Final Report of the Committee to Review Proposals to the 2010 Ohio Third Frontier (OTF) Wright Projects Program (WPP)

Committee to Review Proposals to the 2010 Ohio Third Frontier (OTF) Wright Projects Program (WPP)
Aeronautics and Space Engineering Board
Division on Engineering and Physical Sciences
NATIONAL RESEARCH COUNCIL
OF THE NATIONAL ACADEMIES

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Acknowledgments

This report has been reviewed in draft form by S. Michael Hudson, independent consultant, 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. Hudson 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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April 27, 2010

Lisa Patt-McDaniel
Director
Ohio Department of Development
77 S. High Street
Columbus, OH 43215-6130

Dear Ms. Patt-McDaniel:

This letter details the work and transmits the final report of the Committee to Review Proposals to the 2010 Ohio Third Frontier (OTF) Wright Projects Program (WPP). This activity was supported by a contract of 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 eighth year the NRC is reviewing proposals for the Third Frontier Commission (TFC).

Program Objectives

The purpose of the WPP is to provide support for the OTF goal of building strong research capabilities within the state's colleges and universities that support the needs of Ohio industry. The program offers grants for capital equipment that will benefit entrepreneurial and commercial purposes in the short term and help contribute to the training and education of the workforce in the long term. The program requires collaborations led by Ohio universities and colleges in partnership with Ohio businesses to further the near-term (within 3 years) commercialization of new technologies or capabilities.

Scope of Engagement

For the 2010 WPP, a total of 18 proposals were submitted, all of which passed an administrative review by ODOD and were reviewed by the committee. Proposals spanned the five opportunity areas

identified in the program's Request for Proposal (RFP): Advanced/Alternate Energy; Advanced Materials; Advanced Propulsion; Biomedical; and Instruments, Controls, and Electronics (Table 1).[1]

This report provides the committee's assessment of all of the received proposals. The committee recommends that the TFC consider funding 7 of the 18 proposals; these 7 recommended proposals make a strong case that they would achieve the goals and purpose of the WPP. The total amount of state funds requested by the recommended proposals is $20,624,038.

TABLE 1 Wright Projects Program Proposal Distribution by Opportunity Area

Advanced/ Alternate Energy	Advanced Materials	Advanced Propulsion	Biomedical	Instruments, Controls, and Electronics	Number of Proposals
X					4
	X				5
		X			0
			X		2
				X	2
	X			X	1
X	X			X	1
X				X	1
	X		X		1
		X		X	1

Review Methodology

Committee members were recruited based on their familiarity with the subject areas of the 18 proposals to be evaluated and for their experience with business practices, technology transfer, and economic development. The committee was chaired by T.S. Sudarshan, president and CEO of Materials Modifications, Inc. The committee comprises a combination of working engineers, academics, and business executives; two members are also members of the National Academy of Engineering. The committee roster appears on page v, and biographical sketches of the committee members can be found in Appendix D.

Based on criteria and proposal requirements specified in the RFP, ASEB staff developed an evaluation worksheet (Appendix C) to help guide the initial evaluation of the proposals. Committee members were then assigned approximately 3 to 4 proposals to review. For each proposal assigned, a committee member was designated as a primary or secondary reviewer for the purposes of guiding committee discussions at the first meeting.

The committee held its first meeting in Irvine, California, on February 12, 2010. At that meeting, the primary and secondary reviewers used the worksheets they completed to lead the rest of the committee in a discussion of the strengths and weaknesses of each of the 18 proposals. Because of their subjective nature, the evaluation worksheets were used only to guide discussions. Based on those

[1] Ohio Third Frontier Wright Projects Program Fiscal Year 2010 Request for Proposals (RFP), Ohio Department of Development, available at http://development.ohio.gov/ohiothirdfrontier/Documents/WrightProjects/2010RFP/WP_FY10_Final_RFP.pdf.

discussions, the committee selected 12 proposals by consensus for further examination at the committee's second and final meeting. The committee also developed a list of follow-up questions that addressed areas of concern for each of these 12 proposals. These questions were sent to ODOD, who forwarded them to the lead applicants prior to the second meeting.

The committee held its second meeting in Columbus, Ohio, on March 12-13, 2010, and interviewed the applicant teams of the 12 proposals selected at the first meeting. Each applicant team was given 20 minutes to address the committee's follow-up questions, followed by 20 minutes of additional discussions led by the committee. The committee subsequently reached consensus on which proposals to recommend as most qualified.

Evaluation Criteria and Key Differentiators

The WPP's RFP details the evaluation criteria used by the committee. The evaluation worksheet used to guide the committee's initial evaluation of the proposals grouped these criteria into five broad sections (Appendix C). Some of the included criteria were the following:

- *Technical Merit and Plan.* Are technical and commercial challenges described? How will goals and objectives carry technology forward into each phase of the Technology Commercialization Framework? How will goals and objectives be met? Are the scientific objectives original and innovative? Are novel concepts, approaches, or methods employed? What is the scientific and technical feasibility?
- *Commercialization Strategy and Potential.* Does the proposal define benefits of the proposed approach and explain why the market values these benefits? How will new intellectual property be managed to benefit Ohio-based companies? Is the proof of principle already demonstrated? Does the proposal accurately assess the market and have realistic assumptions about market share that could be captured? What is the degree of customer readiness? What is the needed investment and time to market? Does the proposal have the ability to leverage Ohio's supply chain, existing or emerging?
- *Experience, Qualifications, and Eligibility.* Does the proposal demonstrate commitment of the lead applicant and collaborator(s) to building a sustainable partnership? Is leadership demonstrated in all critical phases? Does the team have relevant organizational experience to perform technical and commercialization work involved? Will the proposal realize near-term commercialization (within 3 years) with the potential for future potential?
- *Performance Goals and Objectives.* Are the capital acquisitions and improvements at an Ohio college, university, or nonprofit institution? Will the project have an impact on job creation or retention? Are the forecasts of new jobs, income, and revenue realistic? Are the direct economic impacts identified for each distinct product or platform that will come from state investment?
- *Budget and Cost Share.* Is the budget justified and adequate to meet proposal goals? Is it adequately explained in the proposal's budget narrative? Is no more than 20 percent budgeted for indirect costs? Is the cost share necessary and reasonable? Are commitment letters provided and sufficiently detailed?

During the course of the study, the committee prepared an Overview Table (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* RFP requirements, "M" and the color yellow indicate that the proposal *meets* RFP requirements, and "D" and the color red indicates that the proposal *does not meet* RFP requirements.

Recommendations

The committee recommends that the TFC consider funding seven proposals that make a strong case that they would achieve the goals and purposes of the WPP. 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 18 proposals appear in Appendix B. As requested by Ohio, the committee rank-ordered the proposals based on the degree to which they met the standards set forth in the RFP (Table 2). Three of the proposals are ranked in positions 1, 2, and 3. The remaining four proposals are all ranked in position 4, because they are essentially equal in merit and equally meet the standards set forth in the RFP. One of these four proposals is recommended with a caveat: 10-505 warrants consideration for funding only if the electrofluidic display section is removed from the proposal and focus is placed solely on developing the medical diagnostic device potential in order to allow the team to focus on commercializing the proposal's most promising and more advanced aspects. Even with this change of focus, the amount of requested funds for the proposal need not change.

TABLE 2 Wright Projects Program Proposals Recommended for Funding, Ranked by Adherence to Request for Proposals Standards

Proposal		Rank
10-519	Clinically Applied Rehabilitation Engineering (CARE) Project	1
10-510	Center for Algal Engineering Research and Commercialization	2
10-504	Hybrid Fabrics for Multifunctional Composites	3
10-527	Center of Excellence for Energy Storage Technology	4
10-516	Center for High Performance Power Electronics (CHPPE)	4
10-531	Development of a Quantitative Analysis System for Stem Cells	4
10-505	The Ohio Center for Microfluidic Innovation (OCMI)	4

The top three proposals are summarized as follows:

1. *Clinically Applied Rehabilitation Engineering (CARE) Project (10-519)* is focused on inventing, developing, and commercializing rehabilitation products for patients with impaired mobility/ability who cannot perform activities of daily living and who therefore require rehabilitative intervention. The project would build a state-of-the-art dynamic testing platform to develop, prototype, test, manufacture, and commercialize advanced rehabilitative medicine products. Strong leadership, the potential for innovations, and the leveraging of existing Ohio infrastructure make this proposal a strong contender for OTF funds. The applicant team has demonstrated that these products could be commercially viable, and the only concern is the management of intellectual property, which the committee is confident can be handled by the interested parties. The lack of firm commitments from investors is slightly discouraging, but is outweighed by the positive aspects of this proposal, and the committee believes that firm commitments will most likely be made once the program begins meeting its goals.
2. *Center for Algal Engineering Research and Commercialization (10-510)* is submitted by Ohio University on behalf of itself, University of Toledo, Harrison County in Ohio, and several Ohio-based private sector entities. It proposes to establish a Center of Excellence (COE) entitled "Center of Excellence for Algal Technology and Commercialization" that will invest in algae systems engineering and commercialization for production of biofuel/bio-oil and valuable co-products such as high-protein supplements for feed. This proposal has strong technical merit, relationships with industry partners that will undoubtedly leverage the outputs of the COE, and well-defined and focused performance goals and objectives. If the proposal is funded, the committee recommends that Ohio University work out a more

formal system for the management of intellectual property to ensure that it stays within the State of Ohio and brings maximum benefit to the COE and Ohio University.

3. *Hybrid Fabrics for Multifunctional Composites (10-504)* focuses on the production of a multi-scale hybrid material (called NAHF-X), which is made by growing carbon multiwalled nanotubes by chemical vapor deposition on a fiber preform or textile comprising catalyst-coated glass, carbon, or ceramic fibers. The proposed work is technologically feasible. Creditability for the commercial significance of the proposed effort is supported by results presented on lightning-strike protection and the willingness of Goodrich's and Renegade Materials' to provide a total of $1,500,000 in cost share.

In alphabetical order, the four remaining proposals, ranked in position 4, are summarized as follows:

- *Center for High Performance Power Electronics (10-516)* seeks to put Ohio first in the adoption of silicon carbide (SiC) power electronics by creating a Center for High Performance Power Electronics (CHPPE) at Ohio State University (OSU). SiC has been targeted by the Department of Defense (DOD) as the critical switching material in electrical power handling. Recent press releases indicate that SiC power switches are rapidly becoming a reality. Past DOD, Department of Energy, and National Institute for Standards and Technology investments have resulted in commercial SiC-based diode devices and in prototype switches. SiC power electronic switches are now entering commercial markets. The proposed center will establish a world-class laboratory specifically designed for exploiting SiC power semiconductor capabilities with hardware-in-the-loop capability to rapidly develop and demonstrate control technology for the unique characteristics of the new semiconductor power switches.
- *Center of Excellence for Energy Storage Technology (10-527)* is submitted by OSU, on behalf of itself; CAR Technologies, LLC; Vanner, Inc.; and STMicroelectronics, Inc. The focus of the project is to develop a COE for Energy Storage Technology at OSU. The goal of the center is to provide engineering services that support vehicle electrification (hybrid vehicles). The proposal identifies a clear market opportunity for battery test services and a battery management system where there is a real need and identifies an opportunity for rapid commercialization in a sector that is receiving considerable attention by the investment community.
- *Development of Quantitative Analysis for Stem Cells (10-531).* Case Western Reserve University and its partners BioInVision, the Cleveland Clinic Foundation, and Cleveland Cord Blood Center, along with a diverse set of collaborators, have assembled a consortium focused on technology research and commercialization of non-embryonic umbilical cord blood (UCB) stem cells as a Food and Drug Administration-licensed novel cellular therapeutic product in hematology transplant patients (LeuCord™). Building on this base, the team also plans to focus on related and supporting technologies leading to commercial products. The proposal very clearly lays out the performance goals and objectives for each of the three target product areas, building on the fundamental platform of a profitable world-class UCB stem cell bank. The technical milestones are well defined and the steps to commercialization are clearly identified.
- *The Ohio Center for Microfluidic Innovation (OCMI)—New Products and Competitive Manufacturing Spanning Emerging Biomedical, Electronics, and Sensor Applications (10-505)* is directed at microfluidics research, development, and commercialization. It is centered at the University of Cincinnati where microfluidics technology has been developed over the past several decades, resulting in several start-up companies. The project requests funds to enhance the commercial opportunities—specifically lab-on-a-chip for biomedical applications and electrofluidic devices—for electronic paper, signage, and various display applications. The project has strong points in the technical background and achievements in microfluidics. The proposal properly notes that a low-cost fabrication processes will be needed for the project to be an economically viable candidate for the proposed markets. The major concern of the committee involves the electrofluidic device project for the display market. The committee is concerned that it is too early in the development phase to be considered for present funding, and the

competition in this area is too intense for the proposal to be considered without major customer involvement. The committee thus concluded that this proposal warrants consideration for funding only if the electrofluidic display section is removed from the proposal and the focus placed solely on developing the medical diagnostic device potential.

All of the remaining 11 proposals scored substantially lower than the 7 proposals listed above *when ranked against the criteria and requirements specified in the WPP'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, WPP 10-514, Northern Ohio Structural Laboratories: Advanced Imaging and Microanalysis, has excellent technical goals and objectives but is lacking in the area of commercialization. This proposal is better suited for COE resource funding rather than the WPP, which requires near-term product commercialization. The specific strengths and weaknesses of all the WPP 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 WPP's RFP.

