iVHR redundantly as a tool and a platform, as well as a corporation. There is insufficient description of any corporation capacity, resources, headcount, or management structure. As such, it is difficult to determine whether iVHR is being proposed as a spin-out (as the job creation and budget suggests) or to evaluate its commercial potential. The proposal does not meet the requirements of the RFP on Commercialization Strategy.

- **Performance Goals**

The projection of 10 jobs for the first year is realistic, but given the lack of details on the commercialization tasks, projections for the other years are not clear. The proposal does not meet the requirements of the RFP on Performance Goals.

- **Experience and Qualifications**

Both the Cleveland Clinic and Avandia have the required expertise to develop an initial version of the iVHR, but not sufficient expertise to bring the product to commercialization. The report discusses future potential alliances to help with commercialization efforts, but such collaborators have not been secured. While the technical expertise is excellent, the proposal does not meet the requirements of the RFP on Experience and Qualifications.

- **Budget and Cost Share**

Although the budget and cost share as described meets the RFP requirements, it is unclear how the newly formed iVHR, Inc. will be able to sustain its match commitment of $1,403,456 over 3 years without any funding or revenues. The proposal does not meet the requirements of the RFP on Budget and Cost Share.

Summary of Review and Recommendation

The proposal does not meet the requirements of the RFP in several areas: (1) the technical plan does not realistically describe the technical challenges of moving iVHR from a Cleveland Clinic-based solution to a commercial solution, including the ability to interface with multiple systems and source data providers; (2) the commercialization strategy does not realistically address the difficulties of physician and hospital adoption (including supporting the proposed pay-for-performance pricing model), the formidable challenges presented by more resource-rich competitors (e.g., McKesson, Cerner, GE Centricity), and the effort required to provide installation and support to a product that requires intense efforts to maintain satisfied customers; and (3) although the experience of the collaborators seems satisfactory to complete an initial version of the proposed iVHR product, it is insufficient to complete the successful commercialization of the product. The committee does not recommend that this proposal be considered for funds under the Ohio Third Frontier Innovation Platform Program.

OTF IPP 12-251
The FLEX Scoring Catheter
University of Toledo

Proposal Summary

Proposed Budget		
	State Funds	Cost Share
Operating Funds	$1,000,000	$1,000,000
Capital Funds	$0	$0
Subtotal	$1,000,000	$1,000,000
TOTAL	$2,000,000	

The Flex Scoring Catheter (Flex) proposal involves the continued development, funding, and commercialization of the Flex catheter that has been developed by VentureMed, LLC, through the innovation platform of University of Toledo (UT) Research and Economic Development and through the academic health center, which is a partnership between UT and ProMedica, a regional health system. Rocket Ventures has provided initial funding to the program and will continue to consult on this project. The goal is to bring to market the device in a 3-year time period. The Flex catheter seeks to address the issue of multiple balloon angioplasties associated with the treatment of peripheral arterial disease. It is a cutting and scoring device for plaque modification with more flexibility and reach, as compared to the current U.S. Food and Drug Administration (FDA)-approved devices for plaque modification. The Flex catheter has a custom cutter that allows the surgeon to score custom lengths of plaque without the need for repeated balloon inflations. The lead applicant is the University of Toledo, and the collaborating partners are VentureMed LLC, Creganna-TACTx Medical, and Promedica.

Detailed Review

- **Technical Merit and Plan**

The technical plan of the project is the development of a flex catheter, which will allow the surgeon to score custom lengths of the plaque within the artery. This mitigates the need for multiple balloon angioplasties and, in turn, enhances the structural efficacy of the arterial wall and causes less tissue damage. There are currently three FDA-approved devices that use either blunt or rigid instruments with length only up to 300 mm, but which do not have the flexibility and reach of the proposed device. The exact specs of the Flex catheter are not clearly articulated in the proposal. Thus, it is difficult to gauge the accuracy and the effectiveness of the Flex catheter. Key technical challenges are the engineering design and the durability of the scoring device, as well as their functionality in the in vivo models. The applicants claim that they have completed a few animal in vivo tests, but this critical data is not included in the proposal. A number of details pertaining to the execution of the aims are missing, and there is a lot of generalization on the execution.

As the technical plan focuses on addressing the advanced research and development issues of the project, it is not yet ready for the current requirements of the RFP. From a development standpoint, it would be useful to see go/no-go decision milestones for proceeding from in vivo experiments into clinical testing. For example, the metrics that are important for a performance advantage need to be clearly articulated. A detailed description of the contingencies in place to successfully execute the project also needs to be clearly explained. The proposal does not meet the requirements of the RFP on Technical Merit and Plan.

- **Commercialization Strategy**

The team has worked in the assembly of resources in the San Francisco Bay area and Minneapolis for future rounds of venture capital funding. The commercialization plan indicates a plan for out-licensing the Flex Scoring Catheter and downstream products to a major medical company for manufacturing and distribution/marketing/sales. Prospective companies are not named, so it is difficult to determine whether

Ohio would retain any downstream development benefit. A local assembly and production facility is mentioned, but this may be inconsistent with the pure out-licensing model described.

The product proposes 6 percent market penetration with annual yield revenues approaching $22 million by 2016. The exact strategy to achieve this is unclear, as is the rationale for the proposed commercialization pathway. The exact number of Ohio jobs created is also not clear. The initial jobs created will be those of post-doctoral associates and graduate students. As the commercialization strategy proposes leveraging multiple entities, it may not meet success. A provisional patent has been filed, and a full utility patent needs to be filed before the end of year one, as well as trademark protection. Funds will be required to achieve these. A limited freedom to operate has been obtained by the Toledo law firm of McMillan, Sobanski, and Todd for the applicant. The proposal does not meet the requirements of the RFP on Commercialization Strategy.

- **Performance Goals**

The first goal of the proposal is developing a good laboratory practice (GLP)-grade catheter ready for the first human trial experiments in 18 months. The second goal is the completion of the regulatory 510(k) process by 21 months. The third goal is the securing of financing beyond the 3-year point. At this point there is approximately $1.5 million from venture capital funding and $1 million requested from the OTF state funds. The projected cost of entering the U.S. market is $10 million, so significant follow-on funding still needs to be generated. It is not clear that any additional jobs are generated at VentureMed or its subcontractors for the proposed commercialization. The number of jobs created to sustain this activity is unclear. It appears that venture capital funds will need to be obtained outside of the OTF award and perhaps outside the state of Ohio to sustain this effort. Because the first 3 years is primarily in-depth research and development work, significant job growth in Ohio after the 3-year period is unlikely. It appears that the major economic advantage will remain as licensing fees and royalties to the University with only student and part-time academic jobs created through the OTF efforts. The proposal does not meet the requirements of the RFP on Performance Goals.

- **Experience and Qualifications**

The project management will be spearheaded by Dr. Pigott for the University of Toledo. Jon Klotz is the chief financial officer of VentureMed with 30 years of corporate management experience; he will assist in the management duties, and his salary is being paid by Rocket Ventures. The University of Toledo will subcontract Creganna TACTx for prototype and pre-production devices. Gene Jung has more than 20 years of experience in cardiac catheters, but his role in this project is not clearly defined. Dr. John Simpson, an internationally recognized pioneer in interventional cardiology, is a consultant on the project. An engineering facility will be set up in conjunction with Creganna at the University of Toledo for prototype and pre-production of devices. Device biocompatibility for preclinical testing will be conducted by the Ohio-based clinical research organization NAMSA to prepare data for the FDA in conjunction with the 510(k). The company recognizes the need to have a future product pipeline. The proposal meets the requirements of the RFP on Experience and Qualifications.

- **Budget and Cost Share**

The initial development of the Flex catheter was through VentureMed, LLC, which received capital through Rocket Ventures and Promedica. There is a $1.5 million capital investment, but this number is not consistent throughout the proposal. The proposers need to clearly establish the funds available through other mechanisms. An additional $1 million has been requested through the OTF mechanism. The $1.5 million is expected to suffice for the 16-18 month initial period, and at that check point, the first human trials are expected to be ready. Subsequent funding is expected to be secured for a CE mark

(approval to use in European markets) and a small European trial. It is after this that consideration for U.S. trials will be evaluated. Time to market is a projected 3-year timeframe. The total anticipated cost to market in the United States is $10 million.

There is a 1:1 match between the state funds and the cost share; each is at $1 million. Total capital expenses either from state or cost share is zero dollars. This will most likely come from venture capital funds. VentureMed has a cost share of $402,000, and the state funds requested are $605,000. The state funds are requested for personnel and purchased services. Creganna TACTx has a cost share of $50,000 for materials, and the state funds requested are $195,000, primarily for materials and supplies. Creganna is not an Ohio-based company, but with the funds from this proposal, a design capability is expected to be established in Ohio. This is a capability-building effort and does not meet the requirement of the RFP. Promedica has a cost share of $250,000, primarily in form of purchased services. The proposal does not meet the requirements of the RFP on Budget and Cost Share.

Summary of Review and Recommendation

The team has the skill set for addressing the challenges of advanced research and development of the Flex catheter. Animal testing, biocompatibility testing, and obtaining information for 510(k) regulatory certification are important metrics, but the details for project execution are vague. The proposal misses a number of key technical details. The proposal is not clear on the exact amount of funds raised. The key challenges will be to secure follow-on funding, and this will primarily be venture capital outside Ohio. At least three times the funding will be needed to get the device into the market after preclinical trial testing. The jobs created in Ohio after the 3-year period are not clearly tangible and likely insignificant. Jobs will primarily be created in an academic environment and may not be self-sustaining. The partners of VentureMed (Promedica and Creganna TACTx) are well established, but Creganna is not an Ohio-based company, and this proposal is supposed to support the capability-building efforts for the company in Ohio. The innovation of the technology has garnered VC funding from Rocket Ventures, but the role of VentureMed in furthering commercial development is unclear. Moreover, risk associated with the project is high. The proposal is not yet ready for the OTF IPP. The committee does not recommend that this proposal be considered for funds under the Ohio Third Frontier Innovation Platform Program.

OTF IPP 12-265
Novel Regenerative Therapies for Treatment of Cardiovascular Disease
Summa Health System

Proposal Summary

Proposed Budget		
	State Funds	Cost Share
Operating Funds	$2,953,155	$2,985,025
Capital Funds	$0	$0
Subtotal	$2,953,155	$2,985,025
TOTAL	$5,938,180	

The goal of this proposal is to combine and leverage the proprietary stem cell technologies of proposal collaborators Athersys, Inc. (MultiStem adult stem cell products) and Juventas Therapeutics, Inc. (molecular factors for an improved stem cell product) for a variety of conditions involved in cardiovascular diseases (CVD), including acute myocardial infarction (AMI) and chronic heart failure (CHF). The proposal intends to use the funds requested to demonstrate improvement of stem cell therapies through cofactor modulation from the Juventas portfolio. The lead applicant is the Summa Health System, and the primary collaborators are Athersys, Inc., and Juventas Therapeutics, Inc.

Detailed Review

- **Technical Merit and Plan**

This is an interesting proposal for the use of Juventas molecular factors (JVS-100, Dab2-siRNA, MCP-3) to improve the ability of Athersys MultiStem cells to repair and restore cardiovascular function. It would be helpful to see data (which was referenced but not shown) for Project #3 from project leader Dr. Penn's laboratory. From a development standpoint, it would be useful to see technical performance metrics, along with go/no-go decision milestones, for improved or revived cardiovascular capacity before proceeding from in vitro to in vivo experiments to clinical testing. For example, which metrics are important for demonstration of repair and which contingencies are considered if performance metrics are only partially met. The proposal meets the requirements of the RFP on Technical Merit and Plan.

