Strategic Technology Partnerships (STP) reflects a name change for Glenn Research Center’s Regional Economic Development (RED) initiative, placing a more direct focus on the activities of the initiative. STP works to establish regional partnerships with external organizations that lead to economic development by the private sector in business sectors of critical importance to the region and the Nation.

STP’s goal is to create jobs, new technologies and products, and new and expanded supply chains for NASA; and to increase, in measurable ways, the commercialization and deployment of NASA-developed technology. STP connects Glenn’s competencies with comparable competencies in the region, creating a unique NASA-developed technology. STP connects Glenn’s competencies at the local, regional, and national levels. Glenn’s core competencies are

- Aircraft Propulsion
- Communications Technology and Development
- Space Propulsion and Cryogenic Fluids Management
- Power, Energy Storage and Conversion
- Materials and Structures for Extreme Environments
- Physical Sciences and Biomedical Technologies in Space
- Aerospace Manufacturing
- Astrobiology
- Atmospheric Science
- Geosciences and Earth System Science
- Earth Observing Systems

In 2018, additive manufacturing, energy, and water were the focus of three separate Tech Connect events. For each event, companies applied for the opportunity to consult with NASA SMEs to find innovative solutions to specific technical challenges. Selected companies received up to 8 hours of consultation with NASA SMEs. The ultimate goal of Tech Connect events is to assist with technical challenges in the region and the eventual creation of jobs in the Midwest and other regions of the country.

Glenn leads the Agency’s Water Initiative, which is designed to identify and mine water-related activities across the 10 NASA centers and deploy them to address technology challenges for small and midsized companies in the water space. The 2018 Midwest Water Initiative Summit was the first event of its kind to offer companies the opportunity to consult with NASA SMEs on water-related technical challenges. The Summit took place on March 21, 2018, at the Ohio Aerospace Institute.

The purpose of the Midwest Water Initiative Summit Tech Connect was to provide consultations to companies who needed expert assistance solving an in-house, water-related challenge. Four diverse companies from four different states attended this first-of-its-kind event to consult with NASA researchers and physicists. Glenn SMEs included Tom Drehe, Mike Krasowski, Larry Greer, Norm Prokop, Michael Hicks, Isaiah Blankson, Ray Wade, Mariabelly Kennedy, and William Meyer, Senior Scientist, Universities Space Research Association.

In addition to Glenn, event partners included the Cleveland Water Alliance, The Water Council (Milwaukee), the Manufacturing Advocacy and Growth Network (MAGNET), the Wisconsin Manufacturing Extension Partnership (WMEP), and the Ohio Aerospace Institute (OAI).

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What is Additive Manufacturing?

An innovative and versatile approach to industrial production, AM uses digital 3D design data to create components by depositing material in layers using a range of metals, plastics, and composite materials. AM's advantages over conventional manufacturing include more flexibility in design and customization as well as the ability to create highly complex structures that remain light and stable. NASA uses AM to create and repair components on the International Space Station and has used the process to make rocket engine parts.

TECH CONNECT SUCCESS

Company: Product Evaluation Systems (PES) provides mechanical, metallurgical, and chemical testing services for clients in the United States and Europe.

Challenge: Though additive manufacturing (AM) technologies and materials are advancing rapidly, standards and testing protocols have been lagging. PES wanted to offer their customers the technical authority a vetted specification provides.

Solution: From their discussions with NASA experts, PES was able to develop matrices for minimum and recommended testing plans based on various technology readiness levels. They also learned about specific AM equipment that will enable the company to expand its capabilities for characterizing metal powders.

"The opportunity to meet with NASA's experts easily saved us 12 to 24 months in development time. The opportunity to participate in Tech Connect substantially shortened our additive manufacturing learning curve."

—Walt Moorhead, Product Evaluation Systems President

"I know of no other opportunity, or organization, that is able to help small companies achieve these types of results."

—Connie Pulocka, Catalyst Connection

Participating Companies

General Carbide Corp. (Greensburg, Pennsylvania), a producer of tungsten carbide finished tooling, wear parts, and specialty components, consulted with Glenn SME Dr. Dave Ellis on composite wear parts.

Winter Equipment Co. (Wilmington, Ohio) serves the Ohio Department of Transportation and municipal snow plow market with aftermarket and value-added quality wear parts. Winter Equipment consulted with Glenn SME Bob Carter on the quantification of wear characteristics for a particular material.

Technimark LLC (Latrobe, Pennsylvania) is a contract manufacturer specializing in injection molding in the production of medical devices and equipment. Technimark consulted with Dr. Luke Roberson of Kennedy Space Center to determine the best AM method for medical applications.