Sincerely,

T.S. Sudarshan, *Chair*

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

Appendixes

A Overview Table
B Individual Summary Evaluations
C Evaluation Worksheet
D Biographical Sketches of Committee Members

Appendix A
Overview Table

This table was prepared by the committee to summarize how well each proposal satisfied the evaluation criteria of the Request for Proposals (RFP) for the 2010 Ohio Third Frontier Wright Projects 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 and Potential**	**Experience, Qualifications, and Eligibility**	**Performance Goals and Objectives**	**Budget and Cost Share**	
Recommended						**Rank**
10-519 Clinically Applied Rehabilitation Engineering (CARE) Project (Cleveland Clinic, Cleveland)	**E**	**E**	**E**	**E**	**M**	1
10-510 Center of Excellence for Algal Engineering Research and Commercialization (Ohio University, Athens)	**E**	**E**	**E**	**M**	**M**	2
10-504 Hybrid Fabrics for Multifunctional Composites (University of Dayton Research Institute, Dayton)	**E**	**M**	**E**	**M**	**M**	3
10-527 Center of Excellence for Energy Storage Technology (Ohio State University, Columbus)	**E**	**M**	**M**	**M**	**M**	4
10-516 Center for High Performance Power Electronics (CHPPE) (Ohio State University, Columbus)	**M**	**M**	**E**	**M**	**M**	4
10-531 Development of a Quantitative Analysis System for Stem Cells (Case Western Reserve University School of Medicine, Cleveland)	**E**	**E**	**M**	**M**	**M**	4
10-505 The Ohio Center for Microfluidic Innovation (OCMI) (University of Cincinnati, Cincinnati)	**E***	**M**	**M**	**M**	**M**	4

Proposal (Lead Applicant)	Technical Merit and Plan	Commercialization Strategy and Potential	Experience, Qualifications, and Eligibility	Performance Goals and Objectives	Budget and Cost Share	
Not Recommended						**Key Weaknesses**
10-506 Northeast Ohio Automation Systems Technologies Research Center (University of Akron, Akron)	**M**	**D**	**M**	**D**	**M**	Lack of focus on any one product and limited commercial potential
10-507 High Power Density Powder Coating System for Infrastructure (University of Akron, Akron)	**D**	**D**	**D**	**M**	**M**	Technical hurdles remain unaddressed, proposed technology is not commercially viable in current coatings market, and the proposal team is missing a key expertise
10-509 Corrugated Paper Center of Excellence (Stark State College of Technology, North Canton)	**D**	**D**	**D**	**D**	**D**	Lack of critical university-industry research collaboration, little to no information on how applicant partners will maintain a sustainable competitive advantage, lack of a coherent budget narrative
10-511 Center for Nano Graphene Materials and Devices (Wright State University, Dayton)	**D**	**M**	**M**	**M**	**M**	Lack of sufficient detail in Technical Merit and Plan and no discussion of A, B or C level metrics as is required by the RFP
10-512 Turbine Innovation for Wide Wind Operation (Ohio State University, Columbus)	**D**	**D**	**M**	**M**	**D**	Disjointed technical proposal, applicant team lacks expertise in large wind turbines, very limited commercialization strategy, lack of a budget narrative as is required by the RFP
10-513 Cyber-controlled Microgrid for Intermittent Renewable Power and Storage (Ohio State University, Columbus)	**E**	**D**	**E**	**M**	**M**	No clear path towards commercialization or exploitation of intellectual property
10-514 Northern Ohio Structural Laboratories: Advanced Imaging and Microanalysis (Case Western Reserve University, Cleveland)	**M**	**D**	**E**	**D**	**M**	No clear link between equipment purchase of Titan microscopes and path to commercialization, and the proposal lacks any concrete deliverables as is required by the RFP

Proposal (Lead Applicant)	Technical Merit and Plan	Commercialization Strategy and Potential	Experience, Qualifications, and Eligibility	Performance Goals and Objectives	Budget and Cost Share	
10-517 Enabling Flexible Fabrication and Robotic Assembly through Agile Manufacturing (Ohio Northern University, Ada)	**D**	**D**	**M**	**D**	**M**	No clear link between proposed R&D work and path to commercialization, and no indication of any direct impact on Ohio job creation or creation of new companies
10-530 Commercialization of Carbon Fiber for Large Scale Carbon/Graphite Materials Application (National Composite Center, Kettering)	**D**	**E**	**M**	**M**	**M**	Lack of sufficient detail in Technical Merit and Plan, in particular a lack of evidence to back up their claims and/or assumptions
10-534 Photovoltaics Commercialization, Research and Education Facility (PCREF) (University of Toledo, Toledo)	**D**	**D**	**M**	**D**	**D**	No technical merit directly related to specific commercialization or jobs creation, proposal offers no obvious short-term commercial opportunity, and all commercial matching is in-kind
10-535—Alternative Materials Product Commercialization and Workforce Training Center (Cuyahoga Community College District, Cleveland)	**D**	**D**	**M**	**D**	**M**	Lack of a scientific or research component, no clear link to commercialization, and narrow performance goals and objectives

* Proposal 10-505 exceeds the requirements of the RFP only if the proposal is refocused, as described in the in-depth review of the proposal in Appendix B.

Appendix B
Individual Summary Evaluations

Summary evaluations of the 18 proposals to the 2010 Ohio Third Frontier (OTF) Wright Projects Program (WPP) are given below. Proposals were evaluated according to criteria given in the Request for Proposals (RFP).

OTF WPP 10-504
Hybrid Fabrics for Multifunctional Composites
University of Dayton Research Institute (UDRI)

Proposal Summary

Proposed Budget		
	State Funds	Cost Share
Operating Funds	$2,500,000	$3,004,333
Capital Funds	$500,000	$0
Subtotal	$3,000,000	$3,004,333
TOTAL	$6,004,333	

This proposal focuses on the production of a multi-scale hybrid material (called NAHF-X), which is made by growing carbon multiwalled nanotubes (MWCNT) by chemical vapor deposition (CVD) on a fiber preform or textile comprising catalyst-coated glass, carbon, or ceramic fibers. The specific goals of the project are to (1) construct a facility to produce 50,000 m^2 of 60-inch-wide NAHF-X by 2011, (2) optimize a variant of NAHF-X to meet Goodrich requirements for commercial aircraft lightning-strike protection of composite structures and achieve market entry, and (3) develop other product forms of NAHF-X to expand the market base for this family of materials. The Ohio-operating collaborators of the University of Dayton Research Institute (UDRI) are Renegade Materials Corporation (who will provide substrate textiles), BF Goodrich (Goodrich Corporation and Goodrich Aerostructures Group, who would like to use an improved NAHF-X as a protective layer on textiles for providing lightning-strike protection), and Owen Corning Science and Technology, LLC (whose focus is on nanotubes grown on glass fabrics).

Detailed Review

- **Technical Merit and Plan**

The applicants' strategy for going from the current 12-inch sheet width to a 60-inch sheet width certainly seems technologically feasible and is important for larger-scale applications, evaluations, and commercialization. However, the applicants urgently need quantitative data (for the described variants of NAHF-X) on basic sheet properties and how they perform for the targeted applications. More specifically, application for lightning-strike protection and de-icing are targeted for first and second applications, respectively, and obtaining quantitative data for these applications should be a first priority—including quantitative assessments of figures of merit. Also, detailed materials-performance comparisons with properties obtained using alternative approaches (like gas-phase delivery of nanotubes formed by chemical vapor synthesis in the gas phase) should be a priority. Additionally, while other possible applications are mentioned (aircraft wheels and brakes, smart structures, lightweight composite armor, fuel cells, photovoltaics, electronic shielding, and communication antennas), the proposal does not provide data for these applications. They need to determine which of these applications are the most promising and focus on only a few. Despite these problems, the proposal exceeds the requirements of the RFP on Technical Merit and Plan.

- **Commercialization Strategy and Potential**

Evidence for the possible importance of the hybrid composites for lightning protection is found in the support of $1,500,000 cost share by Goodrich and Renegade Materials, although it is unclear whether BF Goodrich is committed to locating a manufacturing plant to Ohio if the program is successful. In addition, the proposers provide photographs suggesting that their composites provide attractive performance for lightning-strike protection compared with present state-of-art materials. The team proposes applications of the catalyst to only part of the fibers in a textile, so that nanotubes are present only in specific patterns, which may allow for the in situ growth of electronic circuits that can be used for conformal antennas and morphing structures. Many alternative technologies seem much more suitable for achieving these

benefits, and the concept of morphing structures seems unreasonable for their material. Nevertheless, largely because of promising initial results on lightning-strike protection, the proposal meets the requirements of the RFP on Commercialization Strategy and Potential.

- **Experience, Qualifications, and Eligibility**

The proposal team is highly qualified to conduct a successful program. The UDRI has a well-established track record of success in advancing early-stage technologies toward commercialization, especially for Air Force applications. Goodrich is a key supplier of materials systems for Department of Defense (DOD) applications, and Renegade Materials is a well-established, small company that has special capabilities in the composites area. The principal investigator (Dr. Khalid Lafdi) is the inventor of the NAHF-X technology and leads a full-time professional staff and graduate students to continue its development. He has previously invented and commercialized other carbon-based technologies. The proposal exceeds the requirements of the RFP on Experience, Qualifications, and Eligibility.

- **Performance Goals and Objectives**

Performance goals and objectives are adequately described. Foremost is the goal to optimize and upscale production of NAHF-X for use in aircraft lightning-strike-protection systems manufactured by Goodrich Aerostructures. Equally important are the objectives that include strategies for demonstrating other applications of NAHF-X and obtaining additional funding to enable commercialization. The proposal meets the requirements of the RFP on Performance Goals and Objectives.

- **Budget and Cost Share**

The cost share of $3,004,333 essentially equals the requested state contribution of $3,000,000. This cost share includes $1,504,333 in the form of cash from UDRI, which comes from waiving 26 percent of its indirect costs on state funds and use of monies derived from Air Force programs. Goodrich's cost share amounts to $1,000,000 cash over the 3-year project and is directed toward the development, certification, and market entry for the lightning-strike NAHF-LS material. Renegade Material's cost share amounts to $500,000 cash over the 3-year project period and is directed toward meeting the production needs of the Goodrich application, as well as new product development, principally for Air Force applications. Owens Corning promises $1,000,000 in cost match, but these funds were counted as leverage for the project rather than cost match. The proposal meets the requirements of the RFP on Budget and Cost Share.

Summary of Review and Recommendation

Creditability for the commercial significance of the proposed effort is supported by results presented on lightning-strike protection and the commitment of Goodrich and Renegade Materials to provide a total of $1,500,000 in cost share. The proposed work is technologically feasible. The committee recommends that the OTF Commission consider this proposal for funding.

OTF WPP 10-505
The Ohio Center for Microfluidic Innnovation (OCMI)—New Products and Competitive Manufacturing Spanning Emerging Biomedical, Electronics, and Sensor Applications
University of Cincinnati

Proposal Summary

Proposed Budget		
	State Funds	Cost Share
Operating Funds	$366,675	$2,536,406
Capital Funds	$2,590,000	$420,270
Subtotal	$2,956,675	$2,956,676
TOTAL	$5,913,351	

This proposed project is directed at microfluidics research, development, and commercialization. It is centered at the University of Cincinnati where microfluidics technology has been developed over the past several decades, resulting in several start-up companies. The project requests funds to enhance the commercial opportunities—specifically, lab-on-a-chip for biomedical application and electrofluidic devices—for electronic paper, signage, and various display applications. Both opportunities are in progress with start-up companies, and in the case of lab-on-a-chip, commercial activity is in progress. The request for funding from the WPP is predicated on the need to develop a high-speed, low-cost fabrication technology (e.g., roll-to-roll processing) to yield a significant competitive advantage. Collaborators on this proposal include Siloam Biosciences, Inc., Gamma Dynamics LLC, Sun Chemical Corporation, and EnMonT.

Detailed Review

- **Technical Merit and Plan**

The technical discussion of the proposal was well written and the discussion was presented according to the phases of the project—imagining, incubating, and demonstration—which could also be defined as research, development, and commercialization. The initial opportunity, lab-on-a-chip, is an area in which microfluidics can offer an advantage over state-of-the-art devices if the cost per unit can be dramatically reduced with roll-to-roll microreplication processing. This is an advanced technology market with significant opportunity and exceptionally high-growth potential. This area has intense competition, but the proposal appears to make a solid case with lower-cost fabrication. In addition to the application of microfluidics, there are other promising medical applications in diagnostics, drug delivery, and biological implants. The second opportunity, electrofluidic devices for electronic paper, and so on, is not as far along in development and commercialization. It is also in an extremely competitive field with activity by major display manufacturers. This microfluidics project will also require low-cost microreplication processing technology development and thus fits the primary focus of this project on requesting funds. If the proposal is refocused solely on microfluidic applications (i.e., lab-on-a-chip), as opposed to electrofluidic applications, then the proposal exceeds the requirements of the RFP on Technical Merit and Plan.

- **Commercialization Strategy and Potential**

Lab-on-a-chip has strong commercial potential only if the lower-cost fabrication issues can be resolved. The electrofluidic device potential is much more problematic, with significant competition and many players nationally and internationally in the field with various technologies. The commercial success of this specific project would appear to require cooperation with a major display partner. Three of the four companies (and the three major participants) are quite small and in the very early stages of commercial activity and still have to prove the ability to develop a viable business strategy and demonstrate performance in their business area. Another concern is that the academic–industrial cooperation is considered virtually one and the same, as the companies involved with the commercialization were start-up companies that evolved out of the academic department heading this proposal. Another concern is that the project is predicated on several of the start-up companies receiving substantial funding (Level A

metrics). It is not clear how failure to attract this funding would affect the overall project. This was addressed in the second meeting with some resolution of this latter concern. The proposal meets the requirements of the RFP on Commercialization Strategy and Potential.

- **Experience, Qualifications, and Eligibility**

The academic leadership on this project is very well-versed in the technology and has demonstrated the capability to translate concepts from the laboratory into developmental and even commercial prototypes and products. One aspect of the proposal that some might consider a strong point, and others a weak point, is that the academic and industrial partners are virtually one and the same. The advantage is a well-established working relationship, but the disadvantage is a lack of diversity in experience and opinion in such a close-knit group. The business development and marketing expertise at this early stage of commercialization is somewhat limited, but many team members have had experience with start-up companies. The proposal meets the requirements of the RFP on Experience, Qualifications, and Eligibility.