- **Commercialization Strategy**

This proposal describes the primary commercial goal of validating and commercializing the Juventas JVS-100 and Dab2-siRNA factors as clinical reagents. Given the described potential for improved cell therapies for an important area such as CVD, a clinical reagent model seems like the least interesting commercial outcome (and lowest return) for the proposal. Leveraging the Juventas factors to produce an improved proprietary cell therapy would seem to be a better use of the combined intellectual property (IP). Under this business model, there appears to be little benefit to Athersys for its collaboration if anyone can purchase the reagent non-exclusively. A better business model (and more compelling use of Ohio's investment) would be an exclusive (field limited) arrangement between Juventas and Athersys for the improved products, with Athersys entitled to rights of first refusal (in good-faith negotiation) rather than rights of first negotiation. Clarity should be provided on the impact or restrictions of the Athersys-Angiotech partnership (for MultiStem treatment of AMI) on the proposed area of development, given the area of technical overlap. The proposal does not meet the requirements of the RFP on Commercialization Strategy.

- **Performance Goals**

The projection of technical performance is sound; however, it is not clear how these achievements would add to the existing workforce of Summa Health System, Juventas, or Aventis. The Aventis and Juventas technologies (cells and reagents, respectively) either have existing development and production

infrastructure or currently outsource production (SironRX, Aldevron). Simply shifting production capacity to Juventas could be done without the technical achievements proposed in this application. In the proposal, it is stated that positive results from a Phase II clinical trial would be leveraged to attract commercial partnerships. As the proposed work stops at preclinical studies, the timeline for successful completion of a Phase II trial is well beyond the scope of this proposal, and there is no way to attract commercial funding within the 5 years specified by the RFP. The proposal does not meet the requirements of the RFP on Performance Goals.

- **Experience and Qualifications**

The Penn laboratory at Summa Health System clearly has the required expertise to develop the various programs for improving cell therapy, having developed most of the IP that was exclusively licensed to Juventas. However, a more clearly defined path for commercialization via Juventas, or preferably Athersys, would strengthen the proposal. The proposal meets the requirements of the RFP on Experience and Qualifications.

- **Budget and Cost Share**

Although the budget and cost share as described meets the RFP requirements, the majority of the Summa Heath System request for funding is for three research and development components, rather than commercialization. In the Juventas budget, it is not clear how a vice president or director will be required to dedicate a significant amount of time for this work (25 percent and 50 percent, respectively), since the research-grade materials will be made by SironRX. Nonetheless, the proposal meets the requirements of the RFP on Budget and Cost Share.

Summary of Review and Recommendation

While the committee finds this project to be an interesting proposal for research using combined technologies, there is no specific platform close to commercialization as stipulated within the timeline of the RFP objectives. As such, the committee does not recommend that this proposal be considered for funds under the Ohio Third Frontier Innovation Platform Program.

OTF IPP 12-266
Grid Energy Storage Integration Platform for Industrial Power Quality Management
The Tech Belt Energy Innovation Center

Proposal Summary

Proposed Budget		
	State Funds	Cost Share
Operating Funds	$444,000	$360,000
Capital Funds	$514,184	$514,184
Subtotal	$958,184	$982,184
TOTAL	$1,940,368	

The proposal is focused on developing and evaluating distributed energy storage systems (DESS) at commercial and industrial end customer sites. The proposal team is led by the Tech Belt Energy Innovation Center (TBEIC), with collaborators RW Beckett Corporation (Beckett Energy Systems), Case Western Reserve University, Rockwell Automation, and FirstEnergy Solutions. TBEIC would provide a facility where clients could access a multilevel range of testing capabilities to help accelerate their commercialization lifecycle. Beckett Energy Systems would use the laboratory to test their system that is targeting behind-the-meter customer utility bill rate arbitrage by either time-shifting energy use or reducing instantaneous peak demand charges. There may be other benefits in terms of power quality that would accrue to the host customer of such a system.

Detailed Review

- **Technical Merit and Plan**

There is little doubt that a system as proposed by Beckett Energy Systems can be built. However, the details on the technical and cost aspects of what precisely would be built are lacking in the proposal. The key to success will be the power electronics and control system that can dynamically determine what it should be doing to meet the end customer's economic or operational goals at any one time, while also determining the end impact of those actions on the lifetime of the battery portion of the system. More discussion of this part of the technical aspects of the development would strengthen the proposal. The other part of the proposal that is not clear is the operational status of the TBEIC. The reference to the Department of Energy funds and comments in some of the support letters lead to a view that the platform capabilities of the center are not yet operational. There is also confusion as to why a Dry Lab is needed for the testing of the Beckett system. The proposal does not meet the requirements of the RFP on Technical Merit and Plan.

- **Commercialization Strategy**

The proposal is light on commercialization and market data that would support the viability of the Commercial and Industrial (C&I) Energy Storage System (ESS). The proposal seems to reference utility-scale storage connected to the grid with the utility as the customer, not the unique aspects of a system placed behind the utility meter at a customer's site. The focus on the report from Sandia National Laboratories on market sizes for utility applications seems to be a mismatch with the focus of the proposal. The proposal does not meet the requirements of the RFP on Commercialization Strategy.

- **Performance Goals**

The high-level 2016 goals of unit sales projections (500 C&I EES Units and 110k Battery Modules) and job creation (288 full-time employees) are well articulated, but, again, the lack of more detailed metrics on costs per kilowatt and kilowatt hour make it difficult to evaluate the commercial probability of meeting these goals. Limited mention of the economics, cycle life, utility rate structures, etc., does not give the

committee much confidence that the macro performance goals would be achieved. The proposal does not meet the requirements of the RFP on Performance Goals.

- **Experience and Qualifications**

Similar to the comment in the Technical Merit and Plan section, the status of the TBEIC in terms of facility build-out and personnel is unclear. The strength of an innovation platform will be based on the proven strength of both the facilities' capabilities and the experience of the key people. More details on the TBEIC's operational status and more description of the key personnel and their unique capabilities relating to energy storage systems would strengthen the proposal, should the team decide to resubmit in the future. The proposal does not meet the requirements of the RFP on Experience and Qualifications.

- **Budget and Cost Share**

A significant portion of the budget is allocated to capital funds relating to the Dry Lab. It is not clear how this relates to testing of the Beckett product that seems to be the primary focus of the proposal. Elaborating how the Dry Lab would be used to support this function would be critical if the applicant team resubmits the proposal in the future. The support of Rockwell Automation appears to be more as a hardware vendor than a true collaborator, as the majority of the cost for Rockwell is for its existing product hardware and not personnel costs that may be used to strengthen the center. It would appear that Rockwell equipment is needed to functionalize the TBEIC center, but beyond that there is not much of a collaboration. The proposal does not meet the requirements of the RFP on Budget and Cost Share.

Summary of Review and Recommendation

The proposal has several main deficiencies. The commercialization plan is not well laid out. The focus on utility market opportunities is confusing, given the focus of the main product being tested under the proposal. There is a very interesting C&I opportunity for energy storage, but it is not elaborated on in the proposal. The performance goals are not supported with critical data on the C&I product capabilities and economics. Finally, the budget and cost share on the capital funds do not seem to support the focus of the proposal directly, but rather provide indirect support for TBEIC. The committee does not recommend that this proposal be considered for funds under the Ohio Third Frontier Innovation Platform Program.

OTF IPP 12-269
Integrated Regional Device Manufacturing (IRDM)
Lorain County Community College

Proposal Summary

Proposed Budget		
	State Funds	Cost Share
Operating Funds	$3,000,000	$1,851,000
Capital Funds	$0	$1,149,000
Subtotal	$3,000,000	$3,000,000
TOTAL	$6,000,000	

The focus of this project is on demonstration and development of three microsystems packaging applications. The areas of focus are sensing and automation technologies, medical technologies, and situational awareness and surveillance systems. The lead applicant is Lorain County Community College (LCCC), in collaboration with Therm-O-Disk, H-Cubed, and Orbital Research, Inc.

Detailed Review

- **Technical Merit and Plan**

The proposal consists of three very different projects in terms of market and application: sensing and automation technologies, medical technologies, and situational awareness and surveillance systems. The proposal presents reasonable project plans but lacks any details on technical methods or approaches to be used in addressing the technical challenges of the proposed projects. The details associated with executing the sensor design and implementation is varied for the three sensor platforms. One project needs animal studies, which cannot be supported by the proposed platform. The project personnel seem qualified to lead project execution but lack expertise in the three application areas. The technical challenges in developing commercially viable products cannot be overlooked. The proposal does not meet the requirements of the RFP on Technical Merit and Plan.

- **Commercialization Strategy**

The commercialization strategy for the first two projects is highly dependent on the proposal's two industrial partners (Therm-O-Disk and H-Cubed). These companies are active in the applications area and are capable of handling the described commercialization activities in the proposal. The third project commercialization partner is Orbital Research. The market opportunity in this area is limited, and there are off-shore competitors. While the plan for the first two projects is reasonable, the third is weak and does not address the production issue. The proposal does not meet the requirements of the RFP on Commercialization Strategy.

- **Performance Goals**

The performance goals of this project are ambitious in terms of economic development impact and job creation. The proposal suggests a cumulative economic impact of $30.4 million, including 23 jobs created. Attracting additional companies is unlikely beyond the existing industrial partners. However, the overall goals do meet the program requirements. The project proposes development and maintenance of micro packaging capability at LCCC to provide services to commercial entities, which appears to be a service function and not especially consistent with the principal goals of the OTF IPP. The proposal does not meet the requirements of the RFP on Performance Goals.

- **Experience and Qualifications**

The project team is well qualified to manage the project execution; however, they lack experts in related technology areas of the three projects described in the proposal. The demonstration of the proposed projects will depend highly on overcoming many technical challenges that need to be addressed. This is a critical failure in the proposal. The proposal does not meet the requirements of the RFP on Experience and Qualifications.

- **Budget and Cost Share**

The LCCC cost share includes $609,000 for building and structures and $80,000 for architectural engineering professional services. These funds are to support the development or expansion of a not-yet-in-place innovation platform, which is not consistent with the intent of the program's RFP. The IPP is targeting existing platforms, but this data shows that this platform infrastructure (new facility) is still under development. The budget items from Therm-O-Disk and Orbital Research include outsourcing circuit board design and layout for two of the proposed products. The budget allocation for these tasks is very small, even though the activities represent a very important part of this proposal. The proposal does not meet the requirements of the RFP on Budget and Cost Share.

Summary of Review and Recommendation

The proposal presents an ambitious plan to support the development of products in three different technology and application areas. Two of the partners are established in their respective application area, while the third (Orbital Research) is a small company with relevant research. The innovation platform relevant to the proposal is not fully developed and will need time to complete, tool, and calibrate. A major weakness in this proposal is the lack of expertise to address the technical development of the products, raising serious concerns regarding the applicant team's ability to meet the stated performance goals. In addition, two of the partner companies indicate that they will outsource their design activities, but no entity is identified to do this work. The committee does not recommend that this proposal be considered for funds under the Ohio Third Frontier Innovation Platform Program.

