Ohio | Department of Development

Final Proposal Evaluation

2010

Third Frontier Advanced Materials Program
Third Frontier Sensor Program

March 2010

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Third Frontier Advanced Materials Program
FY 2010 Review Summary and Rankings

Legend: **Strength** (S) - **Met Requirements** (M) - **Weakness** (W)

										Technical Risk			Commercialization Risk			Mission Impact			
Rank	TF ID	Applicant	Project Title	Collaborators	TFRDF $	WCF $	Total Funding Requested	Match	2nd Rnd Score	Technical Reach	Resource Limitations	Technology Protection	Path to Market	Corporate Stability	Commercial Infracture	Cluster Formation	Ohio Economics	Business Model	Proposal Review Summary
RECOMMENDED FOR FUNDING																			
1	10-665	Kent Displays Inc.	Advanced Liquid Crystalline, Chiral and Dye Materials for Flexible Liquid Crystal Films	· Kent State University · Akron Polymer Systems	$1,000,000	$0	$1,000,000	$1,000,885	95.5	S	S	M	S	S	S	S	S	S	· Enhancement of KDI's Replex LCD technology through use of unique chiral and polymer materials for use in electronic skins, e-tablets, e-cards and e-media · KSU will assist in the chiral material development, APS will engineer the polymer materials and KDI will be the commercial outlet for display products · KDI's economic impacts are very aggressive projecting $100 million in sales by 2013 and 500 new jobs by 2015 · Demonstration-level prototypes using the new materials have not been built yet therefore the expected performance enhancements have not been proven
2	10-603	Momentive Performance Materials Quartz, Inc.	Optimized Boron Nitride and Production Efficiency for Lower Cost Polymer Composites in LED Luminaries	· SABIC Innovative Plastics · University of Akron · Steer America · Polymer Ohio	$918,000	$0	$918,000	$1,272,000	85.2	M	S	S	S	S	S	M	S	S	· Low cost boron nitride (BN) powder for use in LED lamp housings · MPM, UA and Steer will develop a lower cost manufacturing process for the powder, the functionalized polymers and the compounding process respectively and SABIC will evaluate the final product for LED housings · The project will create 5 new jobs at MPM growing to 35+ by 2015 with $45 million in sales · LED lamp entry into the mainstream lighting market is a key to product success. BN powder is a major portion of the hosing cost, but the housing is a smaller part of the LED lamp cost
3	10-653	Maverick Corporation	Low Cost Fabrication of High-Temperature Composites	· Akron Polymer Systems · NASA Glenn Research Center · Renegade Materials Corporation	$1,000,000	$0	$1,000,000	$1,000,000	77.7	S	S	S	S	S	S	S	M	S	· A family of high-temperature polyimides resins for aerospace applications · Maverick, APS and Renegade will each scale up current batch resin production operations and process the output resins into rolls sufficient for customer samples · Product sales (resin, film and prepregs) are expected to begin in 2011, and by 2013, 22 jobs created growing to over 60 by 2015
4	10-601	Alphamirror, Inc.	Manufacturing of Plastic Liquid Crystal Auto Dimming Mirror	· AlphaMicron Inc. · Elbit Systems Ltd · Magna Mirrors GmbH	$1,000,000	$0	$1,000,000	$1,000,000	74.5	M	S	S	S	S	S	S	M	S	· A family of high-temperature polyimides resins for aerospace applications · Maverick, APS and Renegade will each scale up current batch resin production operations and process the output resins into rolls sufficient for customer samples · Product sales (resin, film and prepregs) are expected to begin in 2011, and by 2013, 22 jobs created growing to over 60 by 2015
5	10-679	Lockheed Martin MS2 Integrated Defense Technologies	Reduced-Permeability, High-Modulus Film Project for Military Lighter-Than-Air	· Akron Polymer Systems · Chemsultants International, Inc · University of Akron	$1,000,000	$0	$1,000,000	$1,000,000	66.6	M	M	S	S	S	S	S	M	S	· Improve the properties of a polymer/nano-based film and adhesives developed for lighter-than-air airships · UA will develop the modified materials-materials and adhesive formulations, APS will produce the film solution, Chemsultants will optimize the film casting process and LM confirm material and adhesive properties and produce samples for performance testing · The LM job impacts are based introduction of the HAA in 2013 that will support 80 new jobs and grow to 200 by 2015 · Earlier TFP award to UA led to current film, but weight and permeability need to be reduced to meet operational specifications for the full-scale High Altitude Airship design
6	10-640	Materials Research Institute, LLC	Metalized Nanomaterials	· Engineered Materials Systems, Inc · Wright Brothers Institute · EMTEC	$791,000	$0	$791,000	$831,000	66.1	M	W	M	M	M	W	S	S	S	· Conductive metalized nanomaterials for signal power transfer, electromagnetic shielding, electrical grounding and energy storage and conversion · A 3rd generation metalized carbon anode material and a conductive ink product are currently close to meeting customer specifications · MRI impacts are aggressive as it projects creating 40 jobs by 2013 and 175 by 2015, but its potential anode material customer GrandTek (Taiwan) has indicated it will establish operations in Ohio · GrandTek has committed to the cost share requirements and plans on further investments, but if these do not materialize MRI will fall back on expected SBIR support to continue commercialization
			TOTAL				**$5,709,000**												

Third Frontier Advanced Materials Program
FY 2010 Review Summary and Rankings

Legend: **Strength** (S) - **Met Requirements** (M) - **Weakness** (W)

										Technical Risk			Commercialization Risk			Mission Impact			
Rank	TF ID	Applicant	Project Title	Collaborators	TFRDF $	WCF $	Total Funding Requested	Match	2nd Rnd Score	Technical Reach	Resource Limitations	Technology Protection	Path to Market	Corporate Stability	Commercial Infrastructure	Cluster Formation	Ohio Economics	Business Model	Proposal Review Summary
NOT RECOMMENDED FOR FUNDING																			
7	10-667	General Nano, LLC	Manufacturing Conductive, Strong, Lightweight Yarn from Long Carbon Nanotubes for Aerospace and Defense Applications	· Parker Hannifin Corporation · University Of Cincinnati · AFRL/RZP · Atkins & Pearce · General Cable	$1,000,000	$946,943	$1,946,943	$2,540,657	60.8	S	M	M	M	M	M	M	M	S	· CNT-based threads and yarns produced from long CNTs made with a proprietary technique developed at UC · General Nano produces the long CNTs (Black Cotton) and is partnering with Atkins & Pearce (Covington, KY) to produce the yarns for collaborator application evaluations · General Nano's impact projections are very aggressive as it claims it will create 27 Ohio jobs by 2012 and more than 40 by 2015 · The site for the yarn production is not clear as the original plans for it to be in KY have been changed to Ohio, but the resources needed for this to happen are not explained
8	10-632	Momentum Technologies inc.	Accelerating the Commercialization of a Novel Bio Resource Resin for Agricultural, Construction, and Industrial Applications	· The Ohio State University Ohio Agricultural Research and Development Center –OARDC · TurfCare Supply Corporation · Innoventor LLC · Polymer Ohio · Kokosing Materials Inc · Crafco Inc · Royal Chemical Corp	$990,014	$500,000	$1,490,014	$1,492,880	58.3	M	M	W	S	M	S	S	M	M	· Biodegradable resin (BR2) from animal waste to replace petroleum-based asphalt · MTi has acquired marketing rights to BR2 for fertilizer coating applications and asphalt paving products and will work with OARDC and Ohio end-users to establish an Ohio production and distribution network that will span farm collection to end-user delivery · MTi's direct economic impacts are modest with 11 staff hired by 2013, growing to 18 by 2015, but it claims Ohio impacts from suppliers/end-users of its products will be significantly greater · MTi's business is product distribution and laboratory services and the technology ownership lies with its collaborator Innoventor (St. Louis, MO)
9	10-647	Applied Sciences, Inc.	VGCF Pre-preg for Advanced Composites	· Technical Fibre Products · Pyrograf Products, Inc	$999,978	$0	$999,978	$1,115,500	56.3	M	M	S	M	M	M	S	W	S	· Continuous carbon fiber mat production for various military, consumer electronics, wind energy and energy storage applications · Technical Fiber Products (NY) and ASI plan a joint venture to optimize and scale-up the production process to create CNF mat on a continuous roll basis and Renegade will impregnate the mat with resin to form the pre-preg material · Pilot-level production at Pyrograf is projected to create $3 million in sales by 2013 and 14 jobs · Sample materials are being evaluated by several potential end-users, but results of these evaluations have not been completed
10	10-686	Kent State University	Advanced Liquid Crystal Alignment Materials for e-Books	· LXD, Inc.	$1,029,429	$10,000	$1,039,429	$1,053,875	50.2	M	S	M	W	S	W	M	M	M	· An advanced thin film coating material that improves LCD-based e-book performance · KSU has developed the materials and a proprietary manufacturing approach and LXD will design and construct alpha prototype displays followed by a demonstration-level complete e-Book · LXD projects the e-Book will be introduced in 2013 and sales by 2015 will reach about $3 million creating 20 to 25 jobs · LXD's HQ, R&D and North American distribution is in Cleveland, but LCD and module manufacturing will be at existing facilities in Asia
11	10-622	GrafTech International Holdings, Inc.	Carbon Fibers from Biomass for Wind and Solar Applications	· SuGanit · University of Toledo	$1,000,000	$0	$1,000,000	$1,028,980	47.6	M	M	W	S	S	S	S	W	M	· Pilot production of lignin-based high quality carbon fibers · SuGanit, a developer of a cellulosic ethanol process (under a TFP award) will provide lignin, a byproduct of its process to GrafTech that will convert it to carbon fiber for potential application to a variety of products · GrafTech projects the carbon fiber production would create 5 to 20 jobs by 2015 · A third party has produced carbon fibers from a bio-based lignin, but GrafTech has not yet tested the SuGanit produced lignin
12	10-644	Applied Sciences, Inc.	CNF Materials for Battery Applications	· Pyrograf Products, Inc	$999,976	$0	$999,976	$1,245,000	44.6	W	M	M	M	M	M	M	W	M	· Silicon-coated carbon nanofibers (Si-CNF) for LI-ion battery anodes · ASI will scale-up to pilot production of Si-CNF at Pyrograf to provide sufficient material for customer evaluations · The pilot plant production is projected to generate material sales of $4 million by 2013 creating 17 jobs growing to over 70 jobs by 2015 · ASI was awarded an earlier TFP grant that projected similar economic impact results and these have not been achieved

Third Frontier Sensor Program
FY 2010 Review Summary and Rankings

Legend: **Strength** (S) - **Met Requirements** (M) - **Weakness** (W)

										Technical Risk			Commercialization Risk			Mission Impact			
Rank	TF ID	Applicant	Project Title	Collaborators	TFRDF $	WCF $	Total Funding Requested	Match	2nd Rnd Score	Technical Reach	Resource Limitations	Technology Protection	Path to Market	Corporate Stability	Commercial Infracture	Cluster Formation	Ohio Economics	Business Model	Proposal Review Summary
RECOMMENDED FOR FUNDING																			
1	10-767	Pressco Technology, Inc.	High Performance Spectroscopy Sensor Applications in High Speed Product Testing	· Miami University - Molecular Microspectroscopy Laboratory	$406,000	$0	$406,000	$944,500	85.8	M	S	M	S	S	S	M	S	S	· Real-time, electro-optical thickness measurement system for polymer container inspection during production · Miami University (Ohio) will use specialized equipment to provide guidance for sensor design and Pressco will integrate the new sensor into a complete inspection system. · Pressco is a leader in food & beverage packaging inspection systems and will 50 new jobs by 2015. · Pressco uses Ohio suppliers, but this is its initial development activity that leverages the Ohio sensor technology cluster
2	10-750	NexTech Materials, Ltd.	Hydrogen Sensor Manufacturing Technology	· Therm-O-Disc, Inc.	$1,000,000	$0	$1,000,000	$1,069,289	81.4	S	S	S	S	S	M	S	M	S	· Low-cost hydrogen sensor element for a battery monitoring system to be used in data and telecom center backup power rooms · NexTech will develop and produce the sensor element and Therm-O-Disc will integrate it into a complete system for sale to Liebert and others · By 2013 NexTech and Therm-O-Disc will create 40 new jobs and up to 200 by 2015. · NexTech has received multiple TFP awards and has grown steadily, but volume-level production line has not yet been established
3	10-705	YSI, Inc.	Advanced Modified Carbon Nanotube Based Nutrient Sensor	· Riehl Engineering · University of Cincinnati	$998,635	$129,238	$1,127,873	$1,127,873	80.2	M	S	S	S	S	S	S	M	S	· Direct electron sensor for in-situ testing of nitrate pollution levels in runoff water · Riehl will provide proprietary CNTs for sensor substrates, UC will provide electrochemical expertise and YSI will integrate the sensor into a complete system · YSI is a leader in water quality sensing and will add 10 new jobs by 2013 and another 10 by 2015. Riehl will also create new jobs · In an earlier project, YSI attempted to produce a microfluidic-based E-coli sensor for water quality, but this approach did not prove out.
4	10-701	INNOVA, Inc.	Scalable, Miniaturized, Low Cost Solid State Laser System for Sensor Applications	· UDRI / IDCAST · UDRI / LOCI · FLIR / D-Diode	$848,000	$0	$848,000	$848,000	73.1	S	S	S	M	M	M	S	S	S	· A miniaturized diode pump laser that enables smaller high-powered laser illuminators and rangefinders · UDRI and IDCAST are providing technical support, Innova will build diode pump lasers and FLIR will incorporate them into a weapon-mounted rangefinder. · Innova projects creation of 90 jobs by 2014 · The project will lead to demonstration-level prototype for specific customer evaluations
5	10-711	Persistent Surveillance Systems	Colorization and Resolution Enhancement of Airborne Wide-Area Persistent Surveillance Sensors for Law Enforcement Operations	· UDRI / IDCAST	$906,315	$0	$906,315	$910,370	72.2	S	M	S	M	M	M	S	S	S	· Wide-area airborne surveillance service (WAAS) based on innovative camera and imaging techniques and algorithms · UDRI and IDCAST are providing analytical software and imaging algorithms to enhance PSS's current WAAS systems that are based on DOD-supported technology · PSS's HQ and central processing services will be in Ohio creating 50 jobs by 2013 · PSS has current customers, but is a relatively new company and has limited capital for growth
6	10-729	L-3 Communications Nova Engineering	Sensor and Fusion Enhancement (SAFE) Program	· UDRI · Science Applications International Corporation (SAIC) – Monitoring Systems Division	$689,550	$0	$689,550	$1,122,636	71.1	S	S	S	S	S	S	S	M	S	· Low cost, ground-based sensor system for gathering information from multiple sensors to enhance target detection and decision-making · L3 Nova transceiver technology will be coupled with SAIC (California) sensor fusion software and Beta prototypes provided to DOD and DOI agencies for evaluation · L3 Nova's Ohio impact projections are conservative and call for 7 new jobs and cumulative revenues of about $20 million by 2015. · The proposed project will lead to a demonstration-level prototype
			TOTAL				**$4,977,738**												

Third Frontier Sensor Program
FY 2010 Review Summary and Rankings

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Rank	TF ID	Applicant	Project Title	Collaborators	TFRDF $	WCF $	Total Funding Requested	Match	2nd Rnd Score	Technical Reach	Resource Limitations	Technology Protection	Path to Market	Corporate Stability	Commercial Infrastructure	Cluster Formation	Ohio Economics	Business Model	Proposal Review Summary
NOT RECOMMENDED FOR FUNDING																			
7	10-753	Lake Shore Cryotronics, Inc.	Advanced Optical Sensors and Instruments for Alternate Energy, Aerospace and Other Industrial Applications	· The Ohio State University	$853,109	$145,795	$998,904	$999,064	62.0	M	S	S	W	S	S	M	M	S	· Fiber optic sensor reading technology for hydrogen, force and electrical property measurements in harsh environments · LSC will develop and prototype a hydrogen sensing system for potential customer evaluations and OSU will investigate force and electrical property applications · LSC forecasts an aggressive market capture creating over 50 jobs by 2013 and over 100 by 2015 · The targeted market for a hydrogen sensing system may not develop as fast as projected, but the applications identified in the OSU work may find near-term applications
8	10-718	Parker Hannifin Corp., Gas Turbine Fuel Systems Division	Piezoelectric Mass Flow Sensor for Online Control of Fuel Flow Schedule in Advanced Commercial and Military Gas Turbine Engines	· Viking AT, LLC	$297,000	$0	$297,000	$297,008	60.7	S	S	S	S	S	S	M	M	S	· Proprietary platform for low cost sensor for measuring mass flow rates of liquids/gasses · Parker has acquired technology from an out-of-state company that it will use to develop and test a new mass flow control for industrial and turbine engine applications · Near-term Ohio impacts are modest with projections of 7 new jobs by 2015. Over 50 are projected within 5 to 7 years of project completion · Commercialization funding will be sought from Parker corporate and this project will compete with other Parker developments for that support
9	10-734	STAR Dynamics Corporation	Target Detection and Tracking using Airborne Weather Radar	· Honeywell International · The Ohio State University - Electro Science Lab	$1,000,000	$0	$1,000,000	$1,000,000	58.3	M	S	S	S	S	S	M	M	S	· Multifunctional airborne radar system (MARS) with detection and tracking capabilities for commercial and military aircraft · STAR will modify Honeywell's current airborne weather radar system (IntuVue) using the OSU Electro-science Lab's technical assistance and support · The project will create 5 jobs at STAR with component sales to Honeywell projected to begin in 2015 · A larger economic impact potential exists as the product is certified for various aircraft platforms, but the timing for adoption is likely outside TFP impact objectives
10	10-755	Woolpert, Inc.	The Development of Low-Cost 3D Models That Will Lead to Sustainable Advantage in Geospatial Markets	· UDRI / IDCAST · Tidex Systems, Ltd. · Air Force Research Laboratory	$994,000	$0	$994,000	$1,010,920	57.0	M	W	M	W	S	S	M	M	S	· Software and modeling modules that provide conversion of two-dimensional (2-D) digital video camera images to three-dimensional (3-D) images · Tidex will upgrade its 2D to 3D software to operate on standard computer platforms and Woolpert, with UDRI and AFRL technical support, will add a user-friendly interface · Targeted markets, aerial and ground-based images of terrains and building exteriors and interiors, are projected to create 10 new jobs by 2013 and 35 jobs by 2015 · While the project relates to video sensors (cameras), the technology development is involved is directed toward imaging software
11	10-752	UES, Inc.	Real-Time, E. coli Detector Using Containment Sensor NETwork (COSNET)	· The Ohio State University Meat Sciences Laboratory · EDAptive Computing, Inc.	$999,916	$0	$999,916	$1,000,000	50.4	M	S	M	W	M	W	M	M	M	· Sensor system that detects strains of E-coli in food and water and distinguishes harmful from non-harmful strains · The sensor platform is licensed from UC and EDApaptive will develop the hardware and software to be integrated into a system by UES. Woolpert is the distribution partner for water applications and OSU is testing the technology for food applications · Sales revenues are projected to grow to $500K by 2015 and 14 new jobs are projected at UES by that time · Changing federal standards would appear to limit the potential of a strain-specific sensor for surface water monitoring
12	10-774	H-Cubed, Inc.	Wireless Implantable Biomedical Sensor	· Cleveland Clinic BioMEMS Lab · Cleveland Clinic Polymer Lab · SimuTech Group – Central Valtronic Technologies · Southworth & Associates · Earles & Associates	$799,564	$32,000	$831,564	$931,688	41.6	W	W	S	W	W	W	M	M	M	· In-vivo, micro-miniature pressure sensor to assess the functionality of implanted shunts used for patients with hydrocephalus · H-Cubed will produce initial sensor prototypes and its collaborators will provide simulation modeling support, sensor design and packaging, regulatory submission support and business development · Beta prototypes will be produced by 2015 and they are projected to produce sales of $900K, creating 16 jobs at H-Cubed · The plan for obtaining the additional funding required for demonstrating the sensor for human use is yet to developed

PROPOSAL REVIEW TEAM

❖ TARATEC CORPORATION

- Edward Ungar, President
- Paula Dunnigan, Project Leader
- Chuck Meadows
- Bill Munk
- Reed Slevin

❖ Six (6) EXTERNAL REVIEWERS

PROPOSAL REVIEW PROCESS

❖ FIRST ROUND

- Conflict of Interest evaluation for all reviewers
- Each proposal read by 3 reviewers
- Scored 3 times using instrument based on RFP criteria
- All scores entered into database in duplicate
- Reviewers comment on areas requiring clarification
- Database produces list of proposals ranked by average score
- Top scoring proposals make Competitive Range and advance to Round 2

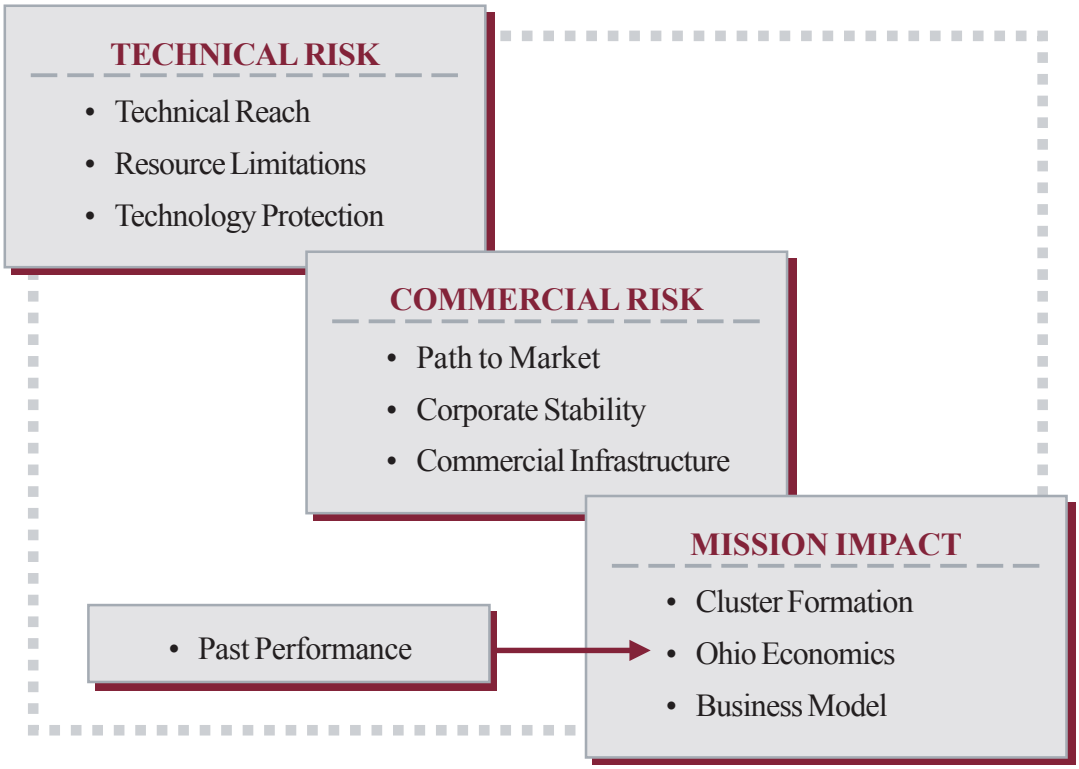
❖ SECOND ROUND

- Set of customized questions prepared for each proposal
- Applicant submits responses
- Face-to-face meeting (90 min.) of reviewers and applicants to discuss issues
- Preparation of detailed project write-up
- Final risk-benefit scoring by entire review team
- Scores entered into database
- Final recommendations developed
- Preparation of materials for Third Frontier Commission

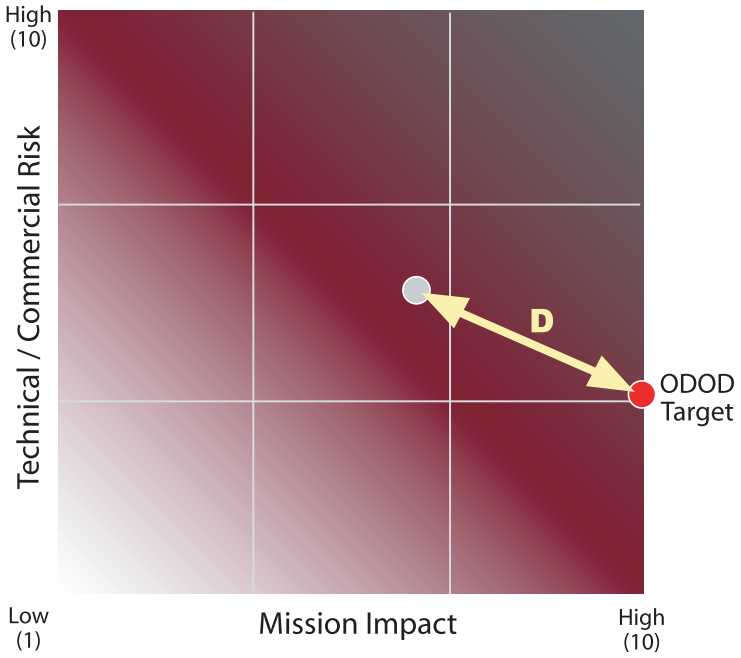
SUMMARY OF FIRST ROUND EVALUATIONS

	TFAMP	TFSP
Proposals Received	32	31
Recommended for 2nd Round	12	12
Lowest Score Recommended	62.0	61.7
Highest Score Not Recommended	60.7	58.3
TFRDF Available	$8M	$8M
TFWCF Available	$2M	$2M
Cumulative TFRDF Requested	$11.8M	$9.8M
Cumulative TFWCF Requested	$1.5M	$0.4M

SECOND ROUND EVALUATION FACTORS



SCORING METHODOLOGY



2010 TARGETS

	Technical Risk	Commercial Risk	Mission Impact
Advanced Materials	3.5	2.5	10
Sensors	3.5	1.8	10

2010 TFAMP

Third Frontier Advanced Materials Program

Summaries of Proposals in Competitive Range

RECOMMENDATIONS FOR FUNDING
2010 Third Frontier Advanced Materials Program (TFAMP)

	APPLICANT	PROPOSAL TITLE	TFRDF REQUESTED	TFRDF CUMULATIVE	TFWCF REQUESTED	TFWCF CUMULATIVE	RECOMMENDED CONTINGENCY
1.	Kent Displays, Inc.	Advanced Liquid Crystalline, Chiral, and Dye Materials for Flexible Liquid Crystal Films	$1,000,000	$1,000,000	$0	$0	
2.	Momentive Performance Materials Quartz Inc.	Optimized Boron Nitride and Production Efficiency for Lower Cost Polymer Composites in LED Luminaires	$ 918,000	$1,918,000	$0	$0	
3.	Maverick Corporation	Low Cost Fabrication of High-Temperature Composites	$1,000,000	$2,918,000	$0	$0	
4.	Alphamirror, Inc.	Manufacturing of Plastic Liquid Crystal Auto Dimming Mirror	$1,000,000	$3,918,000	$0	$0	
5.	Lockheed Martin MS2 Integrated Defense Technologies	Reduced-Permeability, High-Modulus Film Project for Military Lighter-Than-Air	$1,000,000	$4,918,000	$0	$0	
6.	Materials Research Institute, LLC	Metalized Nanomaterials	$ 791,000	$5,709,000	$0	$0	