- **Performance Goals and Objectives**

The applicant team has very clearly outlined what they hope to achieve in terms of job and revenue growth for the first 3 years of the project and 2 additional years. The committee does not doubt the ability of this project to generate jobs and revenue, but is somewhat skeptical of the specific projections put forth by the applicant. That said, the committee believes that regardless of the proposed projections, it is confident that the jobs created are significant enough to factor in to the proposal's consideration. The proposal meets the requirements of the RFP on Performance Goals and Objectives.

- **Budget and Cost Share**

The budget is heavily weighted toward manufacturing and characterization equipment. The cost share is distributed between the university research funds and collaborating industrial partner program funds for microfluidic device fabrication. The proposal meets the requirements of the RFP on Budget and Cost Share.

Summary of Review and Recommendation

The proposed project has strong points in technical background and achievements in microfluidics. The need for low-cost fabrication processes to be an economically viable candidate for the proposed markets is properly noted to be a key factor to success. The commercial strategy and potential appear good, but there are some concerns about the ability of the commercial partners to obtain funding to push these projects forward. The primary commercial partners are all quite early in their start-up status, thus viability is a concern. The major concern of the committee involves the electrofluidic device project for the display market, which is too early in the development phase to be considered for present funding, and the competition in this area is too intense to be considered without major customer involvement. The committee thus concluded that this proposal warrants consideration for funding only if the electrofluidic display section is removed from the proposal and the focus is placed solely on developing the medical diagnostic device potential, which will allow the team to focus on the primary goal of commercializing the most promising and more advanced aspects of this proposal. With this caveat, the committee recommends that the OTF Commission consider this proposal for funding.

OTF WPP 10-506
Automation Systems Technologies Research Center
The University of Akron

Proposal Summary

Proposed Budget		
	State Funds	Cost Share
Operating Funds	$368,750	$723,375
Capital Funds	$1,475,000	$1,120,375
Subtotal	$1,843,750	$1,843,750
TOTAL	$3,687,500	

This proposal concerns the establishment of a new research center at the University of Akron. The center will develop hardware and software technologies for automation systems, with a specific initial focus on material-handling conveyor systems. The University of Akron will collaborate with Rockwell Automation, Western Datacom, Western Reserved Controls, and ADAP Nanotech in the effort.

Detailed Review

- **Technical Merit and Plan**

The proposed work will initially focus on establishing a facility that includes the newly designed, reconfigurable conveyor system test bed that will provide a framework for faculty and industries to collaboratively evaluate new automation technologies. Using new communications and transducer standards from the Institute of Electrical and Electronics Engineers (IEEE), the facility will implement new wireless communications systems and software technologies that build from the core research strengths of the university faculty. The system has two key and original components: a conveyor unit with local proximity sensors and actuators and a controller comprised of an integrated microcontroller and a low-power wireless transceiver. The system will also provide a hands-on experience for education and is designed to reproduce a variety of real-world system contexts for applications in automation. The proposal meets the requirements of the RFP on Technical Merit and Plan.

- **Commercialization Strategy and Potential**

The proposed work will facilitate improvements to a commercial product, Holocon, in the near term and will also create automation software products. The committee assessed the market penetration of such products to be small, relative to the size of the investment by the State of Ohio. This project is at the demonstration test bed stage and may evolve into an effective regional center for automation systems and technologies. However, most of the potential commercial impact is likely to be indirect, and there may not be a specific new product from this work. The proposal does not meet the requirements of the RFP on Commercialization Strategy and Potential.

- **Experience, Qualifications, and Eligibility**

The key university research staff are well qualified and experienced in automation systems, and the industry partner is also well qualified, although limited to one individual. The proposal meets the requirements of the RFP on Experience, Qualifications, and Eligibility.

- **Performance Goals and Objectives**

Although the proposal addresses the fact that a research platform, and therefore a process for generating new ideas in automation, will be built, there is little discussion of what will happen if the system fails to perform. The proposal does not meet the requirements of the RFP on Performance Goals and Objectives.

- **Budget and Cost Share**

The proposal seeks operating funds to support salaries of faculty and graduate students and some tuition. The proposal also seeks capital funds to purchase components for setting up an experimental station consisting of a reconfigurable conveyor system. There is a donation of equipment from Rockwell and the support of students and research from Western Datacom. The budget describes a 50:50 cost share with the state funding. The proposal meets the requirements of the RFP on Budget and Cost Share.

Summary of Review and Recommendation

Overall, this project seeks to create a test bed for research and applied research ideas in a novel area of reconfigurable and wireless conveyor systems. It is the committee's opinion that the creation of a specific product or product-manufacturing system is not imminent, and therefore the proposal does not meet the requirements of the WPP. The committee does recognize that the project team has identified an issue important to Ohio, namely loss of manufacturing jobs over the past two decades, which is now partly being replaced with new contract manufacturing. The committee does not recommend that the OTF Commission consider this proposal for funding; however, the committee does encourage the team to resubmit next year and focus on identifying one or more specific products.

OTF WPP 10-507
High density Powder Coating Systems for Infrastructure
The University of Akron

Proposal Summary

Proposed Budget		
	State Funds	Cost Share
Operating Funds	$500,000	$4,203,356
Capital Funds	$2,500,000	$123,000
Subtotal	$3,000,000	$4,326,356
TOTAL	$7,326,356	

This proposal aims to use high-density infrared (HDI) technology licensed from Oak Ridge National Laboratory (ORNL) to deposit coatings on a wide variety of surfaces. The aim is to extend the corrosion life of surfaces in numerous applications. Specific products targeted are tubular, sheet plate, and sheets. Industry collaborators MesoCoat, Inc., and Edison Materials Technology Center will bring diverse capabilities to this project. The University of Akron will serve as the integrator and the workforce trainer for the program in addition to providing technical support and characterization.

Detailed Review

- **Technical Merit and Plan**

The committee agrees that the concept of overcoming corrosion with a new generations of coatings would be a significant advancement of the technology. Much of the research would leverage work done by ORNL and the earlier work done by MesoCoat through Small Business Innovation Research (SBIR) and non-SBIR programs. It is not clear how the issues related to coefficient of thermal expansion would be addressed, because several of these coatings may see exposure under a range of temperatures, and any break in the coating could result in significant electrochemical activity due to the creation of an area vulnerable to corrosion. It is also not clear how these coatings would behave under both impact and bend loading conditions, as much of this will be experienced during transport, installation, and service. The cost of the coatings relative to all other current existing products was not given. The committee is also concerned about the need to use HDI lamps, and it is not clear on how the HDI equipment manufacturer would integrate into this program. The proposal does not meet the requirements of the RFP on Technical Merit and Plan.

- **Commercialization Strategy and Potential**

While the commercial potential for any coating to combat corrosion to extend equipment life is significant, the barriers to entry for any new, unproven technology within 3 years are next to impossible to overcome. Most large manufacturers have intensive specifications for their products and require extended exposure and cyclic testing at a range of temperatures. Since the coatings will be developed during the course of this program, the ability to expand this into sales within 3 years is minimal. The Department of Energy (DOE) has funded this technology at ORNL for over a decade, and, except for Caterpillar, few companies have been able to see economic value in the use of these coatings. Since conventional paints and galvanizing have existed as a base for corrosion protection for more than 5 to 6 decades, the aspect of displacing these coatings with new technology is difficult and will not happen within 3 years. In addition, most of the letters of commitment appeared to be templates and were lukewarm with no significant commitment from any customer. The proposal does not meet the requirements of the RFP on Commercialization Strategy and Potential.

- **Experience, Qualifications, and Eligibility**

The team has excellent experience in the area of powder coatings and corrosion technology. However, what is lacking is the knowledge base of the industry as a whole and the numerous barriers to entry. In addition, the lack of an electrochemical specialist minimizes the effectiveness of the team to combat problems associated with implementation and possible misuse. The proposal does not meet the requirements of the RFP on Experience, Qualifications, and Eligibility.

- **Performance Goals and Objectives**

All of the tasks are well laid out with great detail. Most of the tasks are self explanatory, although the role of the University of Akron is minimized and unclear. Most of the knowledge base is retained by MesoCoat, Inc., and the committee feels that the project is oriented more toward research. The proposal meets the requirements of the RFP on Performance Goals and Objectives.

- **Budget and Cost Share**

The travel amount of about $90,000 provided by MesoCoat is excessive, considering that all the players are within the state. Furthermore, the number of personnel shown by MesoCoat for cost share is excessive; it is highly unlikely that they will not be required in the first year, and the overstaffing is significant for a project of this level for subsequent years, given that the technical risk and marketability has not been proven. The proposal meets the requirements of the RFP on Budget and Cost Share.

Summary of Review and Recommendation

This is deemed as a research project with limited prospects for short-term commercialization and with some technical issues and numerous barriers to entry based on cost and performance. The lack of a clear understanding on the commitment of the HDI manufacturer to this development is also considered to be a negative aspect of this technology. There are no firm commitments from any of the end users, although a number of them are mentioned in the proposal. In addition, when compared with paint and galvanized coatings, the potential of the technology is significantly minimized with respect to ease of training and familiarity. The committee does not recommend that the OTF Commission consider this proposal for funding.

OTF WPP 10-509
Corrugated Paper Center of Excellence
Stark State College of Technology

Proposal Summary

Proposed Budget		
	State Funds	Cost Share
Operating Funds	$364,800	$1,445,170
Capital Funds	$2,505,370	$1,425,000
Subtotal	$2,870,170	$2,870,170
TOTAL	$5,740,340	

Stark State College of Technology (SSC) proposes the development of a Corrugating Center of Excellence pilot facility. Industrial partners are Cargill Inc., Kohler Coating, Palm Group, the Stark Development Board, COPAR Corporation, and Foltz Machines. The pilot facility would be located at the Kohler Coating site in Canton, Ohio, and would carry out development and commercialization of reduced-energy corrugated packaging technology using a new machine and process developed by Kohler. The pilot facility will provide training for technical students enrolled at SSC and will serve as a pilot and demonstration facility for prospective customers of Kohler.

Detailed Review

- **Technical Merit and Plan**

The proposed Center of Excellence (COE) would carry out research and commercialization-related development and marketing for second-generation corrugated-packaging technology. This technology is intended to improve the strength of the corrugated product and reduce process-related energy consumption by 30 percent. The center also would perform research on an advanced fiber-orientation corrugated-packing technology to improve board strength and reduce process-related consumption. The overall goal is the development of a corrugated-paper product with significantly higher (50 percent) board strength and lower energy requirements for processing. The center would serve as a "demonstration project" for marketing the technology to prospective purchasers and would provide training for process operators. This proposal does not appear to involve research collaboration between an Ohio institution of higher education and industry. Instead, it appears to be a vehicle for an Ohio firm to establish a pilot-scale demonstration facility for a new technology in corrugated-paper production. As it stands, the primary academic benefit is workforce training. The proposal does not meet the requirements of the RFP on Technical Merit and Plan.

- **Commercialization Strategy and Potential**

The technical development program outlined in the proposal involves final-stage research and development (R&D) on a product that is about to be introduced into the market. The proposed research has considerable commercial relevance, and its relatively short-term focus fits the goals of the TFP. The proposal says little or nothing, however, about the strategy of Kohler and other industrial participants to develop a sustainable competitive advantage in a line of business in which Kohler currently has a very modest global market share. The proposal does not meet the requirements of the RFP on Commercialization Strategy and Potential.

- **Experience, Qualifications, and Eligibility**

SSC plays little role as a research collaborator. Greater academic research involvement in areas such as polymer synthesis, rheology, and microstructure-depended mechanical properties would have strengthened the proposal. Indeed, the proposed pilot facility would be located on the premises of the industrial collaborator. A vaguely defined "joint use agreement" (JUA) would govern its use by the firm

and SSC students and faculty. But no information on the terms of the JUA is provided. Given the reliance by the industrial collaborator (Kohler) on trade-secret protection of some portion of its intellectual property, the possibility that trainees might work for competing firms and/or otherwise inadvertently disclose these secrets appears to be significant. The proposal does not meet the requirements of the RFP on Experience, Qualifications, and Eligibility.

- **Performance Goals and Objectives**

Very few of the program goals and objectives listed in the proposal (other than training) involve SSC. Reflecting the project's goals, the proposed technical work is very incremental, and the prospects for commercialization of the technology are reasonable. The projections of job creation do not match the assumptions outlined in the proposal. No basis is provided for the proposal's assumptions that each million dollars in annual sales at Kohler and Foltz Machine will create a total of four new jobs (two jobs per million dollars per company), nor is there any basis in the proposal for the additional assumptions that four "indirect" jobs in the "community" will result from each additional million dollars in annual sales. In addition, the sales projected to be realized by year 5 seem to indicate larger employment effects than what is detailed in the proposal: the roughly $206 million in sales should yield more than 400 "direct" jobs and 800 "indirect" jobs. The proposal instead projects only 200 "direct" and 200 "indirect" jobs. The proposal does not meet the requirements of the RFP on Performance Goals and Objectives.

- **Budget and Cost Share**

There is no coherent budget narrative. All of the cost-sharing contributions from the industrial partners are "in-kind," in spite of the RFP preference for cash. Indeed, the primary industrial collaborator (Kohler) claims its "donation" of a prototype of the new machine (which will remain on the firm's premises) as an in-kind contribution. SSC provides no financial contribution. Cargill's contribution is small and exclusively in-kind. The proposal does not meet the requirements of the RFP on Budget and Cost Share.

Summary of Review and Recommendation

This proposal appears to be a vehicle for an Ohio firm to establish a pilot-scale demonstration facility for a new technology in corrugated-paper production. Although the proposed research has considerable commercial relevance, there is little evidence of academic research involvement in areas such as polymer synthesis, rheology, and microstructure-depended mechanical properties. As noted above, the physical siting of the proposed "pilot facility" on the premises of the industrial participant raises complex issues concerning access and training of students that require more than a passing reference to a "joint use agreement" whose terms are not spelled out. The proposal's discussion of the sustainability of any competitive advantage developed through its research program, its economic effects (particularly job creation), and its budget also lacks detail and coherence. The committee does not recommend that the OTF Commission consider this proposal for funding.