OTF IPP 12-270
Advancing Material Technologies in Ohio through Surface Engineering
Case Western Reserve University

Proposal Summary

Proposed Budget		
	State Funds	Cost Share
Operating Funds	$709,307	$1,101,862
Capital Funds	$386,886	$0
Subtotal	$1,096,193	$1,101,862
TOTAL	$2,198,055	

This proposal describes cooperative projects among the lead applicant, Case Western Reserve University (CWRU), specifically its Case Center for Surface Engineering (CCSE) and its Swagelok Center for Surface Analysis of Materials (SCSAM), and three industrial partners. The overall objective is to improve the analytic capabilities of SCSAM to enhance its capacity for performing analytic services to Ohio companies, and thus create jobs. The improved analytic capacities are to be demonstrated by applying them to problems of interest to the industrial partners, specifically improving coatings for corrosion resistance, improving lifetimes of fuel cells, and improving the corrosion resistance of turbine blades that must function in high-pressure, high-temperature environments. The industrial collaborators are MesoCoat, Inc.; Rolls-Royce Fuel Cell Systems (U.S.), Inc. (RR); and GE Aviation (GE).

Detailed Review

- **Technical Merit and Plan**

The centerpiece of the project is the purchase of four strategic upgrades to five major SCSAM instruments, which will enhance the capabilities of the organization to analyze materials, thin films, structures, surfaces, and interfaces, and are of central importance to the proposed research. The proposal is based on the strategy that, if these upgrades are made, the laboratory will be in a better position to service outside requests and will therefore be more attractive to local industry.

The specific applications involving the three industrial partners are (1) characterization of MesoCoat's *PComP*™ family of corrosion-resistant nanocomposite coatings, which are tough, avoid the toxicity of Cr plating, are cheaper than carbide coatings, and have been shown to result in significantly improved wear resistance in several applications; (2) generating better understanding of the nanoscale degradation and poisoning mechanisms in the cathodes and anodes of RR fuel cells; and (3) generating better understanding of the damage mechanisms of blades in GE turbine engines, which must function in corrosive, high-pressure, and high-temperature environments. While these applications all have merit, the first priority of the proposal is clearly the equipment upgrade. The remaining projects are not well described and give every indication of merely being add-ons to justify the purchase of equipment. As such, the proposal does not meet the requirements of the RFP on the Technical Merit and Plan.

- **Commercialization Strategy**

The stated commercialization strategy is to keep Ohio competitive by leveraging state-centric assets to the benefit of Ohio companies. While this is a worthwhile goal, it is not a substitute for innovation or for a commercial product. The proposal does not meet the requirements of the RFP on Commercialization Strategy.

- **Performance Goals**

The performance goals listed are very general and make no mention of quantitative measures of improved performance of coatings, fuel cells, and turbine blades. Job creation is admittedly hard to estimate, but the only specific estimate given in the proposal is that of MesoCoat. The committee further notes that protecting and enhancing jobs is not equivalent to job creation. While the introduction of the proposal lists the improvements to be made to the different instruments, these are also very general and cannot be considered goals. The proposal does not meet the requirements of the RFP on Performance Goals.

- **Experience and Qualifications**

The project director, Dr. Frank Ernst, is the Leonard Case Jr. Professor of Engineering at CWRU. He has more than 25 years of experience on transmission electron microscopy and associated diagnostic techniques. The MesoCoat project leader is Mr. Andrew Sherman, founder and president of MesoCoat, Inc., who has 25 years of experience in coatings, has authored more than 95 papers in the field, and has been involved in 11 startups. The RR technical leader is Dr. Zhien Liu, materials and process engineering senior specialist, who has more than 20 years of experience in the field. The GE lead is Dr. Douglas Konitzer, manager of airfoil materials in the material and process engineering department. He is responsible for the development of alloys and coatings for gas turbine engines. The proposal meets the requirements of the RFP on Experience and Qualifications.

- **Budget and Cost Share**

The industrial partners are providing the following amounts to the program: $300,000 from MesoCoat; $363,297 from RR, and $50,000 from GE. The remainder is being provided by CWRU. The contribution from MesoCoat is a combination of salary support for necessary personnel, supplies, and contracted services from SCSAM. The RR contribution is mainly cash. Part of the GE contribution is a pass-through of a contract with the Office of Naval Research, but this can be considered acceptable under the RFP. The proposal meets the requirements of the RFP on Budget and Cost Share.

Summary of Review and Recommendation

The primary objective of this proposal is to purchase upgrades to existing SCSAM instrumentation to enhance the capability of the center for analysis and thus make it more attractive for performing analytic services to industries in the area. In principle, this is worthwhile but it misses the point of the IPP. Of the three partners, the project that appears to have the most job-creation potential is that involving MesoCoat. This is reflected in the fact that the only specific job-creation estimate is that given by MesoCoat, the others being indirect. Given all the shortcomings described above, the committee does not recommend that this proposal be considered for funds under the Ohio Third Frontier Innovation Platform Program.

OTF IPP 12-276
Innovation Platform for Solar Photovoltaics
University of Toledo

Proposal Summary

Proposed Budget		
	State Funds	Cost Share
Operating Funds	$2,996,365	$3,115,899
Capital Funds	$0	$0
Subtotal	$2,996,365	$3,115,899
TOTAL	$6,112,264	

This proposal seeks to establish an Innovation Platform for Solar Photovoltaics (IPSPV) at the University of Toledo, which will support the near-term commercialization goals of four Ohio-based companies. In each case, the collaborators have a product that requires additional research in the area of photovoltaics (PV) in order to accelerate market entry and sales growth. The IPSPV, working through the framework established by the University of Toledo Wright Center for Photovoltaics Innovation and Commercialization (UT/PVIC), will support the following companies and products: Willard & Kelsey, Low Voltage cadmium telluride (CdTe) PV Modules; Solar Spectrum, PV Windows; Xunlight, Off-Grid PV products; and Isofoton, High Concentration PV.

Detailed Review

- **Technical Merit and Plan**

The main goal of this proposal is to establish an Innovation Platform for Solar Photovoltaics research to help Ohio-based companies solve technical challenges related to commercialization of existing products. The key high-level challenges to this effort are the risks of shared environments, conflicts between student education and commercialization, competing priorities, and translation of laboratory-scale innovation to products and markets. These challenges will be met by implementing policies and procedures around equipment and personnel access, involving students in commercialization activity, focusing on resource allocation, and scaling up prototyping for new products. More specifically, the technical challenge for Willard & Kelsey is final development of low-voltage, high-efficiency modules that are cost competitive**.** For Solar Spectrum, the key challenge is proving the viability of their product at commercial scale, with high enough efficiency to compete against established alternative products. Xunlight will have to prove their manufacturing process relating to their smaller niche products. Isofoton's key technical challenge is having a low enough production cost that they can compete in today's ultracompetitive market place. Though these tasks will be challenging, they may be achievable by the proposal team. The proposal meets the requirements of the RFP on Technical Merit and Plan.

- **Commercialization Strategy**

The proposal seeks to assist in the commercialization strategy of its four Ohio-based collaborators by accelerating and facilitating market entry. Willard & Kelsey will work with UT/PVIC to address technical and commercial challenges to complete development of low-voltage CdTe PV modules. Given the fact that Willard & Kelsey recently laid off a significant portion of their workforce, the committee has major concerns about this collaborator's ability to execute its commercialization and market entry. Willard & Kelsey's answers to questions at the committee's second meeting were insufficient to alleviate this concern. The other three collaborators appear well positioned for their commercializations. Solar Spectrum will develop a transparent PV window technology to gain market entry into the commercial building market. Xunlight Corporation will work with UT/PVIC to solve commercial challenges related to market entry into the off-grid solar market. Isofoton will develop a manufacturing technique for next-generation high concentration PV modules.

Despite these stronger strategies, the committee has some concern regarding the overall solar market at this time and whether the future market will be receptive to these new products. Given this issue and the serious concerns about Willard & Kelsey, the committee believes that the proposal does not meet the requirements of the RFP on Commercialization Strategy.

- **Performance Goals**

The proposal states that as a result of this grant, after 3 years, 299 jobs will have been created and $135 million of revenue generated. Considering the technical challenges related to some of the technologies, these targets seem to be a bit aggressive, especially in a 3-year timeframe. More specifically, Willard & Kelsey has not sufficiently demonstrated successful performance on past grants and loans from ODOD, which seriously draws into question their ability to perform here. Additionally, there have been some performance issues (failing to generate the expected number of jobs) related to current loans outstanding to ODOD. The proposal does not meet the requirements of the RFP on Performance Goals.

- **Experience and Qualifications**

The academic, research, and commercial collaborators involved in the project have extensive experience in their specific areas of expertise. The inclusion of Professor Heben, along with the high-level executives from the Ohio-based companies, adds strength to this proposal. The team at Willard & Kelsey receives high marks for experience and qualifications, but their involvement in the project raises some concerns in the area of execution due to the recent business downturn at the company. The other commercial partner team members have relevant experience and qualifications for the most part. Despite the concern about Willard & Kelsey, the committee believes that the proposal meets the requirements of the RFP on Experience and Qualifications.

- **Budget and Cost Share**

The ratio of cost share to state funds is slightly over 1:1, and the overall budget is reasonable. The commitment letters from each of the collaborators state their financial commitments to the project. Additionally, the proposal includes numerous letters of support from indirect beneficiaries of the grant. While there is a high level of interest from a diverse group of companies, the letters do not include any commitments of substance. Regarding the budget, the committee has a small concern, namely that the collaborators have an even split amongst them, which raises the question as to the basis for determination of these amounts. Despite this concern, the proposal meets the requirements of the RFP on Budget and Cost Share.

Summary of Review and Recommendation:

The committee feels that Xunlight and Solar Spectrum have good commercialization plans and are far enough along that there is a reasonable chance of success within the 3 to 5 year timeframe. While Isofoton also has a good commercialization plan, the committee feels there is somewhat more significant execution and commercialization risk; however, this risk is not the chief problem with this proposal. Regarding Willard & Kelsey, the committee feels that given their apparent performance on past grants/ loans and recent need to re-tool their operation (which resulted in substantial lay-offs), the execution risks are simply too high in this proposal. The applicant team should seriously consider pursuing future funding opportunities, particularly if they are able to persuasively convey the direct connections between the collaborators, as well their ability to execute all elements of their future proposal. The committee does not recommend that this proposal be considered for funds under the Ohio Third Frontier Innovation Platform Program.

OTF IPP 12-277
Ohio Sensor and Semiconductor Innovation Platform (OSSIP)
The Ohio State University

Proposal Summary

Proposed Budget		
	State Funds	Cost Share
Operating Funds	$2,197,999	$2,599,198
Capital Funds	$400,000	$0
Subtotal	$2,597,999	$2,599,198
TOTAL	$5,197,197	

This proposal describes cooperative projects among the lead applicant, The Ohio State University (OSU) Nanotech West Laboratory (NWL), and several collaborators to characterize, grow, pattern, and otherwise process compound semiconductor samples and to give advice and recommendations regarding the design of a proposed cryogenic electro-optic probe station. The proposal is well written, with minor ambiguities clarified during the team's interview at the committee's second meeting. Two of the projects—the development of new infrared-detector arrays and the growth of bulk gallium nitride (GaN)—clearly advance the state of the art and can be accomplished in the 3-year timeframe. The third project—the probe station—does not appear to be significant, but new technologies planned for incorporation were explained during the interview. The collaborators are the Cincinnati Electronics Division of L-3 Communications, Inc. (L-3); Momentive Performance Materials Quartz, Inc. (MPM), and Lake Shore Cryogenics, Inc. (LSC). The Innovation Platform itself is not described in the original proposal, but details were brought out during the interview.