2010 Third Frontier Advanced Materials Program Final Round Scores

Score (Round 1)			City	County	OTFRD $ Requested	OTFRD Cumulative $	WRIGHT $ Requested	WRIGHT Cumulative $
Targets - Mission Impact: 10 Commercial Risk: 2.53 Technical Risk: 3.5								
95.5	**(67.7)**	**TFAMP 10-665** Kent Displays, Inc. Advanced Liquid Crystalline, Chiral, and Dye Materials for Flexible Liquid Crystal Films	Kent	Portage	$1,000,000	**$1,000,000**	$0	**$0**
		Mission Impact: **9.53** (E: 9.7 M: 10.0 C: 8.7) Technical Risk: **3.66** (T: 5.0 R: 3.3 P: 1.7) Commercial Risk: **2.90** (P: 3.3 S: 2.3 I: 3.3)						
85.2	**(62.3)**	**TFAMP 10-603** Momentive Performance Materials Quartz, Inc. Optimized Boron Nitride and Production Efficiency for Lower Cost Polymer Composites in LED Luminaires	Strongsville	Cuyahoga	$918,000	**$1,918,000**	$0	**$0**
		Mission Impact: **8.25** (E: 8.7 M: 9.3 C: 6.3) Technical Risk: **4.12** (T: 7.0 R: 2.3 P: 2.0) Commercial Risk: **2.52** (P: 3.3 S: 2.0 I: 2.0)						
77.7	**(72.0)**	**TFAMP 10-653** Maverick Corporation Low Cost Fabrication of High-Temperature Composites	Blue Ash	Hamilton	$1,000,000	**$2,918,000**	$0	**$0**
		Mission Impact: **7.33** (E: 6.0 M: 8.0 C: 9.3) Technical Risk: **3.64** (T: 3.3 R: 4.3 P: 3.0) Commercial Risk: **3.20** (P: 3.7 S: 3.3 I: 2.0)						
74.5	**(74.7)**	**TFAMP 10-601** Alphamirror, Inc. Manufacturing of Plastic Liquid Crystal Auto Dimming Mirror	Kent	Portage	$1,000,000	**$3,918,000**	$0	**$0**
		Mission Impact: **7.00** (E: 5.0 M: 8.7 C: 9.3) Technical Risk: **2.34** (T: 1.7 R: 3.0 P: 2.3) Commercial Risk: **2.52** (P: 2.3 S: 3.0 I: 2.0)						
66.6	**(66.7)**	**TFAMP 10-679** Lockheed Martin MS2 Integrated Defense Technologies Reduced-Permeability, High-Modulus Film Project for Military Lighter-Than-Air	Akron	Summit	$1,000,000	**$4,918,000**	$0	**$0**
		Mission Impact: **6.20** (E: 5.4 M: 7.3 C: 6.7) Technical Risk: **5.58** (T: 7.0 R: 5.3 P: 3.3) Commercial Risk: **2.86** (P: 3.3 S: 3.0 I: 1.7)						
66.1	**(70.7)**	**TFAMP 10-640** Materials Research Institute, LLC Metalized Nanomaterials	Beavercreek	Greene	$791,000	**$5,709,000**	$0	**$0**
		Mission Impact: **7.83** (E: 7.0 M: 8.3 C: 9.0) Technical Risk: **6.86** (T: 5.3 R: 8.7 P: 6.3) Commercial Risk: **6.22** (P: 5.7 S: 6.0 I: 7.7)						

2010 Third Frontier Advanced Materials Program Final Round Scores

Score (Round 1)			City	County	OTFRD $ Requested	OTFRD Cumulative $	WRIGHT $ Requested	WRIGHT Cumulative $
Targets - Mission Impact: 10 Commercial Risk: 2.53 Technical Risk: 3.5								
60.8	**(74.3)**	**TFAMP 10-667** General Nano, LLC Manufacturing Conductive, Strong, Lightweight Yarn from Long Carbon Nanotubes for Aerospace and Defense Applications	Cincinnati	Hamilton	$1,000,000	**$6,709,000**	$946,943	**$946,943**
		Mission Impact: **6.15** (E: 6.3 M: 6.7 C: 5.3) Technical Risk: **5.46** (T: 4.7 R: 6.3 P: 5.3) Commercial Risk: **6.08** (P: 5.0 S: 6.7 I: 7.0)						
58.3	**(62.0)**	**TFAMP 10-632** Momentum Technologies, Inc. Accelerating the Commercialization of a Novel Bio Resource Resin (BR2) for Agricultural, Construction and Industrial Applications	Uniontown	Stark	$990,014	**$7,699,014**	$500,000	**$1,446,943**
		Mission Impact: **5.33** (E: 4.3 M: 5.7 C: 7.0) Technical Risk: **5.70** (T: 5.3 R: 5.3 P: 7.3) Commercial Risk: **4.34** (P: 4.0 S: 5.0 I: 3.7)						
56.3	**(68.3)**	**TFAMP 10-647** Applied Sciences, Inc VGCF Pre-preg for Advanced Composites	Cedarville	Greene	$999,978	**$8,698,992**	$0	**$1,446,943**
		Mission Impact: **5.18** (E: 2.5 M: 7.7 C: 8.0) Technical Risk: **4.98** (T: 5.3 R: 5.3 P: 3.7) Commercial Risk: **5.40** (P: 5.7 S: 5.3 I: 5.0)						
50.2	**(65.7)**	**TFAMP 10-686** Kent State University Advanced Liquid Crystal Alignment Materials for e-Books	Kent	Portage	$1,029,429	**$9,728,421**	$10,000	**$1,456,943**
		Mission Impact: **4.68** (E: 5.0 M: 4.0 C: 4.7) Technical Risk: **5.82** (T: 6.7 R: 5.0 P: 5.7) Commercial Risk: **6.00** (P: 7.3 S: 3.7 I: 8.0)						
47.6	**(62.7)**	**TFAMP 10-622** GrafTech International Holdings Inc Carbon Fibers from Biomass for Wind and Solar Applications	Parma	Cuyahoga	$1,000,000	**$10,728,421**	$0	**$1,456,943**
		Mission Impact: **3.96** (E: 2.2 M: 4.7 C: 6.7) Technical Risk: **6.54** (T: 7.0 R: 5.7 P: 7.3) Commercial Risk: **2.54** (P: 2.0 S: 2.7 I: 3.3)						
44.6	**(66.3)**	**TFAMP 10-644** Applied Sciences, Inc CNF Materials for Battery Applications	Cedarville	Greene	$999,976	**$11,728,397**	$0	**$1,456,943**
		Mission Impact: **4.00** (E: 2.5 M: 6.3 C: 4.7) Technical Risk: **6.46** (T: 7.3 R: 6.0 P: 5.7) Commercial Risk: **5.78** (P: 6.0 S: 5.3 I: 6.3)						

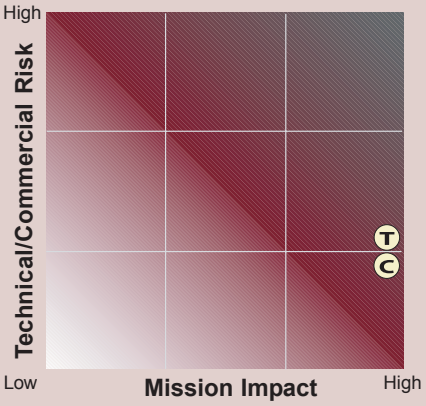
Ohio Department of Development

2010 TFAMP Evaluation Summary

Advanced Liquid Crystalline, Chiral, and Dye Materials for Flexible Liquid Crystal Films

Kent Displays, Inc.

1st Round Score: 67.7 | 2nd Round Score: 95.1 | Rank: 1

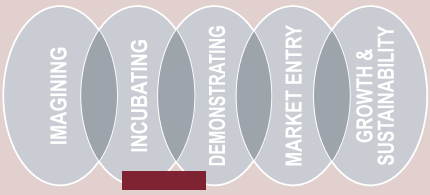


Proposal # TFAMP 10-665

Collaborators:
Akron Polymer Systems
Kent State University

TFRDF Request:	$1,000,000
WCF Request:	$0
TOTAL Request:	$1,000,000
Cost Share:	$1,000,885

Stage of Development



Previous Ohio Investment

Kent Display (KDI) has been supported through TFRDF to develop and set up manufacturing capability for flexible liquid crystal films and displays. Its roll-to-roll LCD manufacturing line is the first of its kind in the world. The result of the efforts to date include commercial products such as e-Tablet, electronic device skins and signage displays that are manufactured in Ohio and are based on KDI's Reflex display technology. Sales of these products are approaching $1 million and KDI has attracted over $7.5 million in additional investments and grant support.

Project Description

KDI proposes to enhance its Reflex display technology through the use of unique chiral materials that will provide improved temperature and color performance, new polymer materials for higher brightness and lower drive voltage, and new dye materials for contrast and color gamut improvement. Four product lines will share the same basic technology developed in the project. These are: electronic skins, writing tablets, e-Cards and e-Media. KDI will establish the product performance specifications and be the commercial outlet for the products developed. KSU will focus on the chiral and dye material developments and Akron Polymer will engineer the new monomers and polymers.

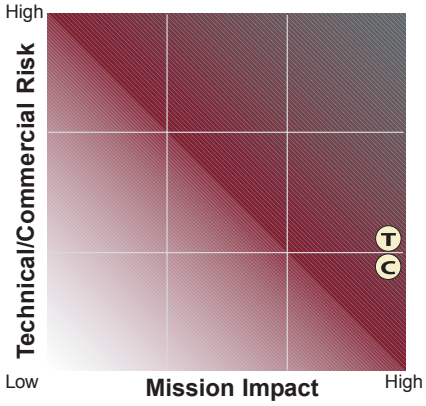
Key Issues

- KDI's economic projections are extremely aggressive. KDI has a committed investor and the potential markets are huge, but it is not clear that the growth projections can realistically be achieved based on the current production capabilities and company structure.
- Commercial prototypes and products produced to date use proven materials. The enhanced products proposed have not yet been created and the features expected may not meet customer specifications on the first iterations, delaying some of the market entry plans.
- KDI's most recent market success is exceeding expectations and it appears the combination of low-cost and ease-of-use are compelling market drivers that will be inherent in all of the products proposed.

TFAMP 10-665

Advanced Liquid Crystalline, Chiral, and Dye Materials for Flexible Liquid Crystal Films

Kent Displays, Inc.



- Flexible Optical and Electronic Device Manufacturing (KSU/KDI collaboration), 2003 & 2005, $1.700,000
- Web Manufacturing of Flexible LCDS, 2006, $350,000
- Flexible Liquid Crystal Film Manufacturing Alliance, 2007, $7,922,000
- Self-powered LCDs, 2007, CMPND Sub-award $400,000
- Electronically Changeable Color Skins for Consumer Electronics, 2009, $4,967,000

Technical Risk

Overall Score = 3.66

Technical Reach

KDI has already developed prototypes and in some cases commercial products for each of the proposed applications using lower performing materials. End-users have provided specific feedback and guidance as to what enhancements are needed that will enable large-scale adoption. Thus, the advances made in this project are close to being "drop-in" solutions to existing product lines. However, some of the material formulation advancements proposed present significant technical challenges that, to date, have only been demonstrated at the proof-of-concept level.

Resource Limitations

The project funding requested is claimed to be sufficient to produce prototypes for customer evaluations of each of the four products proposed. KDI and its development team have the technical capability to accomplish the technical objectives and KDI has been successful in introducing an LCD e-Tablet product currently being sold through Amazon. However, to fully commercialize the proposed products KDI will require financial input beyond its internal resources. KDI is already in discussions with Tier 1 manufacturers of electronic components to be strategic partners in full product commercialization.

Technology Protection

KDI has a strong patent portfolio covering LCD technologies and its Reflex technology that is the basis for the products proposed. KDI and its collaborators have worked together before and have appropriate IP management agreements arranged.

Commercialization Risk

Overall Score = 2.90

Path to Market

KDI is currently engaged with five e-Card display customers, five electronic skin customers and several e-media customers. KDI is directly selling the e-Tablet product (Boogie Board) online through Amazon. These existing customers have defined the features they desire and have all agreed to evaluate prototype devices with plans for product purchases.

Corporate Stability

KDI was founded in 1993 with support from a single investment source. This venture firm has provided over $50 million in support and has indicated it will continue to invest in KDI. KDI has 70 employees and over $6 million of production facilities in place for production of Reflex-based displays including its roll-to-roll manufacturing system. A backlog of orders exists for its e-Tablet and it has plans for a second production line.

Commercial Infrastructure

KDI plans to engage existing customers as strategic partners to reach end-product purchasers. These partners have existing sales and service infrastructure in place to provide display products to the ultimate customers. KDI will need to expand its manufacturing capability to meet the market potentials presented.

Mission Impact

Overall Score = 9.53

Cluster Formation

KDI is one of the several companies formed to develop and commercialize LCD technologies conceptualized at the Kent State Liquid Crystal Institute. It is collaborating with KSU and Akron Polymer, both also part of the polymer and LCD material/technology clusters in NE Ohio. The proposed project and resultant product helps sustain Ohio's leadership in LCD material technology and in innovative LCD displays.

Ohio Economics

Product introductions are expected by the end of 2010 generating 6 jobs at KDI and revenues of $10 million. Rapid sales growth is projected to lead to sales of $100 million by 2013 and $500 million by 2015. These revenues are projected to create up to 500 new jobs at KDI.

Business Model

KDI's business approach for its e-Tablet will continue to be direct sales in the near term. Longer-term sales to OEMs will be introduced. For e-Cards KDI will market to smart card producers, in select cases, providing the entire inlay display. For electronic skins, KDI will sell direct to OEMs of mobile phones and longer term will engage other electronic device OEMs. All of these products will be manufactured at KDI. For the e-Reader, KDI will license the technology to established manufacturers in Asia that have already made the necessary large investment in the production equipment needed.

Ohio Department of Development

2010 TFAMP Evaluation Summary

Optimized Boron Nitride and Production Efficiency for Lower Cost Polymer Composites in LED Luminaires

Momentive Performance Materials Quartz, Inc.

1st Round Score: 62.3 | 2nd Round Score: 85.2 | Rank: 2

Previous Ohio Investment

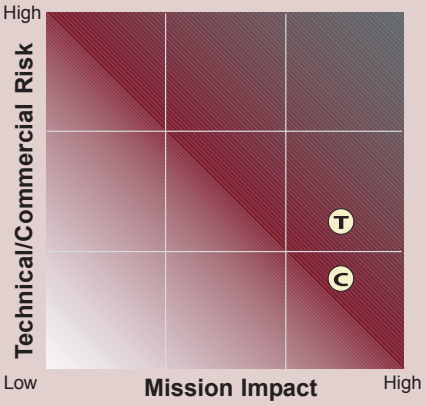
Momentive Performance Materials has not received any prior Ohio funding.

Project Description

The goal of the proposed project is to develop and commercialize lower cost and optimized boron nitride (BN) powder for use in LED lamp housings. BN is an electrically insulating, high thermal conductivity, but expensive powder that increases the heat dissipation of a polymer-based structure. Boron nitride polymer composites (BN-PCs) are currently used for LED lamp housings, but they can contribute more than 60% of the housing cost. Momentive Performance Materials (MPM) will develop a lower cost production process to reduce the cost of the BN powder. The University of Akron will develop the functionalization polymers, and Steer America will develop the special compounding screw to make highly conductive polymer composites with lower amounts of the expensive BN powder. SABIC, an LED-housing producer, will evaluate and provide feedback on the performance of the new BN powders. SABIC plans to purchase the BN powders to make lower cost BN-PC housings for sale to a major LED lamp manufacturer. The end goal is to significantly increase the sales of BN powder in the emerging LED lamp market.

Key Issues

- The technical and commercial objectives of the project present low risks due to the capabilities of MPM in both areas. The major commercial risk will be the adoption of LED lamps into the mainstream markets. Many factors unconnected to technical issues will be involved in the full development of LED lighting in these markets.
- The cost of the BN powder is a major cost component of the polymer housing. However, the housing is a minor cost of the LED lamp. As a result, the technical success of the team and this project is not a critical factor in the success of the LED lamp market. Team success will enhance sales of BN powder as BN-PC housings are used in the emerging LED lamp market.

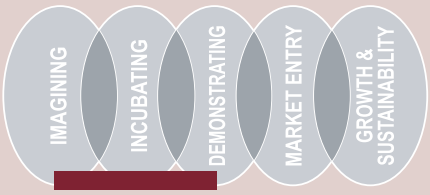


Proposal # TFAMP 10-603

Collaborators:
PolymerOhio
SABIC Innovative Plastics (Exton, PA)
Steer America, Inc.
University of Akron

TFRDF Request:	$918,000
WCF Request:	$0
TOTAL Request:	$918,000
Cost Share:	$1,190,000

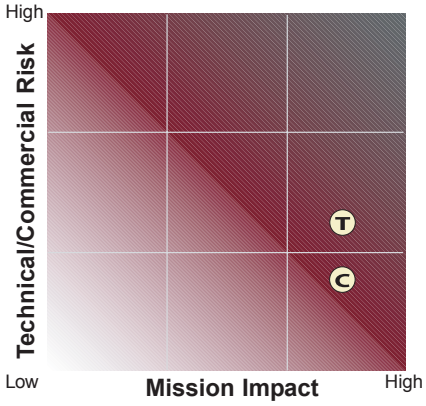
Stage of Development



TFAMP 10-603

Optimized Boron Nitride and Production Efficiency for Lower Cost Polymer Composites in LED Luminaires

Momentive Performance Materials Quartz, Inc.



- *No prior TFP funding*

Technical Risk

Overall Score = 4.12

Technical Reach

MPM has an approach to modifying its current powder-making process that will reduce the high material loss associated with the current process, thereby generating a lower cost powder. The University of Akron will develop functionalizing materials for the BN powder to improve dispersion in the polymer matrix and allow lower BN powder loading without sacrificing thermal dissipation performance. Steer America will develop a screw that will properly disburse the BN powder during the injection molding process. SABIC will evaluate the lower cost powder in its injection molded housings. While the proposed powder/polymer material has not yet been produced, all parties have extensive technical experience in formulating similar materials.

Resource Limitations

The majority of the TFP award will be used by MPM to reduce powder production costs. MPM projects the TFP award will be sufficient to complete its portions of the project. MPM has extensive experience in commercializing BN powders for specific new product applications.

Technology Protection

MPM holds many patents in the production and use of BN powder and products. The parties will retain ownership of the intellectual property of the assets they provide to the project. Arrangements for maintaining confidentiality and downstream cross-licensing have been addressed.

Commercialization Risk

Overall Score = 2.52

Path to Market

MPM is a major world producer and seller of BN powders. MPM's current path to the LED lamp market is via collaborator SABIC, who is currently supplying polymer composite housings (including LED lamp housings) to a major international manufacturer of lighting products. SABIC also claims familiarity with other major lighting manufacturers. MPM is not prevented from selling powder to other polymer composite companies. Lower cost powders will also enhance MPM's BN powder sales to non-LED lamp markets.

Corporate Stability

MPM is the world's second largest producer of silicones and silicone derivatives. It is a global leader in the development and manufacturing of products derived from quartz and specialty ceramics. MPM ceramics and quartz operation is an Ohio-based, multi-million dollar division of a $2.6 billion global organization (based in NY).

Commercial Infrastructure

MPM has established relationships for its BN powder sales. It has manufacturing and sales/marketing infrastructure in place to serve this market. MPM will have to increase production capacity if the projected demand for BN powder for LED lamp housings materializes.

Mission Impact

Overall Score = 8.25

Cluster Formation

MPM has been a prominent member of the advanced materials cluster in Ohio for many years. This project uses other Ohio organizations for technical support (e.g. University of Akron), equipment development (Steer America) and market analysis (Polymer Ohio). It also uses an Ohio supplier for its base raw material, boric acid.

Ohio Economics

Based upon the success of the LED lamp market, MPM forecasts sales of BN powders to the LED market ramping up to $45 million by 2015. MPM also forecasts 5 new jobs at the beginning of the project, with another 15 jobs in 2012, and 35+ cumulative new/retained jobs by 2015.

Business Model

MPM has a successful, on-going business model with its ceramic/quartz division headquarters and sales/marketing located in Strongsville, Ohio facility and manufacturing at three other Ohio locations. The TFP award will speed MPM's manufacturing cost reduction efforts and has the potential to increase both the size of the BN market and its market share.

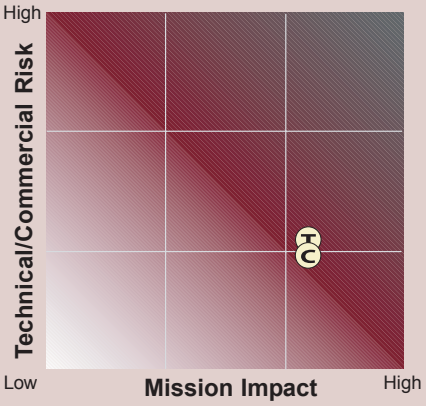
Ohio Department of Development

2010 TFAMP Evaluation Summary

Low Cost Fabrication of High-Temperature Composites

Maverick Corporation

1st Round Score: 72.0	2nd Round Score: 77.7	Rank: 3



Proposal # TFAMP 10-653

Collaborators:
Akron Polymer Systems
NASA Glenn Research Center
Renegade Materials Corporation

TFRDF Request:	$1,000,000
WCF Request:	$0
TOTAL Request:	$1,000,000
Cost Share:	$1,000,000

Previous Ohio Investment

Maverick has been a collaborator on an $8 million 2007 RCP award to the University of Akron entitled, "Commercialization of Functional Polyimide Films and NanoComposites." The $1.1 million of TFP funding Maverick received was used to develop nano-structured, high-temperature polyimide resin for three-dimensional load-bearing composite parts. Maverick created a new company, Renegade Materials located in Springboro, Ohio, to manufacture nano-enhanced prepreg. Maverick has reported 18 new jobs and $10 million in product sales as the result of this OTF funding.

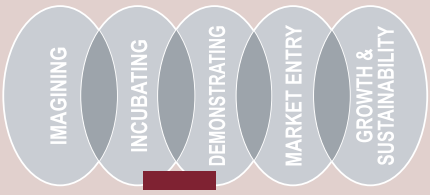
Project Description

The goal of this project is to develop and manufacture three high-temperature polyimides that can be processed by low-cost molding technologies. Eliminating the cost of traditional autoclave and compression molding processes currently used to shape polyimides will significantly reduce the cost of parts for commercial and military aircraft, missiles, launch vehicles, and satellites. Maverick will scale-up production of its MVK-10, a low melt viscosity resin system, to production-size lots of resin or powder by upgrading its reactor and modifying a Twin-screw Compounding Extruder at UDRI. Akron Polymer Systems will install a new reactor to allow scale-up to larger batches for RTM-370, a high-temperature polyimide resin prepared in a NASA-patented solvent-free process. The NASA/APS resin has demonstrated superior properties in comparison with competitive materials. Renegade plans to scale-up its bismaleimide resin to larger batches; it will conduct the film and prepreg processing for all three resins. The resins will be processed into 100-foot long rolls that will be sampled or sold to customers and prospective end-users for evaluation and qualification testing after an internal assessment of their physical and mechanical properties.

Key Issues

- Although performance properties for all three resins have been demonstrated and are superior to the competition, the manufacturing process technology has not yet been scaled-up and proven.
- There are a number of potential competitors such as Cytec and Hexcel Corp. that already manufacture bismaleimide and/or polyimide products for the aerospace industry. These competitors would appear to have access to larger resources than the Maverick team, but the latter claims a superior cost and performance position.
- The opportunity for new materials to be incorporated into several military and civilian aerospace programs is closing, and it is important to qualify these new materials as rapidly as possible. Any development delays could significantly limit the market for a number of years.

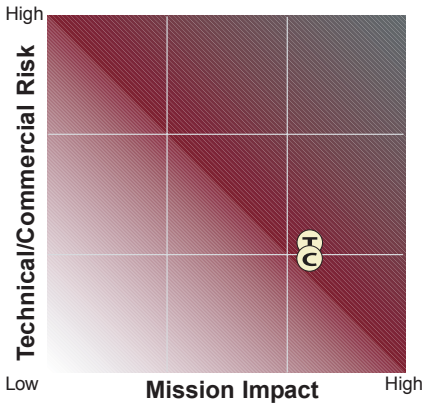
Stage of Development



TFAMP 10-653

Low Cost Fabrication of High-Temperature Composites

Maverick Corporation



- RCP project on Commercialization of Functional Polyimide Films and NanoComposites (collaborator), 2007, $1,100,000 (Maverick's funding)

Technical Risk

Overall Score = 3.64

Technical Reach

All three companies have produced polymer (in quantities of hundreds of pounds) and generated performance data that have met or exceeded that of competitive materials. Samples have been provided to end-users for evaluation. Process scale-up challenges remain, but these are expected to involve engineering expertise rather than basic R&D skills.

Resource Limitations

The equipment that will be purchased for this project will be sufficient to meet production requirements for the foreseeable future. All three companies are currently selling polymer product and receive additional income from SBIR awards. All have demonstrated an ability to commercialize niche high-performance polymers. Funding to support business growth is expected to come from current financial institutions.

Technology Protection

The three polymers to be scaled-up in this project have varying degrees of IP protection. Maverick is developing MVK-10 polyimide resin under a 2001 patent. RTM-370 was developed by NASA under a 2006 patent and licensed to APS. RM-3000 bismaleimide is a Renegade formulation protected by trade secret and NDAs.

Commercialization Risk

Overall Score = 3.20

Path to Market

Maverick, APS, and Renegade plan to demonstrate and qualify new, low-cost, processible, high-temperature materials by 2012. They are working closely with a number of military prime and subcontractors who have agreed to provide technical support and testing. The Ohio companies are trying to hit the qualification window for a number of military and commercial aircraft that are now in the design stage. While sales are expected to begin in 2011, volumes are projected to significantly increase by 2014.

Corporate Stability

Founded in 1993, Maverick has 35 employees and annual sales in the range of $10 million. In 2006, Maverick bought the SuperImide molding business (Stow, OH) from Goodrich. The team expects to receive a purchase order for high-temperature, low-cost polymers by 2011. This order is expected to provide the proof needed by Maverick's bank for additional financing. Maverick has been meeting with the bank on a quarterly basis to keep them apprised of financials and the technical and business progress.

Commercial Infrastructure

Maverick already sells polymer materials to tier one aerospace companies. The letters of support provide evidence that Maverick has been in discussions with many military prime and subcontractors regarding the development and qualification of these materials. There appears to be strong market pull for this concept and a willingness to work with Maverick.

Mission Impact

Overall Score = 7.33

Cluster Formation

This project builds on Ohio's strengths in polymer synthesis, manufacturing, and processing. While each of the three companies has its own polymer synthesis and manufacturing capabilities, the companies are working collaboratively on multiple product forms that would be attractive to end-users. APS has also forged a strong relationship with NASA Glenn and will be commercializing technology licensed from NASA.

Ohio Economics

Initial product sales are expected to begin in 2011. This project is projected to generate $5.6 million in revenues and 22 jobs by 2013 from the sale of resin, film, and prepreg to military and commercial customers. By 2015, revenues are projected to reach $16.7 million with the creation of 66 jobs.

Business Model

APS has a proprietary position on its monomer supply chain that is attractive with respect to its raw material cost. Because these polymer products are intended for defense applications, once the Ohio material suppliers and their Ohio manufacturing sites are qualified, it becomes very difficult and costly to move production. Renegade will convert these polymers into film and prepreg that can be cured "out of autoclave." The additional product forms will create a much larger market opportunity for the three Ohio polymer manufacturers.