OTF WPP 10-510
Center for Algal Engineering Research and Commercialization
Ohio University

Proposal Summary

Proposed Budget		
	State Funds	Cost Share
Operating Funds	$500,000	$2,741,820
Capital Funds	$2,470,063	$228,243
Subtotal	$2,970,063	$2,970,063
TOTAL	$5,940,126	

This proposal is submitted by Ohio University on behalf of itself, University of Toledo, Harrison County in Ohio, and several Ohio-based private sector entities. It proposes to establish a Center of Excellence (COE) for algal technology and commercialization that can invest in algae systems engineering and commercialization for production of biofuel/bio-oil and valuable co-products such as high-protein supplements for feed. The private sector collaborators include Algae Venture Systems; Red Lion BioEnergy; Algae Producers of America; Midwest Biorenewables, LLC; Independence Bio-products; Tricounty Career Center; Innovative Food Technologies; Recombinant Innovations; and Univenture, Inc., under advisory board members, including those from Lubrizol Corporation and Parker Hannifin Corporation.

Detailed Review

- **Technical Merit and Plan**

The technical plan of the proposal addresses steps needed for integration of multiple technologies for sustainable algae production and engineering system development to be used for algae oil and co-products for commercialization and for educational purposes. The technical plan for the proposed project convincingly assures clear market potentials for the above products. The goals and objectives are well written and focus on job creation and commercial success of the products. This proposal exceeds the requirements of the RFP on Technical Merit and Plan.

- **Commercialization Strategy and Potential**

Most of the private sector collaborators are well qualified to commercialize this COE's products, and in an ideal collaborative world, the commercial products of the proposed COE could include a service that uses waste streams as nutrient sources for algae (a bioremediation system), animal feed supplements, and fertilizers from algae, reduces phosphorous and nitrogen load in waste treatment facilities, and reduces carbon dioxide emissions. However, it is hard to see what arrangements could be made among these companies as to who should commercialize what products. The committee felt that the applicant team's relationship with industry partners and the potential for success based on technical merit are enough to carry this project to commercialization. There are some complicated issues with managing the intellectual property in this proposal, and if the proposal is funded, the committee recommends that Ohio University work out a more formal system for the management of intellectual property to ensure that it stays within the State of Ohio and brings maximum benefit to the COE and Ohio University. This proposal exceeds the requirements of the RFP on Commercialization Strategy and Potential.

- **Experience, Qualifications, and Eligibility**

The project directors and all others involved are well qualified for the proposed work, the team is comprised of a strong group of university and industry experts. The proposal clearly describes the roles and responsibilities of the lead applicant and collaborators and also addresses the possibility of dilution of focus given the number of actors involved. To this end, the committee was pleased to see a board of advisors involved in the program that will be established to help guide the commercialization plan. The proposal exceeds the requirements of the RFP on Experience, Qualifications, and Eligibility.

- **Performance Goals and Objectives**

The goals and objectives of the proposal are very appropriate and fit well with the capabilities of the partners. The job and revenue growth numbers proposed by the team over 3- and 5-year periods do not appear to be unrealistic, but it is still unclear what the exact impact will be on the state from each individual output of the program. The proposal meets the requirements of the RFP on Performance Goals and Objectives.

- **Budget and Cost Share**

The budget is appropriate, and the amount of matching funds is acceptable. The proposal identifies several sources of funding, much of which is in-kind funding from collaborators for personnel. State funding is primarily devoted to buildings and equipment, all of which appears to be purchased in the first year. The committee would have liked to see more information provided about the program partners that did not provide cost-share information, even those that provided a letter of commitment. The proposal meets the requirements of the RFP on Budget and Cost Share.

Summary of Review and Recommendation

This proposal has strong technical merit, relationships with industry partners that will undoubtedly leverage the outputs of the COE, and well defined and focused performance goals and objectives. Furthermore, the applicant team demonstrated the ability to handle issues related to sustainability, potential externalities of algal cultivation, and the distribution and retention of intellectual property. If the proposal is ultimately funded, the committee recommends that Ohio University work out a more formal system for the management of intellectual property to ensure that it stays within the State of Ohio and brings maximum benefit to the COE and Ohio University. The committee recommends that the OTF Commission consider this proposal for funding.

OTF WPP 10-511
Center for Nano Graphene Materials and Devices
Wright State University

Proposal Summary

Proposed Budget		
	State Funds	Cost Share
Operating Funds	$500,000	$3,000,000
Capital Funds	$2,500,000	$0
Subtotal	$3,000,000	$3,000,000
TOTAL	$6,000,000	

This proposal is submitted by Wright State University, on behalf of itself, Air Force Research Laboratory, Angstron Materials, EYZtek, Inc., MRLets Technologies, Inc., and Ultra Cell Corporation. The focus of the project is to develop a Center for Nano Graphene Materials and Devices at Wright State University. The goal of the center is to promote and assist in the development of graphene-enhanced products and energy storage and conversion devices in the State of Ohio and to become a national center of excellence in graphene research and development. The center plans to leverage the unique properties of graphene, including high intrinsic strength, electron mobility, and thermal conductivity, to address important applications such as anodes for lithium ion batteries, bipolar plates for fuel cells, electrodes for supercapacitors, and so on.

Detailed Review

- **Technical Merit and Plan**

The proposal focuses on a wide variety of product opportunities that offer the possibility of performance enhancement or cost reduction via the utilization of graphene. While the technical intent described in the proposal is very good—graphene research is fertile, multidisciplinary, and can impact a broad range of applications—the proposal provides only limited detail relative to the technical plan for achieving specific performance enhancements in one or more of these important product opportunities. The proposal does not include any discussion of A-, B-, or C-level metrics, as is required by the RFP, and provides no discussion relative to performance targets for the proposed activity. The proposal does not meet the requirements of the RFP on Technical Merit and Plan.

- **Commercialization Strategy and Potential**

The commercial possibilities outlined in the proposal appear to be significant if graphene plays a key role in advancing important technologies in key market sectors. The proposal also provides a reasonable justification of the size and scope of these markets. Limited information is provided that specifically defines and characterizes the competitive advantage of graphene-enhanced products over a wide range of competitive product options. Alignment of the center with a leading R&D company that holds a considerable intellectual property portfolio is very positive. Discussion of the means to handle project intellectual property appears to be on target but lacks detail. There is very limited discussion of the receptivity of capital markets and potential for leverage. The potential for global competition and a strategy for addressing global market needs is not convincing, because it lacks detail. The proposal marginally meets the requirements of the RFP on Commercialization Strategy and Potential.

- **Experience, Qualifications, and Eligibility**

This program is organized around a strong team, including the leadership of Wright State University in partnership with Wright Patterson Air Force Research Laboratory and several Ohio industries, including Angstron Materials, Co., UltraCell Corporation, EYZtek, Inc., and MRLets Technologies, Inc. The project directors, including principal investigator (PI) Dr. Yan Zhuang and Drs. Jang and Xue, appear to

be qualified to lead the proposed activity. Active participation by the industrial partners further strengthens this proposal. The proposal meets the requirements of the RFP on Experience, Qualifications, and Eligibility.

- **Performance Goals and Objectives**

Although the goals and objectives are stated in the proposal, there is very little detail relevant to the impact of this potential investment on the products and markets. It appears that important job growth resulting from the intensified R&D activity will help increase visibility of the partner company, potentially leading to enhanced sale of graphene materials and the development of complimentary technologies in the future. But, unfortunately, without sufficient detail, the proposal does not make a strong case to justify funding. The proposal meets the requirements of the RFP on Performance Goals and Objectives.

- **Budget and Cost Share**

The budget for this project appears to be appropriate, and the matching funds of the non-lead participants are significant. Funds for key pieces of equipment, including those used for high-resolution and multi-functional characterization and fabrication of graphene-based materials and general characterization of graphene-based materials, appear to be properly allocated to achieve project objectives. Participant cost share, including significant cash contributions on the part of project team members, provides strong support for proposed program activities. The proposal meets the requirements of the RFP on Budget and Cost Share.

Summary of Review and Recommendation

While the idea for a Center for Nano Graphene Materials and Devices is appealing and technically interesting, the proposal lacks sufficient detail, particularly in the technical section, to justify funding. From a structural standpoint, the proposal was not well organized, in that a logical pathway leading from technology through markets toward commercialization was not clearly defined, making it difficult to justify the funds required to support the center. Key objectives and the rationale for supporting those objectives were not clearly spelled out, and the proposal suffers from a lack of focus. The proposal would also have benefited from careful proofreading (although this fact did not influence the committee's deliberations). The committee does not recommend that the OTF Commission consider this proposal for funding.

OTF WPP 10-512
Turbine Innovation for Wide Wind Operation
The Ohio State University

Proposal Summary

Proposed Budget		
	State Funds	Cost Share
Operating Funds	$445,512	$2,269,840
Capital Funds	$1,824,328	$0
Subtotal	$2,269,840	$2,269,840
TOTAL	$4,539,680	

The objective of this proposal is to improve performance of a typical large-scale wind turbine by 25 percent throughout its operating envelope and to reduce the acoustic signatures by 10 decibels, and to manufacture the advanced technology composite blades and evaluate their field performance for a range of wind conditions. The collaborators for this proposal are Orbital Research, Belcan Engineering Group, and Phillips Electrical.

Detailed Review

- **Technical Merit and Plan**

Although the proposed research topic is relevant and timely, the synthesis of various proposed technologies elements is disjointed because of the team's apparent lack of aeromechanics experience in large wind turbines. The proposal's approach is to (1) refine plasma actuators for flow control, (2) build a blade section with embedded plasmas and test in a wind tunnel, (3) develop multidisciplinary optimization analysis in conjunction with genetic algorithms (kriging surrogate approach) and couple with the MSC ADAM commercial wind-turbine code and search optimal blade design with distributed plasma actuators, (4) use Northwind 100 wind turbine blades as a baseline system and redesign it with new airfoil technology, (5) manufacture a new set of composite blades, and (6) install the wind turbine with new blades on farmland outside of Columbus, Ohio, and carry out testing for its performance evaluation. The new site for construction of the turbine, which is different from the original proposed site of South Bass Island, does not have the same strength and frequency of winds as South Bass Island and is not as strong a site for carrying out a demonstration. The proposal also lacks budget and cost metrics for its performance goals, even though these are specifically required by the RFP, and indicates that these metrics will be established during the second year of the project's life. The proposal does not meet the requirements of the RFP on Technical Merit and Plan.

- **Commercialization Strategy and Potential**

The participants include local Ohio industries such as Belcan and Phillips, who will, respectively, design the wind turbine and operate the wind turbine. It is not clear whether any of the investigators have any prior experience in the use of a commercial-wind-turbine code. Although one of the members of the applicant team has specific experience in commercialization of novel technologies, the proposal itself has essentially nothing in the way of a commercialization strategy. It is highly unlikely that this project will result in the near-term commercialization of a product or platform technology, as required by the RFP. The proposal does not meet the requirements of the RFP on Commercialization Strategy and Potential.

- **Experience, Qualifications, and Eligibility**

The committee recognizes that the applicant team has world-class expertise in many areas relevant to the proposal, but it is not clear that their combined expertise translates to large-scale wind turbines. Biographical data provided in the proposal shows that the applicant team has little experience in large rotating systems, and as such, the technical contents look very superficial. These facts do not necessarily

preclude the team from adequately carrying out their proposal, but it does not instill a great deal of confidence in the committee. The proposal meets the requirements of the RFP on Experience, Qualifications, and Eligibility.

- **Performance Goals and Objectives**

The project could help enhance in-house infrastructure, but future commercial exploitation of this technology is unclear. Furthermore, the proposal's roadmap to synthesize different technologies is somewhat disjointed. Given that there is no detailed commercialization plan, the committee is not convinced that the performance goals and objectives can be achieved in the timeframe specified in the RFP. Despite these concerns, the committee determined that the proposal meets the minimum requirements of the RFP on Performance Goals and Objectives.

- **Budget and Cost Share**

There is significant in-house and in-kind industry cost share, but the proposal lacks a budget narrative as required by the RFP, as well as any cash contributions. The lack of detail in how OTF funds will be spent is discouraging. The proposal does not meet the requirements of the RFP on Budget and Cost Share.

Summary of Review and Recommendation

The proposal's strengths include timely and relevant research, an accomplished researcher as the principal investigator, an innovative plasma flow control technique, and state-of-art multi-disciplinary optimization methodology. The proposal's weaknesses include a lack of investigators with prior experience in large rotating systems, many unrealistic assumptions and expectations, too many buzz words that make the approach seem somewhat superfluous, inexperience in the use of a commercial-wind-turbine code, and a disjointed roadmap to synthesize different technologies. Large wind turbines suffer from numerous aerodynamic and dynamic issues, which is now a very popular area of research. The proposal investigators are urged to carry out in-house pilot studies toward the development of a large-scale (100-kilowatt-level) wind turbine and obtain background and insights on the aeromechanics of large rotor systems. The committee suggests that investigators collaborate with a wind turbine manufacturer (preferably located in the State of Ohio) and carry out initial joint studies related to large wind turbines. Additionally, there exist many federal opportunities in this area, and the committee is uncertain that the technologies explored in the proposal are sufficiently mature to warrant the involvement of the State of Ohio. The committee does not recommend that the OTF Commission consider this proposal for funding.