Detailed Review

- **Technical Merit and Plan**

The project makes good use of the different strengths and capabilities of the participants. NWL will make available its compound semiconductor expertise and capabilities to assist L-3 in producing a working 100 mm focal-plane indium antimonide (InSb) detector array of pixel size 10 μm × 10 μm. The result will be a 2× size reduction compared to the present 15 μm × 15 μm technology. With the larger size already a product, fabrication should not create insurmountable problems. The realization of a short-wavelength infrared detector aimed at atmospheric windows will be based on indium gallium arsenide (InGaAs) and use a multi-quantum-well structure. This is a more difficult challenge and will require more involvement by NWL.

MPM is planning to produce 100 mm substrates of GaN for sale to manufacturers of light-emitting diodes (e.g., Cree, Inc.). At present, GaN material is typically grown on sapphire, which results in large numbers of defects that compromise device performance. The availability of large-area GaN substrates would solve this problem, so there has been a clear market need for some time. The unavailability of such substrates is not for lack of trying (DARPA has invested over $100 million in GaN), but is a consequence of the technical challenges, which are immense. The MPM process grows GaN material at 20 μm/hour using vapor phase epitaxy at a pressure of 100,000 psi and a temperature of 700°C. MPM has already made wafers smaller than the 4″ diameter target size, so this is definitely worth the effort. The resulting material will be characterized by NWL.

In its interaction with LSC, NWL will give advice and recommendations for designing a next-generation cryogenic electro-optic probe station intended for large-area samples. As a user well experienced in compound-semiconductor characterization, NWL should have no difficulty fulfilling this role. Advances here include the introduction of optical probes, giving additional diagnostic power.

The proposal meets the requirements of the RFP on the Technical Merit and Plan.

- **Commercialization Strategy**

The commercialization strategy for L-3 and LSC is well specified and reasonable. The major customer of L-3 is the military, to which typical commercial measures do not apply. However, L-3 also sells to other organizations, and their strategy here is reasonable. LSC has been in business for more than 50 years and is a well known, well established, and well respected vendor of cryogenic equipment with a large user base and a solid reputation. Although the proposal is short on information regarding target customers, this information was provided during the interview at the committee's second meeting.

However, the committee has a major concern regarding the commercialization strategy of MPM. Taking the numbers provided in the proposal and verifying these during the interview, it is impossible for them to show a profit for the 4″ GaN wafer project in the foreseeable future. This holds true not only for high-end customers for which reduced-defect GaN would offer considerable cost savings and competitive advantages, but also for contingency customers should the proposed benefits of MPM GaN substrates not be realized. Using the numbers provided, MPM must either charge substantially more per wafer or materially cut production costs to make their business model viable. The proposal does not meet the requirements of the RFP on Commercialization Strategy.

- **Performance Goals**

The proposal's goals are reasonable and the mileposts clearly specified. However, the committee has concerns about the overall nature of the project, in addition to the specific concerns about MPM described above. The proposal and the interview results generate the distinct impression that this project is designed more to provide opportunities for NWL than to create jobs in Ohio. This impression is further supported by the general lack of overlap between the MPM project and the rest of the group. As a result of these drawbacks, the proposal only marginally meets the requirements of the RFP on Performance Goals.

- **Experience and Qualifications**

The principal investigator of this proposal is Dr. Robert J. Davis, the current director of NWL, who has extensive management experience both in this position and in industry. His management experience, coupled with more than 28 years of experience in semiconductor device materials, fabrication, and test, make him an excellent choice for this task. Dr. Mark Greiner, chief technical officer of L-3 Cincinnati Electronics, also has approximately 28 years of experience in the field. Dr. Kirsh Afimiwala, GaN platform leader of MPM, has more than 35 years of experience in technology development, commercialization, and solving complex problems in materials applications. The proposal meets the requirements of the RFP on Experience and Qualifications.

- **Budget and Cost Share**

The industrial partners are giving substantial funding to the program: $1,200,000 from L-3, $526,764 from MPM, and $330,000 from LSC. Approximately $400,000 of this will go into capital equipment to be located at NWL. The budget narrative clearly spells out how funds will be spent, and the letters of commitment are specific and detailed. The remainder of the cost share is being provided by OSU. The proposal meets the requirements of the RFP on Budget and Cost Share.

Summary of Review and Recommendation

As stated above, the proposal is well written with only a few loose ends, and these were resolved during the interview at the committee's second meeting. The collaborators are skilled and experienced in what they do and overlap well with the NWL, if not in every case with each other. In particular, all three collaborators plan to make substantial advances in the present state of the art: L-3 in infrared detector arrays, LSC in probe stations, and MPM in the growth of GaN substrates. However, the proposal also has several shortcomings, particularly with regard to MPM's commercialization plan. The committee does not recommend that this proposal be considered for funds under the Ohio Third Frontier Innovation Platform Program.

OTF IPP 12-282
Bio-Based Composites Innovation Platform
The Ohio State University

Proposal Summary

Proposed Budget		
	State Funds	Cost Share
Operating Funds	$2,779,946	$2,402,910
Capital Funds	$220,000	$600,000
Subtotal	$2,999,946	$3,002,910
TOTAL	$6,002,856	

This project is aimed at developing or adapting existing polymer matrix composite (PMC) processing technology to bio-based composites. The lead applicant is The Ohio State University (OSU), along with three industrial collaborators that are PMC manufacturers: Commercial Vehicles Group Inc. (CVG), GDC Inc., and Natural Fiber Composites Corporation (NFCC). The program seeks to validate existing manufacturing processes for bio-based materials to address needs of industrial partners including extrusion, injection molding, thermoforming and three dimensional molding. In addition, the use of alternative bio-based resins and fibers will be explored. Additional effort will be focused on supply chain development and recruitment of customers and end users of the materials and components developed in this program.

Detailed Review

- **Technical Merit and Plan**

The proposal aims to transition bio-based composite materials developed at OSU's Ohio Bioproducts Innovation Center (OBIC) to a host of products. However, the proposal would be more effective and achieve greater clarity if a small number of specific parts were identified that would lead to feasible and economically viable commercial transitions. A missing element of this proposal is the identification of specific requirements for the composite parts, how these parts are currently manufactured, and how the use of bio-based composites provides a competitive advantage in either performance or cost. The technical strategies to achieve the proposed transitions are surprisingly unclear, unsupported by technical data, and lacking in specifics. The proposal does not meet the requirements of the RFP on the Technical Merit and Plan.

- **Commercialization Strategy**

The commercialization opportunities focus on CVG's existing product lines in the vehicle area and also on developing or adapting existing products from CVG and NFCC. The proposed commercialization plan is vague, with only a single part clearly identified as a commercialization opportunity (a component of a planter). GDC offers to develop small, medium, and large-scale parts without offering details on specific components. The proposal does not meet the requirements of the RFP on the Commercialization Strategy.

- **Performance Goals**

The proposal shows an impressive array of products that could exploit the bio-based composites technology. However, such a large set of products seems to be a superficial approach to commercial transition in that no single set of products would receive sufficient attention to achieve a successful commercial transition. The committee notes that the Bio-Preferred Label is a key product discriminator, and specifying which products would benefit from such a label would be helpful to the reviewers. Successful execution of this activity requires the hiring of a new faculty member who is an expert on bio-based composites, as stated by the proposers. However, it is unlikely that a new faculty member could be

hired, who could then hire students and train them to be sufficiently productive to meet the research goals of the project, in the proposed timeline.

OTF IPP funding would have significant economic impact in that there would be a projected net job growth of more than 120 Ohio-based jobs created, which would result in wages totaling more than $13.2 million a year. The proposers claim that this is a very conservative estimate and that the realized impact after 5 years could be much more substantial. The proposal meets the requirements of the RFP on Performance Goals.

- **Experience and Qualifications**

OSU will serve as the lead on this project. The faculty members from OSU are qualified and sufficiently experienced in aggregate to lead this proposal. OBIC had prior support under a Third Frontier award of $11.5 million in 2005. OBIC also received support on the Wright Capital Project Awards to develop a bio-based composites pilot plant, which was completed. The industrial collaborators are committed to the project and have clear synergy with the processes that are to be updated and validated for use with bio-based composites. The committee noted the support letter from GDC, Inc., stating their intention to open a manufacturing line in Ohio. The letter was not compelling because of the lack of a clear commitment from GDC. The supply chain from product development through commercial utilization is clearly defined. Key personnel and their skills are well articulated in the proposal. The proposal meets the requirements of the RFP on Experience and Qualifications.

- **Budget and Cost Share**

The overall budget appears reasonable relative to the proposed scope of the project. The cost share from CVG, GDC, and NFCC appears reasonable. The lead institution has committed cost share to the program, including $600,000 in engineering and architectural services, as well as $672,000 in unrecovered indirect costs and cash by the university. All three industrial collaborators have also committed substantial cost share to the program at greater than the level required by the RFP ($1,350,000 state versus $1,730,000 industry for a cost share ratio of 128 percent). This shows tremendous support by the industrial collaborators for this project. The proposal exceeds the requirements of the RFP on Budget and Cost Share.

Summary of Review and Recommendation

This proposal seeks to advance processing technology for bio-based composites. Several processes would be considered in the proposed program for high-volume manufacture of bio-based composites. A focused technical plan, as well as associated commercialization plan, is not articulated in the proposal; specifics on products and potential impact on high-volume manufactured components are missing. Reliability and performance of the parts produced by the various processes is not given enough attention in this proposal. The combination of partners offers the potential to develop an industry based in Ohio. The committee is intrigued by the support letter from GDC stating the intention to open a manufacturing line in Ohio, although a stronger commitment would have been more compelling, as well as a job creation forecast by CVG and NFCC for Ohio-based jobs. Addressing the weaknesses described in this review would greatly strengthen this proposal should it be resubmitted again in the future. The committee does not recommend that this proposal be considered for funds under the Ohio Third Frontier Innovation Platform Program.

OTF IPP 12-284
Ohio Platform for Tomorrow's Industrial Medical Imaging Systems and Equipment—OPTIMISE
Case Western Reserve University

Proposal Summary

Proposed Budget		
	State Funds	Cost Share
Operating Funds	$3,000,000	$2,864,592
Capital Funds	$0	$330,000
Subtotal	$3,000,000	$3,194,592
TOTAL	$6,194,592	

With collaborations that involve all of the major original equipment manufacturers (OEMs), the medical imaging physics group at Case Western Reserve University (CWRU) is growing into the Ohio Platform for Tomorrow's Industrial Medical Imaging Systems and Equipment (OPTIMISE), an innovation effort that uses its expertise in sophisticated mathematical modeling, the design of new industrial products, optimization of the performance of those products, and the providing of feedback for corrections during the manufacturing of the products to assist companies with the later-stage development and commercialization of innovative products—activities that they cannot carry out by themselves or even, perhaps, with a single additional partner.