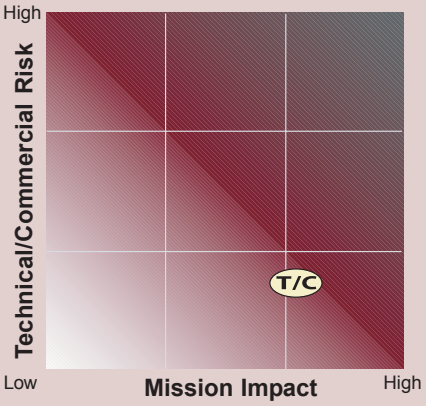
Ohio Department of Development

2010 TFAMP Evaluation Summary

Manufacturing of Plastic Liquid Crystal Auto Dimming Mirror

Alphamirror, Inc.

1st Round Score: 74.7	2nd Round Score: 74.5	Rank: 4

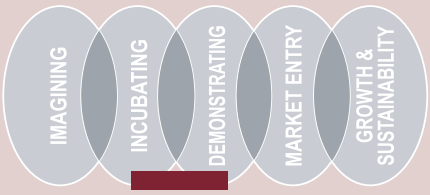


Proposal # TFAMP 10-601

Collaborators:
AlphaMicron, Inc.
Elbit Systems (Haifa, Israel)
Magna Mirrors GmbH & Co. KG (Dorfprozelten, Germany)

TFRDF Request:	$1,000,000
WCF Request:	$0
TOTAL Request:	$1,000,000
Cost Share:	$1,000,000

Stage of Development



Previous Ohio Investment

AlphaMicron has received previous ODOD funding of $6.5 million from 4 previous awards, one of which was directed to AlphaMirror, a joint a joint venture of Elbit and AlphaMicron, for the development of an aftermarket auto-dimming mirror. This product, introduced in the fall of 2007, is a clip-on auto dimming mirror that is battery operated. Orders have exceeded pilot run production capability and have attracted the interest of Magna Mirror and automotive OEMs. Alpha Micron has used the other TFRDF awards to develop LCD ski goggles and adaptive window technology. Adaptive window technology sales have reached nearly $1 million, ski goggles sales are over $1 million and term sheets for over 35,000 goggles over the next 3 years are in place. AlphaMicron currently has 39 employees and has 2009 revenues of over $5 million. During the period since 1997 AlphaMicron has generated over $20 million of additional investment from grants and the sales of its products.

Project Description

The proposed project is to commercialize an economically competitive auto dimming mirror (ADM) for the automotive OEM market. The OEM design and performance requirements are significantly more stringent than those of the currently served ADM after-market. An OEM-acceptable ADM requires developing a new and inexpensive, but durable, plastic housing, optimizing the mirror and film to meet cost and performance requirements, configuring the production equipment for high-volume manufacturing and field-testing commercial prototypes. AlphaMicron will lead the technical development activities, and AlphaMirror will set up the manufacturing system and perform the initial product testing. Magna Mirrors, a leading global supplier of automotive mirrors will support the commercial product testing and qualification.

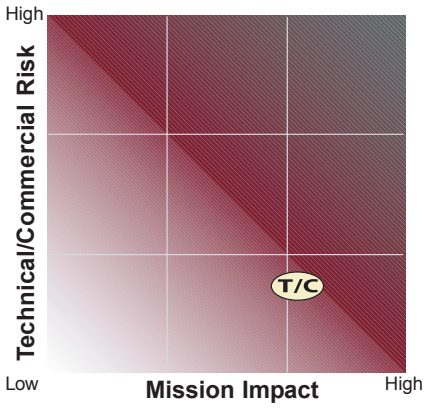
Key Issues

- There are new rules for European cars that demand curved outside mirrors which would eliminate the potential of using electrochromic technology, the current technology used by OEMs for auto dimming mirrors. These regulations could stimulate demand for liquid crystal technology with curved plastic surfaces, AlphaMirror's proposed product. The timing of market entry is important.
- The new product development cycle of the automotive OEMs makes it likely that 2–3 years will be required to reach production after initial product approval is obtained. The magnitude of the cost reduction offered by this product should provide an incentive to the OEMs to minimize this time.
- The joint venture that will have responsibility for manufacturing and selling this product is still at the discussion stage. Firm financial commitments are not yet in place.

TFAMP 10-601

Manufacturing of Plastic Liquid Crystal Auto Dimming Mirror

Alphamirror, Inc.



- Concept Demonstration of Liquid Crystal Ski Goggles, 2002, $1,200,000
- Digital Mirror Commercialization, 2006, $350,000
- Flexible Liquid Crystal Film Manufacturing Alliance, 2007, Sub-grant of $3,000,000
- Adaptive Windows: Path to Zero Energy Buildings, 2009, $5,000,000

Technical Risk

Overall Score = 2.34

Technical Reach

After two years of selling auto dimming mirrors in the aftermarket and a year of evaluation and testing with Magna Mirrors, AlphaMirror plans to qualify its technology for automotive OEM use. This product involves liquid crystals on flexible plastic substrates. The major challenges involve high volume production at low cost, exterior mirror performance under extreme environmental conditions, and thermoforming of the outside mirrors. Magna Mirrors has performed the initial environmental and optical tests on these devices and obtained good results. Initial response from automotive OEMs appears positive.

Resource Limitations

Since this project is intended to result in a 70% cost reduction in outside mirrors and a 30% reduction in inside mirrors, resources are expected to be available if the project is successful. AlphaMirror estimates that $3 million in investment will be needed to initiate production of the auto dimming mirror in 2–3 years. In addition to the requested state funding and cost share ($1 million each), Magna Mirrors is expected to contribute $2 million of in-kind support. Additional sources of support include customer orders and investments from current shareholders and automotive investors.

Technology Protection

AlphaMicron claims a solid IP portfolio of US and international patents which is augmented by trade secret and know-how. Its specialty is in liquid crystal films on plastic. Magna Mirror has over 200 patents in rear view mirrors and mirror electronic features. Any IP generated in this program will have rights that follow the standard U.S. Patent Office guidelines.

Commercialization Risk

Overall Score = 2.52

Path to Market

Magna Mirrors is the largest rear view mirror manufacturer in the world and the second in auto dimming mirrors. Magna Mirrors plans to invest $2 million in this project, relocate a program manager to Ohio, and have Ohio operations if it is successful. Magna Mirrors is considering becoming a partner in AlphaMirror but has specified that AMI must remain in any joint venture formed. AMI will develop the new liquid crystal formulation for this application and will modify the current formulation to allow production on the roll-to-roll manufacturing line. The new entity will manufacture and distribute this product.

Corporate Stability

The proposed joint venture with Magna Mirrors is yet to be formed, but staffing for this project involves all three participants. Although it looks likely that Magna Mirrors will be the joint venture partner of choice, several other auto parts manufacturers have shown an interest in teaming with AlphaMirror and are potential financial sources. AMI has been in business for 10 years with annual revenues exceeding $5 million, and Elbit has approximately $2 billion in annual revenues.

Commercial Infrastructure

Magna Mirrors currently produces over 26 million interior mirrors and 28 million exterior mirrors annually in its manufacturing facilities located in North America, Europe, and Asia, and it has more than 40% market share. Magna Mirrors provides sales, marketing, and technical service to many of the automotive OEMs located throughout the world. The proposed joint venture would be the primary supplier of functional mirror films to Magna Mirrors, and Magna Mirrors would accelerate the market entry process and subsequent growth.

Mission Impact

Overall Score = 7.00

Cluster Formation

This project provides synergy between the liquid crystal display work at Kent State, the needs of the automobile industry for cost reduction of components, and Ohio's polymer industry. AMI has been producing aftermarket clip-on mirrors and motorcycle mirrors based on liquid crystal technology since 2007 in Ohio. It purchases customized equipment and supplies from local suppliers and will continue to do so.

Ohio Economics

AlphaMirror anticipates creating 2 additional jobs during this project and AMI will create/retain 5 jobs. Product sales will begin in 2013 and will generate $500,000. Revenues are projected to increase to $4.5 million in 2015creating a total of 9 jobs.

Business Model

AMI formed a joint venture with Elbit, a large Israeli defense company, resulting in the establishment of AlphaMirror in Ohio in 2004. AMI intends to follow this same model with Magna Mirrors. The plan appears to be to form a joint venture in Ohio involving AMI, Elbit, and Magna Mirrors in 2013 and to produce liquid crystal products using the roll-to-roll processing line already developed.

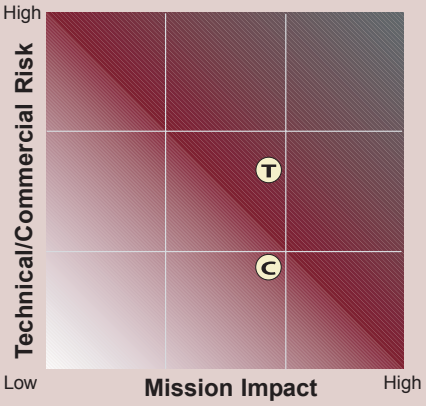
Ohio Department of Development

2010 TFAMP Evaluation Summary

Reduced-Permeability, High-Modulus Film Project for Military Lighter-Than-Air

Lockheed Martin MS2 Integrated Defense Technologies

1st Round Score: 66.7 | 2nd Round Score: 66.6 | Rank: 5

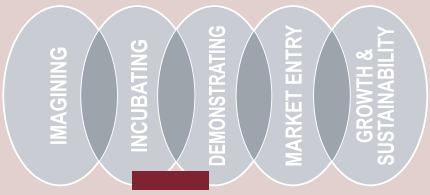


Proposal # TFAMP 10-679

Collaborators:
Akron Polymer Systems
Chemsultants International Inc.
University of Akron

TFRDF Request:	$1,000,000
WCF Request:	$0
TOTAL Request:	$1,000,000
Cost Share:	$1,000,000

Stage of Development



Previous Ohio Investment

Lockheed Martin M2 Integrated Defense Technologies (LM) has received 2 prior TFRDF awards for solid oxide fuel cell development for military generator sets. However, the team within LM conducting these programs is different than the team involved in the proposed project. This LM team has received funding as a collaborator under an RCP awarded to the University of Akron (UA) that involved the development of a high-strength polyimide film for potential use in LM's High Altitude Airship (HAA) application. While the project led to a new film "suitable" for the HAA demonstration vehicle, it was too heavy for use on the fully operational HAA. Reduced permeability was not a target objective in that project. Subsequently the team developed a new material currently being produced by a Massachusetts company, although it is hoped that production capability can be transferred to Chemsultants.

Project Description

The proposed 2-year project is intended to further improve the properties of a polymer/nano-based film developed under the 2007 UA-led RCP. This film is designed for use as the hull fabric for lighter-than-air airships (LTAs) for the military. Specifically the proposed project is aimed at the Army's HAA to reduce the permeability of the hull fabric by 50% and increase the strength of the adhesive that is used to laminate the film, creating fabric and seaming panels for the HAA hull structure. Technical challenges involve the use and scaling of nanoclays to reduce permeability and the addition of carbon nanofibers to improve the adhesive's performance. UA will develop the modified nanoclay, Akron Polymer Systems (APS) will produce the film solution, LM will confirm the film properties and Chemsultants will optimize the film casting process. LM and UA will produce the strengthened adhesive samples, evaluate their performance, and determine if existing seaming equipment can use the new formulation.

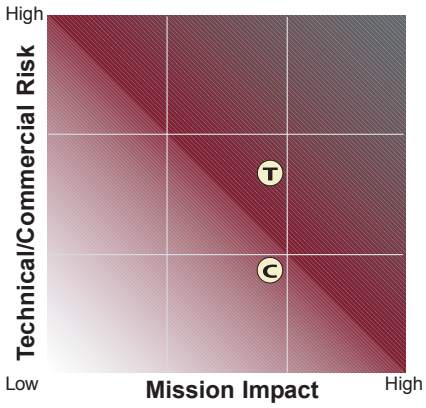
Key Issues

- The economic impacts from the proposed project are contingent upon the military maintaining its HAA implementation schedule. While this project has the potential to accelerate the schedule for operational unit demonstration, the purchase and introduction into service of multiple units will depend on budgets and priorities that are not controlled by LM.
- Although the development team has referenced R&D showing proof-of-concept for reducing polyamideimide (PAI) film permeability with the use of nanoclays, a fabric has not yet been produced and evaluated that meets the stated objectives.
- LM's goal is to use Ohio suppliers to the extent possible; the collaborators involved support that objective. However, LM's overall business objective is to construct LTAs and it will pursue and utilize all suppliers that can provide materials and subcomponents that meet its performance and cost requirements.

TFAMP 10-679

Reduced-Permeability, High-Modulus Film Project for Military Lighter-Than-Air

Lockheed Martin MS2 Integrated Defense Technologies



- Military SOFC Ruggedization, 2010, $1,000,000
- Military SOFC Genset Project, 2009, $998,393
- Commercialization of Functional Polyimide Films and Nanocomposites, 2007, $500,000 (Subcontract)

Technical Risk

Overall Score = 5.58

Technical Reach

The PAI film developed under the UA RCP project is the base material for the reduced permeability fabric proposed. Literature indicates that the addition of nanoclays has proven to reduce permeability of films in other applications and LM anticipates achieving the target goal of 50% permeability reduction relative to the current fabric/adhesive system. The deliverables of the proposed project are large-scale fabric samples for testing and trials using existing fabric construction systems

Resource Limitations

LM expects the project funds proposed will be sufficient to produce and evaluate the new fabric samples. Application of the fabric to an operational HAA and flight-testing of that vehicle will require continued funding from the Army Space and Missile Command that supports the overall HAA program. Funding for the HAA program is in the 2010 budget, but funding has not been approved as of this proposal review. The TFP funding will accelerate the hull fabric development and will leverage the potential for accelerated HAA support.

Technology Protection

LM's team traces its experience with lighter-than-air airships back to the original Goodyear operations and it remains the recognized leader in the field. LM owns background knowledge and IP associated with the overall LTA technology. This includes several patents on fabric materials on LTA hull fabric materials. APS has IP on the new PAI materials and UA has IP on the incorporation of nanoclays into PAI that are being provided to LM.

Commercialization Risk

Overall Score = 2.86

Path to Market

LM is the prime contractor for LTA production, including the HAA vehicle. LTAs are an integral component of the Army's plans for persistent surveillance and other uses in multi-mission operations. HAA production is scheduled for 2015, but this schedule is subject to budget and priority issues. Other applications for the proposed film-based fabric exist, but market paths have not yet been fully explored.

Corporate Stability

LM's Persistent Surveillance market segment is located in Akron and the LTA operations are anchored there by its unique airdock. Overall the LM operations in Akron are growing with employment currently about 700.

Commercial Infrastructure

LM is an established and qualified USDOD supplier/contractor and, as stated above, it is the prime contractor for LTA vehicles and support. LM has top-secret clearance and has ISO 9001 and 14001 registrations.

Mission Impact

Overall Score = 6.20

Cluster Formation

LM is a collaborator in, CMPND, the Wright Center based at OSU. It has partnered with APS and UA to develop the hull material/fabric to be used for the Army's HAA and plans on potentially using another Ohio company, Chemsultants, for the film casting. Together, these Ohio suppliers coupled with current Ohio suppliers (e.g. Lubrizol) would increase the content of Ohio products in the hull fabric from 1% to 30%. The construction of LTAs in Ohio will result in significant supply chain opportunities for Ohio companies.

Ohio Economics

Based on LM's projected production schedule for HAAs, it will create 120 new jobs in the LTA group by 2013 adding to the current staff of 80. These resources will be needed to construct the 1st HAA vehicle and prepare for multi-unit production. By 2015, another 200 jobs are projected. APS and Chemsultants project creating 10 to 15 new jobs during this period in direct support LM's materials needs. The final fabrics will likely be woven outside Ohio, as cloth weaving is not an Ohio manufacturing strength.

Business Model

LM's potential share of LTA vehicles for military and surveillance markets is estimated to be greater than $2 billion. LM's objective is to maintain its leadership position in LTAs and to construct the HAA vehicles in Akron.

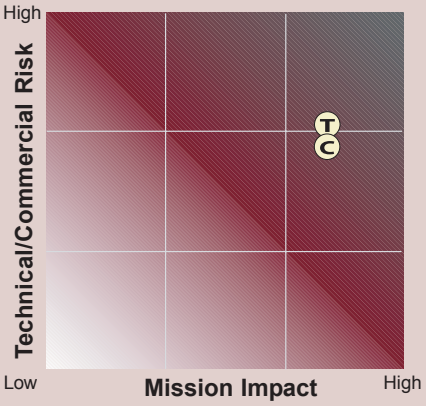
Ohio Department of Development

2010 TFAMP Evaluation Summary

Metalized Nanomaterials

Materials Research Institute, LLC

1st Round Score: 70.7 | 2nd Round Score: 66.1 | Rank: 6

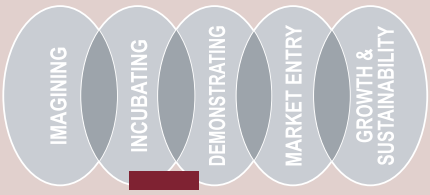


Proposal # TFAMP 10-640

Collaborators:
EMTEC
Engineered Materials Systems, Inc.
Wright Brothers Institute

TFRDF Request:	$791,000
WCF Request:	$0
TOTAL Request:	$791,000
Cost Share:	$831,000

Stage of Development



Previous Ohio Investment

Materials Research Institute has not received any prior Ohio funding.

Project Description

Materials Research Institute (MRI) proposes producing and optimizing a unique class of conductive metalized nanomaterials (MNMs) for signal power transfer, electromagnetic shielding, electrical grounding, energy storage and conversion and conductive metal cladding. MNMs utilize silver, copper or nickel cladding on substrate materials such as carbon nanotubes, carbon fibers and nanoclays. In this project, MRI collaborators and product end-users will test the MNMs for three specific applications—conductive coatings for PV panels and electronics, surgical gloves with embedded printed circuits and lithium-ion battery anodes. The project budget includes funding for the purchase and installation of equipment for material pretreatment, production and post-treatment. GrandTek, a Taiwanese battery company, wants to invest in an Ohio production facility, if product performance requirements are met. EMS, a Delaware, Ohio producer of conductive coatings and adhesives, plans to use MNMs to reduce the amount of silver in its products. The Air Force is interested in using MNMs for shielding in the War Fighter program.

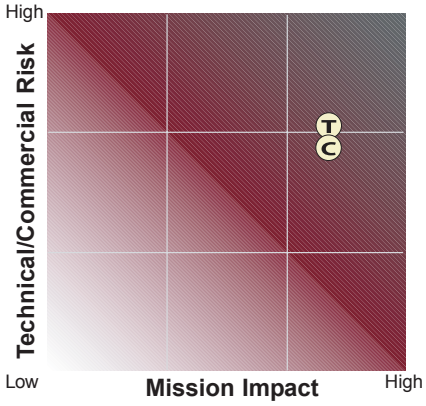
Key Issues

- GrandTek, a Taiwanese company of 300 employees with annual revenues of $40 million, has raised $30 million from investors to diversify into the electric bicycle lithium-ion battery market in China. This electric bicycle market has lower battery performance requirements than the lithium-ion batteries for the automotive market. GrandTek's market entry strategy appears to be quick entry with a product that is better than current technology and can meet the needs of the bicycle market.
- The MNM anode material produced by MRI has been tested by an independent third party in button cell configurations. It appears that earlier versions of the product have come close to meeting performance requirements but have not yet attained that goal. Product improvements are continuing.
- The possibility of attracting foreign investment from GrandTek to construct a manufacturing facility for this material in Dayton is attractive. Early site identification work has been initiated.

TFAMP 10-640

Metalized Nanomaterials

Materials Research Institute, LLC



- *No prior Ohio investments*

Technical Risk

Overall Score = 6.86

Technical Reach

The Industrial Technology Research Institute (ITRI) in Taiwan has already independently tested two rounds of product for the lithium-ion battery anode application with initial efficiency retention of 80% through 50 cycles. A third round of product has been shipped to ITRI that is intended to reach the target of 85–95%, but some product development challenges still remain for lithium-ion battery anodes and other end-use applications before manufacturing scale-up is realistic.

Resource Limitations

MRI has relied on primarily on SBIR funding and has had revenues of approximately $300,000 annually for the past three years. MRI anticipates receiving an SBIR Phase II award from the Army entitled "A Viable Method for Nano-Coating of Graphite Microfibers" for an infrared obscurant and will use this as cost share. If this award is not received, GrandTek has wired sufficient funding to cover the cost share for this project. MRI appears to be dependent on a single key individual, so project management is at risk if he is not involved.

Technology Protection

MRI's processing technology is based on trade secrets and not U.S. or international patents. For this reason, MRI would risk losing its IP if a manufacturing plant were set-up in Taiwan or China. The plan is to manufacture the lithium-ion battery anode material in Ohio and ship it to GrandTek in Taiwan for incorporation into the bicycle battery. MRI intends to file patent applications on the technology in the near future.

Commercialization Risk

Overall Score = 6.22

Path to Market

MRI has established relationships with credible end-users that would facilitate entry into the target markets. In addition to GrandTek for lithium-ion batteries, MRI is working with EMS, a Delaware, Ohio company with $11 million of annual sales of adhesives, encapsulants, and conductive inks. MRI also has a relationship with interested end-user National Polymer Laboratories, a 65-person organization in Chagrin Falls, Ohio that develops specialized polymer formulations.

Corporate Stability

MRI was founded in 1998 to conduct sponsored research and product development in materials science. The company can manufacture functional nanomaterials at the pilot scale. It is dependent on SBIR funding and the sale of products such as silver-metalized carbon nanofibers for lightning strike protection and copper-metalized carbon nanofiber for charge collection in lithium-ion batteries.

Commercial Infrastructure

MRI plans to hire marketing and sales personnel to develop new customers beyond the collaborators in this project. Wright Brothers Institute will provide commercialization assistance. It is a not-for-profit organization that facilitates collaborative efforts between AFRL and local technology companies and operates the TecEdge Innovation and Collaboration Center and the TecEdge Rapid Prototyping Laboratory. EMTEC will identify potential customers in the photovoltaic, energy storage, and ICE supply chains.

Mission Impact

Overall Score = 7.83

Cluster Formation

This project addresses one of the targeted advanced materials technologies. It has the potential to create new manufacturing capability in Ohio for lithium-ion battery anodes and to provide a more cost effective additive for an existing Ohio manufacturer of conductive inks and adhesives. The applicant plans to obtain support from two Ohio non-profit organizations.

Ohio Economics

MRI is projecting $8 million in product sales by 2013 and $35 million by 2015. Employment projections are based on revenues minus the cost of raw materials and total 40 in 2013 and 175 by 2015. These numbers appear optimistic based upon the historical growth of other materials companies.

Business Model

GrandTek plans to finance the building of an MRI facility in Dayton,Ohio to produce the lithium-ion battery anode material. This material will be shipped to GrandTek for battery fabrication. These batteries will be used to power bicycles in Asia. The silver coated nanoparticulates will be supplied to EMS for use in conductive inks and adhesives. This product will allow EMS to reduce the silver content of its current product line while maintaining conductivity and reducing cost.

Ohio Department of Development

2010 TFAMP Evaluation Summary

Manufacturing Conductive, Strong, Lightweight Yarn from Long Carbon Nanotubes for Aerospace and Defense Applications

General Nano, LLC

1st Round Score: 74.3 | 2nd Round Score: 60.8 | Rank: 7

Previous Ohio Investment

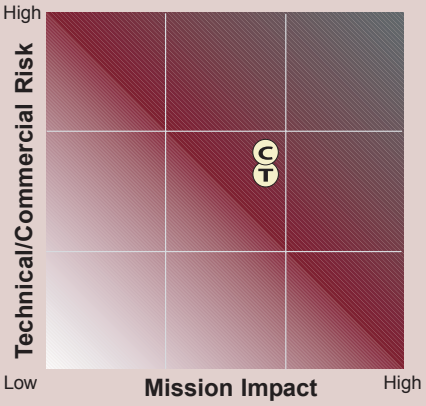
General Nano has not received any prior Ohio funding.

Project Description

The goal of the project is to make long, high quality carbon nanotubes (CNTs) and spin them into threads (or yarns) that are as electrically conductive as aluminum wire, weigh less than 50% of copper wire, and are an order-of-magnitude stronger than conductive metal wires. General Nano (GN) currently makes long CNTs (trademarked Black Cotton™) and has produced lab-scale conductive yarns. The three project objectives are: to improve the synthesis process to make longer and stronger high quality multifunctional CNTs; to optimize the spinning process for forming CNTs into threads and yarns; and to create a pilot-level manufacturing platform to provide CNT yarns to early end-use adopters. Atkins & Pierce (A&P) will make braids from CNT yarns. The Air Force will characterize and test the yarns. Parker Hannifin Fluid Connectors Group will manufacture proprietary products using CNT woven structures from A&P. General Cable will identify and sell the proposed product to its customers in the aerospace/defense, energy, and communications markets. GN's overall goal is to be the first commercial source of CNT yarns that are scalable and price competitive with existing conductive yarn materials.

Key Issues

- GN is a very early stage-company, and continued SBIR support will be needed until product revenues can bring it to a self-supporting level.
- This proposal is seeking $946,943 in WCF to purchase a CVD reactor, Raman spectrometer, confocal microscope, optical microscope, and plasma reactor for UC. A&P will contribute $500K in cash cost share that will be used to purchase an E-beam machine for substrate preparation and a CVD reactor.
- GN originally proposed that the pilot-level production of "Black Cotton"-based yarn would be done at A&P at its existing Covington, KY facilities, and the E-beam and CVD reactor were to be installed there. It appears that this plan was revised to place the equipment being purchased with A&P project cost share at GN's newly acquired facilities in an incubator in Cincinnati, and pilot production would occur there. However, it is not clear that A&P has committed to this revised approach, nor is it clear if the needed clean room space, raw material handling systems, ventilation, and air filtration systems will be available at the incubator.
- The work plan indicates that the team intends to use computer models, dynamic simulations and theoretical calculations to design the braiding and spinning equipment that can be used to test the theories of fiber formation and create functional prototypes. A&P will provide much of the processing and testing expertise, but the staff and equipment to support this activity are located in KY.

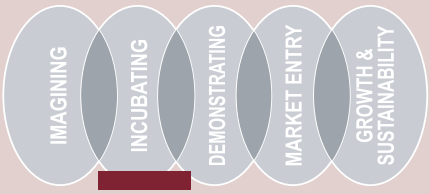


Proposal # TFAMP 10-667

Collaborators:
Air Force Research Laboratory Energy/Power/Thermal Division (AFRL/RZP)
Atkins & Pearce (Covington, KY)
General Cable (Highland Heights, KY)
Parker Hannifin Corporation Fluid Connectors Group
University of Cincinnati Chemical and Materials Engineering—NanoWorld Lab

TFRDF Request:	$1,000,000
WCF Request:	$946,943
TOTAL Request:	$1,946,943
Cost Share:	$2,540,657

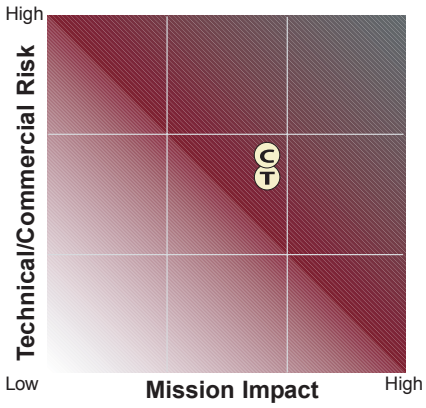
Stage of Development



TFAMP 10-667

Manufacturing Conductive, Strong, Lightweight Yarn from Long Carbon Nanotubes for Aerospace and Defense Applications

General Nano, LLC



- *No prior Ohio investments*

Technical Risk

Overall Score = 5.46

Technical Reach

Using UC-developed technology for creating long CNTs, lab-scale yarns from CNT arrays have been produced and characterized by AFRL, with encouraging results. GN, with UC support, will improve the process to improve the quality of these longer CNTs and increase the size of the process array. The yarn-spinning activities for this project will use hardware from another project. Several technical hurdles relating to scaling-up production of the CNT yarn materials will be addressed in the proposed program.