OTF WPP 10-513
Cyber-Controlled Micro Grid for Intermittent Renewable Power and Storage
The Ohio State University

Proposal Summary

Proposed Budget		
	State Funds	Cost Share
Operating Funds	$500,471	$2,115,694
Capital Funds	$2,082,723	$467,500
Subtotal	$2,583,194	$2,583,194
TOTAL	$5,166,388	

This proposal is submitted by Ohio State University (OSU), on behalf of itself, EMTEC, Hull & Associates, Liebert Corporation, GreenField Solar Corporation, and the Dayton Power and Light Company. There are also two letters of support. The focus of the project is to buy innovative renewable-energy equipment from GreenField Solar for OSU to use in collaboration with GreenField Solar's commercial activity and for other relevant risk-mitigation purposes to the OSU power-delivery system in developing competence in smart grid technologies. Several other related, domain-focused projects are outlined in the proposal, which are to be implemented as the equipment is added to OSU's internal power grid.

Detailed Review

- **Technical Merit and Plan**

There are multiple themes in the proposal, the major one being the creation of a grid-monitoring system and the analysis of resulting data and multiple simulations of the various balances of renewables on grid stability and performance in real time. Considering national progress in integrating renewables on the major power grids, in practice there is clearly a lack of data, which supports the proposal's novel technical approach and the importance of the main focus of this proposal.

The pilot testing of the GreenField Solar combined photovoltaic and combined-heat-and-power (CHP) units is interesting, although it is only approximately 20 percent of the program, based on funding. Spillover of project benefits, such as the possible transfer of work to testing laboratories in Ohio, could also present additional benefits to Ohio's economy The proposal exceeds the requirements of the RFP on Technical Merit and Plan.

- **Commercialization Strategy and Potential**

Although there is potential for substantial learning and intellectual property to be derived from the cyber-controlled micro grid data, it is not being exploited in future commercial activity in this proposal. There is no clear plan to exploit this information and experience beyond an academic interest. There could be, with planning and specific effort, substantial potential for payback, but it does not appear to be a focus of the proposal. The commercial intent of GreenField Solar, though, is significant. For the commercialization portion of the project, however, capital markets, competition, and public policy issues are not fully explored in the proposal. A letter or term sheet from a potential investment partner might have been useful for the committee to evaluate the specific business phase that GreenField Solar is in, to verify both the jobs potential and timing. The proposal's business plan requires significant capital, but this was not sufficiently covered in the plan. The proposal does not meet the requirements of the RFP on Commercialization Strategy and Potential.

- **Experience, Qualifications, and Eligibility**

The project directors and all others involved are very well qualified for leadership. The proposal is also a significant approach to a problem that has not been fully explored of how the insertion of small-scale renewables on the national grid impacts base-loading systems. The proposal exceeds the requirements of the RFP on Experience, Qualifications, and Eligibility.

- **Performance Goals and Objectives**

The goals and objectives individually are well stated and appropriate. There is excellent planning to execute the cyber-controlled micro grid and related activities in the proposal. The proposal meets the requirements of the RFP on Performance Goals and Objectives.

- **Budget and Cost Share**

The budget is appropriate, and the matching funds of the non-lead participants are significant. It must be considered, however, that the matching funds for GreenField Solar are coming out of the purchase of equipment by OSU. If the quality or functionality of the equipment makes it unusable to the OSU grid, or if there are cost overruns incurred by GreenField Solar, this project may be unable to be completed. There should be a backup plan for additional funding if the performance of the GreenField Solar system is deficient. Since this equipment has been in some pilot use, a total loss is not likely, but this might have been worth mentioning in the management plan. The proposal meets the requirements of the RFP on Budget and Cost Share.

Summary of Review and Recommendation

The committee sees significant merit in the cyber-controlled micro grid, but little consideration has been made for specific commercialization and jobs creation within that part of the proposal. Perhaps as a result of that effort, significant public good may result, but the focus of the WPP is for near-term commercialization and jobs creation. The GreenField Solar portion of the program, though technically interesting, is still untested at the CHP level and lacks solid financial support. The committee does not recommend that the OTF Commission consider this proposal for funding.

OTF WPP 10-514
Northern Ohio Structural Laboratories: Advanced Imaging and Microanalysis
Case Western Reserve University

Proposal Summary

Proposed Budget		
	State Funds	Cost Share
Operating Funds	$0	$120,000
Capital Funds	$3,000,000	$3,000,000
Subtotal	$3,000,000	$3,120,000
TOTAL	$6,120,000	

This application proposes the purchase of two cutting-edge, high-resolution electron microscopes for use by an academic–industry consortium. The microscopes would be placed at two existing imaging centers within Case Western Reserve University (CWRU): the Cleveland Center for Membrane and Structural Biology (CCMSB) and the Swagelok Center for Surface Analysis of Materials (SCSAM), together forming the Northern Ohio Structural Laboratories (NOSL). CWRU will be collaborating with Lakeland Community College, ChanTest, Copernicus Therapeutics, Molecular Research Center, Inc., NeoProteomics, Inc., Best Mode Company, GrafTech International Holdings, Inc., Affymetrix, Inc., SSC, Swagelok, Ricerca Biosciences, and Polgenix, Inc.

Detailed Review

- **Technical Merit and Plan**

The proposed NOSL facilities would provide Ohio with a significant competitive advantage for R&D in both materials and biologics. This project proposes the acquisition of two FEI Titan transmission electron microscopes (TEMs). One instrument will physically reside in each Center (CCMSB and SCSAM). The Titan to be installed at the CCMSB will be a FEI Titan Krios 300-keV cryo-TEM capable of electron crystallography and electron tomography. This Krios technology would significantly elevate Ohio's capabilities in high-resolution biologic imaging, and CWRU has already raised over $5 million in donations and pledges ($3 million through the CWRU Medical School) to support the Krios installation. The Titan to be installed at SCSAM will be a FEI 300-keV analytical Titan TEM providing atomic-level imaging and subnanometer-level microanalysis. This Titan system would establish Ohio as a premier site for high-resolution microanalysis for materials, coatings, and lubricants; the only other such system resides in Germany. The proposal meets the requirements of the RFP on Technical Merit and Plan.

- **Commercialization Strategy and Potential**

The proposed academic–industry consortium indicates a wide range of prospective applications that would benefit from the combined facility. However, this proposal lacks specific near-term products or development plans and has no concrete objectives for commercialization of intellectual property and/or products that might arise from the 12-member Ohio consortium. The proposal does not meet the requirements of the RFP on Commercialization Strategy and Potential.

- **Experience, Qualifications, and Eligibility**

This project will be managed by a team of five faculty PIs at CWRU: Prof. Krzysztof Palczewski (PI) with Prof. Frank Ernst, Prof. Arthur Heuer, Prof. Michael Maguire, and Prof. Andreas Engel (co-investigators). This expertise provides world-class infrastructure for advanced surface analysis and microcharacterization of materials and biologicals. The proposal exceeds the requirements of the RFP on Experience, Qualifications, and Eligibility.

- **Performance Goals and Objectives**

The technical goals and objectives of this proposal are well defined, however NOSL seems more appropriate as a research facility than a commercialization center. The application lacks any concrete deliverables, as specifically requested in Section 6 of the RFP. If NOSL and companies of the proposed consortium cannot identify deliverables in advance, this suggests that this application fails the commercialization requirement for the WPP. This proposal appears to be better suited for COE resource funding rather than an RFP that requires near-term product commercialization. While the technical goals and objectives are excellent, the commercialization goals and objectives are severely lacking; thus the proposal does not meet the requirements of the RFP on Performance Goals and Objectives.

- **Budget and Cost Share**

This proposal requests funds to purchase two FEI Titan TEMs, but the committee could not find any list price for either system to justify the requested funds. The microscope supplier, FEI Company, proposes to make significant in-kind contributions, however their letter of support commits to only 1 year of support for two research engineers and two field service engineers ($400,000 total). The CWRU School of Medicine offers $3 million additional support for capital equipment out of existing funds. The proposal meets the requirements of the RFP on Budget and Cost Share.

Summary of Review and Recommendation

The committee does not doubt the contribution that NOSL could make to universities and industry in the State of Ohio. However, the proposal falls outside of the requirements of the RFP in too many areas—particularly in its commercialization strategy and performance goals. The proposal provides little in the way of demonstrating how purchasing the Titan TEMs will actually place NOSL on the path to commercialization within timeframe of the RFP, and the lack of focus on any one field of materials research is also discouraging. The WPP is intended for focused programs with clear objectives and outputs. Given the excellent technical goals and objectives and unconvincing commercialization goals, this proposal may be better suited for a program that funds the creation of COEs. The committee does not recommend that the OTF Commission consider this proposal for funding through the WPP.

OTF WPP 10-516
Center for High Performance Power Electronics
The Ohio State University

Proposal Summary

Proposed Budget		
	State Funds	Cost Share
Operating Funds	$500,000	$1,053,746
Capital Funds	$2,500,000	$5,050,000
Subtotal	$3,000,000	$6,103,746
TOTAL	$9,103,746	

Silicon carbide (SiC) has been targeted by the DOD as the critical switching material in electrical power handling. Recent press releases indicate that SiC power switches are rapidly becoming a reality. This proposal seeks to put Ohio first in the adoption of SiC power electronics by creating a Center for High Performance Power Electronics (CHPPE) at OSU. The Air Force Research Laboratory (AFRL) at Wright Patterson Air Force Base and GE Aviation Systems at Vandalia will collaborate with OSU to commercialize the first Ohio products using SiC: (1) A multi-mode inverter converter controller (MMICC) for strike aircraft that will provide engine starting, 270 VDC conversion/regulation/control, emergency power, battery charging and electrical power transient management; and (2) solid state 270VDC aircraft power controllers—SiC-based circuit breakers that will provide protection (including arc-fault sensing) currently impossible with mechanical equivalents.

Detailed Review

- **Technical Merit and Plan**

This proposal offers to bridge the gap between theory and prototype power semiconductors by developing a CHPPE with the specific focus of driving the exploitation of SiC in products produced by Ohio industries. The CHPPE will include a world-class power electronics laboratory specifically designed to exploit the high-temperature, high-frequency operation and efficiency advantages of SiC-based power electronics. The program addresses all five of the objectives of the OTF WPP. The proposal meets the requirements of the RFP on Technical Merit and Plan.

- **Commercialization Strategy and Potential**

Although the initial applications of SiC power electronics will likely be in the aerospace market, as the costs moderate, SiC will eventually become ubiquitous in application. Using SiC in aircraft power systems hardware offers significant competitive advantage to GE. OSU will also demonstrate both commercialization projects to interested engineers at the DOD (e.g., the U.S. Air Force at Wright Patterson AFB in Ohio and the U.S. Army Transportation Command in Michigan) and for the airframe industry, including the manufacturers of both civil and military aircraft: Boeing, Northrop Grumman, and Lockheed Martin. The proposed center will leverage the massive ($300 million) DOD investment in SiC power semiconductors. In addition, the AFRL at Wright Patterson AFB has issued RFPs for studies ($100,000 maximum) in the MMICC area and for development work in the solid state power controller (SSPC) area ($3.6 million). The proposal meets the requirements of the RFP on Commercialization Strategy and Potential.

- **Experience, Qualifications, and Eligibility**

Roles and responsibilities are clearly defined. The program director (Prof. Xu) is an IEEE fellow for his outstanding achievements in power electronics control of advanced machines. The other members of the team appear equally well qualified for their tasks. The three-way partnership/collaboration between the GE Aviation-Electrical Power business (Vandalia), the Energy/Power/Thermal Division of the AFRL at Wright Patterson AFB, and OSU is very strong. The proposal exceeds the requirements of the RFP on Experience, Qualifications, and Eligibility.

- **Performance Goals and Objectives**

The short-term goal for this project is to establish a COE in the State of Ohio to exploit game-changing power-electronics technology. The specific objectives are clearly stated with well-defined metrics at all levels. The longer-term goal is to serve as a tool for all Ohio industries wanting to exploit advanced power electronics, including transportation, wind power, solar power, lighting, uninterruptable power supplies, and more. The proposal meets the requirements of the RFP on Performance Goals and Objectives.

- **Budget and Cost Share**

The budget is well justified and balanced. State funds are required to upgrade the infrastructure of the OSU laboratory. Additional state funds will be required to purchase equipment and instrumentation that are unique for SiC-based devices and subsystems to be simulated, tested, and model-validated. AFRL will provide $3 million of cost share capital expenditures in year 1 and 2 (Junction Field Effect Transistors of $2.5 million and starter/generator of $500,000) and GE Aviation will contribute one SiC-based inverter/converter/controller ($2.0 million) in year 1 to support the development of the proposed technology. The in-kind cost share from AFRL and GE Aviation is valued at more than $1.67 million per year for 3 years, totaling $5 million. In addition, GE will contribute $53,708 in cash as cost share for purchasing capital equipment and materials and supplies. OSU will use $500,000 from state funds for personnel. No state funds will be used by GE for operational costs; instead, GE will cost share funding for the personnel on the project. The proposal meets the requirements of the RFP on Budget and Cost Share.

Summary of Review and Recommendation

Past DOD, DOE, and National Institute for Standards and Technology investments have resulted in commercial SiC-based diode devices and in prototype switches. SiC power electronic switches are now entering the commercial markets. The proposed center will establish a world-class laboratory specifically designed for exploiting SiC power semiconductor capabilities with hardware-in-the-loop capability to rapidly develop and demonstrate control technology for the unique characteristics of the new semiconductor power switches. The committee recommends that the OTF Commission consider this proposal for funding.

OTF WPP 10-517
Enabling Flexible Fabrication and Robotic Assembly
Ohio Northern University

Proposal Summary

Proposed Budget		
	State Funds	Cost Share
Operating Funds	$500,000	$1,235,000
Capital Funds	$2,500,000	$1,765,000
Subtotal	$3,000,000	$3,000,000
TOTAL	$6,000,000	

This proposal concerns the establishment of a new research center at Ohio Northern University (ONU). The center will develop an agile manufacturing system with a specific focus on enabling the fabrication and assembly of solar panels. ONU will collaborate with American Trim LLC, Motoman, Inc., GreenField Solar Corporation, Ohio Energy and Advanced Manufacturing Center, and American Electric Power Ohio.