For this proposal, CWRU's OPTIMISE group, the lead applicant for the project, will collaborate on the following projects: with Quality Electrodynamics, LLC (QED), to develop new radiofrequency (RF) breast-coil-biopsy-plate systems dedicated to the significant reduction of false positives and false negatives in breast cancer diagnostics; with Philips Medical Systems, Inc., to develop RF spine coils for both excitation and detection of proton signals for ultra-high-field scanners; and with Hyper Tech Research, Inc., to develop magnesium diboride (MgB_2) designs of magnetic resonance imaging (MRI) systems utilizing higher-temperature superconducting main magnets in order to reduce the need for increasingly scarce liquid helium supplies. All three companies have a history of working with CWRU's medical physics group. Philips will also be working directly with QED to produce the spine coil for the 7-Tesla (7T) MRI system.

Detailed Review

- **Technical Merit and Plan**

As written, the proposal suggests that all three commercial participants in the project have a good understanding of the technical issues that need to be addressed to solve the problems stated. It also details how OPTIMISE's hardware modeling and computational programming expertise could be used to facilitate overcoming those challenges and each phase of the work, as well as its key steps, IPP metrics, and very detailed schedules related to the deliverables. Hyper Tech explained that a conduction-cooled niobium-titanium (NbTi) magnet, a high-risk approach, is an alternative to its MgB_2 approach and described well the technical hurdles it expected to encounter in making the MgB_2 products. However, even after significant questioning of the applicant team by the committee, OPTIMISE's leaders did not elucidate the makeup and strength of the proposed platform. For example, they did not adequately answer questions about the uniqueness and intellectual property (IP) status of their hardware modeling and computational programming capabilities, the composition of the platform with regard to software technology, consulting by various members of the faculty in CWRU's physics department, and supporting equipment and facilities. Since the committee is still not convinced that OPTIMISE is an established platform as defined by the RFP, the proposal does not meet the requirements of the RFP on Technical Merit and Plan.

- **Commercialization Strategy**

There are significant market drivers and competitive advantages for all three of the collaborators participating in this project. Beginning in 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 Centers for Medicare and Medicaid Services (CMS) reimbursement for breast scans. The European Imaging Society has recently issued equivalent guidelines. The largest independent RF coil manufacturer, QED, has established relationships with several major MRI OEM's for the supply of RF coils, and supported by previous grants, quickly reached the market entry stage and successfully commercialized multiple RF coils using this global OEM relationship model.

Philips has extensive global multi-functional resources to achieve the commercialization goals, and it will work with QED to produce the spine coil for the 7T MRI system. The coil will be introduced commercially within 5 years as an option to the Philips 7T system and will also be offered to the installed base (3-Tesla [3T]). Philips has thirteen 7T systems installed or waiting to be installed, and its share of the 7T market is increasing, reaching 50 percent in 2011. Philips expects that 7T MRI systems will gain U.S. Food and Drug Administration (FDA) clearance within 5 years; however, much depends on the expansion of clinical applications and the demonstration of utility beyond that of 3T by showing improved diagnosis of pathologies not detectable at 3T.

Hyper Tech has been leading the world in producing MgB_2 wire and electromagnets, and it is currently supplying MgB_2 wire to both Siemens and GE for their MgB_2 magnet programs. Hyper Tech's MgB_2 wire is on track for market entry for mainstream full-body MRI systems by 2014. Importantly, the price of liquid helium will continue to increase drastically through 2017. For MRI systems to remain cost effective in the future, current liquid helium bath-cooled magnets must be replaced by conduction-cooled magnets. Hyper Tech has taken its MgB_2 wire through imaging, incubation, and demonstration stages, and it is currently in the market entry and manufacturing scale-up stages. The proposal meets the requirements of the RFP on Commercialization Strategy.

- **Performance Goals**

All three participants present sound assumptions for their projections of sales (number of units sold and the related sales revenue) and jobs (with fair salary estimates and personal wealth) that will be created during and as a result of this project. Furthermore, the performance of all participants on prior OTF grants was very good. The proposal meets the requirements of the RFP on Performance Goals**.**

- **Experience and Qualifications**

OPTIMISE resides in the Department of Physics at CWRU, which has a well-established reputation for OTF grant commitments. The physics imaging group has had self-sustaining financial support from the industry for 30 years, independent of government grants. OPTIMISE's industrial partners include all five leading OEM's (GE, Hitachi, Philips, Siemens, and Toshiba), and earlier efforts of CWRU's physics imaging group led to four startups, including ViewRay and QED, the leading company in the design and supply of 7T MRI coils to leading MRI research groups around the world. QED has demonstrated the highest-performing MgB_2 and Nb_3Sn superconductors in the world and has a worldwide customer base (Siemens, GE, Philips, Rolls Royce, NASA, the Department of Energy, the National Institutes of Health, the U.S. Navy, and the U.S. Air Force).

Currently, Hyper Tech employs 26 employees for its cryogenics vessels in Eden Cryogenics in Plain City, Ohio, which is a unique business servicing high-technology cryogenic and vacuum applications. In the

past 2 years it has installed $3 million of equipment for advanced manufacturing of MgB_2 superconductors, testing of superconductors, and the fabrication of superconducting coils for MRI, SFCL, and superconducting generators. Hyper Tech's revenue was $2 million in 2009, $5.3 million in 2010, and $5.4 million in 2011. $6 million is forecast for 2012, and $5.2 million (an in-person correction of the $3.2 million shown in the written proposal) is projected for 2013. Hyper Tech was profitable in 2010 and 2011 and is expected to continue to be profitable in the future.

OPTIMISE/CWRU's medical imaging physics group has an RF coil laboratory that will be used for the OPTIMISE development, building, and testing of models for 3T and 7T MRI systems, including head/neck/spine coils, full-body coil systems with RF shielding, and breast coils.

OPTIMISE plans to appoint a program manager and technical director with extensive laboratory management and MRI experience as its principle investigator (PI); an advisory board with members from CWRU's physics faculty, QED, and ViewRay; and a director of the Science and Technology Entrepreneurship Program at CWRU as the commercialization director of OPTIMISE, which the committee feels is a great addition. No one from Hyper Tech or Philips is listed in this section because of the limitation to five bios in the proposal; however, based on their commitment to the program, it is assumed that each of the participating companies will appoint very experienced people internally to be responsible for technology development and commercialization. OPTIMISE/CWRU's leaders do not include a work plan in the proposal, indicating that the commercial partners will drive the individual projects within the platform, while the leaders at OPTIMISE will be responsible for communicating, coordinating data and other information, evaluating and assessing progress, allocating funds, etc. All three commercial entities have worked with CWRU's physics imaging group and have management of IP agreements in place with OPTIMISE; these agreements will be extended to include this project. The proposal exceeds the requirements of the RFP on Experience and Qualifications.

- **Budget and Cost Share**

The ratio of cost share to state funds from the IPP is greater than 1:1, which shows the strong commitment of the non-OPTIMISE participants to the project. $330,000 from QED, which is a third of its cost share contribution, will be used for the purchase of tooling specific to manufacturing the coil biopsy system. Philips will provide cost share of $864,000 as cash plus 200 hours of 7T system time for coil testing in the Cleveland factory, an in-kind contribution valued at $170,000. Indirect costs will be covered by 4 percent of operating expenses from state funds. As required, the entire cost share is in cash. The proposal meets the requirements of the RFP on Budget and Cost Share.

Summary of Review and Recommendation

When the OPTIMISE platform is fully established and its competitive advantages are clearly elucidated, it will be able to serve as a virtual partner and use its simulation, optimization, and mid-production correction tools to overcome the design, prototype, and production challenges of a broader scope of companies in the medical imaging space. The commitments of end-use customers specified in the proposal to use the products that will be developed is global (Samsung and Toshiba for QED; Aurora, ViewRay, and Winged for Hyper Tech), very impressive, and certainly a good sign that their commercialization efforts will be successful. While the committee is not convinced that the platform is, in fact, established (a critical flaw of the proposal for the IPP), it strongly encourages the OPTIMISE team and its collaborators to address the issues raised by the committee and apply for IPP funding in 2013. The committee does not recommend that this proposal be considered for funds under the 2012 Ohio Third Frontier Innovation Platform Program.

OTF IPP 12-287
Integrated Patient Personal Care Center
Cleveland Clinic

Proposal Summary

Proposed Budget		
	State Funds	Cost Share
Operating Funds	$ 2,992,001	$ 3,093,076
Capital Funds	$ 0	$ 0
Subtotal	$ 2,992,001	$ 3,093,076
TOTAL	$ 6,085,077	

This proposal seeks funding for projects at the Cleveland Clinic that include development and commercialization of orthopedic implants and related surgical procedures for applications in the upper extremities. $3 million in funding is requested to develop new product lines for as many as 10 applications in specific wrist, hand, and elbow platform areas. The identified initiatives are projected to generate 35 new jobs and $40 million in annual revenues in 5 years. In collaboration with Cleveland-based Integrated Patient Personal Care (IPPC), the Cleveland Clinic proposes to commercialize the new products; and, through collaboration with i360 Medical (an Ireland-based device development firm with North American headquarters in Cleveland), the Cleveland Clinic proposes to bring European expertise to orthopedic device design, development, prototyping, testing, regulatory approval, and marketing.

Detailed Review

- **Technical Merit and Plan**

This proposal seeks funding to support development of as many as 10 different orthopedic implant products and related surgical procedures. The Cleveland Clinic has assembled an impressive team that should be more than equal to the task; however, the committee sees virtually no chance of commercialization in the timeline outlined in the proposal. The RFP has very clear commercialization and job creation stipulations. The proposed orthopedic implant products are all in the demonstration stage with additional product development, refinement of the product specification, regulatory filings, final prototyping, product benchmarking, cadaveric testing, design qualification, and documentation all required before product release. The specified 3 to 5 years is simply too short a time horizon for all of these activities in an orthopedic implant product development plan. Because the proposed timeline for development of the product is unrealistic, the proposal does not meet the requirements of the RFP on Technical Merit and Plan.

- **Commercialization Strategy**

The proposal has a roadmap for product development and eventual product release; however, the role of IPPC is unclear because the research and development resides in the Graham laboratory and i360 is tagged as a resource for manufacturing. In addition, specific operational roles and responsibilities are not clearly outlined for IPPC itself. Without operations, it is difficult to understand how the aggressive job creation objectives will be achieved. Furthermore, the commercialization strategy, funded by revenue generated from the sale of the first commercial products, is not credible, and the proposed timing is simply not achievable. As outlined above, the product development process will take several years at a minimum for each product. The committee sees no chance of market entry with the required regulatory reviews and approval in as little as 10 months. Because the proposed timeline is unrealistic, the proposal does not meet the requirements of the RFP on Commercialization Strategy.

- **Performance Goals**

The projected terminal targets described in the proposal seem credible for technologically advantaged products in the targeted applications; however, as described above, the projected intermediate target of $4.5 million in year 1.5 is simply not possible given the time and resources required to gain U.S. Food and Drug Administration (FDA) 510(k) clearance for each one of these products. The proposal does not meet the requirements of the RFP on Performance Goals.

- **Experience and Qualifications**

As project director and principal investigator, Dr. Graham of the Cleveland Clinic has assembled a very exciting development team that appears to be well qualified to complete development of the targeted products and procedures. Similarly, the collaborators appear to be capable of commercializing fully developed products in several key markets. The proposal meets the requirements of the RFP on Experience and Qualifications.