Resource Limitations

GN believes that the budget for the 2-year project is sufficient to move the technology into the market entry phase for two specific applications. GN expects an NSF Phase II SBIR at the end of the first project year, and an Air Force SBIR Phase III toward the end of the second project year. These will assist in commercialization of products beyond the initial applications.

Technology Protection

GN has exclusive rights to UC's pending patent for making long CNTs. The UC CNT production process leaves a detectable residual in the CNT that will aid in the enforcement of the patent. In addition, GN and UC have jointly submitted a dozen invention disclosures to the UC IP office. GN is reviewing IP for protecting the spinning technology to make electrically and thermally conductive yarns from the long CNTs. GN indicates it will ultimately make the yarn in-house to control non-patentable trade secrets. A competitive company in New Hampshire also makes CNT yarn, but by a different process and that yarn is not currently at a commercial production level.

Commercialization Risk

Overall Score = 6.08

Path to Market

The goal is to be first to market with a superior CNT yarn. The team will make yarn samples and use the sales/marketing capabilities of its collaborators. GN is already selling lab-produced CNT arrays for non-yarn, thermal management applications. A&P will convert yarns into braids, and supply braids to General Cable and Parker Hannifin for evaluations. GN has also partnered with an Ohio producer of protective garments. It has an SBIR submission with Goodrich (Uniontown, OH) to fund early stage research for aircraft de-icing systems. Yarn samples will also be prepared for evaluation by WPAFB/AFRL for its UAV program.

Corporate Stability

GN was spun off from UC in 2007 to commercialize conductive yarns made from long CNTs. It is supported by three current SBIRs, a purchase order for sample materials from General Cable, a proof-of-concept subcontract on a proprietary Honeywell USDOD project and the proposed investment from Atkins & Pearce. The additional SBIRs mentioned above are also being sought.

Commercial Infrastructure

Initial samples are being produced by GN and UC at UC's lab facilities, and sent to end-users through the project collaborators. Parker, Honeywell, Goodrich and others are also receiving samples. Initial production will come from the pilot facility. If justified, full production (not part of this project) will come from the planned full-scale facility in Ohio. GN will need to develop its business, marketing, and management infrastructure to drive revenues and create market share.

Mission Impact

Overall Score = 6.15

Cluster Formation

General Nano is a spin-off of UC and the NanoWorld Lab. GN claims to produce the longest CNTs in the world. This project expands the manufacturing technology and capacity for long CNT production. Products from GN will go to several Ohio-based manufacturing companies for commercial and military markets. This project has the potential to strengthen the Ohio CNT cluster leveraging technology developed at UC.

Ohio Economics

GN projects it will hire at least 27 new, "Ohio-based" employees by 2012 and generate product sales of $4 million. GN forecasts $7.7 million in sales in 2013, and ramping up to $ 24.3 million by 2015. GN estimates more than forty high-skilled and high-paying jobs will be created in three years. These projections appear to be very aggressive based on the current business and market development status.

Business Model

GN will increase production capacity at UC, and through the project funding, will set-up a pilot-level production facility to supply its collaborators and partners. They will in turn produce end-use products and through their existing infrastructures, sell and service them. GN will need to staff-up its business development, marketing, and management operations. Long-range plans are to build a full-scale production facility in Ohio, but at a later and unspecified date.

Ohio Department of Development

2010 TFAMP Evaluation Summary

Accelerating the Commercialization of a Novel Bio Resource Resin (BR^2) for Agricultural, Construction and Industrial Applications

Momentum Technologies, Inc.

1st Round Score: 62.0 | 2nd Round Score: 58.3 | Rank: 8

Previous Ohio Investment

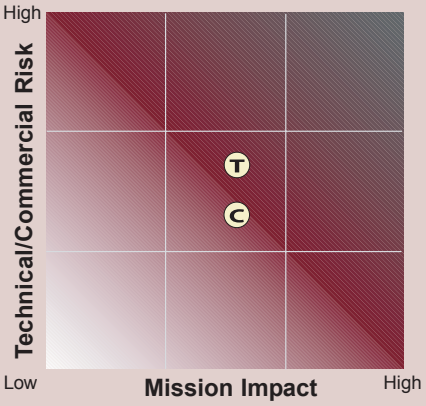
Momentum Technologies has not received any prior Ohio funding.

Project Description

The project goal for Momentum Technologies, inc. (MTi) is to produce and sell a biodegradable resin (brand name BR^2) derived from animal waste that is a lower cost replacement for petroleum-based asphalt. Innoventor LLC will construct the processing equipment that will be placed at the animal farm site to convert the animal wastes into a resin. The resin will be processed into a coated lawn fertilizer by Royal Chemical Corporation. The other collaborators will test the resin for suitability in their respective products. The Ohio State University will receive Wright Capital funds for animal waste processing equipment for its development and testing contributions. The plan is to place processing equipment on swine farms in Ohio and other states to produce large commercial quantities of BR^2 resin for sale.

Key Issues

- MTi has acquired exclusive marketing rights for the sale of BR^2 into the fertilizer coating application and rights along with the technology developer Innoventor, a Missouri-based company, to sell BR^2 into asphalt paving and specialty markets. MTi's IP will be associated with applications.
- Initial processing demonstrations have shown promising results in some of the applications proposed, but further technical challenges remain and long-term demonstration of end-use performance will be required. The support for continued commercialization activity is not fully established and will come from product sales and federal grant support.

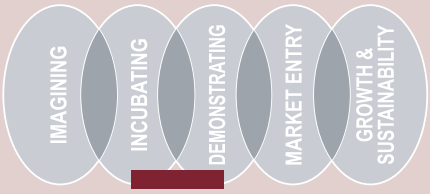


Proposal # TFAMP 10-632

Collaborators:
Crafco, Inc. (Chandler, AZ)
Innoventor, LLC (St. Louis, MO)
Kokosing Materials, Inc.
Ohio State University Ohio Agricultural Research & Development Center (OARDC)
PolymerOhio
Royal Chemical Corporation
TurfCare Supply Corporation

TFRDF Request:	$990,014
WCF Request:	$500,000
TOTAL Request:	$1,490,014
Cost Share:	$1,492,880

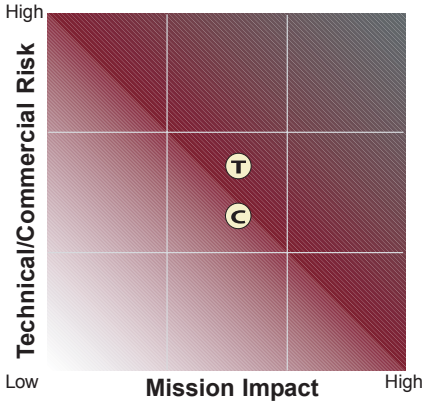
Stage of Development



TFAMP 10-632

Accelerating the Commercialization of a Novel Bio Resource Resin (BR^2) for Agricultural, Construction and Industrial Applications

Momentum Technologies, Inc.



- *No prior Ohio investments*

Technical Risk

Overall Score = 5.70

Technical Reach

Innoventor has constructed two generations of truck-based processing equipment for a swine farm in Missouri and has produced BR^2 resin. MTi has processed lab quantities of resin for lab-scale test applications. The next step is to make a 3rd generation processor and place it on an Ohio swine farm and begin producing scaled up quantities of resin for evaluations by the collaborators. Innoventor has scheduled a paving demonstration project for the spring of 2010 in Missouri using BR^2 as a replacement for asphalt.

Resource Limitations

MTi has assembled a strong project team that includes the technology developer (Innoventor), Ohio R&D support (OARDC) and several end-users willing to evaluate the product for their specific applications. MTi is an established distribution and laboratory services company providing specialty chemicals used to modify asphalt and will rely on its collaborators for technical development. The project leads to a pre-commercial processing system and early product sales revenues are expected to support follow-on commercial activity, although federal grant funding will also be sought.

Technology Protection

MTi has executed a comprehensive marketing and supply agreement with Innoventor that provides for exclusive market rights along with Innoventor for the development and sale of BR^2 into asphalt roofing, paving and specialty markets. MTi has the sole and exclusive rights to sell BR^2 into fertilizer coating applications worldwide. Most of MTi's intellectual property is in the form of patent applications, though some key innovations are kept as trade secrets. MTi believes that the patents will provide MTi, its customers, and technology collaborators with sufficient protection to assure its position as the leader in specialty applications of BR^2.

Commercialization Risk

Overall Score = 4.34

Path to Market

MTi has Ohio-based end-users and a large national end-user that have committed to testing and evaluation of its processed product. MTi has an existing domestic sales and distribution organization with additional international channels. Product sales to the collaborators and others will depend on successful demonstrations in the ultimate product end-uses (e.g. fertilizer, roofing products, pavement crack filler).

Corporate Stability

MTi was founded in 1996 and is a subsidiary of Deli-Universal, a Dutch conglomerate. MTi currently has 12 employees, and annual sales of about $2 million. MTi offers a range of laboratory services (for asphalt roofing and paving industries) and polymer distribution services for the North American Market. MTi's executives were formerly with Firestone.

Commercial Infrastructure

MTi has assembled a team with production and processing capabilities, testing capabilities, and it will provide the sales/marketing/distribution capabilities. The key process technology supplier is not an Ohio company, but has indicated it will open an Ohio office for servicing the R&D and sourcing local components associated with setting up BR^2 production in Ohio.

Mission Impact

Overall Score = 5.33

Cluster Formation

MTi will use Ohio swine farms for raw materials, an Ohio company for resin processing and production, and Ohio-based end-users and distributors of the resin and products made from the resin. It has partnered with OARDC for additional technical support and production equipment optimization and OBIC to assist in obtaining federal grant support.

Ohio Economics

MTi forecasts its direct sales and Ohio job creation to reach $500K and 11respectively by 2013, growing to $1 million and 18 by 2015. It projects significantly more economic impacts from the supply chain and end-use product companies. Revenues for these companies are projected to approach $250 million by 2015 with over 50% going to Ohio suppliers.

Business Model

MTi plans to set up a manure collection, processing and processed product distribution system based on the Ohio swine farming network. It plans to replicate the operations in other swine production states and hopes that Ohio will serve as a regional center for service operations and equipment component supplies.

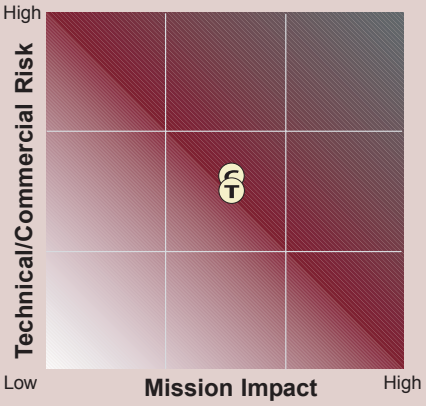
Ohio Department of Development

2010 TFAMP Evaluation Summary

VGCF Pre-preg for Advanced Composites

Applied Sciences, Inc.

1st Round Score: 68.3	2nd Round Score: 56.3	Rank: 9

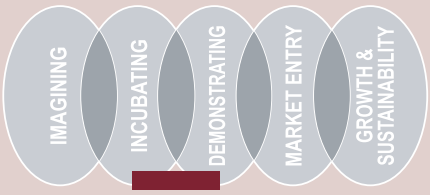


Proposal # TFAMP 10-647

Collaborators:
Pyrograf Products, Inc.
Technical Fibre Products (Newburgh, NY)

TFRDF Request:	$999,978
WCF Request:	$0
TOTAL Request:	$999,978
Cost Share:	$1,115,500

Stage of Development



Previous Ohio Investment

In 2005, ASI received a $175K ORCGP award to commercialize low-cost carbon nanofibers (CNF). Pyrograf Products, Inc. was spun-off to manufacture CNF, and the award has led to the creation of 4 jobs and $5.2 million in product sales. The ODOD database shows that total leverage from this award has been $8.6 million.

ASI received an OTFAEP award of $1 million in 2008 for converting the CNF into anodes for lithium-ion batteries that has retained 2 jobs and attracted $170K in federal funding. The project was expected to lead to a JV with an Ohio company that would produce 30,000 pounds of coated CNF by 2010 generating $2 million in revenue and creating 10 new jobs. However, there was a disagreement between the two companies over IP ownership and the other company did not participate in this OTFAEP project. In another 2010 proposal, ASI is applying for additional state funding to continue the lithium-ion battery application. There is no evidence that the planned production capacity for coated CNF has progressed.

Project Description

Technical Fiber Products, a carbon fiber veil producer, and ASI, a CNF producer, have developed a continuous carbon fiber mat. In this project, production of the mat will be scaled-up and optimized to achieve performance specifications of various end-users. The proposed JV will purchase capital equipment for a reel-to-reel CNF mat production process to produce 64" wide CNF mat on a continuous basis. A key challenge will be to obtain homogeneous deposition of the CNF onto the carrier veil. Renegade will impregnate the mat with resin to create pre-preg material. The mat and the pre-preg material will be supplied to end-users for testing and evaluation in end-user applications such as radar cross-section reduction in aerospace vehicles, unmanned aerial vehicles, and naval ships; EMI adsorption in consumer electronics and windmill blades; and lithium-ion batteries.

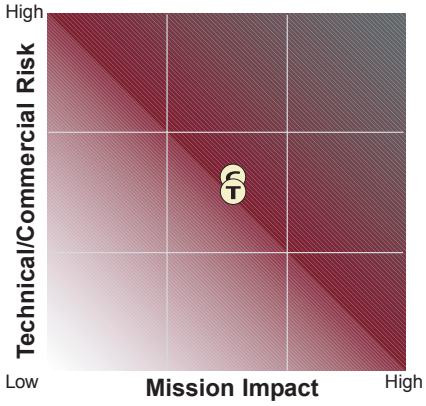
Key Issues

- Pyrograf has scaled up manufacturing capability for volume production of carbon nanofibers. Currently this capacity is underutilized as 2009 sales were mainly sample quantities. Sales have declined each year since 2006. ASI attributes this decline to the difficulty that end-users have had in uniformly dispersing the nanofibers and to the termination of offshore distribution agreements.
- There are a number of unresolved budget issues associated with this proposal regarding the equipment to be purchased, the nature of the cost share, and the subcontracts. This information was not provided in the proposal or in response to the reviewers' questions.
- An interested end-user tested a pre-preg sample (nanofibers manually applied onto a chopped PAN fiber veil which was subsequently impregnated with resin) and reported that most of the individual samples taken from multiple locations throughout the sheet exceeded the requirements for a particular end-use application.
- Nanomat samples have been provided to ten end-users. These samples are still in the initial stages of evaluation, so it is unclear if they will meet the end-user requirements.

TFAMP 10-647

VGCF Pre-preg for Advanced Composites

Applied Sciences, Inc.



- Low-cost Carbon Nanofiber Production, 2005, $174,657
- Development of Specialty Carbons for Energy Storage, 2008, $999,999

Technical Risk

Overall Score = 4.98

Technical Reach

There is risk in scaling-up the manufacturing process prior to demonstrating that the product meets end-user requirements. While manufacturing scale-up is likely to reduce cost and improve product uniformity, scale-up of the Pyrograf process for producing vapor grown CNF appears to have occurred before end-users had addressed material handling and performance issues.

Resource Limitations

Team members have demonstrated the ability to produce both CNF and a manual version of the CNF/carbon veil product. ASI estimates that this project will require a tenfold increase of annual production capacity by the end of 2017. Details as to how this 10X expansion would be accommodated were not provided.

Technology Protection

Technical Fiber Products received a patent in 2007 covering a method of incorporating CNF into a paper made from pitch or PAN carbon fibers. In 2009, ASI filed two patent applications—one for a method of producing a carbon-carbon material having high electrical and thermal conductivity with the use of CNF/carbon fiber paper and one for an improved method for creating CNF/carbon fiber paper with enhanced uniformity.

Commercialization Risk

Overall Score = 5.40

Path to Market

While ASI has received grants totaling $10 million from NIST and the Air Force to explore the use of Pyrograf's CNF in automotive and defense applications, the only end-uses for CNF that have been identified were in sporting goods and direct digital manufacturing. Many additional companies are in the process of evaluating both the nanofibers and the mats, but none has progressed to the point where it shows evidence of carrying the technology to the market.

Corporate Stability

The planned JV between ASI and Technical Fiber Products to commercialize the CNF mat will be called Technical Nanofibre Products. Its staff will consist of current staff from ASI, Pyrograf, and Technical Fiber Products. Formation of the JV is contingent upon ASI's receiving this award as is the availability of the $1 million in cost-share from Technical Fiber Products. Scale-up of the pilot line is expected to require an additional $10 million to be funded by operations, additional rounds of investment by JV partners, or new alliances with customers.

Commercial Infrastructure

Technical Fiber Products is headquartered in the UK and has manufacturing operations in both the UK and in the US. Technical Fiber Products purchased Diamond Fiber Composites in Cincinnati in 2007 where it produces nickel-coated carbon fiber intended for the same end-uses as this project. It has worldwide annual sales of $30 million for its high-end nonwoven products. Technical Fiber Products is currently selling carbon veils, but not nanoveils. A significant portion of its business is military, so it is likely to have the sales and marketing infrastructure that could support this product.

Mission Impact

Overall Score = 5.18

Cluster Formation

Both ASI and Technical Fiber Products have existing manufacturing operations in Ohio. The yet-to-be-formed JV will also work with Renegade (Springboro, OH) to fabricate the pre-preg mats. This project will involve nanomaterials and polymers, both advanced materials areas of interest to Ohio.

Ohio Economics

The JV is projected to generate $3 million in sales of CNF mats and to create 14 jobs by 2013. Projections for 2015 were not provided, but it is assumed that they will reflect somewhat higher production rates on the existing pilot line. A major scale-up in capacity is not planned until 2018.

Business Model

This project will fund the creation of a pilot line to produce CNF mats for customer evaluation. This line will be located in the Pyrograf manufacturing facility in Cedarville, OH. The mats will be sent to Renegade and to Cytec for polymer impregnation, and then on to military and industrial parts fabricators. When process scale-up is required, it is likely to involve both CNF and mat production.

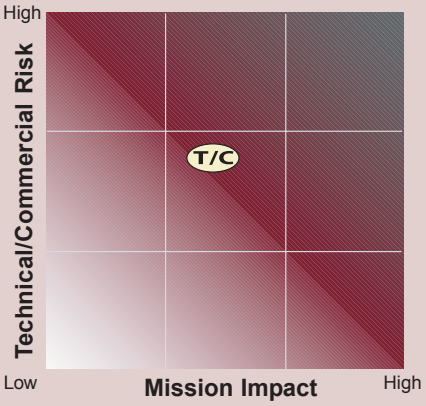
Ohio Department of Development

2010 TFAMP Evaluation Summary

Advanced Liquid Crystal Alignment Materials for e-Books

Kent State University

1st Round Score: 65.7	2nd Round Score: 50.2	Rank: 10

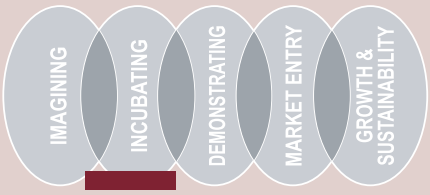


Proposal # TFAMP 10-686

Collaborators:
LXD, Inc.

TFRDF Request:	$1,029,429
WCF Request:	$10,000
TOTAL Request:	$1,039,429
Cost Share:	$1,053,875

Stage of Development



Previous Ohio Investment

Kent State University (KSU) has been the lead on two TFRDF awards, both related to the development of Liquid Crystal Display (LCD) materials and manufacturing technologies and a collaborator in numerous other TFRDF supported projects. KSU is a recognized world leader in LCD technologies and serves as the core resource for the LCD technology cluster in NE Ohio. Several companies, such as LXC, AlphaMicron and Kent Displays trace their roots to KSU and its Liquid Crystal Institute.

The ORSGP brought Professor Hiroshi Yokoyama to KSU and his background in alignment layer materials has accelerated the proposed technology as well as stimulating research projects approaching $3 million in 2009.

Project Description

Kent State University (KSU) proposes developing an advanced thin film coating alignment material that improves LCD-based eBooks' performance by allowing a reduced and variable display refresh rate. A variable refresh rate allows high-speed updating for browsing or scanning and low-speed updating for page reading. Since power consumption is proportional to refresh rate, the variable refresh rate results in lower power requirements. Power requirements for current e-Books limit video display and color imagining capability. KSU will lead the development effort for the low-power LCD e-Book and LXD will develop the module manufacturing, evaluate prototype products. LXD will be the commercializing partner for the resulting e-Book product.

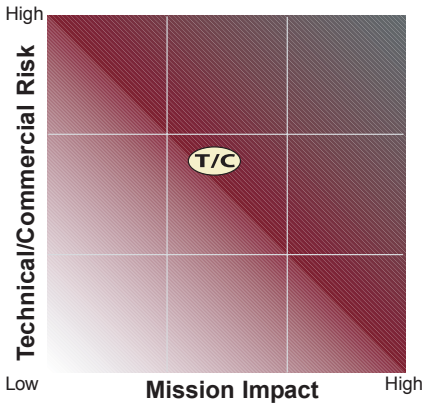
Key Issues

- LXD's commercialization plan is to use existing LCD and module manufacturing capability outside the U.S. This is because volume production of LCD modules requires very large equipment investments that are already in place elsewhere. LXD's role at its Ohio headquarters will be for continued R&D and North American distribution.
- The technology is at a relatively early stage in terms of a commercial product and product introduction is not expected until 4 to 5 years from project initiation. Coupled with the plan for volume manufacturing outside Ohio, the near-term Ohio economic impacts are moderate and "on the edge" of the TFP target.

TFAMP 10-686

Advanced Liquid Crystal Alignment Materials for e-Books

Kent State University



- Research Cluster in Advanced Materials, 2009, $15,300,000
- Wright Center on Flexible OptoElectronic Device Manufacturing, 2003 & 2005, $1,700,000

Technical Risk

Overall Score = 5.82

Technical Reach

KSU has demonstrated the basic concept proposed for the advanced alignment layer and the details of the approach have been disclosed and accepted for publication. However, a better understanding of the how the alignment layer materials function in mitigating ion movement, the key to low power performance, and the design of the alignment layer deposition method need to be investigated. After the material and deposition challenges are met, LXD will design and construct alpha prototypes followed by a complete LCD E-book prototype for demonstration.

Resource Limitations

KSU and LXD have the technical capabilities to accomplish the project goals and expect that the project budget proposed will lead to a complete e-Book prototype system with color and video display capabilities. KSU will seek additional R&D support for the general technology area from federal agencies and LXD will seek $1 million in support from industry organizations and private investors to complete the commercialization of the new eBook. Intel has supported early development at KSU and may be a source of continued support.

Technology Protection

LXD is currently negotiating with KSU for unrestricted use of the IP developed in both prior and future joint KSU projects related to proposed technology. KSU and LXD have agreements in place to handle IP developed in the proposed project.

Commercialization Risk

Overall Score = 6.0

Path to Market

LXD plans to build its sales channels after the prototype unit is demonstration-ready. Its business strategy is confidential, but it expects to seek marketing/sales support from larger electronics distributors such as Amazon and Apple. Intel is also expected to assist in these efforts.

Corporate Stability

LXD is the commercializing partner for the proposed product. It has been in business for over 35 years and trace its roots back to the inventors of twisted nematic LCDs. It has 30 employees and annual sales between $5 and $10 million. It is a leader in supplying custom LCDs for outdoor signage and has capability for limited production.

Commercial Infrastructure

LXD has its main sales office in Cleveland and branch offices in Asia. It uses independent representatives for North American sales. As stated earlier, its business plan for the eBook is not yet finalized, but it expected to follow the approach used by the Kindle eReader that uses Amazon as its sales outlet. Discussions related to such an arrangement have not yet been initiated.

Mission Impact

Overall Score = 4.68

Cluster Formation

KSU and its Liquid Crystal Institute are the cornerstones of the NE Ohio's LCD technology cluster. LXD was the first LCD manufacturer in the world although this capability has since moved almost entirely to Asia. The LCD technology proposed offers innovation that is not available elsewhere in the world and provides IP that will be controlled by an Ohio company. End-users and suppliers of like products have requested the capabilities/features projected for the eBook proposed.

Ohio Economics

LXD projects introducing the proposed eBook in 4 years from the start of the project. By 2013, sales will be for demonstration-level products with revenues of about $600k derived mainly from additional investments. By 2015 sales will reach $3 million and LXD will add from 20 to 25 employees to support sales of about $8 million in 2016.

Business Model

LXD plans to remain an R&D center for LCD technology with continued technical support from KSU. It will provide low volume/trial manufacturing for alignment layering and LCD processing. Volume manufacturing for LCD modules will be done in China using the facilities of LXD's current JV partner there. Contract manufacturers located in China and Mexico will do the eBook assembly. LXD will serve as the distribution center for North America and provide technical support for products.

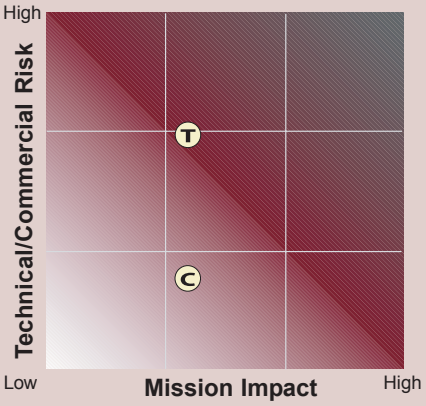
Ohio Department of Development

2010 TFAMP Evaluation Summary

Carbon Fibers from Biomass for Wind and Solar Applications

GrafTech International Holdings Inc.

1st Round Score: 62.7	2nd Round Score: 47.6	Rank: 11

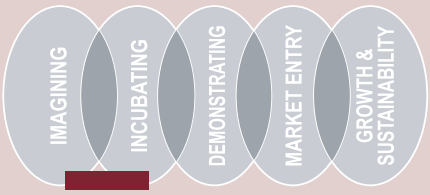


Proposal # TFAMP 10-622

Collaborators:
SuGanit Systems Inc.
University of Toledo (UT)

TFRDF Request:	$1,000,000
WCF Request:	$0
TOTAL Request:	$1,000,000
Cost Share:	$1,028,980

Stage of Development



Previous Ohio Investment

GrafTech has received a total of $3.4 million in Ohio investment through 4 earlier fuel cell awards and has been the lead or collaborator in 2 additional RCP projects totaling $16 million. Three of the 4 fuel cell awards have been completed. For the 4 fuel cell projects, GrafTech has identified 7 jobs that were created or retained in Ohio and has generated a total of $2.6 million in leverage which included both product sales and grants. For the $8 million RCP project led by GrafTech, the team claimed to have created 17.65 jobs and generated $5.5 million in leverage with 1 new company created or relocated.

Ohio has also invested a total of $1.25 million in Suganit and the University of Toledo (UT) for cellulosic ethanol. These awards included a grant of $250,000 in 2008 for "A Novel Cellulosic Biomass Fermentation Process for Ethanol Production" and a grant of $999,900 in January 2009 for "Scale-up of Cellulosic Ethanol Process Based on Novel Biomass Pretreatment and Efficient Co-fermentation." Although both of these grants are still in progress, they have resulted in the creation or retention of 6.2 jobs and have generated $800,000 in leverage.

Project Description

The goal of the 2-year project is to demonstrate that low cost, high quality carbon fibers can be produced in a pilot-scale facility using a low cost feedstock from a biomass source. SuGanit will produce the high quality lignin from local biomass in a previously funded Advanced Energy project. GrafTech will install a pilot-scale fiber spinning facility to make suitable isotropic and anisotropic fibers from the SuGanit-generated lignin. GrafTech will evaluate the fibers for internal use in its current insulation products and in other advanced composites such as wind turbine blades.