Detailed Review

- **Technical Merit and Plan**

The proposal aims at R&D and commercialization of an agile manufacturing system based on ideas of flexible fabrication and robotic assembly of products that will be commercialized for the alternative and advanced energy market. The proposed work builds from the PI's experience in NASA and synergistically combines the skills and resources of the industrial collaborators. The proposed facility will implement agile manufacturing paradigms, thereby impacting new designs and prototypes for solar panels that build from the core skill and interests of the university–industry collaboration. However, specific details on the proposed R&D work and the direct link to commercialization impact are quite unclear. The proposal does not meet the requirements of the RFP on Technical Merit and Plan.

- **Commercialization Strategy and Potential**

The value proposition of the proposed work is to impact the production of solar panels. However, the proposal does not allow a quantitative assessment of how the proposed solutions directly influence the proposed commercialization. The proposal fails to convincingly argue why the commercialization could not be undertaken without a major influence by the proposed academic research. The proposal does not meet the requirements of the RFP on Commercialization Strategy and Potential.

- **Experience, Qualifications, and Eligibility**

ONU will serve as the project lead. The project manager has extensive management experience at NASA's Jet Propulsion Laboratory and at ONU. In addition, a technical lead has been assigned by ONU to develop the proposed agile manufacturing system. Further, the commercialization lead, from American Trim, will coordinate the commercialization of products emerging from implementing the agile manufacturing system. The representatives of ONU and its industrial collaborators are well qualified to undertake the proposed work. The proposal meets the requirements of the RFP on Experience, Qualifications, and Eligibility.

- **Performance Goals and Objectives**

The proposed work includes major capital acquisitions and improvements at ONU through the establishment of the agile manufacturing research center. It is anticipated that the long-term use of capital will promote educational and training programs for technical workers and students. However, the project does not demonstrate a direct impact on job creation and retention, nor does it support the creation of new companies that will substantially promote wealth generation in the State of Ohio. The proposal does not meet the requirements of the RFP on Performance Goals and Objectives.

- **Budget and Cost Share**

The proposal seeks operating funds to support staff and students. The proposal also seeks capital funds to support the construction of an agile manufacturing center and to select equipment relevant to the proposed work. ONU will provide $405,000 in cost-share funds through reduced indirect costs as well as in-kind faculty and staff support throughout the project period. In addition, a $1 million Economic Development Agency grant for constructing the center will result in cash share, if successful. The bulk of the remaining cost share will be provided largely by in-kind contributions from American Trim and Motoman. Surprisingly, GreenField Solar, whose products will be benefit the most from the proposed project, will neither receive nor contribute any funds. Despite this fact, the proposal meets the requirements of the RFP on Budget and Cost Share.

Summary of Review and Recommendation

The proposal will support the establishment and operation of an agile manufacturing center that will be operated by ONU. The center will interact with key industrial stakeholders that will support the supply stream for solar panel production. While the basic principle underlying the proposed work has merit, the details provided in the proposal do not make a convincing case of how the center would directly impact the commercial activity. Further, a broader case of having sufficient research direction and funds to support the operation of the center has not been established. The committee does not recommend that the OTF Commission consider this proposal for funding.

OTF WPP 10-519
Clinically Applied Rehabilitation Engineering (CARE) Project
Cleveland Clinic

Proposal Summary

Proposed Budget		
	State Funds	Cost Share
Operating Funds	$500,000	$3,591,512
Capital Funds	$2,500,000	$150,000
Subtotal	$3,000,000	$3,741,512
TOTAL	$6,741,512	

The Clinically Applied Rehabilitation Engineering (CARE) Project is focused on inventing, developing and commercializing rehabilitation products for patients with impaired mobility/ability who cannot perform activities of daily living and who therefore require rehabilitative intervention. This project would build a state-of-the-art dynamic testing platform to develop, prototype, test, manufacture, and commercialize advanced rehabilitative medicine products. Bertec Corporation of Columbus, Ohio, would be employed as principal subcontractor to construct the platform. The platform would be established in Cleveland on the main campus of the Cleveland Clinic. Advanced prototyping, testing, and workforce training facilities would also be established in Cleveland at both the CWRU and the Veteran's Administration Research Center. Parker Hannifin Corporation (PHC), a multinational corporation headquartered in Cleveland, Ohio, would handle downstream product development, manufacturing, and commercialization. Bertec Corporation of Columbus, Ohio, and the L. Stokes Cleveland Veterans Affairs (VA) Medical Center will also collaborate with the Cleveland Clinic.

Detailed Review

- **Technical Merit and Plan**

The scientific and technical program of CARE has four key goals: (1) improving the overall prototyping capacity at the VA Medical Center, (2) developing unparalleled facilities for assessing new rehabilitation technologies, (3) closing the gap between companies developing new medical or research devices and clinical end users, and (4) devising advanced mobility rehabilitation methodologies. The CARE investigators and engineers at the Cleveland Clinic, VA Medical Center, and Bertec have identified five innovative projects that address major problems facing rehabilitation patients: an instrumented treadmill, an ambulatory assist orthosis, hybrid orthoses for ambulation and stair climbing, an integrated stimulation device, and controllers for forced exercise for Parkinson's patients. Many of the companies involved are already in the development stage, and a few have prototypes of their own. The committee was particularly impressed with the proposal's technical merit. The proposal exceeds the requirements of the RFP on Technical Merit and Plan.

- **Commercialization Strategy and Potential**

The consortium of engineering and development expertise shows strong potential for innovation, with a joint committee between the lead parties for commercialization of products and for leveraging the VA's quality-control system to smooth the path to product development. The Cleveland Clinic and PHC have worked together for the past 2 years in a joint committee to identify development ideas outside of CARE; PHC intends to support consideration of all commercialization models, even those not directly beneficial to PHC. The two parties would construct an inter-institutional agreement to handle questions of commercialization, intellectual property, and so on. Intellectual property is anticipated to reside within the Cleveland Clinic or PHC, exclusively or jointly; PHC requires some intellectual property control for sustained value. The proposal exceeds the requirements of the RFP on Commercialization Strategy and Potential.

- **Experience, Qualifications, and Eligibility**

The CARE investigators and engineers at the Cleveland Clinic, VA Medical Center, and Bertec are world-class and have an impressive background in biomechanical engineering R&D. PHC plays a major role in the commercialization of devices and intends to develop significant medical device expertise in tandem with innovation and product development; furthermore PHC will make best efforts to maintain manufacturing within Ohio. The proposal exceeds the requirements of the RFP on Experience, Qualifications, and Eligibility.

- **Performance Goals and Objectives**

This proposal includes clear performance goals for the initiatives described in the technical plan, including new rehabilitation methodologies, prototyping, rehabilitation facilities, and clinical validation and testing. The development goals and objectives are detailed and thorough. It is commendable that this proposal includes FDA approval timelines and cost to market projections, and the joint committee can assist in the transition from innovation to development and into the marketplace. The proposal exceeds the requirements of the RFP on Performance Goals and Objectives.

- **Budget and Cost Share**

Several sources of cost share funds are indicated in the proposal: Cleveland Clinic provides $750,000 per year to support technology development and prototyping, CWRU/VA's Advanced Platform Technology Center brings ~$1.2 million to this project through various funded projects, Bertec and the Cleveland Clinic have a combined Phase 1 and 2 SBIR, and PHC provides an investment of ~$15 million per year in targeted R&D. The proposal was slightly limited by having no mention of any ongoing concrete communication with investors, but this is more likely to prove fruitful once feasibility data is in hand. This proposal meets the requirements of the RFP on Budget and Cost Share.

Summary of Review and Recommendation

Strong leadership, the potential for innovations, and the leveraging of existing Ohio infrastructure make this proposal a strong contender for OTF funds. The applicant team has demonstrated that these products could be commercially viable, and the only concern is the management of intellectual property, which the committee is confident can be handled by the interested parties. The lack of firm commitments from investors is slightly discouraging, but is outweighed by the positive aspects of this proposal. The committee believes that firm commitments will most likely be made once the program begins meeting its goals. The committee recommends that the Ohio Third Frontier Commission consider this proposal for funding.

OTF WPP 10-527
Center of Excellence for Energy Storage Technology
The Ohio State University

Proposal Summary

Proposed Budget		
	State Funds	Cost Share
Operating Funds	$500,000	$2,910,155
Capital Funds	$2,500,000	$90,000
Subtotal	$3,000,000	$3,000,155
TOTAL	$6,000,155	

This proposal is submitted by OSU, on behalf of itself; CAR Technologies, LLC; Vanner Inc.; and STMicroelectronics, Inc. The focus of the project is to develop a Center of Excellence for Energy Storage Technology at OSU. The goal of the center is to provide engineering services that support vehicle electrification (hybrid vehicles), including characterization, testing, and life cycle validation for advanced propulsion batteries and supporting battery management systems (BMS) (protects cells during charge/discharge, balances charge amongst cells, provides communications during charging) engineering for commercial vehicles.

Detailed Review

- **Technical Merit and Plan**

The proposal successfully outlines the project goals and objectives, defining A, B, and C metrics with specific performance goals and a means of measurement. The principal objectives are to deploy an advanced battery test laboratory, develop commercial-grade advanced-battery engineering services, create and demonstrate a second-generation BMS, and create programs to support education and training—all are successfully outlined in table form in the proposal. The technical approach and work plan provides a reasonable framework to address these objectives but could be strengthened with more detail on how key objectives will be accomplished. Deliverables and milestones seem sufficient to support technical execution and commercialization. The proposal exceeds the requirements of the RFP on Technical Merit and Plan.

- **Commercialization Strategy and Potential**

The proposal provides a strong case for commercialization of the test services being developed and could be strengthened even further by a more complete description of how these test services may be parlayed into a sustainable business. The close business relationship between OSU and CAR Technologies is an important aspect of the proposed activity and provides a pathway for test service commercialization. Additional specifics concerning the value proposition to the end-user for both test services and the BMS would further strengthen the proposal. The market opportunities for these products appear to be substantial. Capital markets are very receptive to clean-tech ideas, and vehicle electrification falls squarely within the zone of interest for many investors. The applicants have outlined their advantages relative to global competition, but more detail would further support the case. Although at least one significant potential end user, Caterpillar, has provided a letter of support, no commitments of financial support have been received from either Caterpillar or other major end-users. A significant financial commitment from a major end-user such as Caterpillar would be considered a plus. The proposal meets the requirements of the RFP on Commercialization Strategy and Potential.

- **Experience, Qualifications, and Eligibility**

The project directors and all others involved are qualified to lead the proposed activity. Specifically, the principal investigator, Dr. Giorgio Rizzoni, has substantial experience in leading large, complex program

activities and organizations. Other key program participants have significant track records of success in similar activities. CAR Technologies has demonstrated success in developing similar test services and in raising customer awareness of their product. The proposal meets the requirements of the RFP on Experience, Qualifications, and Eligibility.

- **Performance Goals and Objectives**

The goals and objectives are stated in the proposal and appear to be in line with the RFP. A conservative case is presented for job creation. There are some questions regarding the real potential for job and business growth using the proposed business model. The proposal meets the requirements of the RFP on Performance Goals and Objectives.

- **Budget and Cost Share**

The budget for this project appears to be appropriate, and the matching funds of the non-lead participants are significant. One puzzling aspect of the proposal budget is the omission of the apparent financial commitments from AeroVironment as potential cost-sharing. A more detailed description of the relationship between CAR Technologies, OSU researchers, and AeroVironment would be beneficial. The proposal meets the requirements of the RFP on Budget and Cost Share.

Summary of Review and Recommendation

This is a well-written proposal. It identifies a market opportunity for battery test services and a battery management system where there is a real need and identifies an opportunity for rapid commercialization in a sector that is receiving considerable attention by the investment community. The committee recommends that the OTF Commission consider this proposal for funding.

OTF WPP 10-530
Commercialization of Carbon Fiber for Large Scale Carbon/Graphite Materials Application
National Composite Center

Proposal Summary

Proposed Budget		
	State Funds	Cost Share
Operating Funds	$500,000	$2,315,700
Capital Funds	$2,500,000	$684,300
Subtotal	$3,000,000	$3,000,000
TOTAL	$6,000,000	

The technical and commercial goal of this project is to find a feasible route to produce low-cost carbon fiber suitable for applications. The proposed project comprises three components: precursor selection, fiber processing (spinning, carbonization/oxidation, and sizing) and commercial validation. Pitch type precursors from petroleum and coal tar will primarily be investigated by the proposers for both graphite and carbon fiber. As an alternative to these petroleum precursors, they also plan in the future to investigate the use of lignin (an inexpensive chemical product commonly derived from wood) as a precursor. The plan is to seek suitable fiber processing technology and install and optimize processing equipment to produce low-cost carbon and graphite fiber. Using equipment for carbon fiber spinning, stabilization, sizing, and carbonization that is installed at National Composite Center (NCC), they plan to scale-up capacity of 40 to 100 pounds per hour. Collaborators of the lead institution, NCC, are GrafTech International Holdings Inc., Michelman, Inc., University of Dayton Research Institute (UDRI), University of Cincinnati (UC), Adisco, Inc., and EB Manufacturing Company, Inc.

Detailed Review

- **Technical Merit and Plan**

Because of the ever growing need for high-performance carbon fiber and the expanded sales opportunities if cost can be reduced, the area of the proposed project is one in which there are major opportunities. Since so many companies have long tried to reduce carbon and graphite production costs, the most convincing proposal in this area would describe at least a few fresh new ideas and evidence suggesting that these ideas are likely to work. Instead, the applicants largely propose to revisit old approaches and make them work by largely undisclosed means (and possibly by obtaining rights to off-the-shelf technologies). They provide little insight into why their efforts might succeed while so many others have failed (except by their proposed combination of advances that enable the full yarn production process, which should also be obvious to their competitors). In their "alternative future approach for the precursor" they describe the use of lignin (instead of coal or petroleum derived pitches). This again is an old approach, as the authors acknowledge: "Lignin has been adapted to carbon fiber manufacture over many years, yet no commercial product line based on lignin has ever come to market." The proposers do not appear to have a strong technological strategy for achieving success, nor do they explain why the previous lignin process never came to market. They largely just state that technological advances have been made on low-cost precursor, low-cost spinning technology, and the application of low-cost carbon fiber, and that they plan to take advantage of these advances. No proof is provided that they will be able to access the intellectual property of others, and no evidence is provided that they will be successful in developing their own improvements. As such, the proposal does not meet the requirements of the RFP on Technical Merit and Plan.