- **Budget and Cost Share**

The ratio of cost share to state funds is slightly greater than 1:1; 100 percent of state funds will be used to pay operational expenses, including personnel, various direct and indirect project costs, and subcontracted product development activities. The cost share is necessary and appears to be reasonable with more than half of the cost share funds from the collaborators: $844,008 from Integrated Personal Patient Care and $542,995 from i360 Medical. The proposal meets the requirements of the RFP on Budget and Cost Share.

Summary of Review and Recommendation

With the many challenges related to the development and eventual commercialization of orthopedic implants and related surgical procedures, the probability is very low that any one of the products derived from this effort will have a significant industry and economic impact within 3 to 5 years. Significant amounts of time, effort and money have already been spent on product development and control of intellectual property in the selected applications; however, the risk factors stated in the proposal are poorly defined and do not take into account that the time horizon required for commercialization does not credibly meet the requirements for this RFP.

The committee recognizes that the applicant team is highly qualified, but does not agree with the proposal's implication that an experienced and talented team alone is sufficient to ensure the success of the proposal. Simply stated, the committee sees this as a very exciting project that cannot possibly be done in the proposed timeframe. The committee does not recommend that this proposal be considered for funds under the Ohio Third Frontier Innovation Platform Program.

Appendix C
Evaluation Worksheet

A. Technical Merit and Plan	GRADE:
1. **Evaluate the degree to which technical challenges can be met**	
2. *Problem Statement:* Does the Lead Applicant understand the eventual customer and market needs as well as performance requirements?	
3. *Project Goals and Objectives* a. Are these realistic? i. The described goals should cover the Platform's near-term commercialization and innovation purposes ii. The objectives should be related to the Platform's commercialization, innovation, and new product development activities as well as how they are expected to provide the evidence and proof needed to carry the technology forward into market entry	
4. *Technical Approach and Work Plan* a. How will goals and objectives be met? i. Proposal should include a comparison of research techniques, methods, facilities, and equipment with alternatives. ii. Are there significant risk factors? iii. How will progress be made and measured, and how will the project generate the proof necessary to attract additional financial resources required to advance the technology toward successful commercialization? b. **Are all original and innovative technical objectives addressed? Are the concepts, approaches, or methods for achieving these objectives novel?**	
5. *Long-Term Usage* a. Does the proposal include a plan for beyond the 3-year time period? Evaluate this plan in terms of how well it could enable continued development, innovation and commercialization in partnership with Ohio industry.	
B. Commercialization Strategy	GRADE:
1. *Ability to Achieve Market Entry* Does the team understand the total resource requirements for achieving market entry and full commercialization, the type of knowledge that must be produced at the identified positioning stage, and who will likely be the funding providers for the market entry stage? The Lead Applicant must identify any commitments from potential resource providers about their willingness to fund the market entry stage.	
2. *Value Proposition*. What is the specific value proposition of the Lead Applicant's proposed approach and what are the differentiating benefits associated with the proposed technology? Is sufficient evidence shown to support the contention that the market values these benefits?	
3. *Management of Intellectual Property (IP)*. How will new Intellectual Property be managed to benefit Ohio-based companies? See page 13 of RFP for additional IP-related criteria.	
4. *Potential for Products.* Consider the near-term (within 3 to 5 years) industry and economic impacts. **The Innovation Platform must have already achieved at least Proof of Principle**. What are the competitive advantages of the IPP's technologies or products over existing and alternative technologies?	
5. *Size of Opportunity.* Proposal accurately assesses market and has realistic assumptions about market share that could be captured, potential customers, and competitors/competing products	
6. *Degree of Customer Readiness*. Are functionality and market needs realistic? Is there input from potential customers, especially from collaborators who are committed end-users or may be eventual customers?	
7. *Investment and Time to Market*. How much money and time is needed to bring the product to market? Is this reasonable?	
8. *Receptive Capital Markets.* Does the proposal describe the potential for long-term financing to support the growth of a commercial enterprise? Evidence of interest in this technology by various sources of capital should be provided.	
9. *Potential for Leverage*. How will the IPP leverage OTF funds with other sources for continued commercialization and innovation activities? Goals and plans for leveraging OTF Funds must be specifically defined.	

10. *Ability to Compete Globally*.
    a. Applicants should demonstrate an understanding of the global marketplace and trends, including barriers to market entry and competitors
    b. Particular attention should be given to situations where initial markets and major competitors are global, where others have committed major resources to this technology, and where barriers to market entry favor international firms.
    c. How well does the Lead Applicant understand and compete for international business opportunities?
11. *Degree of Sustainable Competitive Advantage*. The proposed project fits within, or can create, an environment which enables Ohio to maintain a leading, competitive advantage. Advantage can be created from the IP.
12. *Ohio's Supply Chain*. How closely matched is the project with existing or emerging supply chain's capabilities?

C. Performance Goals	GRADE:

1. Project demonstrated to have an impact on Ohio in **three or more of the following areas:** job creation (for-profit, not-for-profit, retained); personal wealth (average salary of jobs created); new sales of products; companies created or attracted to Ohio; follow-on investments and new industry funding for research and technical services that fit within the Platform's mission talent recruitment; and enhanced Ohio, national, and/or international recognition
2. The Proposal must contain a realistic forecast of the economic impacts of the Innovation Platform (for 3 and 5 years after start of project), including: direct employment, payroll, and product revenue.

D. Experience and Qualifications	GRADE:

1. Leadership is demonstrated in all critical phases, including research, IP protection, regulatory compliance, product development, leveraging of additional funding, and commercialization
2. Team has relevant organizational experience to perform technical and commercialization work involved
3. *Management Plan.*
    a. Proposal discusses plans for internal means of communication, coordination of data and information management, evaluation and assessment of progress, allocation of funds and personnel, and other specific issues relevant to the proposed activities.
    b. Sub-awards: Assess the Lead Applicant's oversight plan for any sub-awards, particularly how the Lead will ensure both financial accountability as well as adherence to the Innovation Platform's scope of work.

E. Budget and Cost Share	GRADE:

1. **Is the budget justified in a detailed narrative with the appropriate forms? Is it adequate to meet proposal goals? Is the cost share necessary and reasonable?**
2. *Indirect Costs:* No more than 20% of the total direct OTF Funds requested may be budgeted for indirect costs. A rate of 20 percent of total direct costs may be used for facilities and administrative indirect costs, but only on the operational portion of the budget and not against equipment, renovation, or construction costs.
3. *Cost Share: Magnitude (at least 1:1 ratio with state funds)*
    a. All Cost Share must be identified in the Proposal by amount, proposed use and source
    b. Cost Share must be documented on the budget forms and in a signed commitment letter from each organization contributing Cost Share.
    c. The Cost Share must represent a specific new commitment, including the dollar amount or value, to the Innovation Platform described in the Proposal
    d. **What form does it take? Ohio gives preference to discretionary, unrestricted and unallocated cash cost share**
4. *Cost Share: Sources and Uses*
    a. **Cost Share must be in the form of cash** and must be for allowable costs that are verifiable and auditable.
    b. Cost Share must be used directly in support of the Innovation Platform rather than for coincidental or related/similar allocations.
    c. Other OTF or other State funding may not be used as Cost Share for this Proposal
5. Cost Share: Constraints:
    a. Resources that have already been designated as Cost Share for some other award cannot be used as Cost Share for an IPP award. The Cost Share must be applied to the Innovation Platform during the Project Period. Expenses incurred outside of the Grant Period do not count toward the Cost Share requirement.
    b. Proposed Cost Share must be firmly committed, with no contingencies or conditions, from known sources and available to the Innovation Platform at the time of Proposal submittal.
6. Commitment letters are provided and are sufficiently detailed including an explanation of cost share commitment

Appendix D
IPP Program Definitions, Goals, and Critical Criteria

The Ohio Department of Development anticipates awarding up to $18 million in Grants through the fiscal year (FY) 2012 Innovation Platform Program (IPP). Development anticipates awarding six (6) to nine (9) grants through IPP, with each grant in the range of $1 million to $3 million.

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 purpose of the IPP is to link the development and innovation capabilities and capacities of an already established Innovation Platform and all its resources at an Ohio college or university or not-for-profit research institution to specific late stage development and innovation needs of Ohio companies. This linkage must in turn lead to job creation and business opportunities within Ohio through development and commercialization of new technologies, innovations and products that will have beneficial long-term economic impacts for Ohio.

The specific goal of the IPP is to support commercial partnerships involving an Innovation Platform at a single Ohio college, university or other not-for-profit research institutions, and Ohio for-profit companies. Partnerships are to be formed to further the near-term (within three (3) to five (5) years of the start of the Project Period) commercialization of new technologies, innovations, and products.

A Lead Applicant is the entity that submits a Proposal and will be legally and financially responsible for the administration of any resulting award of OTF Funds. The Lead Applicant will be responsible for the administration of the Proposal should it be awarded. The Lead Applicant must also serve as administrative director of the Innovation Platform. The Lead Applicant must either be an Ohio college or university or a non-profit public or private research organization in Ohio.

A Collaborator is an organization, company or other legal entity that is not an affiliate of the Lead Applicant which is anticipated to receive OTF Funds and/or is contributing to cash Cost Share. Proposals must include collaborations with at least two Ohio for-profit companies. All Collaborators must submit a Letter of Commitment. A contribution of cash Cost Share resources by a Collaborator is strong evidence of that commitment. Teams with strong commercialization structures are required.

A committed end-user is a business or governmental entity that has a commercial interest in, and commits to commercial application of, the results of the Innovation Platform. A committed end-user may submit a letter.

Term of the Project is the plan of activity or activities that make up the total scope of work for which an award of OTF Funds is requested and for which a Proposal is approved. The term of IPP Grant Agreements will be up to five (5) years. The Project Period during which the active work funded by the Grant will take place shall be no more than three (3) years. For an additional two (2) years of the Grant, annual reports detailing the overall status of commercialization and innovation activities and the economic impacts of the Innovation Platform will be required.

Evaluation Criteria: Only the most meritorious proposals are sought for funding. Proposals will be evaluated based on responsiveness to all the requirements of the RFP and on the Lead Applicant's response to any additional information that may be requested. Implicit in those requirements and evaluation criteria is the quality of the Proposal and budget.

Management of IP: Control and management of Intellectual Property (IP) are key success factors. The Proposal should clearly define the IP directly related to the technology proposed for commercialization, identify its status (e.g., trade secret, disclosure, patent application filed, patent awarded), identify who controls the IP, and explain how the IP differentiates the technology from its competition. The Proposal should demonstrate that the commercializing entity has the freedom to operate and has the ability to sustain a competitive advantage. The Proposal should also clearly define how the IP will be protected from the competition and how the Lead Applicant intends to manage new IP, how it will work with the technology transfer office (if applicable) and Collaborators to quickly and efficiently establish ownership and/or licensing rights, and how it will work with Ohio-based companies and/or investors to realize positive economic impacts from the business opportunities being realized and brought to fruition in Ohio from the IP.