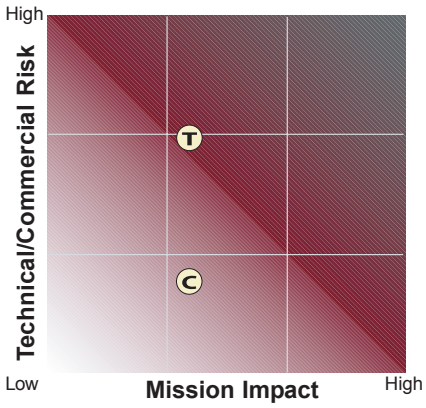
Key Issues

- The technical and economic parameters associated with Suganit's process are still being studied. There is a risk that if Suganit's process does not prove to be commercially viable, there will not be sufficient lignin by-product available to supply GrafTech. The cost of producing carbon fiber from lignin will not be evaluated until the final quarter of this project further raising the risk, but GrafTech believes that lignin-based fibers will be its most cost-effective feedstock option.
- If the cost reduction projections for the lignin-based material are robust enough to justify proceeding, it is unclear why GrafTech's management has not funded the basic proof-of-concept work for this project. This might include characterizing the carbon fibers produced from Suganit's lignin, showing that the carbon fibers come close to meeting the performance requirements of GrafTech's products, and building a basic business case.
- GrafTech purchases several hundred tons per year of carbon fibers from Asia for its carbon product lines and wants to vertically integrate using fibers produced from non-petroleum or non-coal-based feedstocks. If the project is successful, GrafTech plans to scale-up carbon fiber production at the location that best meets its needs. Its Lakewood, OH plant is one option that will be considered. GrafTech currently produces its high-temperature insulation at Clarksburg, WV, Lakewood, OH, and Parma, OH.

TFAMP 10-622

Carbon Fibers from Biomass for Wind and Solar Applications

GrafTech International Holdings Inc.



- Volume Manufacturing for Commercialization of Flow Field Plates for PEMFCs, 2004, $1,044,226
- Commercialization of PEMLITE® Systems: Fuel Cell Analysis Tool, 2004, $781,787
- Commercialization of Unique Natural Graphite Gas Diffusion Layer, 2005, $602,044
- Commercialization of Functional Polyimide Films and Nanocomposites (collaborator to University of Akron), 2007, $8,000,000
- Development and Commercialization of Graphite Nanocomposites for the Next Generation of Electronic Devices, 2007, $7,945,465
- Commercialization of GRAFCELL® Bipolar Plates for Phosphoric Acid Fuel Cell Systems, 2008 $973,154

Technical Risk

Overall Score = 6.54

Technical Reach

GrafTech has not made carbon fibers from SuGanit lignin. Proof-of-concept was demonstrated by a third party using material from a different lignin production process. SuGanit is currently developing a pilot-scale production facility to produce high quality lignin. Although small quantities are available today, Suganit will have the ability to produce kg-quantities/day in the summer of 2010 and hundreds of kg-quantities/day by 2011. GrafTech will purchase carbon fiber spinning equipment to set up a pilot-scale process for making carbon fibers from the lignin feedstock. GrafTech recognizes the lignin generation and fiber production processes will likely require modifications to produce the quality of carbon fibers needed for the current GrafTech product lines. Many years ago, GrafTech sold its technology to make petroleum- or coal-based carbon fibers, but still has internal memory of the technology to make carbon fibers.

Resource Limitations

Half of the requested funds will go to SuGanit and UT for their work on the lignin production and purification, but it is not clear that team has a clear path to overcoming the remaining technical hurdles. GrafTech will use the other half of the award to fund equipment, supplies, and its time. GrafTech is a $1+ billion company, but this project is being driven by R&D and has not yet shown support from a business unit. GrafTech has no financial investment in the SuGanit facility.

Technology Protection

GrafTech holds several patents on carbon-based products and has vigorously defended them. However, the first task in the work plan involves doing a literature and a patent search on the production of carbon fibers from biomass sources to establish the current state of the art. UT licensed to SuGanit a series of patents relating to the conversion of biomass to cellulosic ethanol in a process that creates high-purity lignin as a by-product.

Commercialization Risk

Overall Score = 2.54

Path to Market

GrafTech has an existing sales and marketing force that is currently selling carbon-related products to domestic and foreign markets. GrafTech intends to use the lignin-based carbon fibers for its graphite rigid insulation product line that provides high temperature insulation for growing single crystal and polysilicon production for solar panels. GrafTech can also sell lignin-based carbon fibers into other market applications.

Corporate Stability

GrafTech International Ltd. (formerly the Carbon Products Division of Union Carbide) is a 1.2 billion dollar manufacturer of carbon products and world leader in graphite material science with more than 120 years of experience in the carbon and graphite industry. Suganit is a 3-person start-up R&D company that is in the process of scaling-up a new process for producing cellulosic ethanol.

Commercial Infrastructure

GrafTech is an Ohio-headquartered company with domestic and international production, sales, and marketing capabilities. The main goal of this project is to build an internal capability at the pilot-scale to manufacture suitable, low cost carbon fibers from SuGanit's lignin. If the fibers are suitable and larger quantities are needed, GrafTech will scale-up carbon fiber production at either its Lakewood Ohio plant or at some other location that best serves its needs.

Mission Impact

Overall Score = 3.96

Cluster Formation

GrafTech, an Ohio-based company, currently purchases all of its carbon fibers on the open market. GrafTech plans to set-up a pilot-scale carbon fiber spinning facility and will obtain the high-quality lignin feedstock from SuGanit's Ohio-based cellulosic ethanol production facility. If GrafTech is able to use Suganit's by-product lignin, it is likely not only to improve the economics of Suganit's process but also to lower GrafTech's cost of carbon fiber.

Ohio Economics

GrafTech has not provided a clear forecast of sales and jobs created by this project. GrafTech projects that 5–20 jobs created by 2015 and verbally estimated that sales would reach $40 million by 2015. Since this project will result in substitution of an internally produced carbon fiber for purchased carbon fiber, job creation would appear to be limited primarily to fiber manufacturing operations. No new product sales forecasts for other applications such as wind turbines were provided. If the project is successful and if GrafTech needs a large-scale carbon fiber production facility, substantial investment would be required.

Business Model

The precursor to the current GrafTech organization sold the carbon fiber-making technology to another organization. GrafTech is currently manufacturing and selling carbon products using imported carbon fibers. GrafTech is interested in making production quantities of low cost, high quality, lignin-based carbon fibers for its existing products and other potential applications. If this project is successful, GrafTech anticipates scaling-up carbon fiber production at one of its existing facilities but did not make commitments regarding funding and location.

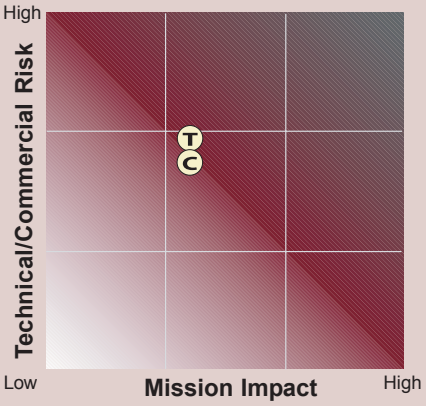
Ohio Department of Development

2010 TFAMP Evaluation Summary

CNF Materials for Battery Applications

Applied Sciences, Inc.

1st Round Score: 66.3 | 2nd Round Score: 44.6 | Rank: 12

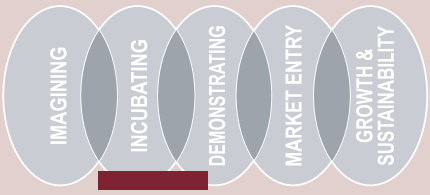


Proposal # TFAMP 10-644

Collaborators:
Pyrograf Products, Inc.

TFRDF Request:	$999,976
WCF Request:	$0
TOTAL Request:	$999,976
Cost Share:	$1,245,000

Stage of Development



Previous Ohio Investment

In 2005 Applied Sciences, Inc. (ASI) received a $175K ORCGP award to commercialize low-cost carbon nanofibers (CNF). Pyrograf Products, Inc. (PPI) was spun-off to manufacture CNF, and the award has led to the creation of 4 jobs and $5.2 million in cumulative product sales. The ODOD database shows that total leverage from this award has been $8.6 million.

In 2008, ASI received an OTFAEP award of $1 million to convert the CNF and nanographene platelets into anodes for lithium-ion batteries by coating them with silicon using a fluidized bed system. This 2008 project was intended to prepare samples for evaluation at GM and A123 and was expected to lead to a JV with an Ohio company that would produce 30,000 pounds of coated material by 2010 generating $2 million in revenue and creating 10 new jobs. However, there was a disagreement between the two companies and the other company is pursuing its own technology to incorporate silicon. To date the 2008 project has retained 2 jobs and attracted $170K in federal funding. This proposal is seeking additional TF funding for scale-up of the silicon coating process to 15,000 pounds.

Project Description

ASI has demonstrated that the use of anodes made from silicon-coated nanomaterials will increase the performance and life of lithium-ion batteries. However, the data presented show that the material has not yet attained GM's performance requirements for cycle efficiency retention in small-scale testing and does not meet the requirements for automotive use. The goal of the project is to reduce the cost of the material by scaling-up production of silicon-coated carbon nanofibers (Si-CNF's). The material will be provided to various lithium ion battery manufacturers to make and test anodes made from Si-CNF's and to generate data on battery performance using the Si-CNF anodes. ASI plans to set-up a custom-designed fluidized bed reactor at PPI to coat CNF's with silicon in large production quantities for further evaluations and characterization. Production of Si-CNF powder will begin in Year 2 of the 3-year project and is intended to lead to fabrication of large format batteries.

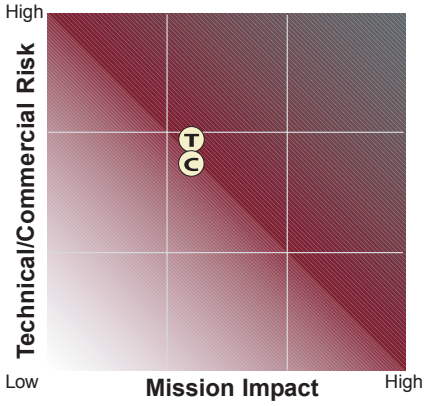
Key Issues

- ASI currently has 2 reactors—a horizontal coating reactor that processes at the laboratory scale and a fluidized bed reactor with a capacity of 2,000 pounds per year that was designed and built as part of the 2008 project. Both reactors produce Si-CNF powder with similar electrode performance. ASI plans to purchase a fluidized bed reactor ($250k) with a capacity of 15,000 pounds per year to study the quality of the silicon coating that is produced in that equipment.
- The silicon coating will be evaluated using scanning electron microscopy, energy dispersive x-ray, high-resolution transmission electron spectroscopy, and photoelectron spectroscopy to study the structure-composition and surface chemistry of Si-CNF powder before fabricating the material into anodes for electrical testing. This type of analytical work is indicative of fundamental R&D that is being done to gain an understanding of how Si-coating affects electrical performance.
- It appears that ASI is simultaneously pursuing both a Si-CNF powder and a Si-CNF mat for incorporation into lithium-ion battery anodes. ASI received TF funding in 2008 to develop Si-CNF powder for this end-use application, and this project would represent a continuation of that effort. ASI has submitted another funding request in this competition to develop CNF mat. Both 2010 proposals refer to Si-CNF mat and ASI's intent to use the mat for lithium-ion battery anodes.

TFAMP 10-644

CNF Materials for Battery Applications

Applied Sciences, Inc.



- Low-cost Carbon Nanofiber Production, 2005, $174,657
- Development of Specialty Carbons for Energy Storage, 2008, $999,999

Technical Risk

Overall Score = 6.46

Technical Reach

The work plan for this project emphasizes the purchase and installation of new processing equipment for producing Si-CNF powder. ASI has not yet identified the key technical issues that must be resolved in order to attain the anode performance needed for automotive applications. Cycling instability has been observed during testing in small button cells, prismatic pouch cells, and wound cells. Prototypes still need to be fabricated to prove capability in real world conditions. ASI has created a plan to move into larger format batteries with high power and high-energy requirements but has not presented a clear path to overcoming the technical challenges.

Resource Limitations

The 2008 project produced some improvement in anode performance at a cost of $1.5 million. ASI claims to have secured approximately $1 million in federal funding for this technology and $230K of in-kind funding since the first TFP award. It projects that an addition $1-2 million will be needed to scale-up the silicon coating process to produce 30,000 pounds of silicon-coated carbon per year. This funding is expected to come from partners, investors, and venture capitalists.

Technology Protection

ASI has licensed 11 patents from General Motors on carbon nanofibers and one from Aircraft Braking Systems. The applicant holds many other related patents, and possesses a body of trade secrets. However, there are several companies and research organizations working on silicon coatings for Li-ion battery anodes, including two previous ASI collaborators, and although the licensed Aircraft Braking patent addresses the technology, others are also tendering patents.

Commercialization Risk

Overall Score = 5.78

Path to Market

ASI plans to work directly with GM to qualify its materials for use in lithium-ion batteries that will be used in electric vehicles and hybrids. If ASI is able to deliver superior battery performance that extends the range of the electric vehicle, GM is likely to pull this technology into the market. However, ASI's sales will depend when GM decides to commercialize an electric vehicle and if GM decides to specify ASI's material to its battery supplier.

Corporate Stability

ASI was founded in 1984 and currently has 16 employees. The majority of its annual revenue of less than $3 million comes from government contracts. ASI is planning to rely on new contracts from the military and DOE to fund product development through 2014. It estimates that an investment of $10-12 million would be needed to support scale-up to meet the volumes of the automotive industry and anticipates that GM will be motivated to fund plant expansion once the anode's performance has been demonstrated. ASI's spin-off, PPI, is one of three large-scale producers of carbon nanofibers. ASI was able to attract $8 million to fund PPI in 2000, and production began in 2002.

Commercial Infrastructure

ASI is a contract research and development organization. Product is produced and sold through PPI. PPI sells directly to customers in North America and has distribution agreements with firms in Europe and Asia. Plans will have to be developed to expand manufacturing capabilities and to provide the needed sales, marketing product support infrastructure to support scale-up of this product.

Mission Impact

Overall Score = 4.00

Cluster Formation

ASI is teaming with its spin-off company PPI in this project. It is funding an individual to run tests at GM's facility in Michigan. ASI believes that its anode material will be a good complement to BASF's expansion of its production facilities in Elyria, OH where cathodes for lithium-ion batteries will be produced. However, the project work plan does not include any technology development involving BASF.

Ohio Economics

The proposal projects that this project will generate $4 million in annual sales and 17 jobs by 2013. By 2015, sales will increase to $8 million with 73 jobs created. The earlier 2008 proposal projected that the JV would produce $16 million and 64 new jobs by 2015 by selling silicon-coated materials for battery applications.

Business Model

PPI will manufacture the silicon-coated CNF at its facility in Cedarville, OH. As demand increases, ASI will plan for expansion of the Cedarville facility. ASI is projecting that a major expansion will occur in 2018 when the demand for carbon will exceed 2 million pounds annually for use in lithium batteries for automotive applications.

2010 TFSP

Third Frontier Sensor Program

Summaries of Proposals in Competitive Range

RECOMMENDATIONS FOR FUNDING
2010 Third Frontier Sensor Program (TFSP)

APPLICANT	PROPOSAL TITLE	TFRDF REQUESTED	TFRDF CUMULATIVE	TFWCF REQUESTED	TFWCF CUMULATIVE	RECOMMENDED CONTINGENCY
1. Pressco Technology, Inc.	High Performance Spectroscopy Sensor Applications in High Speed Product Testing	$ 406,000	$ 406,000	$0	$0	
2. NexTech Materials, Inc.	Hydrogen Sensor Manufacturing Technology	$1,000,000	$1,406,000	$0	$0	
3. INNOVA, Inc.	Scalable, Miniaturized, Low Cost Solid State Laser Systems for Sensor Applications	$ 848,000	$2,254,000	$0	$0	
4. YSI, Incorporated	Advanced Modified Carbon Nanotube Based Nutrient Sensor	$ 998,635	$3,252,635	$129,238	$129,238	
5. Persistent Surveillance Systems	Colorization and Resolution Enhancement of Airborne Wide-Area Persistent Surveillance Sensors for Law Enforcement Operations	$ 906,315	$4,158,950	$0	$129,238	
6. L-3 Communications Nova Engineering	Sensor and Fusion Enhancement (SAFE) Program	$ 689,550	$4,848,500	$0	$129,238	

2010 Third Frontier Sensor Program Final Round Scores

Score (Round 1)			City	County	OTFRD $ Requested	OTFRD Cumulative $	WRIGHT $ Requested	WRIGHT Cumulative $
Targets - Mission Impact: 10 Commercial Risk: 1.8 Technical Risk: 3.5								
85.8	**(73.3)**	**TFSP 10-767** Pressco Technology, Inc High Performance Spectroscopy Sensor Applications in High Speed Product Testing	Solon	Cuyahoga	$406,000	**$406,000**	$0	**$0**
		Mission Impact: **8.25** (E: 9.3 M: 9.7 C: 4.7) Technical Risk: **3.74** (T: 6.7 R: 2.0 P: 1.3) Commercial Risk: **2.08** (P: 2.7 S: 2.0 I: 1.0)						
81.4	**(87.0)**	**TFSP 10-750** NexTech Materials, Ltd. Hydrogen Sensor Manufacturing Technology	Lewis Center	Delaware	$1,000,000	**$1,406,000**	$0	**$0**
		Mission Impact: **7.79** (E: 6.6 M: 9.3 C: 8.7) Technical Risk: **4.12** (T: 4.3 R: 4.0 P: 4.0) Commercial Risk: **2.46** (P: 2.3 S: 2.0 I: 3.7)						
80.2	**(64.7)**	**TFSP 10-701** INNOVA, Inc. Scalable, Miniaturized, Low Cost Solid State Laser Systems for Sensor Applications	Centerville	Greene	$848,000	**$2,254,000**	$0	**$0**
		Mission Impact: **7.83** (E: 7.3 M: 8.7 C: 8.0) Technical Risk: **3.68** (T: 5.0 R: 2.7 P: 3.0) Commercial Risk: **3.46** (P: 3.3 S: 3.7 I: 3.3)						
73.1	**(61.7)**	**TFSP 10-705** YSI, Incorporated Advanced Modified Carbon Nanotube Based Nutrient Sensor	Yellow Springs	Greene	$998,635	**$3,252,635**	$129,238	**$129,238**
		Mission Impact: **6.67** (E: 4.7 M: 10.0 C: 7.3) Technical Risk: **3.90** (T: 5.3 R: 2.3 P: 4.3) Commercial Risk: **1.80** (P: 2.7 S: 1.3 I: 1.0)						
72.2	**(71.3)**	**TFSP 10-711** Persistent Surveillance Systems Colorization and Resolution Enhancement of Airborne Wide-Area Persistent Surveillance Sensors for Law Enforcement Operations	Xenia	Greene	$906,315	**$4,158,950**	$0	**$129,238**
		Mission Impact: **7.30** (E: 7.3 M: 7.3 C: 7.3) Technical Risk: **4.74** (T: 2.7 R: 7.0 P: 4.3) Commercial Risk: **4.66** (P: 3.7 S: 5.3 I: 5.3)						
71.1	**(68.3)**	**TFSP 10-729** L-3 Communications Nova Engineering Sensor And Fusion Enhancement (SAFE) Program	Cincinnati	Hamilton	$689,550	**$4,848,500**	$0	**$129,238**
		Mission Impact: **6.43** (E: 5.0 M: 9.0 C: 6.7) Technical Risk: **3.16** (T: 3.7 R: 2.7 P: 3.0) Commercial Risk: **2.06** (P: 3.0 S: 1.3 I: 1.7)						

2010 Third Frontier Sensor Program Final Round Scores

Score (Round 1)			City	County	OTFRD $ Requested	OTFRD Cumulative $	WRIGHT $ Requested	WRIGHT Cumulative $
Targets - Mission Impact: 10 Commercial Risk: 1.8 Technical Risk: 3.5								
62.0	**(66.3)**	**TFSP 10-753** Lake Shore Cryotronics, Inc. Advanced Optical Sensors and Instruments for Alternative Energy, Aerospace and othe Industrial Applications	Westerville	Franklin	$853,109	**$5,701,609**	$145,795	**$275,033**
		Mission Impact: **5.73** (E: 4.3 M: 9.0 C: 5.3) Technical Risk: **5.26** (T: 7.0 R: 4.3 P: 3.7) Commercial Risk: **4.02** (P: 6.7 S: 2.0 I: 2.7)						
60.7	**(77.0)**	**TFSP 10-718** Parker Hannifin Corporation Piezoelectric Mass Flow Sensor for Online Control of Fuel Flow Schedule in Advanced Commercial and Military Gas Turbine Engines	Mentor	Lake	$297,000	**$5,998,609**	$0	**$275,033**
		Mission Impact: **5.15** (E: 4.0 M: 7.3 C: 5.3) Technical Risk: **4.00** (T: 5.0 R: 4.0 P: 2.0) Commercial Risk: **2.46** (P: 4.0 S: 1.0 I: 2.3)						
58.3	**(72.0)**	**TFSP 10-734** STAR Dynamics Corporation Target Detection and Tracking using Airborne Weather Radar	Hilliard	Franklin	$1,000,000	**$6,998,609**	$0	**$275,033**
		Mission Impact: **4.90** (E: 3.3 M: 8.0 C: 5.0) Technical Risk: **4.54** (T: 7.0 R: 2.0 P: 4.7) Commercial Risk: **2.66** (P: 4.0 S: 2.0 I: 1.3)						
57.0	**(66.7)**	**TFSP 10-755** Woolpert, Inc The Development of Low-Cost 3D Models That Will Lead to Sustainable Advantage in Geospatial Markets	Dayton	Montgomery	$994,000	**$7,992,609**	$0	**$275,033**
		Mission Impact: **5.45** (E: 4.7 M: 7.7 C: 4.7) Technical Risk: **6.86** (T: 7.0 R: 7.3 P: 5.7) Commercial Risk: **3.98** (P: 6.3 S: 2.3 I: 2.7)						
50.4	**(66.0)**	**TFSP 10-752** UES, Inc Real-time E. coli detector using COntaminant Sensor NETwork (COSNET)	Dayton	Montgomery	$999,916	**$8,992,525**	$0	**$275,033**
		Mission Impact: **5.18** (E: 4.7 M: 5.0 C: 6.3) Technical Risk: **5.74** (T: 6.7 R: 5.0 P: 5.3) Commercial Risk: **6.88** (P: 8.0 S: 4.7 I: 9.0)						
41.6	**(63.0)**	**TFSP 10-774** H-Cubed, Inc. Wireless Implantable Biomedical Sensor	Olmsted Falls	Cuyahoga	$799,564	**$9,792,089**	$32,000	**$307,033**
		Mission Impact: **4.65** (E: 4.3 M: 4.7 C: 5.3) Technical Risk: **7.80** (T: 7.7 R: 9.3 P: 5.0) Commercial Risk: **7.26** (P: 7.3 S: 6.7 I: 8.3)						

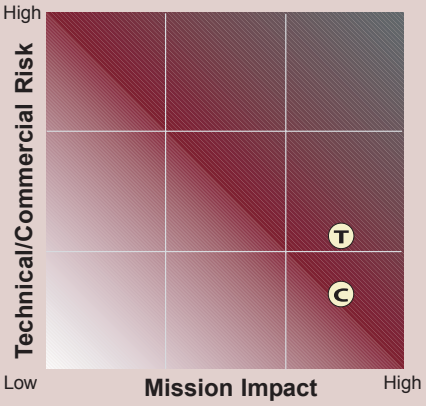
Ohio Department of Development

2010 TFSP Evaluation Summary

High Performance Spectroscopy Sensor Applications in High Speed Product Testing

Pressco Technology, Inc.

1st Round Score: 73.3 | 2nd Round Score: 85.8 | Rank: 1

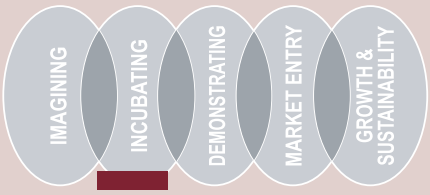


Proposal # TFSP 10-767

Collaborators:
Miami University—Molecular Microspectroscopy Laboratory

TFRDF Request:	$406,000
WCF Request:	$0
TOTAL Request:	$406,000
Cost Share:	$944,500

Stage of Development



Previous Ohio Investment

Pressco has not received any prior Ohio funding.

Project Description

The goal of the project is to develop a real-time, high speed, reliable, electro-optical, non-destructive, complete inspection system for measuring the thickness of polymer bottles as they move down the bottle production line. This next generation inspection system for the manufacturers of food and beverage containers will improve their ability to control the production process, reduce product scrapping, and improve the quality and reliability of the bottle integrity. Pressco, a manufacturer of electro-optical inspection systems for this industry, is the lead applicant and system integrator. The Miami University Molecular Microspectroscopy Laboratory (MML) will use their specialized instruments to determine the optimal spectral region for the sensor. Pressco will use this information to continue the development and produce a final system. The proposed sensor system will not only help Pressco continue its leadership position in this market, but the technology will also open the door to inspection systems for wider market applications.

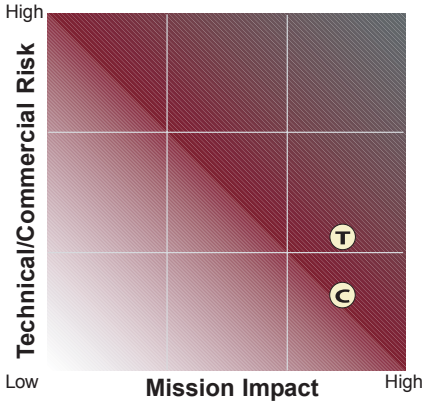
Key Issues

- Pressco has admittedly worked somewhat independently from others in the Ohio sensor technology cluster. They have reached out to Miami University for assistance and while the work there is important to the project success, Miami's role is modest.
- The economic benefits claimed are conservative and based on Pressco's experience in moving new technology into a very conservative industry.

TFSP 10-767

High Performance Spectroscopy Sensor Applications in High Speed Product Testing

Pressco Technology, Inc.



- *No prior Ohio investments*

Technical Risk

Overall Score = 3.74

Technical Reach

Using equipment and supplies purchased with the TFP funding, Pressco will modify existing instruments at the Miami University to determine the optimal spectral regions for the proposed high-speed inspection system. The appropriate additional components will be purchased and assembled for an in-house prototype, and system integration. The end result will be a prototype system for customer evaluation. Pressco has extensive electro-optical sensing and system integration experience and a history of introducing new products and technology into their market.

Resource Limitations

Pressco has extensive technical expertise with the design, manufacturing, and servicing of optical inspection systems for high volume container production systems. The TFP funding is expected to be sufficient to reach the project goal. Pressco will provide the funding and resources necessary to conduct the market entry and future commercialization activity.

Technology Protection

Pressco owns over 30 related patents, has 9 patents pending, and will file for additional patents as they identify the patentable features of the proposed product. The proposed product technology will offer unique features related improved insensitivity to external factors (e.g. process heat, vapors) and an output that provides a predictive thickness capability.

Commercialization Risk

Overall Score = 2.08

Path to Market

Pressco is a leading manufacturer of electro-optic inspection systems for the domestic and international food and beverage container industry, and has direct contacts within that industry. Existing customers have provided input on the capabilities desired and have expressed serious interest in evaluating and using the proposed sensor system. The proposed system will be retrofitted on existing inspection systems, and will be sold as the next generation technology for new systems.