- **Commercialization Strategy and Potential**

While the proposers do not provide important new insights on the commercial potential of low-cost graphite and carbon yarn production, there is no doubt of the enormous commercialization opportunity that would be provided by achievement of the targeted goal of low-cost production of carbon and graphite fibers having deployable properties. Therefore, the proposal exceeds the requirements of the RFP on Commercialization Strategy and Potential.

- **Experience, Qualifications, and Eligibility**

The assembled team appears technologically strong, which is why the absence of a strong technical plan is puzzling. The assembled institutions and companies have the expertise for success. The proposal meets the requirements of the RFP on Experience, Qualifications, and Eligibility.

- **Performance Goals and Objectives**

The proposal states that participants will research the precursor selection, fiber processing, and commercial validation, but the proposers do not provide significant evidence that they will ever reach the commercial market, much less in the targeted time period where an opportunity window might exist. However, judging just the worthiness of the goals (without factoring the probability that these goals will be realized), the proposal meets the requirements of the RFP on Performance Goals and Objectives.

- **Budget and Cost Share**

GrafTech's commitment to $1 million in cost share match is commendable, although it is difficult to separate this commitment from funds that would have been spent whether or not this proposal is successful. However, the budget put forward has all in-kind contributions. Cash contributions from team members would better indicate the strength of their commitment, and the lack of such should have been explained. The proposal meets the requirements of the RFP on Budget and Cost Share.

Summary of Review and Recommendation

The absence of a well-defined technical plan that goes beyond exploiting the results of others is a major problem, especially when concrete evidence of the ability to use the inventions of others is not provided. In addition, descriptions are not provided for problems that must be overcome for these prior-art technologies to be commercially deployable. While technology from GrafTech is also available, no details are provided on the importance of GrafTech's advances and the need for state funding to exploit these advances. Overall, this proposal is weak. The committee does not recommend that the Ohio Third Frontier Commission consider this proposal for funding.

OTF WPP 10-531
Development of a Quantitative Analysis System for Stem Cells
Case Western Reserve University, School of Medicine

Proposal Summary

Proposed Budget		
	State Funds	Cost Share
Operating Funds	$499,972	$1,806,294
Capital Funds	$2,197,328	$912,000
Subtotal	$2,697,300	$2,718,294
TOTAL	$5,415,594	

CWRU and its partners BioInVision, the Cleveland Clinic Foundation (CCF), and Cleveland Cord Blood Center (CCBC), along with a diverse set of collaborators, have assembled a consortium focused on technology research and commercialization of non-embryonic umbilical cord blood (UCB) stem cells as a FDA-licensed novel cellular therapeutic product in hematology transplant patients (LeuCord™). Building on this base, the team also plans to focus on related and supporting technologies leading to commercial products. Two specific products have been identified for this proposal focused on necessary preclinical research to validate new imaging technology (CryoViz™ and Colonyze™) to render reliable and reproducible quantitative measurements of UCB stem cells in vitro and in vivo preclinical assay models. The overall long-term goal of the project is to create a self-sustaining UCB stem cell business that will bring revenue into the State of Ohio and create job opportunities for Ohio's citizens.

Detailed Review

- **Technical Merit and Plan**

The proposed project will engage in preclinical and clinical research to develop a pipeline of new UCB products, with an initial focus on accelerating three products: LeuCord™, CryoViz™, and Colonyze™. The project will focus on technology research and commercialization of UCB stem cells as a novel therapeutic product in hematology transplant patients (LeuCord™) and novel imaging instrumentation for UCB stem cell enumeration and validation (CryoViz™ and Colonyze™).

LeuCord™ UCB units are an alternate hematopoietic stem cell (HSC) source with clinical and market advantages. Several key activities are mapped out in the proposal. A research strategy will focus on developing a good manufacturing process grade isolation and banking of cord blood hematopoietic stem cells for future cell therapy trials focused on sickle cell disease. Development strategies include testing specific approaches to increasing recovery of nucleated cells during UCB processing and evaluating proprietary serum preparations to prime UCB-derived HSCs in a potential combined therapeutic for peripheral vascular disease. In the near term, the team will launch the biologic license application process with the FDA and begin collection, processing, and distribution of LeuCord™ for clinical transplantation. The new UCB stem cell bank will offer a significant contribution to meeting the vast shortage of available transplants for both clinical and research purposes.

Colonyze™ is an existing quantitative tool for cell and colony analysis in pilot use, developed by the Clinical Tissue Engineering Center located at the Cleveland Clinic. This project goal is to adapt and validate Colonyze™ for a new application to reproducibly and reliably assess the quality (biological potential and function potency) of UCB stem and progenitors cells for clinical applications and to develop this tool as a robust, versatile, and commercially available platform that can serve both the industrial and academic needs of the cellular therapy industry. Current state of practice is manual enumeration. By using advanced imaging and processing technology, this automation process tool has the potential to significantly impact the challenges and costs associated with validating patient samples.

CryoViz™ is a prototype preclinical imaging system developed by BioInVision and CWRU that will significantly improve a serious limitation in the field to quantify stem cell homing and engraftment. This prototype has served as the basis for highly successful cryoimaging results. The project will create and install the first commercial prototype at CWRU Medical Center and optimize/validate the software and experimental methods for quantitative analysis of UCB stem cells. CryoViz™ will be the first fully commercially available automated imaging instrument for quantification of stem cells in vivo for homing and biodistribution analysis.

The projects are well defined, with clear timelines, deliverables, roles, and responsibilities. The team clearly understands the requirements and risks and provides clear options and mitigation plans. The proposal exceeds the requirements of the RFP on Technical Merit and Plan.

- **Commercialization Strategy and Potential**

The consortium seeks to leverage past state investment and the rapidly growing demand for UCB-derived stem cells to build a unified COE and competitive cluster of economic activity in Ohio. The focus is to build out a platform that can be used to develop new diagnostic and medical therapeutic products in stem cell regenerative markets, with a focus on the three products noted above. The project has the potential to help position Ohio in a market-leading position in a targeted area. The market size and customer base for the three products are well understood. The market penetration strategy for LeuCord™ is very well defined and leverages existing infrastructure and networks. The market strategy for the two imaging products is clearly outlined, but somewhat less defined. Commercialization potential for the imaging products would benefit from partnering with an instrument or device partner with national or global reach. The proposal exceeds the requirements of the RFP on Commercialization Strategy and Potential.

- **Experience, Qualifications, and Eligibility**

The technical leadership team is highly qualified. The partners bring teams with decades of experience in the key scientific and technical disciples. The partners have solid experience and a good track record on prior TFP awards. The teams' weaknesses are in commercialization and business management (especially for a young start-up business). The proposal meets the requirements of the RFP on Experience, Qualifications, and Eligibility.

- **Performance Goals and Objectives**

The proposal very clearly lays out the performance goals and objectives for each of the three target product areas, building on the fundamental platform of a profitable world-class UCB stem cell bank. The technical milestones are well defined and the steps to commercialization are clearly identified. Objectives associated with commercialization remain too general. The proposal meets the requirements of the RFP on Performance Goals and Objectives.

- **Budget and Cost Share**

The budget appears reasonable for the tasks defined in the proposal. Cost share is primarily donated staff time and associated indirects, listed as cash. Two pending CCBC DOD Technology Development Awards (totaling $212,872) are listed as cash-match. The proposal meets the requirements of the RFP on Budget and Cost Share.

Summary of Review and Recommendation

This proposal leverages investments already made by the State of Ohio in this field, and the applicant has demonstrated a thorough understanding of the market that will help put this project on the path to commercialization. Although the commercialization strategy outline put forth by the applicants was very good, the committee would have liked to have seen more detail. That said, the performance goals and objectives are very clear and well detailed. The committee recommends that the OTF Commission consider this proposal for funding.

OTF WPP 10-534
Photovoltaics Commercialization, Research and Education Facility
University of Toledo

Proposal Summary

Proposed Budget		
	State Funds	Cost Share
Operating Funds	$497,655	$1,791,842
Capital Funds	$2,500,000	$1,246,000
Subtotal	$2,997,655	$3,037,842
TOTAL	$6,035,497	

The Photovoltaics Commercialization, Research and Education Facility (PCREF) proposal is submitted by the University of Toledo on behalf of itself, Brush Engineered Materials, Inc., and National Exposure Testing (NET). There are 10 additional end user letters of support from participants in an existing and related program. The proposal is to set up and add on to an additional facility at the University of Toledo of 5,600 ft^2 of more general purpose space related to its existing programming (PVIC), and 2,000 ft^2 of laboratory space, which will be half occupied by the two collaborative partners. The use of the other half of laboratory space is to be used by two additional commercial partners in the future (referred to as PCREF program in the proposal).

Detailed Review

- **Technical Merit and Plan**

The build-out of the existing PVIC program, although related to this proposal from the standpoint of support, has no technical merit directly related to a specific commercialization or jobs creation as stated in the RFP. Although the successes of the PVIC program in jobs creation are significant, this proposal lacks a *major direct connection* to a specific job-creation plan. The technical merit and plan of the equipment placed for use by the two new tenants does not indicate clearly more than an attempt to justify equipment for expansion of existing educational purposes and for expansion of business incubation space for the future. Less than 25 percent of the time usage of the smaller space will be used by the new tenants. The equipment for this space represents about one-third of the project investment. The proposal does not meet the requirements of the RFP on Technical Merit and Plan.

- **Commercialization Strategy and Potential**

Commercial success of the project portion of the two tenants is well within the capacities of these two companies. The issue is the timing of the commercial activities and the total jobs creation. The NET participation fits an existing need for local testing, but it is only $400,000 of the proposal. Because of the economy, the Brush commercialization is on a delay, and as a result, a revised plan and the timing of the jobs creation is beyond the timeline specified in the RFP. The proposal does not meet the requirements of the RFP on Commercialization Strategy and Potential.

- **Experience, Qualifications, and Eligibility**

All parties in the proposal related to the commercialization plan are very well qualified. It is unclear how much of the University of Toledo's extremely qualified staff will have hands-on participation in each part of the project. There is lack of clarity in this area if the impact of the university staff is critical to the two tenants' success, although it is possible the university educational component and the local economy's solar cluster will gain expertise from Brush, but it is dependent on intellectual property and trade secret considerations. The proposal meets the requirements of the RFP on Experience, Qualifications, and Eligibility.

- **Performance Goals and Objectives**

Within the two commercialization plans, the objective of NET is clear, but for Brush it is less so. In addition, the economy has delayed Brush's decisions. The remainder of the goal is to build capacity for future unspecified but promising programs. It appears that the early use of the facilities does not specifically address significant short-term commercial opportunity as the central requirement of the grant request. The proposal does not meet the requirements of the RFP on Performance Goals and Objectives.

- **Budget and Cost Share**

The appropriate and matching parts of the budget do not fully meet the requirements. All of the commercial matching amounts are in-kind, leaving the program exposed to a change in the plans or economic shifts that may occur with the partners. Some of those changes have already occurred. The proposal does not meet the requirements of the RFP on Budget and Cost Share.

Summary of Review and Recommendation

The direct commercial activities, as stated above, are speculative and minor in relation to the entire proposal. There are questions of the timing of jobs creation to put those beyond the 3-year time frame of the RFP. The committee does not recommend that the OTF Commission consider this proposal for funding.

OTF WPP 10-535
Alternative Materials Product Commercialization and Workforce Training Center
Cuyahoga Community College District

Proposal Summary

Proposed Budget		
	State Funds	Cost Share
Operating Funds	$287,922	$676,058.40
Capital Funds	$1,099,076	$1,000,000.00
Subtotal	$1,386,998	$1,676,058.40
TOTAL	$3,063,056.40	

This proposal is a cooperative effort between Cuyahoga Community College District, Winston Products LLC, and Polymer Ohio to set up a workforce training center at the college to assist the market entry of SmartShingles, a product of Winston Products. The long-range benefit noted in the proposal is to provide a resource for additional commercialization opportunities where workforce training would be required. The SmartShingles technology is noted in the proposal to be a cost-effective approach for reroofing, offering improved energy efficiency over conventional approaches. The proposal is thus narrow in scope and directed at the workforce training of a new roofing product, with potential for other less-defined training opportunities for the future.

Detailed Review

- **Technical Merit and Plan**

This proposal is primarily directed at a training program to provide a company with a ready-trained workforce to install their product. It does not include a scientific or research component in the proposal, and thus appears to have no or limited relevance to the technical requirements of the RFP. The proposal does not meet the requirements of the RFP on Technical Merit and Plan.

- **Commercialization Strategy and Potential**

The proposal is directed toward the training of a workforce for installation of SmartShingles. While workforce availability is important to the commercialization of a new product, it is only one element of an overall strategy. The other important aspects were not included, and thus are not considered part of the strategy. The training required for each worker is 40 hours. The overall goal of the proposed program is to provide the capability to train workers for emerging commercialization opportunities in support of for-profit Ohio companies. Two of the companies offering letters of support (Tomco and Tremont) had discussion sections in their letters that were identical, which raises questions regarding the sincerity of the letters. The proposal does not meet the requirements of the RFP on Commercialization Strategy and Potential.