Specific ***criteria designated in the RFP with the highest relevance to and weighting*** for the IPP:

- Degree to which technical challenges can be met;
- Availability of all financial and other resources needed to conduct the work;
- Degree to which applicant has a protected position with respect to their proposed technology;
- Quality and likely achievability of the commercial path to market;
- Financial stability of the applicant and key team members, particularly partners who will take the technologies to the market;
- Degree to which this Innovation Platform will help build the State's supply chain and overall technology cluster;
- Impact of the Innovation Platform in terms of additional revenue and employment in 3 and 5 years;
- Realism and achievability of the proposed business model;
- Sustainability and continued relevance and likely use of the innovation platform by Ohio industry;
- Compliance with this RFP's administrative requirements; and
- If applicable, the current economic impact of previous related OTF grant(s).

In addition to the above specific criteria, also consider how well the proposal aligns with the IPP purpose, goals, objectives, eligibility, funding, and Cost Share requirements (further described in Section 2 of the RFP).

Additional Pieces from the RFP

A ***major goal*** of the OTF is to catalyze collaborations in technology commercialization, innovation, and product development between the State's colleges and universities and Ohio industry. The IPP supports this goal by offering Grants to provide funding for operations, capital equipment and facility costs of existing Innovation Platforms that will benefit commercial purposes in the short-term and contribute to the sustainability and industrial relevance and use of the Innovation Platform in the long-term.

The ***objectives of IPP*** are:

- To support existing Innovation Platforms at Ohio colleges, universities, or not-for-profit research institutions that will serve specifically defined near-term commercialization objectives of two or more Ohio for-profit companies;
- To support Innovation Platforms that will develop and launch new products, innovations, or services into the commercial market within three (3) to five (5) years of the Project start date;
- To kick-start the long-term, sustained use of the Innovation Platform by multiple Ohio industry partners.
- To support Innovation Platforms that will create wealth and employment opportunities within Ohio.

Each Proposal must address at least one or a combination of the following technology areas:

- 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

Cost Share

The partnership between the Lead Applicant and all Collaborators must have the capability for commercializing any resulting technology. Collaborators must be committed to the long-term commercialization of the technology and play a role in accomplishing that goal. A contribution of cash Cost Share resources by a Collaborator is strong evidence of that commitment.

Cost Share Requirements—Magnitude: The monetary value of the cash Cost Share commitment must be one dollar for every dollar of OTF Funds requested (i.e., a ratio of 1:1). All Cost Share must be identified in the Proposal by amount, proposed use and source. The Cost Share must represent a specific new commitment, including the dollar amount or value, to the Innovation Platform described in the Proposal. Preference will be given to Proposals that pledge discretionary, unrestricted, and unallocated cash.

Cost Share Requirements—Sources and Uses: Cost Share must be in the form of cash and must be for allowable costs that are verifiable and auditable. Cost Share must be used directly in support of the Innovation Platform rather than for coincidental or related/similar allocations. Cost Share must be necessary and reasonable to support the Innovation Platform objectives. The expense of the Cost Share must take place during the Project Period. Cost Share must be charged to resources of the Lead Applicant or Collaborator and documented within the financial books of the Lead Applicant or Collaborator, as the context requires. Other OTF or other State funding may not be used as Cost Share for this Proposal, and funds awarded under this RFP may not be used as Cost Share against other OTF Projects

If an organization has a published Indirect Cost rate, un-recovered Indirect Costs (the difference between 20 percent and the published rate) may be used as Cost Share. Only Indirect Costs not fully

recovered from the requested OTF Funds are eligible to be used as Cost Share. Please note, a published Indirect Cost rate must be published as part of the general policies of the organization and applied uniformly to all grants or contracts. A federally negotiated and approved Indirect Cost rate is one form of a published Indirect Cost rate. In those cases where the Lead Applicant does not have a published Indirect Cost rate agreement, the Lead Applicant is limited to using 20 percent of its Cost Shared direct costs as Cost Shared Indirect Costs and no other un-recovered Indirect Costs from the operating budget may be claimed.

Cost Share Requirements—Constraints: Resources that have already been designated as Cost Share for some other award cannot be used as Cost Share for an IPP award. The Cost Share must be applied to the Innovation platform during the Project. Expenses incurred outside of the Grant Period do not count toward the Cost Share Requirement. The Lead Applicant is solely responsible to have adequate funds to cover all expenses of the Innovation Platform not covered by the OTF Funds awarded. **Please note, the Cash Cost Share proposed by the Lead Applicant and all Collaborators must be firmly committed, with no contingencies or conditions, from known sources and available to the Innovation Platform at the time of Proposal submittal.**

Appendix E
Biographical Sketches

COMMITTEE MEMBERS

T.S. SUDARSHAN, *Chair,* is president and CEO of Materials Modification, Inc. Dr. Sudarshan is responsible for the management and technical development of innovative materials, processes, and techniques and the development of new technologies related to surface engineering and nanotechnology. He has raised more than $45 million in government agency and industrially sponsored programs centered on high-risk, high-payoff advanced technology proposals that were awarded through competition and in non-traditional areas. Dr. Sudarshan has been the recipient of numerous awards and honors, including the Design News Award and R&D 100 for the microwave plasma technique Nanogen and for the Plasma Pressure Compaction technique. He has served on numerous committees of the National Science Foundation (NSF), the National Institutes of Health, the U.S. Army, the Michigan Economic Development Council, and ASM International—The Materials Information Society. Dr. Sudarshan has also served on the technical advisory boards of numerous companies over the past two decades. He is the editor of the journals *Materials and Manufacturing Processes* and *Surface Engineering*, and he is the author of more than 175 papers and editor of more than 25 books in the field of surface engineering. He is a fellow of ASM International; the Institute of Metallurgy, Mining, and Materials; and the International Federation for Heat Treatment and Surface Engineering. Dr. Sudarshan received his B.S. in metallurgy from the Indian Institute of Technology in Madras, India, and his M.S. and Ph.D. in materials engineering science from the Virginia Polytechnic Institute and State University. He has previously been involved with several National Research Council (NRC) activities, including four committees that reviewed proposals for the State of Ohio (2008 and 2009 as a member and 2010 and 2011 as chair); the Committee on Small Business Innovative Research to Support Aging Aircraft; the Committee on Review of the National Nanotechnology Initiative; the Panel on Armor and Armaments of the Army Research Laboratory Technical Assessment Board; the Committee for Review of the DOE Industrial Technologies Program; and the National Materials Advisory Board.

VIOLA L. ACOFF is head and professor of the Department of Metallurgical and Materials Engineering at the University of Alabama. Her research interests are focused on joining of intermetallics, particularly the areas of cold roll bonding and reaction annealing and the effects of texture on welded and roll-bonded structures. She has received the NSF CAREER Award and has been awarded Best Paper honors by both the American Welding Society (Warren F. Savage Memorial Award) and The Minerals, Metals, and Materials Society (TMS) Symposium on Gamma Titanium Aluminide. Additionally, Dr. Acoff served as chair of the Birmingham chapter of ASM International-The Materials Information Society and chair of the ASM International Joining Critical Sector. She received her B.S., M.S., and Ph.D. in materials engineering from the University of Alabama at Birmingham. She previously served on several NRC committees, including the Committee on NIST Technical Programs Panel on Manufacturing Engineering and the 2006 and 2011 committees that reviewed proposals for the State of Ohio.

CATHERINE G. AMBROSE is an associate professor of orthopaedic surgery at the University of Texas Health Science Center at Houston. She is also the director of the Biomechanics Laboratory at the University of Texas Medical School at Houston. Dr. Ambrose also serves as a visiting assistant professor and part-time lecturer at Rice University and as a member of the scientific staff at Shriners Hospitals for Children in Houston. Her research interests are in material property assessment for orthopaedic materials, including bone, cartilage, ligaments, and tendons; biodegradable materials for orthopaedic applications; diagnosis and treatment of metabolic bone diseases, including osteoporosis and osteogenesis imperfecta; and in vitro and in vivo models for orthopaedic applications. She received her B.S. in mechanical engineering from Washington University and her M.S. in biomedical engineering and Ph.D. in

mechanical engineering from the University of Texas, Austin. Dr. Ambrose previously served on the 2011 NRC committee that reviewed proposals for the State of Ohio.

DAVID E. ASPNES is Distinguished University Professor in the Department of Physics at North Carolina State University. He is presently at KyungHee University, Seoul, as a recipient of a World Class University appointment by the Republic of Korea. Following a year as a postdoctoral research associate at the University of Illinois, Urbana-Champaign, and another at Brown University, he joined Bell Laboratories, in Murray Hill, N.J., as a member of the technical staff. Dr. Aspnes then became head of the interface physics department in the newly created Bellcore, the part of Bell Laboratories associated with the operating companies in the AT&T divestiture. He joined North Carolina State University as a professor of physics, and he was named Distinguished University Professor of Physics in 1999. Dr. Aspnes is best known for his experimental and theoretical contributions to the development and application of optical techniques for the analysis of materials, thin films, interfaces, and structures. These include theory and practice of spectroscopic ellipsometry, modulation spectroscopy, reflectance-difference spectroscopy, and materials and interface analysis using nonlinear optics. He received his Ph.D. in physics from the University of Illinois, Urbana-Champaign. Dr. Aspnes is a member of the National Academy of Sciences. He has previously served on a number of NRC committees, most recently the 2011 NRC committee that reviewed proposals for the State of Ohio, the Committee on NIST Technical Programs Panel on Manufacturing Engineering, and the Committee on NIST Technical Programs Panel on Chemical Science and Technology.

CAROL CHERKIS is a life sciences industry consultant at NewCap Partners, Inc. With over 30 years of experience in that sciences industry, she supports the investment banking firm's efforts by helping its clients in that industry to identify partner companies for M&A, strategic alliances and corporate equity investments. Dr. Cherkis is also the president of BioInfoStrategies, a consulting firm that she founded after a 20-year multi-functional career with The Dow Chemical Company. There her advisory services focus on assisting small and medium-sized, fast growing companies in biotechnology/pharmaceuticals, diagnostics, medical devices, mobile and IT-health, regenerative medicine, biochemical reagents, and the biology-related areas of cleantech (biodetection/instrumentation, and production of fuels, chemicals and biomaterials from biomass) with assessing the commercial feasibility of their technologies, developing and implementing business strategies, and establishing licensing, co-development, marketing, and distribution alliances. Her client base includes government agencies, startups, and well-established companies. She has and continues to serve as a director on company boards. Recently, her efforts have focused on work with companies and/or government groups in the USA, China, Japan, and Canada. Dr. Cherkis started her career with the Dow Chemical Company. After 10 years as a scientist and research manager, she moved into the company's business functions. In her last position at Dow, she was the biotechnology program director in the Corporate Ventures Group and had global responsibility for identifying small and medium-sized companies as sources of new technology as well as corporate partners to expedite market penetration of existing and future products. Later, she served as the director of healthcare at Frost & Sullivan. Dr. Cherkis has a Ph.D. in biological chemistry from the University of Michigan Medical School and an A.B. in biology from Bryn Mawr College. She previously served on the 2011 NRC committee that reviewed proposals for the State of Ohio.