Corporate Stability

Pressco is a family owned manufacturing company formed in Ohio in 1966, and began manufacturing thickness-measuring systems in 1983. Pressco annual revenues are between $20 and $50 million and it currently employs more than 80 people, most in Ohio.

Commercial Infrastructure

Pressco is the dominant supplier of packing system inspection equipment with a significant market share. Pressco has worldwide sales and service offices selling directly to end-users of its electro-optical inspection systems. Most of its products are shipped out of Ohio and the U.S. It reinvests a substantial amount of its revenue into new product R&D to maintain its leadership inspection systems for the domestic and international food and beverage container industry.

Mission Impact

Overall Score = 8.25

Cluster Formation

Pressco has successfully operated somewhat independently of the Ohio food equipment manufacturer cluster. Pressco has reached out to the Miami University to leverage its internal R&D capabilities and plans on expanding its relationships with other Ohio institutions with expertise in electro-optic sensors and food packaging technology (e.g. OSU). Pressco utilizes Ohio labor and the Ohio supply chain for its current product lines and will continue to do so for its proposed next generation product.

Ohio Economics

The 2-year project proposed will lead to sales of the new system beginning in early 2013. Pressco forecasts sales of $15 million in 2013, ramping up to $35 million in year five (2015), creating approximately 50 new jobs by year five (2015). Two-thirds of the Pressco bill of materials is from Ohio suppliers.

Business Model

Pressco maintains its headquarters, product development, production, technical service, and sales/marketing in the Solon, Ohio facility. Its overall business model relies upon product innovation to maintain its leading presence and success in the food and beverage container industry. The proposed system will be sold as a retrofit on existing customer inspection systems, and will be sold as the next generation technology for new systems.

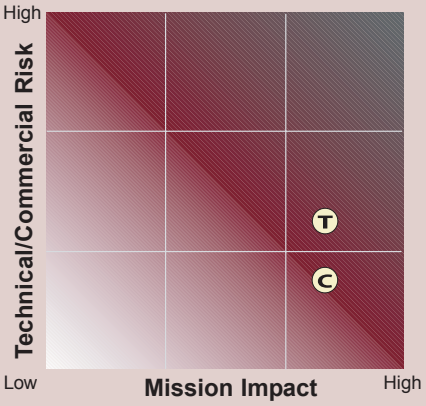
Ohio Department of Development

2010 TFSP Evaluation Summary

Hydrogen Sensor Manufacturing Technology

NexTech Materials, Ltd.

1st Round Score: 87.0	2nd Round Score: 81.4	Rank: 2

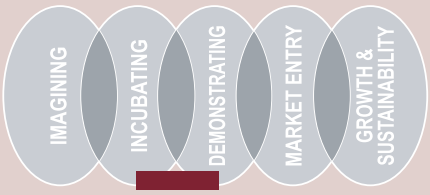


Proposal # TFSP 10-750

Collaborators:
Therm-O-Disc, Inc.

TFRDF Request:	$1,000,000
WCF Request:	$0
TOTAL Request:	$1,000,000
Cost Share:	$1,069,289

Stage of Development



Previous Ohio Investment

NexTech has received 5 TFFCP awards, 1 TFAEP, and 4 ORCGP awards totaling $5.6 million and has collaborated on a number of additional projects. One of the TFFCP projects and the TFAEP project ($799K of State funding) involved development of hydrogen sensor technology. These projects have led to a tubular design sensor design that is being introduced into the market in 2010. Overall, as of June 2009, TFP support has resulted in a total of 16 new jobs at NexTech. The company has been successful in leveraging the state investment into $23 million of product revenues, grants, and additional investments. NexTech is conducting development and manufacturing activities in its 56,000 sq. ft. facility and operates four commercial divisions: fuel cell stacks, sensors, fuel cell materials and components, and commercial services.

Project Description

The goal of the project is to develop a low cost, planar-design hydrogen sensor element for data and telecom center battery backup rooms. NexTech is the lead and will modify its current tubular sensor element design into a planar design and develop the volume manufacturing process for this element. Therm-O-Disc, an Emerson company, will assemble the sensor element into a commercial monitoring device. Liebert Power and Cooling, the committed end user, will incorporate the monitoring device into its turnkey battery backup room design and perform field-testing and evaluation at one of its own sites. Completion of the project will position NexTech and Therm-O-Disc to enter the Market Entry phase of the hydrogen-sensing product.

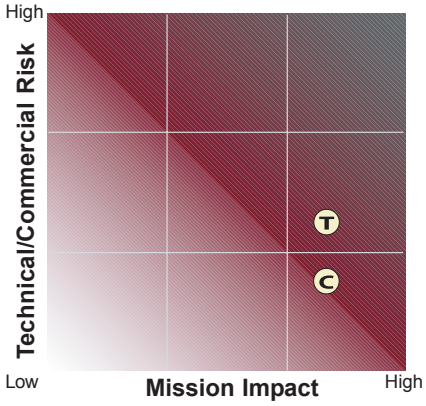
Key Issues

- The current tubular hydrogen sensor design is now being introduced into the marketplace. The applications targeted favor this design, but the planar design promises a lower cost manufacturing approach and may eventually displace the tubular design in some of the larger potential markets originally targeted for the tubular design.
- In the fuel cell area, NexTech has met its proposed technical objectives in each of the TFP projects, but as a component supplier, the slow development of fuel cell markets have hindered NexTech's ability to meet projected Ohio economic development objectives, including those for the hydrogen sensor for the SOFC application. Commercialization of the hydrogen sensor for other applications is scheduled to begin in 2010 and initial marketing activities are currently underway. However, sales projections for 2010 have been revised downward from $1.6 million to $200K.

TFSP 10-750

Hydrogen Sensor Manufacturing Technology

NexTech Materials, Ltd.



- H2 Sensor for Solid Oxide Fuel Cell Systems, 2007, $250,000
- Market Readiness of Hydrogen Sensor for Advanced Energy Applications, 2008, $549,000

Technical Risk

Overall Score = 4.12

Technical Reach

NexTech's original proof-of-concept hydrogen sensor element was actually performed using a planar design, but it was transitioned to a tubular design to better suit the fuel cell application it was targeting. However, to achieve the cost targets needed for the battery monitoring application the manufacturing costs need to be lowered and a planar sensor design lends itself to higher volume and lower cost manufacturing. The planar sensor developed will be adapted for use in the current Liebert sensor network interface. NexTech will make the sensor element and Therm-O-Disc will assemble the sensor into a finished monitoring system. Initial field-testing will be performed at Liebert Power and Cooling and other locations. The NexTech/Therm-O-Disc team has the expertise to address and resolve the technical challenges in the proposed project.

Resource Limitations

The funds requested are projected to be sufficient to set up pilot level manufacturing and to test and qualify commercial prototypes of the planar hydrogen sensor system. NexTech expects to support increased manufacturing capacity through SBA loans and bank financing and Therm-O-Disc will seek Emerson support for the investments needed for market entry-level production of the monitoring systems. Both Therm-O-Disc and NexTech have experience in commercializing new products.

Technology Protection

NexTech has one issued patent and three pending related to sensor technology proposed. Specific patent protection (worldwide) for the hydrogen sensor technology was filed in 2005 and issuance is expected this year. The team has experience with patent handling and will have a joint development agreement in place covering foreground and background IP.

Commercialization Risk

Overall Score = 2.46

Path to Market

Therm-O-Disc provides a strong, immediate path for applications in uninterruptable power system (UPS) rooms for datacenters via Liebert Power and Cooling, as well as access to other Emerson affiliates. Liebert has committed to evaluate the monitoring system and is a likely candidate for initial commercial sales. Other markets and end-users are identified, and the team has sales and marketing capabilities to penetrate these opportunities.

Corporate Stability

NexTech was founded in 1994 and currently has approximately 35 employees. The company manufactures ceramic materials and catalysts, and is developing sensors, fuel cells and fuel cell stacks. It has total annual revenues of approximately $5 million. Roughly 70% of these revenues represent commercial sales and industrial development contracts. The remainder consists of government grants. Collaborator Therm-O-Disc has current sales of approximately $50 million and about 300 employees. Therm-O-Disc and end user Liebert Power & Cooling are divisions of Emerson.

Commercial Infrastructure

NexTech has established four commercial divisions, has a five-year plan in place, and is recruiting key individuals to implement it. While NexTech has internal sales and marketing capabilities to support its current business, for this project NexTech will rely upon Therm-O-Disc for market entry, initially to Liebert. Both team members will develop or expand their manufacturing capabilities for their respective portions of the project.

Mission Impact

Overall Score = 7.79

Cluster Formation

NexTech is solidly involved in the Ohio fuel cell cluster and has leveraged that involvement to identify the need for and develop its hydrogen sensor technology. NexTech has partnered with an established Ohio-based sensor system manufacturer, Therm-O-Disc. It has also enlisted an Ohio-based system integrator, Liebert, to evaluate the final commercial product that also represents a first customer for its own internal uses and for incorporation into its established commercial product line.

Ohio Economics

NexTech projects sensor element sales will generate over $1.5 million in 2013, growing to over $10 million in 2015. Thermo-O-Disc sales of complete monitoring systems will be approximately double those figures. Based on these revenues, total job growth for the two companies will be over 40 in 2013 and over 200 by 2015.

Business Model

Both team members are located in Ohio and have structured the business plan for penetrating an existing industrial market, with plans to penetrate other related industrial markets. NexTech has sufficient space at its facility in Lewis Center, Ohio to accommodate product development, manufacturing, sales, and marketing activities to support its current business and the growth that it is anticipating. Therm-O-Disc also has sufficient space and marketing infrastructure to support the new product market entry and growth.

Ohio Department of Development

2010 TFSP Evaluation Summary

Scalable, Miniaturized, Low Cost Solid State Laser Systems for Sensor Applications

INNOVA, Inc.

1st Round Score: 64.7 | 2nd Round Score: 80.2 | Rank: 3

Previous Ohio Investment

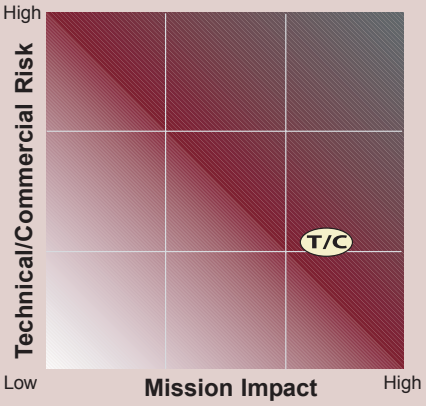
INNOVA has not received any prior Ohio funding.

Project Description

The goal of the proposed project is to reduce the size, weight, and cost of a diode pump laser that will enable the production of smaller size and lighter weight high-powered lasers for use in a wider range of military applications. The smaller laser system will be used as an illuminator and/or range finder for hand held systems and inside smaller unmanned aerial vehicles (UAVs) for tactical and surveillance purposes. INNOVA, as the project lead, will convert the current laboratory demonstration design into a demonstration-level prototype. UDRI's LOCI will provide services of their laser scientists, image processing engineers, and integration engineering capabilities. UDRI's IDCAST will provide engineering services for integrating the laser illuminator with suitable camera. FLIR/D-Diode will provide components and assist in marketing. The team will generate three prototype systems: one for UDRI/IDCAST to perform real life testing, one for FLIR to incorporate into a weapon-mounted rangefinder, and one for INNOVA's life testing and market/revenue related activities.

Key Issues

- INNOVA has unique capabilities to make high power lasers at one-tenth the size and weight of competitive laser systems. This opens up new opportunities for use as illuminators and rangefinders in UAVs as well as ground troop hand-held systems (rifles).
- The miniature, high power diode laser has been demonstrated in a laboratory setting, but a specific application design is only envisioned at this point. The project proposed will create a demonstration-level device that is expected to attract sufficient end-user interest and support commercial-level product prototypes.

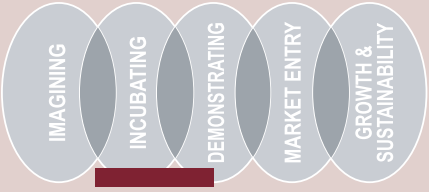


Proposal # TFSP 10-701

Collaborators:
FLIR/D-Diode, LLC
Institute for Development and Commercialization of Advanced Sensor Technology (IDCAST)
Ladar and Optical Communication Institute (LOCI)
University of Dayton Research Institute (UDRI)

TFRDF Request:	$848,000
WCF Request:	$0
TOTAL Request:	$848,000
Cost Share:	$856,467

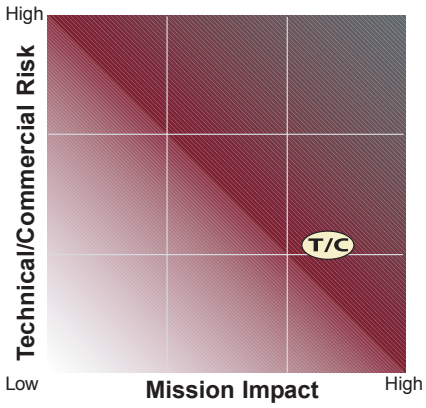
Stage of Development



TFSP 10-701

Scalable, Miniaturized, Low Cost Solid State Laser Systems for Sensor Applications

INNOVA, Inc.



- *No prior Ohio investments*

Technical Risk

Overall Score = 3.68

Technical Reach

The keys to miniaturization are INNOVA's novel thermal management techniques. By miniaturizing the size and weight of the high-powered laser by a factor of ten, the proposed laser system will be useable in more military applications that require significantly smaller platforms. The applicant has made a bench-top version of the miniaturized diode pumped laser, and is in the process of making a working demonstration version that is expected to be ready by June of 2010. INNOVA has strong technical experience with designing, building, and maintaining lasers for military applications.

Resource Limitations

The applicant has extensive technical experience with lasers for military and commercial applications, has an existing laser repair business for military laser systems, has formed a joint venture with FLIR (D-Diode to market high-power laser systems, has a working agreement with Zeiss, and has recently received an SBIR award from the Navy to continue development of miniature lasers for small UAV's. The project budget is projected to be sufficient for producing the demonstration prototypes and revenues from first adopter purchases and private investors full product commercialization will support sales and marketing staff expansion.

Technology Protection

INNOVA holds several patents in the field, including one for the novel thermal management techniques enabling laser miniaturization. INNOVA and each collaborating party will be responsible for licensing their own IP/technology. All collaborations will be covered by NDA's.

Commercialization Risk

Overall Score = 3.46

Path to Market

INNOVA is a JV partner with FLIR, the world leader in thermal imaging infrared cameras and has a working agreement Zeiss Optical, a manufacturer of high quality rangefinders. INNOVA will focus on the technical aspects of development and production, will provide products to Zeiss and FLIR, and rely upon Zeiss and FLIR's extensive military business and contacts for sales into military applications. In a few years, INNOVA will investigate other marketing channels for commercial applications.

Corporate Stability

INNOVA, Inc. is the current name of an organization that was established in the Dayton area in 1981. INNOVA has designed, developed and commercialized high tech products for the military, NASA, commercial and industrial applications. In late 2008 INNOVA received a $500K loan from the Dayton Development Coalition Entrepreneurial Signature Program. In 2008 FLIR and INNOVA formed the joint venture D-Diode LLC with 51%-49% respective ownership. INNOVA currently employs approximately 15 people with current product sales of approximately $3M.

Commercial Infrastructure

INNOVA has facilities for R&D, prototype production, small volume manufacturing, laser repair, and a lab for MIL certification. Current sales are through the JV with FLIR and existing arrangements with Zeiss. INNOVA has sufficient existing manufacturing capacity for the near-term forecasted sales, but will need to expand its marketing and sales staff as the markets develop.

Mission Impact

Overall Score = 7.83

Cluster Formation

INNOVA has its roots in the University of Dayton, continues close working relationships with UDRI and the local military sensor/instrument cluster. INNOVA currently uses the Ohio supply chain for a variety of subcomponents. Zeiss closed other laser repair facilities and shifted its repair work to the INNOVA facility, which further strengthens the local cluster, as does the formation of D-Diode LLC in the Dayton area.

Ohio Economics

INNOVA predicts sales of the proposed product will begin in 2010, ramping up to $8 million in 2012 and $21M in 2014. INNOVA also predicts the creation of approximately 90 jobs by 2014, all in the Dayton area.

Business Model

INNOVA has its headquarters, R&D facility, manufacturing facility, and qualification lab in its Centerville, Ohio facility. INNOVA has product development and supply agreements with FLIR, and agreements with Zeiss to manufacture and repair products for their military customers. After a few years, INNOVA plans to investigate the expansion of a sales and marketing force for commercial applications.

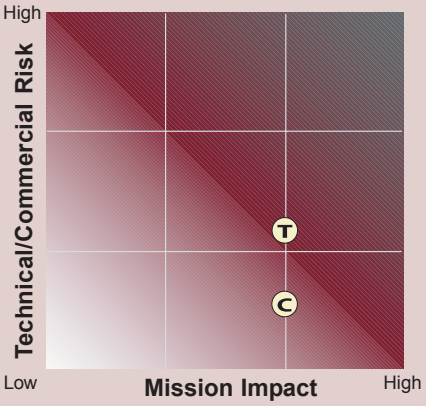
Ohio Department of Development

2010 TFSP Evaluation Summary

Advanced Modified Carbon Nanotube Based Nutrient Sensor

YSI, Incorporated

1st Round Score: 61.7	2nd Round Score: 73.1	Rank: 4



Proposal # TFSP 10-705

Collaborators:
Riehl Engineering Ltd.
University of Cincinnati

TFRDF Request:	$998,635
WCF Request:	$129,238
TOTAL Request:	$1,127,873
Cost Share:	$1,127,873

Previous Ohio Investment

YSI received Technology Action Fund (TAF) in 2003 to develop a microfluidic-based instrument to perform a complete immunoassay of water supplies. The objective of that project, the proof of concept of the instrument, was successfully reached and YSI leveraged that effort to gain a $929K USDOD Plus-up grant (with UDRI) to focus the technology on specific applications. Further federal support led to a two-stage device that included an Immunomagnetic Affinity Separator and a microfluidic analyzer that was tested and favorably reviewed by the Army. Testing continues at the USEPA and it remains under review for commercial introduction. However, the USEPA has recently has changed the contamination indicator requirements for drinking water, effectively diminishing the utility and commercial viability of this device as well as other E-coli sensing methods. YSI has reassessed its microfluidic approach and determined that the technical hurdles now being faced and the limited market potential for that technology dictate a new sensing approach is required. Although not leading to a commercial product, the TAF project led to the creation of about 10 jobs and leveraged over $2 million in federal funds.

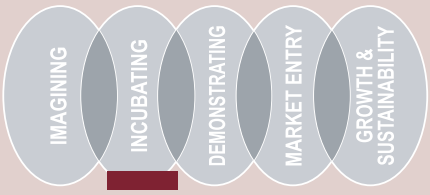
Project Description

The goal of the project is to develop and commercialize a direct electron transfer (DET) based sensor for accurate, on-line, in situ testing of nitrate pollutant levels in wastewaters and agricultural runoffs. The proposed sensor is an enzyme-based electrode made from carbon nanotubes (CNTs). Riehl Engineering will provide electrochemical engineering expertise and proprietary catalyst-free CNTs for the sensor substrate. The University of Cincinnati (UC) will provide electrochemistry knowledge, electrochemical sensor design expertise, and testing capabilities and requests funding for the purchase of a specialized spectroscope that will allow electrode surface analysis. Specific project objectives involve optimization of the CNT electrode production and enzyme application processes. YSI will incorporate the DET sensor production into an existing production process resulting in a unique, second generation wastewater sensor product line. This new technology appears to open the potential for YSI to create sensors for other pollutants.

Key Issues

- The keys to YSI's proposed product are the CNTs produced by Riehl Engineering. Although Riehl has successfully produced product for other customers, the specific enzyme loaded electrode has not been produced at a manufacturing level and cost and consistency objectives have yet to demonstrated. Riehl is a relatively new company adding risk to the project success.
- The overall project is at relatively early Incubation Phase of the Commercialization Framework, but indications are that the sensor sensitivity and specificity requirements are achievable. Productizing of the sensor is well within YSI's capabilities.

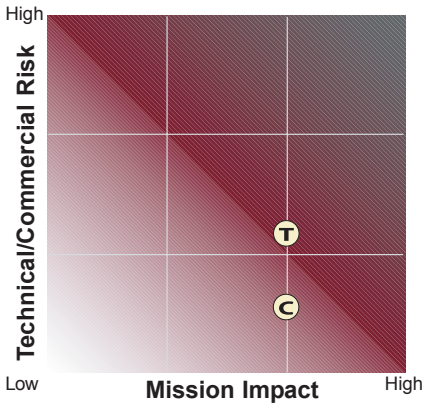
Stage of Development



TFSP 10-705

Advanced Modified Carbon Nanotube Based Nutrient Sensor

YSI, Incorporated



- Rapid Detection of Bioterrorism Agents in Water Supplies, 2003, $904,141

Technical Risk

Overall Score = 3.90

Technical Reach

Riehl Engineering has developed a unique process for producing ultra-small, catalyst-free CNTs that serve as the basis for the proposed electrochemical sensor. YSI and Riehl have a developed method for applying a proprietary enzyme to the CNT electrode that specifically senses nitrate content. Three generations of prototype sensor/electrode designs have been created and initial testing in typical "tap" water has shown a wide range of nitrate sensitivity. Optimizing the CNT production process to lower cost and increase product consistency and optimizing the enzyme deposition and coating processes is required as well as long-term testing.

Resource Limitations

The project funding is expected to be sufficient for demonstrating a functional prototype system against currently accepted nitrate sensing technologies. YSI will use internal funding to bring the product to a commercial product. YSI is a leader in the field of water contaminant sensing and has experience in commercializing innovative technologies. The UC's Electrochemical Sensor Laboratory brings over $2 million in equipment to support the technical efforts.

Technology Protection

Riehl has a patent pending on its catalyst-free CNT production process and YSI has well-established patent protection for its line of multi-parameter sondes into which the nitrate sensor will be integrated. YSI will own and have control of the IP associated with the several forms of the final sensor product.

Commercialization Risk

Overall Score = 1.80

Path to Market

YSI is a market leader in in-situ water quality monitoring instrumentation and also has sales into the biomedical and food and beverage markets. Its current customer base has validated the need for an inexpensive, fieldable and easy-to-use nitrate-sensing device. The USEPA has also verified that such a device fills an unmet need for water quality monitoring. The proposed device currently has no competitive rival and YSI expects that position will be maintained for next several years.

Corporate Stability

YSI is a 60-year old, Ohio-based company with its headquarters and the majority of its operations here. It employs about 350 people with over 200 in Ohio. Annual sales are in the range of $50 to $100 million. YSI continues to show consistent organic growth and uses strategic acquisitions and internal R&D to maintain its business position.

Commercial Infrastructure

YSI has a global sales, marketing, service and distribution network serving the water quality, biomedical and food and beverage industries. About 45% of its sales are outside the U.S. YSI currently expends about 60% of its purchasing with Ohio-based suppliers. A key supplier for the sensor proposed is Riehl, an Ohio based company that has Ohio manufacturing partners.

Mission Impact

Overall Score = 6.67

Cluster Formation

YSI is collaborating with Riehl, an Ohio-based company to develop the technology proposed. UC is a key collaborator in the proposed project. Over many years, YSI has had very close ties to the UC, routinely using its electrochemical facilities and expertise. YSI is also a collaborator and active participant in IDCAST.

Ohio Economics

YSI expects to introduce the nitrate sensor into the market, generate over $2 million in sales and hire 6 new employees in 2012. Sales are projected to grow to over $8 million by 2013 creating 10 additional jobs and to $18 million by 2015 creating another additional 10 jobs. Riehl will also create new jobs and revenues within Ohio from the sales to YSI. Ohio supply chain purchases are expected to be comparable to current YSI levels.

Business Model

YSI will manufacture the water quality sensors and sonde systems in Ohio using its existing facilities and will continue to base its sales and service operations here.

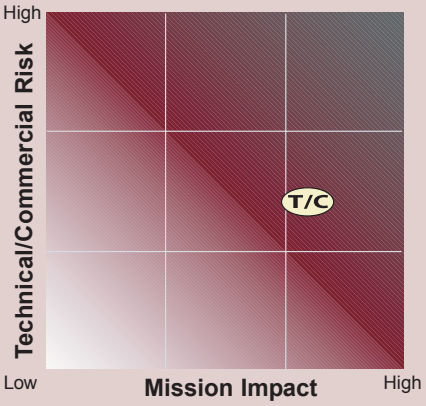
Ohio Department of Development

2010 TFSP Evaluation Summary

Colorization and Resolution Enhancement of Airborne Wide-Area Persistent Surveillance Sensors for Law Enforcement Operations

Persistent Surveillance Systems

1st Round Score: 71.3 | 2nd Round Score: 72.2 | Rank: 5



Proposal # TFSP 10-711

Collaborators:
Institute for Development and Commercialization of Advanced Sensor Technology (IDCAST)
Univeristy of Dayton Research Institute (UDRI)
University of Dayton

TFRDF Request:	$906,315
WCF Request:	$0
TOTAL Request:	$906,315
Cost Share:	$910,370

Previous Ohio Investment

Persistent Surveillance Systems (PSS) has not received any prior Ohio funding.

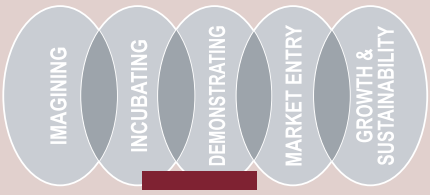
Project Description

PSS will develop an improved, second generation version of its current wide-area airborne surveillance (WAAS) system used by non-military law enforcement agencies in their efforts to generate proof of violent crimes and other incriminating evidence that leads to arrests and convictions. The improvements to the WAAS system include the addition of color, increasing image resolution, and widening the area of coverage. PSS has previously defined the system upgrade requirements utilizing off-the-shelf components. PSS will provide the main systems engineering expertise, develop the subsystems interfaces, integrate and test all subsystems, and flight test the entire system. IDCAST will assist with component engineering and software development.

Key Issues

- PSS is a small, relatively new company and its technology base relies on the company principals. The economic projections stated in the proposal appear to be limited by a reliance on customer revenues for growth. Firm plans for obtaining customer additions are not fully developed.
- PSS has achieved success with its initial customers that are municipal or other government-related entities. Use of surveillance services by these customers is driven by the availability of some form of nonlocal government support (e.g. federal). Unless such support becomes more commonplace, customer development may be limited.
- PSS success rate in crime prevention/solving for its current customers make a compelling value proposition for its service and analysis offerings.

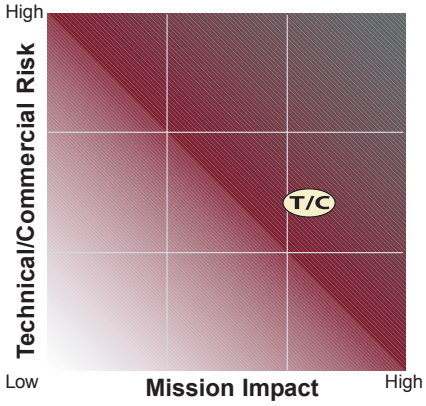
Stage of Development



TFSP 10-711

Colorization and Resolution Enhancement of Airborne Wide-Area Persistent Surveillance Sensors for Law Enforcement Operations

Persistent Surveillance Systems



- *No prior Ohio investments*

Technical Risk

Overall Score = 4.74

Technical Reach

Persistent Surveillance Systems (PSS) has an existing aerial surveillance service business generating revenues from an existing, proven WAAS system. As the result of law enforcement agency feedback, the goal of the project is to increase the resolution (using a commercially-available-off-the-shelf higher resolution camera), increase the area of coverage, add color to the aerial system, and improve on-board data processing and data compression. These appear to be achievable improvements to a product currently in use and generating revenue, and are well with in the capabilities of the team.