- **Experience, Qualifications, and Eligibility**

The principal investigator has a resume that illustrates a background and commitment in formation and execution of training programs in various areas. The commercial partner, Winston Products, is a relatively new company seeking to commercialize a new roofing product, and their representative on this project is the president and founder of the company. The listed collaborators have the background and expertise to conduct the proposed project. The proposal meets the requirements of the RFP on Experience, Qualifications, and Eligibility.

- **Performance Goals and Objectives**

The performance goals are primarily based on the training of roofers for Winston Products for installation of their roofing products in the State of Ohio. The proposal states that 500 jobs will be created, with 50 at Winston Products. This will require 40 hours of training for each roofer. The performance goals and objectives are quite narrow, and the proposal does not meet the requirements of the RFP on Performance Goals and Objectives.

- **Budget and Cost Share**

The majority of the state funds requested will be utilized for capital projects (for building and equipment for a workforce training center). The cost share to be provided by Winston Products involves the training of 500 personnel. Additional cost shares are noted by the college, and the funds are expected (but not committed) from future partners involve training program payments. The proposal meets the requirements of the RFP on Budget and Cost Share.

Summary of Review and Recommendation

The committee does not believe this proposal fits the technical merit and commercial potential goals of the OTF WPP. Rather, it is a training program to provide a workforce for emerging Ohio-based commercialization projects and does not involve development and commercialization of technology. The project proposed may indeed have merit, but not under the guidelines of this program. The committee does not recommend that the OTF Commission consider this proposal for funding.

Appendix C
Evaluation Worksheet

Evaluation Criteria	Score A-F
A. Technical Merit and Plan [all from RFP section 3.3.6]	
1. Understanding the Program Intent. Proposal is responsive to the long-term purposes of the OTF.	
2. Problem Statement. a. Technical and commercial challenges described. Will solutions increase likelihood of achieving commercialization? b. Description of eventual customer needs and performance requirements.	
3. Project Goals and Objectives. a. Objectives described in terms of Level A, Level B, and Level C Metrics (See RFP Appendix A) b. How will goals and objectives carry technology forward into market entry or late demonstration phases?	
4. Technical Approach and Work Plan. a. How will goals and objectives be met? Compare research techniques, methods, and facilities, and equipment to alternatives. b. Tasks described in terms of objectives, approaches, resources, and outcomes. How will progress will be made and measured?	
5. Scientific and Technical Merit a. Scientific objectives are original and innovative; novel concepts, approaches or methods are employed b. Project has potential for new discoveries and understanding; advances beyond previous studies can be expected c. Scientific and technical feasibility; conceptual framework, design, methods, and analyses adequately developed	
6. Deliverables and Schedule described with tangible milestones for commercialization and technical progress	
B. Commercialization Strategy and Potential [all from RFP section 3.3.7]	
1. Value Proposition. Define benefits of the proposed approach and explain why the market values these benefits.	
2. Management of Intellectual Property. How will new Intellectual Property be managed to benefit Ohio-based companies? a. Clear definition of intellectual property status, who controls it, protection from competition, and freedom to operate	
3. Potential for Products. a. Identify focused commercialization opportunity for new products with significant market size and growth within 3 years b. Proof of Principle already demonstrated c. Technologies or products have competitive advantage over existing and alternative technologies	

Evaluation Criteria	Score A-F
4. Size of Opportunity. Proposal accurately assesses market and has realistic assumption about market share that could be captured	
5. Degree of Customer Readiness. Customer input, especially from collaborators who may be eventual customers	
6. Investment and Time to Market. How much money and time is needed to bring the product to market	
7. Receptive Capital Markets. Provide evidence that various sources of capital are interested in the project	
8. Potential for Leverage. Define goals and plans for leveraging OTF grant funds with other non-state funds	
9. Ability to Compete Globally. Demonstrate an understanding of the global marketplace and trends, including barriers to market entry that favor large firms. How well the Lead Applicant is able to compete for international business opportunities.	
10. Degree of Sustainable Competitive Advantage. Demonstrate that the proposed Project fits within, or can create, an environment which enables Ohio to maintain a leading, competitive advantage.	
11. Ability to leverage Ohio's supply chain, existing or emerging	
12. Existence of supporting workforce. Discuss workforce needs and whether Ohio's workforce could be a positive factor for success	
13. Roles and Responsibilities. Roles and responsibilities of the Lead Applicant and Collaborators in the commercialization process	
14. Explanation of cost for next phase of commercialization and what organizations can or have committed to provide resources	
C. Experience, Qualifications, and Eligibility	
1. Proposal demonstrates commitment of the Lead Applicant and Collaborator(s) to building a sustainable partnership [2.2]	
2. Leadership is demonstrated in all critical phases, including research, intellectual property protection, regulatory compliance, product development, leveraging of additional funding, and commercialization [3.3.10]	
3. Team has relevant organizational experience to perform technical and commercialization work involved [3.3.10]	
4. Proposal must realize near-term commercialization (within 3 years) with on-going potential [2.3.1]	
5. Lead applicant and Collaborators demonstrate proof of principle, prototypes, and business cases [2.2]	
D. Performance Goals and Objectives	
1. Project includes major capital acquisitions and improvements at an Ohio college, university, or non-profit institution. [2.2]	
2. Long term use of capital to promote educational and training programs for technical workers and students.[2.2]	
3. Project demonstrated to have an impact on job creation and retention; personal wealth; new sales; companies created; follow-on investments and new funding; talent recruitment; or enhanced Ohio recognition [3.3.8]	

Evaluation Criteria	Score A-F
4. Realistic forecast of direct employment, income, revenue for 3 and 5 years beyond project start [3.3.8]	
5. Direct impacts identified for each distinct product or platform that will come from State investment [3.3.8]	
E. Budget and Cost Share	
1. Budget justified in detailed narrative and forms and is adequate to meet proposal goals; no more than 20% for indirect costs [2.4 and 3.3.11]	
2. Cost share is necessary and reasonable; 1:1 with state funds, and is preferably in the form of unrestricted cash [3.3.11]	
3. Wright Capital Funds used solely to acquire, renovate, or construct facilities or purchase equipment that will be property of an Ohio college, university, or non-profit. [2.4 and 3.3.11]	
4. Explanation of cost for technical proof, and if state funding is not adequate, where will the additional investment come from? [3.3.7]	
5. Commitment letters are provided and are sufficiently detailed including an explanation of cost share commitment [3.3.12]	

Appendix D
Biographical Sketches of Committee Members

T.S. SUDARSHAN is president and CEO of Materials Modification, Inc. He 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. 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, National Institutes of Health, U.S. Army, Michigan Economic Development Council, and ASM International–The Materials Information Society. He has also served on the technical advisory boards of numerous companies over the last two decades. Dr. Sudarshan is the editor of the journals *Materials and Manufacturing Processes* and *Surface Engineering*. He is a fellow of ASM International and the International Federation for Heat Treatment and Surface Engineering. He previously served on NRC committees that reviewed proposals for the State of Ohio (2008 and 2009) and on other NRC panels on corrosion and on the National Nanotechnology Initiative as well as two terms on the National Materials Advisory Board. 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.

SUNDAR V. ATRE is an associate professor in the Industrial and Manufacturing Engineering Department at Oregon State University. Dr. Atre's work involves the integration of nanomaterial synthesis techniques and silicon and non-silicon microfabrication techniques. His research interests include advanced materials and manufacturing techniques for multiscale architectures, with applications in transport, energy, medical, communications, and consumer sectors. Dr. Atre obtained his B.S. in chemical engineering from the Indian Institute of Technology in India and his Ph.D. in materials science and engineering from Pennsylvania State University. Dr. Atre has previously served on two NRC committees that reviewed proposals for the State of Ohio (2008 and 2009).

RAY H. BAUGHMAN is the Robert A. Welch Professor of Chemistry and the director of the NanoTech Institute at the University of Texas, Dallas. Previously, he spent 31 years in industry at Honeywell. He is a member of the National Academy of Engineering; the Academy of Medicine, Engineering and Science of Texas; a fellow of the American Physical Society; an academician of the Russian Academy of Natural Sciences; an honorary professor of three universities in China; and is on editorial and advisory boards of *Science,* the *International Journal of Nanoscience,* and the *Encyclopedia of Nanoscience and Nanotechnology*. His research interests include nanotechnology, photonic crystals, sensors and actuators, ferroelectrics, novel forms of carbon (especially carbon nanotubes), and conducting polymers, as well as the design, synthesis, and application of materials with novel electrical, optical, or magnetic properties. Dr. Baughman has no previous NRC committee service. Dr. Baughman received a B.S. in physics from Carnegie Mellon University and a Ph.D. in materials science from Harvard University.

INDERJIT CHOPRA is the Alfred Gessow Professor of Aerospace Engineering and director of the Alfred Gessow Rotorcraft Center at the University of Maryland. His studies include work on various fundamental problems related to aeromechanics of helicopters including aeromechanical stability, active vibration control, modeling of composite blades, rotor head health monitoring, aeroelastic optimization, smart structures, micro air vehicles, and comprehensive aeromechanics analyses of bearingless, tilt-rotor, servo-flap, compound, teetering, and circulation control rotors. Prior to teaching, Dr. Chopra spent over 4 years at the NASA Ames Research Center/Stanford University Joint Institute of Aeronautics and Acoustics working on the development of aeroelastic analyses and testing of advanced helicopter rotor

systems. Dr. Chopra served on the NRC Panel C: Structures and Materials of the Steering Committee on Decadal Survey of Civil Aeronautics and the Committee on Review of the NASA Institute for Advanced Concepts, and he is a member of the Aeronautics and Space Engineering Board.

SUSAN HACKWOOD is the executive director of the California Council on Science and Technology and is a professor of electrical engineering at the Bourns College of Engineering at the University of California (UC), Riverside. In 1979 she received the Royal Society Ambassador of Science Award and was invited as a visiting researcher at UC Berkeley and Chalmers Institute of Technology. From 1980 to 1984, Dr. Hackwood was a member of the technical staff at AT&T, Bell Laboratories. From 1983 to 1984, Dr. Hackwood was department head of device robotics technology research. In 1985, she received the AT&T Bell Laboratories Award for Technology Transfer. In 1984, she joined UC Santa Barbara as a professor of electrical and computer engineering, where she was founder and co-director of the Center for Robotic Systems in Microelectronics. In 1990, Dr. Hackwood became the founding dean of the Bourns College of Engineering at UC, Riverside, where she has overseen the development of all research and teaching aspects of five degree programs. Dr. Hackwood's current research interests include multimedia technologies, distributed asynchronous signal processing, cellular robot systems, computer vision, 3D modeling, and image processing. In addition to over 100 technical publications and 7 patents, Dr. Hackwood is co-editor and co-founder of the *Journal of Robotic Systems*. She is currently a member of the NRC Naval Studies Board, the NRC Committee on Competing in the 21st Century: Best Practices in State and Regional Innovation Initiatives, and the Advisory Board of the Arnold and Mabel Beckman Center. Dr. Hackwood received a B.Sc. in combined science and a Ph.D. in solid state ionics from DeMontfort University, U.K.

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, RFID (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 State of Michigan 21 Century Jobs Fund, the National Science Foundation, the Development Capital Network (Phase II), and the Fast Pitch Business Plans for the State of Illinois. He received his M.B.A. from Northern Illinois University and his B.B.A. from the University of Wisconsin, Whitewater.

ROSA A. LUKASZEW is the VMEC Associate Professor in the Applied Science and Physics Departments at the College of William and Mary. Prior to working at William and Mary, she taught in the Physics and Astronomy Department at the University of Toledo and was a research scientist at the Mass Spectrometry Laboratory of the National Atomic Energy Commission in Buenos Aires, Argentina. Dr. Lukaszew's research deals with fundamental studies on thin films (epitaxial, magnetic, etc.) and highly anisotropic nano-magnets; the correlation between structure, surface morphology and physical properties in thin films; proximity and induced magnetic effects; magneto-optical applications of magnetic nano-particles and magneto-optical sensors; bio-applications of nano-magnets and biophotonic applications; and transport properties of magnetic thin films and nano-structures, and their spintronic applications. Dr. Lukaszew previously served on the NRC committee that reviewed proposals for the State of Ohio in 2009. She received her B.S. in physical-chemistry from the University of Buenos Aires, Argentina, and her Ph.D. in physics from Wayne State University.

LAURA T. MAZZOLA has 20 years of experience in the biotechnology industry, from research and development to the commercialization of platform technologies. She is currently the vice president of Global Health Products at Wave 80 Biosciences. 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 UC Berkeley. Dr. Mazzola was an early employee at Affymax and Affymetrix, developing the high-density array technology that became the revolutionary GeneChip™ 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. In 2009, Dr. Mazzola served as chair of a prior NRC committee that reviewed proposals for the State of Ohio. She received a B.A. from Kalamazoo College and an M.S. and Ph.D. in physical chemistry from Stanford University.

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. The Connecticut Global Fuel Cell Center was awarded nearly $2 million 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, 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. Dr. Molter has previously served on two NRC committees that reviewed proposals for the State of Ohio (2008 and 2009).

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J.W. WHEELER joined Thomas P. Miller and Associates (TPMA) in 2005 as senior vice president, economic competitiveness policy and research. He served as the policy lead for development of the Strategic Economic Development Plan for Indiana. Recent projects include development of "industry cluster strategies;" various BRAC and Military Transformation projects; energy-related projects in electric and hybrid-electric vehicles, distributed power, and advanced coal technologies; feasibility studies and business plans for business incubators and technology parks; and participation in a variety of health information technology strategy and planning efforts. Prior to joining TPMA, he was director of Electricore's Midwest operations where he was charged with developing corporate-university partnerships in advanced technology development. As executive vice president for TechPoint—a merger between Indiana Technology Partnership (ITP) and Indiana Information Technology Association—and as president of ITP, Dr. Wheeler served as a leader for the statewide technology community's public policy and economic development initiatives (2002-2004) and managed special programs for information technology. He has previously served on several NRC committees that reviewed proposals for the State of Ohio (2005, 2007, 2008, and 2009).