DAVID E. CROW is a consultant and retired senior vice president of engineering at Pratt and Whitney Aircraft Engine Company and professor emeritus of mechanical engineering at the University of Connecticut. At Pratt and Whitney Dr. Crow was influential in the design, development, test, and manufacturing in support of a full line of engines for aerospace and industrial applications. Dr. Crow was involved with products that include high-thrust turbofans for large commercial and military aircraft, turboprops and small turbofans for regional and corporate aircraft and helicopters, booster engines and upper stage propulsion systems for advanced launch vehicles, turbopumps for the space shuttle, and industrial engines for land-based power generation. His involvement included sophisticated computer

modeling and standard work to bring constant improvements in the performance and reliability of the company's products, while at the same time reducing noise and emissions. Dr. Crow is a member of the National Academy of Engineering. He received his Ph.D. in mechanical engineering from the University of Missouri, Rolla, his M.S. in mechanical engineering from Rensselaer Polytechnic Institute, and his B.S. in mechanical engineering from University of Missouri, Rolla. Dr. Crow is currently serving on the NRC Army Research Laboratory Technical Assessment Board and as chair of the Panel on Air and Ground Vehicle Technology–2011. He has previously served on numerous committees, including the 2003 committee that reviewed proposals for the State of Ohio, the Committee on NASA Technology Roadmap: Propulsion and Power Panel, the Committee on Examination of the U.S. Air Force's Aircraft Sustainment Needs in the Future and its Strategy to Meet Those Needs, the Board on Manufacturing and Engineering Design, and the Committee for the Evaluation of NASA's Fundamental Aeronautics Research Program.

PAUL A. ERICKSON is currently an associate professor at the University of California, Davis, in the Mechanical and Aerospace Engineering Department. He is also the director of the Hydrogen Production and Utilization Laboratory and the co-director of the Department of Energy GATE Center of Excellence. Dr. Erickson teaches undergraduate and graduate courses in thermodynamics, fuel cell systems, internal combustion engines, advanced energy conversion systems, and instrumentation. The emphasis of his research is on energy conversion and hydrogen production for both future vehicles and stationary power applications. Dr. Erickson received his B.S. and M.S. degrees from Brigham Young University and his Ph.D. from the University of Florida, all in mechanical engineering. He previously served on the 2011 committee that reviewed proposals for the State of Ohio.

BRUCE D. GITTER is a senior principal scientist and manager of nuclear medicine imaging and histomorphometry, neuroscience, discovery and translational services at Covance Laboratories, Inc. He is also an adjunct professor of radiology at the Indiana University School of Medicine. At Covance, Dr. Gitter leads the Department of Nuclear Medicine Imaging and Histomorphometry, focusing principally on pre-clinical neuroscience, cardiovascular, diabetes, and cancer models. His department uses small animal PET imaging and autoradiography to examine neurodegenerative changes in rodent disease models and pharmacodynamic effects of drugs in the central nervous system. In addition, he utilizes membrane receptor pharmacology, autoradiography, and immunohistochemistry to discover and validate novel tracer biomarkers for multiple therapeutic applications. Prior to joining Covance in 2008, Dr. Gitter worked on drug discovery and development at Eli Lilly & Company for 25 years. During his career, he has issued 10 U.S. patents, authored 41 peer-reviewed scientific publications, gave 102 presentations and posters at research conferences and universities (12 of which were invited lectures at international conferences), and served as a peer-reviewer for multiple neuroscience and pharmacology journals. Dr. Gitter received his B.S. in biochemistry and chemistry, M.S. in microbiology, and Ph.D. in zoology (immunoparasitology) from the University of Georgia.

JAHAN K. JEWAYNI is an independent consultant who has worked as a financial advisor with a national financial advisory firm. His practice focuses on advising middle-market companies in the $10 million to $150 million revenue range. Mr. Jewayni has 20 years of experience in finance and operations of companies ranging from start-ups to Fortune-500 companies. His work covers areas such as renewable energy, satellite communications, consumer electronics, commercial real estate, consumer products, and non-profits. Specifically in the renewables area, he reviews dozens of executive summaries and business plans every year for companies seeking seed capital, growth capital, and advisory services. Some of the recent opportunities involved a concentrated solar power company, a small-scale utility solar installation company, and a fund that would build energy-efficient low-income housing communities in developing countries. Prior to his work in the financial services industry, Mr. Jewayni spent more than a decade as a small business owner and financial consultant to small and medium enterprises. He is actively involved with a number of non-profits and is a board member of Devotion to Children, an organization focused on

helping children from economically disadvantaged families. Mr. Jewayni earned a B.S. in accounting from the Robert H. Smith School of Business at University of Maryland and became a certified public accountant in 1995. He previously served on the 2011 NRC committee that reviewed proposals for the State of Ohio.

MATT JONES is a partner at Nth Power. His main focus at Nth Power is on deal origination, due diligence, and deal structuring. He has been the lead principal on 10 investments in the areas of materials and nanotechnology, distributed generation and storage, and biofuels. He also serves on the board of directors of Tempronics. Prior to joining Nth Power, Mr. Jones was a consultant for Accenture in the utility practice group. He advised clients on market restructuring, cost reduction, risk management, and information technology initiatives, and he helped create a new organization within an investor-owned utility for the purpose of interacting with the deregulated energy market. Mr. Jones received a B.S. in mechanical engineering from the University of California, Davis, and an MBA from Duke University. Mr. Jones previously served on the 2011 committee that reviewed proposals for the State of Ohio.

MOHAMMAD A. KARIM is vice president for research of Old Dominion University (ODU). He is North American editor of *Optics and Laser Technology*, an associate editor of *IEEE Transactions on Education*, and a member of the editorial boards of *Microwave and Optical Technology Letters* and *World Journal of Modeling and Simulation*. Dr. Karim chairs the program committee of the Institute of Electrical and Electronics Engineers (IEEE) International Conference on Computers and Information Technology and is an elected fellow of the Optical Society of America, the Society of Photo-Instrumentation Engineers, IEEE, the Institute of Physics, the Institution of Engineering and Technology, and the Bangladesh Academy of Sciences. He is the author of 18 books, more than 335 research papers, and 7 book chapters, and he has served as guest editor of 29 journal special issues. Prior to joining ODU, Dr. Karim served as dean of engineering at the City College of New York of the City University of New York. He received his B.S. in physics from the University of Dacca, Bangladesh, and his M.S. in physics, M.S. in electrical engineering, and Ph.D. in electrical engineering from the University of Alabama. He previously served on the 2011 NRC committee that reviewed proposals for the State of Ohio.

CHESTER D. KOLODZIEJ is the executive director of Freedom Field Renewable Energy, Inc. His 30 years of experience in manufacturing, technology, and distribution spans a broad range of renewable energy, nanomaterials, radiofrequency identification, and carbon fiber technologies. Mr. Kolodziej has worked with multiple start-ups and has consulted for companies such as Becker Wind Energy, Advanced Composite Industries, NoChemCleaning LLC, Atometrics Micro-Machining, and Materials Modification, Inc. His recent peer-review experience includes committees for the 21st Century Jobs Fund for the State of Michigan, NSF, the Development Capital Network (Phase II), and the Fast Pitch Business Plans for the State of Illinois. He received his B.B.A. from the University of Wisconsin, Whitewater, and his MBA from Northern Illinois University. Mr. Kolodziej previously served on the 2010 and 2011 NRC committees that reviewed proposals for the State of Ohio.

LAURA T. MAZZOLA is currently the senior vice president for global initiatives at Wave 80 Biosciences. She has 20 years of experience in the biotechnology industry, from research and development to the commercialization of platform technologies. Recently, she was CEO of Excellin Life Sciences, a company enabling cell-specific genetic engineering, guiding the enterprise from university spin-out through corporate collaborations and Series A funding. She also founded NanoBioConvergence, a non-profit seminar series for nanotechnology, and has been an invited lecturer at the Walter A. Haas School of Business of the University of California, Berkeley. Dr. Mazzola was an early employee at Affymax and Affymetrix, developing the high-density array technology that became the revolutionary GeneChipTM product line. She then helped reorient business development at Symyx Technologies through pharmaceutical industry collaborations and licensed their first commercial product, earning the Frost and Sullivan 2002 Market Engineering Technology Innovation Award. She has been a technology

analyst for Nature Biotechnology, the California State Senate, the National Institutes of Health, and the National Academy of Sciences. She received a B.A. from Kalamazoo College and an M.S. and Ph.D. in physical chemistry from Stanford University. Dr. Mazzola has previously served on several NRC committees that reviewed proposals for the State of Ohio (2003, 2006, 2008, 2009–chair, 2010, and 2011).

TRENT M. MOLTER is an associate research professor and business development officer for the Center for Clean Energy Engineering (C2E2) of the University of Connecticut, whose mission is to be a world leader in fuel cell research, education, and product development so that Connecticut will be the primary global venue for the sustainable energy industry. C2E2 recently received an award from the U.S. Department of Energy to research the effects of impurities on fuel cell performance and durability. Dr. Molter led this team with the focus on improving the reliable performance of proton exchange membrane fuel cells. Dr. Molter also serves as president and CEO of Sustainable Innovations, LLC, a Connecticut-based company engaged in the development of products that support human sustainability. He has also been responsible for the development and marketing of new technology for fuel cell and hydrogen applications since 2003. Prior to his current employment, Dr. Molter was senior vice president for Proton Energy Systems for 7 years, a chemical company, and prior to that he was an advanced technology engineer for United Technologies Hamilton Sundstrand. He received his Ph.D. from the University of Connecticut in materials science and engineering. Dr. Molter has previously served on several NRC committees that reviewed proposals for the State of Ohio (2008, 2009, 2010, and 2011).

C. BRADLEY MOORE is a professor of chemistry emeritus at the University of California, Berkeley. Dr. Moore's research in physical chemistry focuses on molecular energy transfer, chemical reaction dynamics, photochemistry and spectroscopy. His research group uses lasers to produce and detect molecules in specific energy states. In this way benchmarks are established for the mechanisms of molecular processes and predictive understandings developed. He is particularly interested in the energy states of molecules and free radicals at energies above the dissociation threshold. Applications of this work are found in combustion and atmospheric chemistry, in chemical and molecular lasers, and in isotope separation. He has served in many positions responsible for research administration, including as vice president for research at Ohio State University (OSU; 2000-2003) and at Northwestern University. While vice president at OSU, Dr. Moore also worked on supporting economic development through research initiatives with the university president at the time, as well as with the Ohio Board of Regents for Higher Education, and local and state officials. Prior to working at OSU, Dr. Moore was the director of the Chemical Sciences Division at Lawrence Berkeley National Laboratory. He is a member of the National Academy of Sciences. He currently serves on the NRC Committee on Assuring a Future U.S.-Based Nuclear Chemistry Expertise and previously served on numerous NAS nomination committees, as well as the Committee on Building Cyberinfrastructure for Combustion Research, and the Panel on Chemical Science and Technology.

NABIL NASR is director of the Center for Integrated Manufacturing Studies at the Rochester Institute of Technology (RIT). He is also responsible for the strategic and operational leadership of the Golisano Institute for Sustainability, whose mission is to deliver innovative educational programs in sustainability and to conduct related world-class research. Dr. Nasr founded the National Center for Remanufacturing and Resource Recovery at RIT, a leading source of applied research and solutions in remanufacturing technologies. His background is in sustainable production, remanufacturing, clean production, and sustainable product development. Dr. Nasr is the chair of the Organization for Economic Cooperation and Development's (OECD's) Advisory Expert Group on Sustainable Production. He also served as an expert delegate with the U.S. government in several international forums such as the Asia Pacific Economic Cooperation, the United Nations, and the OECD. He is a member of the editorial board of the *International Journal of Sustainable Manufacturing* and is chair of the Remanufacturing Industries Council and several industry boards. Dr. Nasr received his B.S. in industrial engineering from Helwan

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