Resource Limitations

The management team of PSS possesses the key technology background in persistent surveillance systems gained from their participation in major DOD programs in that area. PSS is small and capital limited resulting in a lack of resources for system improvement and business expansion. This project supports the upgrades customers have requested.

Technology Protection

PSS uses copyright protection for its proprietary software and trade secret knowhow on design and use of the camera array and interface hardware. In particular, its electronic stabilization algorithm, developed in partnership with UD, is unique and advances the state of the art. Although, there are several companies developing aerial surveillance systems, most are focusing on USDOD systems that have higher cost tolerance. PSS appears to be first to offer commercial services and this is in line with its goal is to get into the market quickly to establish a strong foothold.

Commercialization Risk

Overall Score = 4.66

Path to Market

PSS has an existing customer base that is satisfied with its services and has requested specific feature enhancements. PSS will leverage its success with current customers to gain additional clients that are interested in its surveillance services and will be attracted by the new features. For the project proposed, PSS has end-users willing to evaluate the upgraded service capabilities, but no end-user resources are being applied to the project.

Corporate Stability

PSS was started in January 2007. Its sales of services and products are expected to generate revenue of $1 million to $2 million in 2010. PSS employs and employs 10 full time personnel. All profits are reinvested into the company to support its operations. PSS also has several DOD planned and proposed flight testing evaluations of its WAAS sensor systems including those involved in the Air Force SAFEGUARD Program of Record that provides PSS with nearly $5 million over several years.

Commercial Infrastructure

PSS has an existing service business based out of a rented facility at Green County (Ohio) airport. The planes are leased, and the hardware, software, and ground based support equipment are owned by PSS. All employees are focused on current operations, and no separate sales/marketing infrastructure exists. PSS has an existing proven product, has supporting assets, and has an existing customer base.

Mission Impact

Overall Score = 7.30

Cluster Formation

PSS is closely connected to the AFRL sensor directorate at WPAFB and has partnerships with several other Ohio companies that support that activity. PSS currently uses Dayton-area suppliers for hardware and software components and UD and ICAST to assist in development efforts. PSS headquarters will be in Ohio and the hardware/software technology proposed will be developed here. Current services are being used by organizations outside Ohio, but the service proposed is applicable anywhere and PSS will market its service throughout North America.

Ohio Economics

PSS will be headquartered in Ohio and provide centralized information and analytical services from here. The surveillance service business is expected to grow to $9 million in revenues by 2013 and over $15 million by 2015. Job creation in Ohio is tied to the number of surveillance systems placed in service. PSS projects over 50 Ohio jobs by 2013. By 2015 surveillance service sales are projected to support up to 90 Ohio jobs.

Business Model

PSS provides surveillance services that will use the upgraded sensor system. PSS will assemble the airborne and ground support equipment required for each customer and provide aerial surveillance services anywhere in North America. Base operations and supporting services will remain in Ohio. PSS will generate the wide area images for direct clients use and will also offer post-surveillance analysis services from its Ohio base.

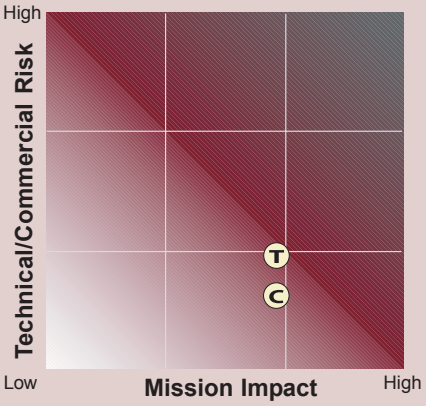
Ohio Department of Development

2010 TFSP Evaluation Summary

Sensor And Fusion Enhancement (SAFE) Program

L-3 Communications Nova Engineering

1st Round Score: 68.3	2nd Round Score: 71.1	Rank: 6



Proposal # TFSP 10-729

Collaborators:
Science Applications International Corporation (SAIC) (San Diego, CA)
University of Dayton Research Institute (UDRI)

TFRDF Request:	$689,550
WCF Request:	$0
TOTAL Request:	$689,550
Cost Share:	$1,122,636

Previous Ohio Investment

L3 Communications Nova Engineering (Nova) is the lead on an Ohio Research and Commercialization Grant Program project that is creating a handheld radio frequency detector initially for use by the military. The detector has been prototyped and the Army is currently evaluating 4 units. Pilot production, DOD qualification, military exercises and initial marketing activities are 60% to 80% complete. Due to delays in the project's start and extended military qualification, the economic development projections are behind schedule by about 1 year. Three jobs have been created at Nova to date, but sales have not yet begun.

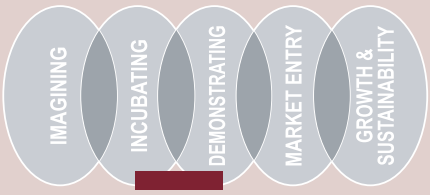
Project Description

The goal of the Sensor and Fusion Enhancement Program is to develop and commercialize a low-cost, ground-based sensor system that extracts detection information from multiple, individual sensors (geophones and magnetometers) and combines the data to produce a single, highly reliable target detection decision. The device proposed combines proven radio and camera technology from Nova with sensors and software from SAIC. Specifically the project goals are to integrate SAIC's sensors with Nova's transceivers to form a ruggedized product for military use, implement SAIC's sensor fusion algorithm within Nova's imager to allow input from a sensor network and transition both to a stand-alone sensor system for target detection. After successfully integrating the team's technologies, Beta testing by current Nova customers will be performed with the project's end-deliverable being delivery of the first pre-production products to customers.

Key Issues

- Nova's economic impact projections resulting from the proposed product appear very conservative based on the potential markets described. Nova indicates that the conservative estimates are due to internal accounting constraints built into its business planning process.
- While the proposed product is based on the integration of demonstrated technologies, a prototype of the integrated product has yet to be built and validated—the objective of the project.
- Nova has made excellent technical progress on the handheld RF detection device supported by Ohio funding, but the commercialization progress is behind schedule and the projected economic impacts are accordingly lagging.

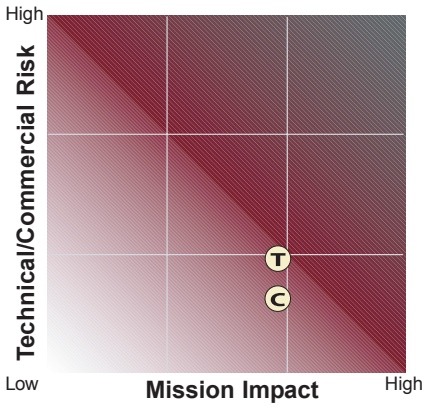
Stage of Development



TFSP 10-729

Sensor And Fusion Enhancement (SAFE) Program

L-3 Communications Nova Engineering



- Handheld Emissions Detector Commercialization, 2008, $350,000

Technical Risk

Overall Score = 3.16

Technical Reach

SAIC's sensors (e.g. geophones and magnetometers) and associated software and Nova's transceiver are existing components with demonstrated capabilities. The integration of the sensor fusion software and graphic user interface development represent the major technical challenges for the project. The activities proposed in the project tasks appear to be adequate for resolving the challenges and creating a complete prototype device for performance validation.

Resource Limitations

The technology proposed is derived from individual, similar products that Nova and SAIC already provide the military. TFSP funding and cost share are sufficient to accomplish the project goals and the project team has strong, proven technical, commercial and management credentials. Both companies have experience in new product introduction for military applications. SAIC and Nova will support full product commercialization using internal resources and continued military funding.

Technology Protection

SAIC wholly owns the sensor processing technology and related software and has agreed in principle to an IP arrangement allowing Nova field-of-use exclusivity. Nova wholly owns the transceiver and target detection algorithm IP. Both companies protect their IP as trade secrets, an approach that experience has shown to be a more effective method for protecting IP than patents in this area.

Commercialization Risk

Overall Score = 2.06

Path to Market

Nova and SAIC have well-established sales/marketing networks to military, law enforcement agencies, and certain industrial markets. The U.S. DOE, Homeland Security and U.S. Border Patrol have expressed interest in the product proposed and have agreed to participate in validation testing of prototypes developed in this project.

Corporate Stability

Nova was founded in 1989 and became part of L3 Communications, a $1 billion/year defense contactor, in 2006. Nova has 3 business units, the largest being the Advanced Technology Unit that generates about $25 million of Nova's $40 million/year revenues. Nova is profitable, and has approximately 170 employees, the majority in Ohio.

Commercial Infrastructure

Nova has proven product development experience, an effective existing sales, service and marketing arm, existing Ohio manufacturing facility, and experienced network of component and service suppliers. Nova has traditionally used Ohio suppliers for materials and services when possible. In 2009, nearly $3 million was expended on Ohio suppliers.

Mission Impact

Overall Score = 6.43

Cluster Formation

Nova is closely tied to the instrument, control and electronics cluster centered around WPAFB. It collaborates with UD and IDCAST and has engaged UDRI/IDCAST to assist in project proposed. Nova uses the Ohio based supply chain, and will continue to use the Ohio supply chain for this project. Nova is in discussion with an Ohio company to support in-theater repair and servicing.

Ohio Economics

Nova has established operations in Ohio and recently hired 35 new employees. The potential market for the proposed product is over $100 million per year, but Nova's business plan is purposely designed to be very conservative in its near term revenue forecasts. Nova projects that initial sales for the proposed product will begin in 2011 and generate $19 million in cumulative sales by 2015, creating at least 7 new Nova jobs and several more in the supply chain. Specific proposed product revenue forecasts for 2012 through 2014 are about $5 million annually.

Business Model

Nova has current manufacturing capability for product at the "thousands-level". When this capacity is exceeded, it will seek outside manufacturing contractors and will attempt to source this with Ohio companies. In all cases, product flow will be out of Nova's Ohio facility and Nova will market and support its products as it does with its existing products.

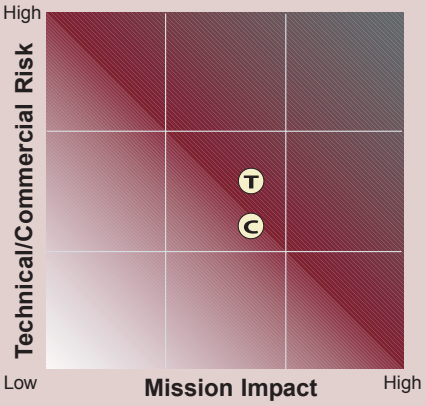
Ohio Department of Development

2010 TFSP Evaluation Summary

Advanced Optical Sensors and Instruments for Alternative Energy Aerospace and Other Industrial Applications

Lake Shore Cryotronics, Inc.

1st Round Score: 66.3 | 2nd Round Score: 62.0 | Rank: 7

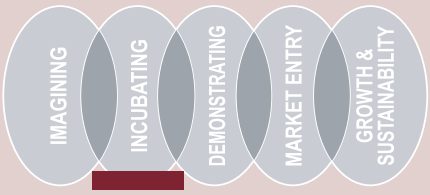


Proposal # TFSP 10-753

Collaborators:
The Ohio State University (OSU)

TFRDF Request:	$853,109
WCF Request:	$145,795
TOTAL Request:	$998,904
Cost Share:	$999,064

Stage of Development



Previous Ohio Investment

Lake Shore Cryotronics has not received any prior Ohio funding.

Project Description

The goal of the project is to further develop a fiber optic sensor reading technology capable of measuring hydrogen, force, and electrical properties in harsh environments. Building on a proprietary detector technology Lake Shore Cryotronics (LSC) has licensed, LSC will initially produce a fiber optic-based hydrogen sensor. In parallel, LSC's collaborator, OSU will focus on force related (pressure, torque, strain, acceleration) and electrical related (electrical and magnetic field) sensors. Specific project objectives include creating the first complete instrument prototype for hydrogen sensing and conducting lab-scale performance tests at LSC; creating force sensors at OSU and a pressure sensor with an end-user partner. LSC will purchase and install a micromachining computerized numerical control center for sensor construction and eventual manufacturing. OSU requests funding to purchase and install optical instrumentation and two tunable lasers to support its efforts. Hydrogen sensors ready for beta release will be produced and prototype force sensors will be the end-deliverable of the 2-year project.

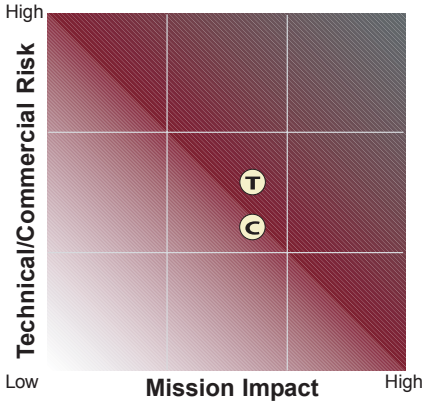
Key Issues

- While strong interest from producers/integrators of fuel cell power generation systems has been received, the market projections for sensor sales to these potential customers will be dependent on their business projections. The market for the power generation systems has been slow to develop and though expectations are that the growth is "beginning to turn the corner", the projections suggested still have to be considered high risk. LSC understands the potential for hydrogen sensor application related to vehicles is further out and it carries even a higher risk for potential market timing. Research applications appear to be strongest near-term market.
- Successful developments stemming from the OSU sensor work may prove to provide more attractive near-term markets, but the size of and requirements for these markets are not fully defined at this point and thus the economic impact potential is less developed.
- The project appears to be in a relatively early stage of the Incubating Phase of the Commercialization Framework with several technical challenges likely to be faced.

TFSP 10-753

Advanced Optical Sensors and Instruments for Alternative Energy Aerospace and Other Industrial Applications

Lake Shore Cryotronics, Inc.



- *No prior Ohio investments*

Technical Risk

Overall Score = 5.26

Technical Reach

Over the last five years, LSC has been developing a fiber optic temperature sensor using similar technology and expects that product to be introduced early this year. A proof-of concept hydrogen sensor was made and characterized in 2007 and using licensed technology from that work and applying proprietary technology licensed from Palo Alto Research Corporation (a Xerox Company), LSC will build the proposed first prototype hydrogen sensing system and the platform for a multiple sensor reading system.

Resource Limitations

The applicant has received an award from the NSF for a STTR Phase 2, and has been a participant in past SBIR and STTR programs and it appears work on the hydrogen sensor was put on hold when that funding ended. LSC has strong technical capabilities, and expertise in commercializing products into their core markets. It indicates the TFP funding will be sufficient to accomplish the project objectives and will internally fund the follow-on commercialization activity. If needed strategic partners or venture capital support will be sought.

Technology Protection

Both patents and trade secrets protect LSC's current product lines. For the sensor product proposed, LSC has two technology licenses covering the critical portions of the proposed fiber optic sensors and sensor system. Six patents cover the licensed technology. LSC has reviewed the patent literature and believe that no patents block its technology.

Commercialization Risk

Overall Score = 4.02

Path to Market

LSC has an established sales/marketing force (domestic and international) serving related application markets, has received interest from potential customers and has identified some specific market opportunities for the proposed hydrogen sensor/system. Customers have indicated their willingness to evaluate prototype sensing systems. However, there are no end-users actively involved in the project. Lower cost and ability to safely operate in flammable gas and harsh environments are claimed as the technology's unique features.

Corporate Stability

LSC is a privately held company formed in 1968. LSC is profitable, has annual sales of over $20 million and currently employ approximately 100 personnel. The introduction of fiber optic-based sensor products is part of the company's overall strategic plans. LSC augments sales and corporate stability with strategic technology acquisition and divestiture. LSC has a history of successfully obtaining USDOD grants and currently has an STTR Phase 2 award from NSF (with the University of Pittsburgh) related to fiber optic sensors. USDOD has given LSC a 95% technology commercialization rating.

Commercial Infrastructure

The applicant has an established domestic and international sales/marketing/support department, and established manufacturing and R&D departments for scientific instruments, sensors, and materials characterization systems. LSC currently uses a base of Ohio component and material suppliers and plans on continuing to use this Ohio supply chain to support the sensor system proposed.

Mission Impact

Overall Score = 5.73

Cluster Formation

The applicant has been in Ohio and in the sensor business for 40 years, uses Ohio employees, and supports the Ohio supply chain. This project will utilize The Ohio State University for extending the sensor development in the areas of force and electrical measurement. The IP comes from outside Ohio, and some of the pieces of the specialized equipment required will come from non-Ohio suppliers. A local pressure and load cell company is expected to be a near-term direct end-user of the LSC product, but the major end-users for the hydrogen sensor will likely be outside Ohio.

Ohio Economics

LSC forecasts sales of $200K beginning in 2010 creating 4 new jobs. By 2013 sales are projected to reach $11 million creating over 50 new jobs and ramping up to over $25 million by 2015 creating over 100 jobs. The cumulative sales estimate for the six-year period is approximately $64 million. However, the sales forecast relies on the growth of hydrogen power generation markets over the next 5 years and other hydrogen related markets. Thus, LSC's forecasts for economic impact have a higher risk level as hydrogen-based systems have a history of delayed implementation.

Business Model

LSC has sufficient manufacturing space at its current facilities to handle the production of the proposed sensors and systems. While LSC has targeted fiber optic sensors as a strategic growth area, the sensor system capability for other than hydrogen measurements may prove to be more attractive. If the business projections for the proposed technology are reduced, LSC's business plans could be affected.

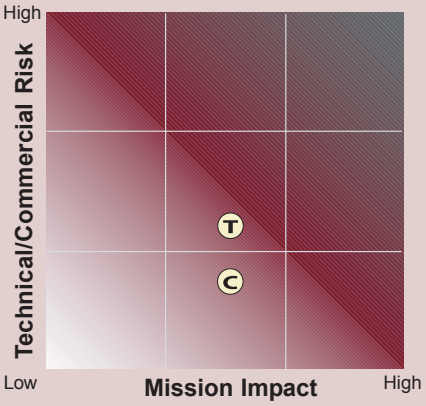
Ohio Department of Development

2010 TFSP Evaluation Summary

Piezoelectric Mass Flow Sensor for Online Control of Fuel Flow Schedule in Advanced Commercial and Military Gas Turbine Engines

Parker Hannifin Corporation, Gas Turbine Fuel Systems Division

1st Round Score: 77.0 | 2nd Round Score: 60.7 | Rank: 8

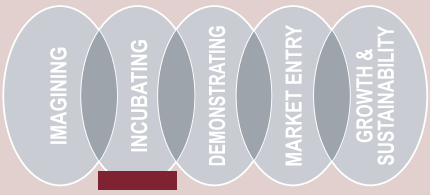


Proposal # TFSP 10-718

Collaborators:
Viking AT, LLC (Sarasota, FL)

TFRDF Request:	$297,000
WCF Request:	$0
TOTAL Request:	$297,000
Cost Share:	$297,008

Stage of Development



Previous Ohio Investment

Parker Hannifin Corporation's Gas Turbine Fuel Systems Division has not received any prior Ohio funding.

Project Description

The goal of the project is to develop and commercialize a novel, high-performance, low-cost sensor for measuring mass flow rates of liquids and gasses using a proprietary piezoelectric platform. The Gas Turbine Fuel Systems Division (Parker GTFSD) of Parker Hannifin will lead the development effort. Viking AT brings expertise in the area of piezoelectric technologies and the specific product proposed and is collaborating on the project to provide technical guidance on manufacturing and characterization of the piezoelectric device, analysis of test results, development of electronic drive circuits, and design improvements. Parker GTFSD will initially develop and test sensors for industrial applications, then offer the product for monitoring fuels for military gas turbine engines. The proposed sensor will be designed for and sold into both industrial and military mass flow control applications.

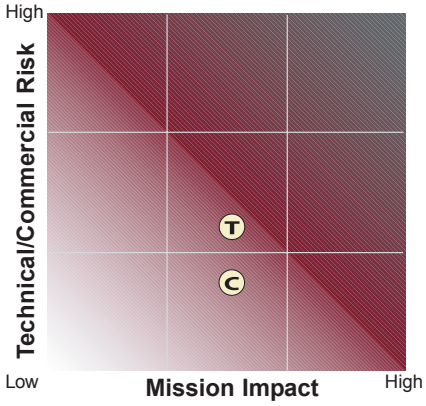
Key Issues

- Economic impacts resulting from the project are conservative, but longer range than targeted by the TFP. This is mainly due to the longer acceptance time required for a sensor system that will be integral to a critical system such as a turbine engine.
- The sensor technology proposed is potentially a disruptive approach to mass flow measurement that could find additional markets not yet explored and currently not served by Parker GTFSD.
- Funding to support continued commercialization activities is expected from Parker Hannifin. This product will need to complete with other Parker Hannifin investment opportunities.

TFSP 10-718

Piezoelectric Mass Flow Sensor for Online Control of Fuel Flow Schedule in Advanced Commercial and Military Gas Turbine Engines

Parker Hannifin Corporation



- *No prior Ohio investments*

Technical Risk

Overall Score = 4.00

Technical Reach

Parker GTFSD has demonstrated proof-of-concept and generated performance data for the piezoelectric actuator design. This critical piezoelectric component has already been commercialized. Technical challenges remain to incorporate the piezoelectric actuator and design the sensor system for mass flow sensing in specific applications and the project will lead to the first fully functional prototype system. The applicant's team has the background knowledge and expertise to resolve the technical challenges.

Resource Limitations

Parker GTFSD has expertise in developing new products for gas engines used in military and aerospace applications and also industrial processing applications, and the proposal team has the background and experience to conduct the proposed project. Parker Hannifin invests significant dollars into its R&D division infrastructure. If Parker GTFSD's project team demonstrates success in meeting the development objectives of the proposed project, the parent company may invest $2 million to advance the project to the next level.

Technology Protection

Parker GTFSD has a significant portfolio of patents for a wide range of sensor and control technologies, including those covering the IP related to the proposed sensor technology. Additional patents are pending that are expected to give Parker GTFSD full control of the core technology.

Commercialization Risk

Overall Score = 2.46

Path to Market

The proposed mass flow sensor is a supporting component for the gas turbine fuel nozzles, which are the primary products for Parker GTFSD. The path to market for the mass flow sensor is through Parker Hannifin and its established marketing, sales and service organization. Full commercial success of the mass flow sensor depends upon adoption into the military aerospace engine fuel nozzle business, but industrial applications offer a smaller, but near-term market and the Parker GTFSD will test the initial mass flow sensor in a confidential, non-military industrial application. Entry into the industrial market will require Parker GTFSD to become more familiar with the industrial applications and requirements via the commercial arm of the parent company.

Corporate Stability

Parker GFTSD is headquartered in Ohio with 120 employees currently located here. Parker Hannifin has recently invested $4 million into a new GTFSD and R&D facility in Mentor, OH. Overall Parker GTFSD employs over 600 people in five locations in the U.S, Europe and Asia. Parker GTFSD is a major supplier of fuel nozzles for military and commercial jet engines.

Commercial Infrastructure

The proposed product is intended for use with Parker GTFSD's main product line at the Ohio facility, where the sales, marketing, and manufacturing activities have been previously established. The critical piezoelectric component for the proposed sensor will be manufactured by a sister division outside Ohio and shipped to the Ohio facility for final assembly, sales, and distribution.

Mission Impact

Overall Score = 5.15

Cluster Formation

Parker Hannifin products cross several of Ohio key technology clusters, including sensors and control systems. Parker routinely is involved with Ohio initiatives related to these clusters. Parker GTFSD uses Ohio-based "approved" companies for machining, quality systems and the majority of system balance of materials. It plans on expanding its Ohio supplier base to include electronics, although the actuator component of the system will come from a sister company outside Ohio.

Ohio Economics

At the end of the 3-year project, and based upon acceptance by a military sub-market, the applicant forecasts $1 million in sales by 2015, ramping up to $25 million by 2020. The project will create 2 new jobs immediately, 2 more in 2014 and 3 more in 2015. Job creation in excess of 50 is expected within 5 to 7 years after project completion.

Business Model

Parker GTFSD's business model is to introduce the initial product for specific industrial applications (e.g. boilers) that do not require the extensive testing and certification requirements associated with the turbine engine application. Using performance feedback from these applications, Parker GTFSD will be in a stronger position to introduce its sensor system for application in military and commercial turbines. With customer acceptance, the applicant plans to expand the manufacturing operation for the proposed product.

Ohio Department of Development

2010 TFSP Evaluation Summary

Target Detection and Tracking Using Airborne Weather Radar

STAR Dynamics Corporation

1st Round Score: 72.0	2nd Round Score: 58.3	Rank: 9

Previous Ohio Investment

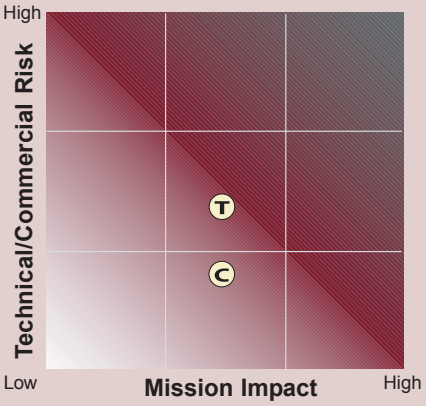
STAR Dynamics has not received any prior Ohio funding.

Project Description

The project goal is to develop and certify a multifunctional airborne radar system (MARS) for commercial and military aircraft. The project will take Honeywell's current airborne weather radar system (IntuVue) and add detection and tracking capabilities that will facilitate its use for search & rescue operations. Star will later add aerial avoidance capabilities to prevent collisions with other aircraft or slow objects (birds, balloons, etc), and ground collision avoidance capabilities to prevent runway accidents. In this project, STAR Dynamics (STAR) will evaluate the current Honeywell system to identify the necessary hardware/software changes needed for adding the desired features, design and build the add-on electronics/software, and test and certify the new system. Honeywell will provide the currently deployed IntuVue radar system and act as technical consultant. The Ohio State University Electro Science Lab will provide technical assistance and consulting. The resulting MARS product will enable the flight deck control panel to transition easily between weather detection and target detection with a single on-board system.

Key Issues

- The economic impacts projected from the project appear based on realistic sales projections for Honeywell systems, but represent a lower than average return for Ohio's investment. While a much larger potential exists as this product is adopted into various aircraft platforms, the magnitude and timing for resultant impacts are only speculative at his time and likely to occur farther in the future than that desired by the TFP.
- The capabilities offered by the proposed STAR enhancements would appear to position Honeywell's product in a superior position to any competitor's product. Honeywell's resource investment seems moderate at best for gaining such a unique product capability.

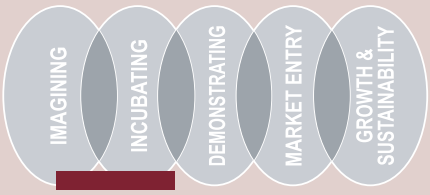


Proposal # TFSP 10-734

Collaborators:
Honeywell International (Phoenix, AZ)
The Ohio State University (OSU)—Electro Science Lab

TFRDF Request:	$1,000,000
WCF Request:	$0
TOTAL Request:	$1,000,000
Cost Share:	$1,000,000

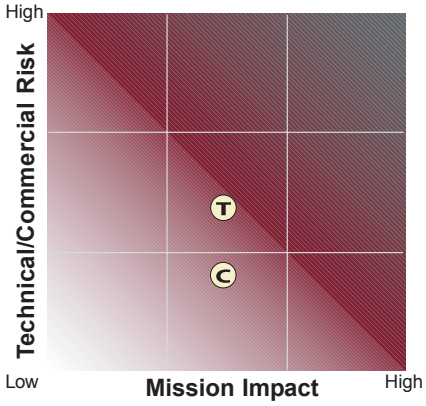
Stage of Development



TFSP 10-734

Target Detection and Tracking Using Airborne Weather Radar

STAR Dynamics Corporation



- *No prior Ohio investments*

Technical Risk

Overall Score = 4.54

Technical Reach

STAR is confident it can develop the hardware and software solution required to provide the proposed tracking and detection features, but laboratory-scale versions of these add-ons have not yet been produced. STAR believes the addition of tracking and detection functions does not present significant challenges and it proposes having a prototype ready for flight-testing within 18 months. STAR has previous experience with developing digital radar systems and components, including products for military stealth applications.

Resource Limitations

STAR has a strong technical team and claims the project funding is adequate to achieve the proposed project objectives. It has previously commercialized similar hardware and software products for the aviation industry. Honeywell and STAR resources will be used to complete the commercialization of the enhanced IntuVue product.

Technology Protection

STAR and Honeywell have nondisclosure agreements that prohibit divulging or independent use of the other party's proprietary information for 10 years. STAR will develop and own the IP from the target detection and tracking portion of the project for its sole use.

Commercialization Risk

Overall Score = 2.66

Path to Market

Honeywell, with established presence in the commercial and military aviation markets, is the current, sole path to market for the STAR software and add-on electronics. STAR will produce a unique product with price and performance advantages for a certain market segment currently served by Honeywell. The dual capability (weather radar and target detection/tracking) in a small, lightweight system will open additional market segments to Honeywell. Interest has been expressed by some end-users, but none are providing resources for the project.

Corporate Stability

STAR Dynamics was started in 2008 and is headquartered in Hilliard, OH, but it is the descendant organization of a company founded in Powell, Ohio in 1988 (Lintek). It was acquired and sold by Aeroflex. Inc. in 1995 and is now owned by a private equity interest. Current annual sales are about $20 million with projections for doubling revenues by 2012. It employs about 100 personnel. STAR has extensive experience in the development and production of digital radar systems for military and commercial applications.

Commercial Infrastructure

STAR has well-established sales/marketing, product development, and low volume, custom manufacturing operations based at the Hilliard facility supporting its digital radar system product lines. STAR has several Ohio suppliers on its approved supplier list and Aeroflex and two Honeywell subsidiaries in Ohio are potential suppliers for the enhanced IntuVue product.

Mission Impact

Overall Score = 4.90

Cluster Formation

STAR is a part of the existing radar technology cluster in Ohio that stems from the OSU-ESL, a collaborator in the project. STAR takes advantage of the trained workforce from OSU and indicates one of its goals is to build relationships with Ohio sensor technology suppliers. With respect to final product sales, the end-user is Honeywell and its customers are major aircraft producers that are not located in Ohio.

Ohio Economics

In its proposal and question responses, STAR projected sales of the components it will produce for Honeywell will begin in 2015 and generate revenues of $1.25 million annually through 2017. Two new jobs will be created at the beginning of the program and will ramp up to 5 jobs by 2014. Longer-term revenues from STAR components to Honeywell level out at $2.5 million annually. A much larger potential for the product exists, but the timing for its adoption is not clear.

Business Model

Honeywell will be the sole market for the product developed in this project. Honeywell and STAR have agreed on a licensing arrangement for sharing the incremental value from the add-on capability. A sale of STAR to Honeywell is not contemplated or planned, but is a possibility. STAR intends to condition any such sale on the operations and workforce remaining in Ohio.

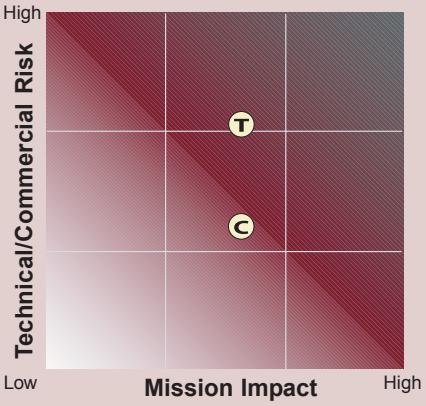
Ohio Department of Development

2010 TFSP Evaluation Summary

The Development of Low-Cost 3D Models That Will Lead to Sustainable Advantage in Geospatial Markets

Woolpert, Inc.

1st Round Score: 66.7 | 2nd Round Score: 57.0 | Rank: 10

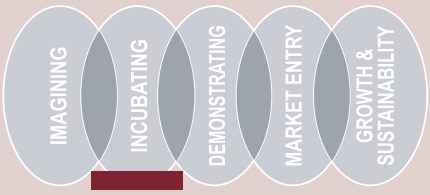


Proposal # TFSP 10-755

Collaborators:
Air Force Research Laboratories
Tidex Systems (Ramat Gan, Israel)
University of Dayton Research Institute (UDRI)

TFRDF Request:	$994,000
WCF Request:	$0
TOTAL Request:	$994,000
Cost Share:	$1,010,920

Stage of Development



Previous Ohio Investment

Although Woolpert has not received a prior TFRDF award, this grant proposal for the development of low-cost 3D models builds on UDRI's Wright Project (WP) program known as the Center for UAV exploitation (CUE) and UD's Wright Center of Innovation IDCAST. UDRI has experienced great success with Ohio Third Frontier Programs. The University has been the recipient of five Wright Project (WP) awards and one Fuel Cell Demonstration Award. In addition, UD has been a large collaborator on two other Wright Centers of Innovation Centers, Ohio Center of Advanced Propulsion (OCAP) and Center for Multifunctional Polymers and Nano Devices (CMPND), and is a lead institution on an Ohio Research Scholars Award. Lastly, UD is the lead institution of the Wright Center of Innovation known as IDCAST. IDCAST plays an integral role in the operation of the CUE and is important to the program's success.

Project Description

The goal of the project is to create fast, accurate, cost-effective 3D models from the output of standard, commercially available, two-dimensional (2D) digital video cameras. Woolpert will capture ground based and aerial video camera images of terrains, building exteriors, and building interiors, and use the proposed software to process the images into 3D models. Specifically the end-users tools proposed are urban terrain and interior room modeling modules. The 3D images will be used by commercial architectural/engineering firms, municipal and commercial organizations, and security/defense/intelligence agencies. Tidex, a 4-person software contractor to the Israeli military, will update the software algorithms of its existing 3D software to be suitable for current computer platforms. Woolpert will develop and add the user interface software to the Tidex software. The University of Dayton Research Institute and the Air Force Research Laboratory will provide engineering, testing and consulting support.

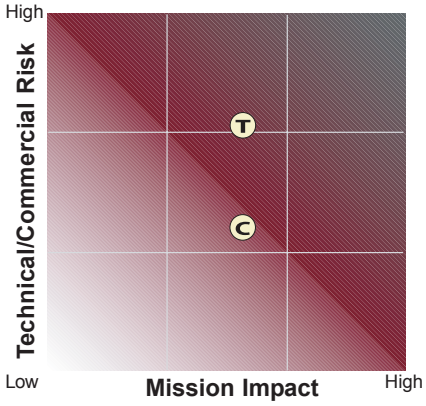
Key Issues

- The Air Force is providing valuable support for the project, but its interest appears to be the longer-term potential for the technology to provide real-time 3D imaging. Target customers are not participating in the project.
- The Woolpert, Tidex, IDCAST JV - i23D, was created to market 3D imaging services to U.S. clients. It does not appear to have a role in this project. The market responsibilities would seem to overlap with Woolpert's service business.
- As a software-based business, the project, other than for technical support, does not leverage any significant Ohio supply chain opportunities and near-term Ohio economic benefits are moderate.

TFSP 10-755

The Development of Low-Cost 3D Models That Will Lead to Sustainable Advantage in Geospatial Markets

Woolpert, Inc.



- *No prior Ohio investments*

Technical Risk

Overall Score = 6.86

Technical Reach

Tidex will update and upgrade its existing 3D algorithms for use on current platforms from its 4-man operation in Israel. Woolpert will develop and add the user interface software, and test the system. While the concept was demonstrated with a simple version of the proposed system, there are significant programming and data processing hurdles to overcome by Tidex. The user must provide manual decisions concerning complex surface features in order for the program to complete its processing. This increases the post-processing time for generating the 3D image. The proposed product heavily depends upon the Tidex work, which will be performed outside the USA.

Resource Limitations

Woolpert's history dates back to 1911 and it currently has over 600 employees and 20 offices nationwide. Approximately 350 of its technical staff focus on geospatial work. Woolpert has estimated the time and investments needed to bring the proposed software products to market and the funding requested in the project proposed is expected to be sufficient for producing a commercial prototype for testing in 18 months. Woolpert will rely on Tidex, a small, but well-funded Israeli company for the base technology software development.

Technology Protection

The project will utilize existing IP owned and controlled by each the collaborators. A non-disclosure agreement is in place between all of the collaborators as is an IP handling arrangement for IP developed in the project. The algorithms to be upgraded are based on over $10 million in development support by Israeli military agencies.

Commercialization Risk

Overall Score = 3.98

Path to Market

The proposed services/products will be targeted at a small group of existing Woolpert and IDCAST clients. The USAF is providing cost share to the project and has committed to test the software on various formats including UAV video files. Other than the USAF, no end-users are participating in the project, but Woolpert believes that it will be able to better approach the targeted customers after the product is developed and tested by the USAF. At that point it will and offer them 3D video imaging services. Technology licensing and/or software sales will be considered later after the service business is established.

Corporate Stability

Woolpert is an established geospatial design, engineering firm providing services and technologies to federal, local/state, and private sector clients. The applicant was founded in 1911, and has a solid D&B financial rating (3A3).

Commercial Infrastructure

Woolpert has an established sales network for reaching customers in the military, federal and local government, and law enforcement agencies. i23D, a JV of Tidex, Woolpert and IDCAST, was formed in Ohio to provide 3D imaging products and services based on the current Tidex technology. It is not clear what role i23D has, if any, in the commercial infrastructure for the proposed technology.

Mission Impact

Overall Score = 5.45

Cluster Formation

Woolpert is a well-established Ohio company with a long history of geospatial related sensor technology. Woolpert is a partner in a JV that has brought an imaging technology company to Ohio and is connected to the geospatial technology cluster forming around IDCAST and the CUE. In this project, Woolpert is relying upon Tidex, the non-Ohio partner in the JV, for the critical core software related to the proposed project.

Ohio Economics

The forecasted sales for the proposed services/products are projected to be approximately $1 million beginning in 2012/2013, and approximately $7 million by 2015. Ten new jobs are projected for 2012/2013 and up to 35 by 2015.

Business Model

Woolpert's core business approach is that of a service provider. Therefore, its initial business plan is to provide services/products based on the 3D modules produced in this project and it will target existing Woolpert and IDCAST mapping and architect/engineering clients. A long-term business plan, yet to be developed, will address the approach for possible sales and support of software.

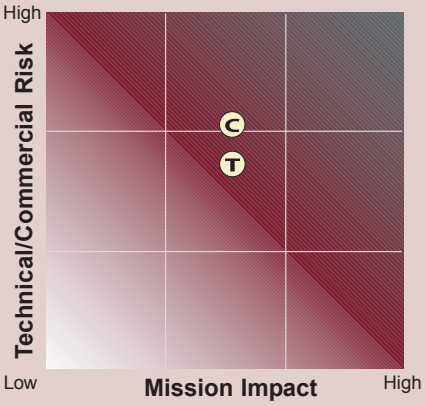
Ohio Department of Development

2010 TFSP Evaluation Summary

Real-time *E. coli* Detector Using COntaminant Sensor NETwork (COSNET)

UES, Inc.

1st Round Score: 66.0 | 2nd Round Score: 50.4 | Rank: 11



Proposal # TFSP 10-752

Collaborators:
EDAptive Computing, Inc.
The Ohio State University (OSU)—Meant Sciences Laboratory

TFRDF Request:	$999,916
WCF Request:	$0
TOTAL Request:	$999,916
Cost Share:	$1,000,000

Previous Ohio Investment

UES received a 2008 ORCGP grant of $339,588 to commercialize Titan Coat, a surface treatment coating that was being applied to die core pins at Honda to triple their life. UES reqested the ORCGP funding to hire a business development person and to scale-up its commercialization effort. UES has only expended $54,000 of the ORCGP funding and has requested an extension for this project because production slow-downs in the automotive industry have made it difficult to conduct field trials. UES is using a manufacturing consulting company as its sales arm. Sales of this product were nearly $800,000 in the 2 years prior to the ORCGP award, and another $800,000 of product has been sold since in the 2 years since the award. One FTE job has been created (0.5 FTE in R&D and 0.5 FTE in Production). Projections at the time of the award were $2 million in annual sales with the creation of 7 new jobs by 2010 and $5 million in annual sales with a total of 12 jobs by 2013.

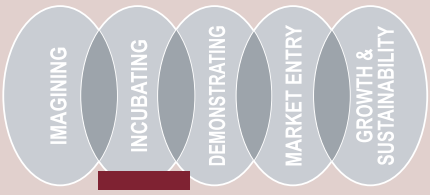
Project Description

The goal is to develop a real-time, passive, commercially viable sensor system that detects and distinguishes between harmful and non-harmful strains of *E. coli* in food and water. UES is trying to develop a biosensor that can detect *E. coli* O*157*:H*7*, Shiga toxin 1 and Shiga toxin 2 in less than 5 minutes. UES is the lead and will coordinate the development of the sensor platform and the computer network that assesses the type of *E. coli* strain. The sensor platform utilizes a patented bio-molecule that has been licensed from the University of Cincinnati. EDAptive Inc. will develop the hardware and software for the computer network, and UES will have the exclusive license from EDAptive Inc. for its patented system. The work plan for this project includes optimizing the technical parameters for EDAptive's BioSwitch sensing platform to reliably and accurately detect the quantity of specific strains of *E. coli*. present in water and meat samples. Subsequent tasks include validating the decision support system, field testing, and assembling two commercial-level products—a handheld device for water quality testing and a sensor network for meat processing plants. Woolpert, the distribution partner for water sensing applications, will make the product available to its customer base in water applications. The Ohio State University Meat Sciences Laboratory will assist in testing the proposed product in the meat processing industry at Bob Evans in Ohio. UES plans to begin manufacturing both products within 5 years of project initiation.

Key Issues

- In 2003, Ohio funded another applicant's development of a strain-specific detector for *E. coli*. That applicant also licensed binding technology from the University of Cincinnati, but development of a viable product took longer and required more resources than originally anticipated. Although that project claimed technical success, the decision was made not to commercialize the product. During the course of its development, EPA changed its regulatory approach to *E. coli* and decided to pursue a different regulatory strategy measuring total fecal coliform or total *E. coli* as indicator organisms. This has reduced the need for a strain-specific detector for *E. coli* in surface waters. This information was subsequently confirmed by senior personnel at USGS, the organization responsible for surface water monitoring.
- The market for this product would be significantly larger if there were a standard for *E. coli* O*157*:H*7* and a requirement to test for it in surface waters and sewage treatment plants. Changing federal water standards to specifically address *E. coli* O*157*:H*7* is likely to consume significant amounts of time and resources. UES is planning to hold discussions with EPA in the near future.

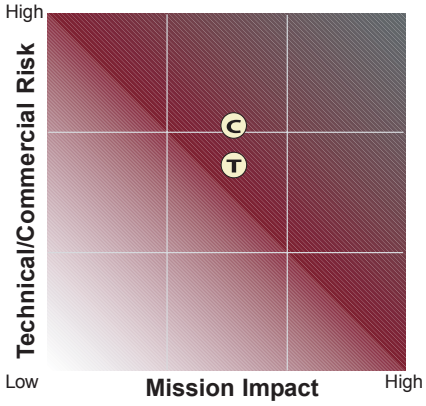
Stage of Development



TFSP 10-752

Real-time *E. coli* Detector Using COntaminant Sensor NETwork (COSNET)

UES, Inc.



- Wear-Resistant Coatings for the Automotive Industry, 2008, $339,588

Technical Risk

Overall Score = 5.74

Technical Reach

UES has produced an initial sensor prototype that responds to the desired strain of *E. coli*. Full characterization of the sensor response is still to be completed, and the key technical challenges remain to be identified. Concurrently, UES will begin work on an NSF Phase I SBIR that will fund the initial assembly and testing of the sensor with lab-created and real world samples. EDAptive has developed and commercialized a software framework called Syscape for analysis and optimization of systems and processes. Syscape will be leveraged for decision support and user interface with the *E.coli* sensor.

Resource Limitations

UES plans to seek additional support for this project from EPA, FDA, and USDA SBIR funding that will sustain it through 2014. UES indicates that it anticipates that these sources will provide additional financial support for field-testing, field implementation, manufacturing, and customer adaptation. If these monies do not materialize, UES plans to commit its own resources.

Technology Protection

The University of Cincinnati has a patent on the strain-specific binding agent and has agreed to exclusively license it to UES. UES described plans to submit a preliminary patent application for the sensor in January 2010 and a full patent application a year later. EDAptive holds the patent on the software. Both companies will contribute IP to the Joint Venture to be formed. The individual institutions will own the IP, and royalties will be paid for resulting licenses.

Commercialization Risk

Overall Score = 6.88

Path to Market

UES plans to apply this sensor first to surface run-off water, then to NPDES discharge water, and finally to meat processing facilities. UES will rely upon Woolpert, an A&E firm with expertise in sewage treatment plants, to bring the product to its customers, and will rely upon Bob Evans to field test the proposed device in meat processing plants.

Corporate Stability

UES is a privately owned research and technology development company established in 1973 that currently has 140 employees. The majority of its revenues have come from over 190 SBIR and STTR awards. UES has commercialized 2 software products that were subsequently sold off and a COTS "full mil spec" ruggedized computer that generated $65 million in annual sales before being sold. UES is currently commercializing a coating for die casting (earlier ORCGP award) and automated 3-D microstructure characterization equipment.

Commercial Infrastructure

UES and EDAptive have entered into an MOU stating that once the *E. coli* sensor technology is mature, a joint venture will be created to market and sell this product. They estimate that $1 million will be required to test and set-up the business development staff and manufacturing facilities. The joint venture will have access to the light manufacturing space at UES headquarters and to the UES finance, accounting, contracts and human resource functions. Sales and marketing staff should be in place by 2012. Additional funding is being sought from SBIRs, the Mentor-Protégé program, and congressional monies.

Mission Impact

Overall Score = 5.18

Cluster Formation

This product will represent UES's initial entry into the sensor market. UES is working closely with EDAptive, another Ohio company, to jointly develop this product that will incorporate IP from the University of Cincinnati. Bob Evans and Woolpert, both Ohio organizations, will be involved in the end-use testing of this product.

Ohio Economics

UES plans to produce commercially viable *E. coli* sensors within 3 years and to establish manufacturing capabilities within 5years. Sales revenues of $100,000 are anticipated in 2013 and $500,000 in 2015. UES plans to create 9 jobs by 2013 and retain 5 jobs. It intends to hire 5 additional employees in 2014 and retain 2 more jobs by 2014. UES estimates that it will hire approximately 75 people between 2015 and 2020 to support this business.

Business Model

The business entity commercializing this product will be the yet-to-be-formed joint venture between UES and EDAptive. Details about its staffing and funding remain to be developed. The joint venture intends to create a light manufacturing operation utilizing COTS components in an existing UES facility. Earlier UES commercialization efforts have resulted in the sale of similar spin-out organizations.

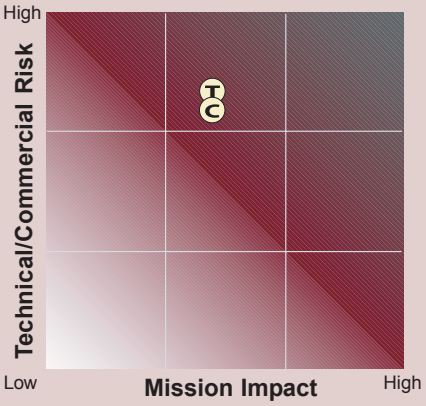
Ohio Department of Development

2010 TFSP Evaluation Summary

Wireless Implantable Biomedical Sensor

H-Cubed, Inc.

1st Round Score: 63.0	2nd Round Score: 41.6	Rank: 12

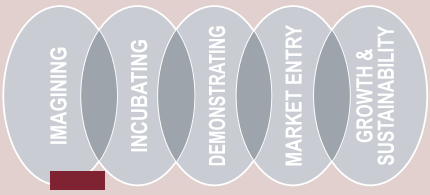


Proposal # TFSP 10-774

Collaborators:
Cleveland Clinic BioMEMS Lab and Polymer Lab
Earles & Associates
SimuTech Group—Central
Southworth & Associates
Valtronic Technologies

TFRDF Request:	$799,564
WCF Request:	$32,000
TOTAL Request:	$831,564

Stage of Development



Previous Ohio Investment

H-Cubed has not been the lead on any prior TFP projects, but has received $215,000 in Ohio funds from Glennan Microsystems. These funds were used to develop high-resolution ultrasonic transducers, wireless pressure sensors, and silicon microneedles. H-Cubed has completed an initial feasibility study on the ultrasound transducer and hopes to begin pilot production in late 2011 or 2012. The wireless pressure sensor project which was initiated in 2005–2006 has attracted $1.4 million in additional SBIR support over the last 3 years. Two spin-off companies have been created to target the orthopedic and ophthalmology markets, and both are pursuing external funding. H-Cubed plans to supply sensors to these companies in 2013 for clinical trials beginning in 2015. The silicon microneedle project has been put on hold because of the success of the drug-eluting stents.

Project Description

The goal of the project is to develop a long-term, *in vivo* (inside the patient), micro-miniature pressure sensor that can be wirelessly monitored to assess the functionality of the implanted shunt system that relieves the build-up of intracranial pressure in hydrocephalus ("water on the brain") patients. H-Cubed is the project leader. The proposed product will be marketed under the brandname InteleFLOW™. SimuTech will simulate the mechanical, electromechanical, and thermomechanical behavior of the intracranial pressure sensor module, and capture flow and pressure conditions within the intracranial pressure system. The Cleveland Clinic BioMEMS Lab will work closely with team members to design and test the sensor. Valtronic will work with team members to design and package the sensor. Southworth & Associates will provide consulting services for medical device regulatory affairs. Earles & Associates will provide consulting services for business and technology development.

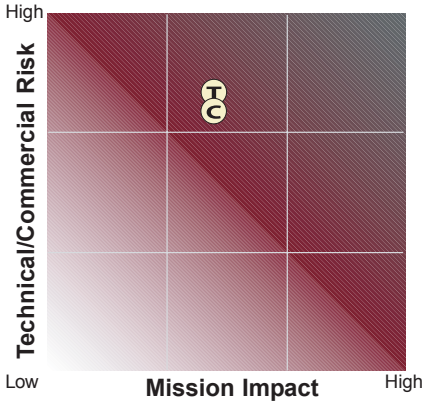
Key Issues

- The proposal indicates that the total world-wide market for this device in hydrocephalus shunt monitoring is $40–60 million annually, and there are a number of potential competitors for this niche. Other markets may exist in monitoring clotting in hemofiltration cartridges and intravascular grafts and stents, and monitoring intraocular and intradiscal pressures that would enlarge the market opportunity to over $100 million, but the work plan for this project does not address these areas.
- H-Cubed estimates that it will require $5.8 million in additional capital beyond this project to demonstrate first human use of the pressure sensor in hydrocephalic shunts. There currently is only a reference to obtaining this funding from major medical device companies, equity financing, foundations and the federal government. The applicant intends to rely on a consultant to create a resource acquisition plan during the project period.
- The business case for this product remains to be developed, and it also will be a project task.

TFSP 10-774

Wireless Implantable Biomedical Sensor

H-Cubed, Inc.



- *No prior Ohio investments*

Technical Risk

Overall Score = 7.80

Technical Reach

H-Cubed has demonstrated bench-top proof-of-concept and preliminary biocompatibility. The project is focused on determining technical parameters, component design, and system design in order to produce demonstration devices leading to an *in vivo* canine study at the end of this project. This canine study is expected to last an additional 6–12 months beyond the end of the project and will be a key component to attracting funding. There are many technical and regulatory hurdles remaining before the product will be ready for clinical trials and commercialization.

Resource Limitations

The work plan for this project involves a single individual from H-Cubed who has both technical and commercialization experience with MEMS devices. He is dependent upon outside funding and services provided by collaborators and consultants to execute the work plan. If this individual becomes unavailable during the project period, it is not apparent how the project will be managed.

Technology Protection

There are a number of patents that have issued to H-Cubed competitors that may cover the same end-use application. H-Cubed claims that it has not found any prior art that describes its sensor chip design approach or the use of an in-line module to monitor shunt functionality. H-Cubed and the Cleveland Clinic have jointly filed 3 patent applications for wireless sensor monitors and are waiting for these patents to issue. The team will apply for patents on any innovations that arise from this project and will share ownership. If third party patents are found that augment H-Cubed's patent portfolio, licensing will be pursued.

Commercialization Risk

Overall Score = 7.26

Path to Market

H-Cubed plans to market its wireless MEMS sensor product to the four major shunt manufacturers for incorporation into their product. With this strategy, H-Cubed intends to leverage the existing sales and distribution channels of these device manufacturers to reach the ultimate end-user, the surgeon. H-Cubed has had discussions with one of the shunt manufacturers who indicated that it would be interested in becoming a potential commercialization partner, if the project objectives were met.

Corporate Stability

H-Cubed is a privately owned, 2-person company founded in 2002. It uses lab space at the MEMS laboratory at the Cleveland Clinic, but conducts business operations from the owner's home. The company generates revenues from development services, consulting, and in-house project development that is funded through federal grants and corporate sponsors. The company's revenues from 5 different projects have totaled less than $1 million during the past 3 years.

Commercial Infrastructure

H-Cubed currently has limited manufacturing capabilities for the ultrasonic transducer including mixing and filtration of the raw polymer material, shaping the transducers, and chip separation. It plans to establish clean room manufacturing facilities within 18 months after completion of this project. During the project period, it will rely on consultants and collaborators to perform the modeling, construct and assemble the sensor modules, handle regulatory issues, and manage the program.

Mission Impact

Overall Score = 4.65

Cluster Formation

The applicant has teamed with Ohio-based organizations in the Ohio biomedical device cluster. SimuTech Group will provide CFD modeling of the sensor module and mechanical FEA of the sensor packaging. Valtronics will provide sensor module assembly and prototype manufacturing. The Cleveland Clinic will be responsible for characterizing and validating sensor performance and prototyping the sensor module housing. Currently MEMSCAP, Inc. (Durham, NC) is developing and manufacturing the sensor chips, but H-Cubed is evaluating the possibility of using Midwest MicroDevices in Toledo.

Ohio Economics

H-Cubed plans to begin selling alpha prototypes in 2014 and beta prototypes in 2015. Sales of these products would generate revenues of $600,000 in 2014 and $900,000 in 2015. This project is expected to create 4 jobs at H-Cubed in 2013 and 16 jobs by 2015. H-Cubed also indicates that it will retain 2 existing jobs in 2013 and a total of 6 jobs by 2015. Additional modest job creation is projected at the Cleveland Clinic and at contract manufacturers.

Business Model

H-Cubed plans to subcontract chip manufacturing through existing semiconductor and MEMS foundries, but it intends to establish its own manufacturing for specialized, value-added processing steps such as wafer-level packaging techniques and device testing. H-Cubed hopes to become a component supplier for the shunt manufacturers. As a component supplier, H-Cubed will rely on its customers to provide sales, marketing, distribution, and technical support.