Product Evaluation Systems (PES; Latrobe, Pennsylvania), a mechanical, metallurgical, and chemical testing laboratory, consulted with Glenn SME Dr. Brad Lench on guidelines and matrices for testing of AM products (see Tech Connect Success).

Energy Tech Connect's Bill Hagstrand provides opening comments to the participants.

"The 2018 Tech Connect program focused on helping Northeast Ohio advanced energy companies grow. A total of four companies met with NASA Glenn Research Center experts to help them find solutions and fuel the momentum, growth and job-creation potential of the advanced energy segment, an increasingly pivotal industry in Northeast Ohio's economy."

—Jay Foran, Senior Vice President of Industry and Innovation, Team NEO
SUCCESS STORIES

Skysun, LLC—Bay Village, OH

PRODUCT

A ganged heliostat, according to Skysun founder Jim Clair, "is simply a device that aims many mirrors to reflect sunlight where it can be used to generate power." The ganged heliostat technology developed by this clean-energy startup company was initially projected to reduce the costs of concentrating solar power (CSP) by over 30 percent. Skysun was already testing a subscale prototype when the company was selected to participate in Adopt-a-City in 2013.

CHALLENGE

Skysun needed to determine their prototype’s wind survivability. At issue was whether the structure would safely sway in the wind or begin oscillating, which could cause the company’s prototype to move in potentially damaging ways. "Wind survivability would need to be demonstrated before commercialization,” noted Clair.

NASA CONNECTION

Skysun was one of six companies selected to participate in the second iteration of Adopt-a-City, a joint effort of the NASA Glenn Research Center, the city of Cleveland, Cuyahoga County, and the Manufacturing Advocacy and Growth Network (MAGNET). Adopt-a-City provided up to 40 hours of pro bono assistance from NASA experts to small and mid-sized manufacturers to help solve technical challenges with a new or existing product. The program also made low-interest loans available through the city of Cleveland and Cuyahoga County. Through Adopt-a-City, Skysun was matched with a team of NASA subject matter experts (SMEs) who would help the company tackle a significant technical challenge.

SOLUTION

NASA Glenn SME Dr. Dennis Huff created a vortex-shedding calculator that would allow Skysun to predict the susceptibility of their structures to wind-induced oscillation, and a team of Glenn SMEs led by Mike Krasowski installed sensitive accelerometers at Skysun’s testing site to measure characteristics of the ganged heliostat’s response to wind. Testing revealed that the prototype was unlikely to suffer damage in high wind conditions. Glenn SME Paul Bartolotta took a lead role in the project, advising the company on how to use the calculator with larger structures and discussing options to reduce wind-induced oscillation. "The findings were extremely helpful to move Skysun’s technology toward commercialization,” reported Clair.

SUCCESS

Skysun used the NASA findings to begin developing wind-mitigating devices, including movement-damping methods to increase prototype accuracy in windy conditions. According to Clair, the NASA findings were critical in generating interest from researchers at Sandia National Laboratories in the United States as well as Germany’s Fraunhofer Institute, Europe’s largest institute for applied solar energy research. “I don’t believe Skysun could have gotten on ‘their radar’ without the Adopt-a-City collaboration,” Clair noted.

Skysun was awarded a $275,000 Department of Energy Small Business Voucher to accelerate development of the ganged heliostat, and an 18-month research program ensued, with findings generally positive for further development.

Economic Impact

• One job created and one part-time summer paid internship
• Total funding to date: $330,000*
• Approximately $130,000 has already benefited Northeast Ohio (e.g., using a local legal IP firm, a local illustrator, and local source materials and products when possible)

* $25,000 Innovation Fund Phase A grant, $275,000 DOE SBV grant, and $30,000 self-funded

"Technology exchange is a two-way street. Awareness of what companies are doing, especially companies that NASA does not normally interact with, opens the possibility of new ideas that can benefit NASA.”

—Dr. Dennis Huff, NASA Glenn Research Aerospace Engineer and consultation team member
SOLUTION
Health-Mor provided the NASA team with a sample of their product as well as flow-rate data sets they had generated. After performing several validation tests, the team carried out a number of CFD runs that illustrated the model’s flow path. Explained Wroblewski, "This type of computational prediction allowed our team to identify ‘bottleneck’ regions in the flow path that cause airflow restrictions and high turbulence, leading to reduced flow rates and increased noise, respectively."

The team was able to help Health-Mor identify options to improve the flow rate and reduce product noise. “Principles that are followed in our propulsion system areas were suggested to help reduce the noise signature,” noted Elliott. “We also utilized the computational fluid dynamics work […] to help with design changes for reduced noise.”

Health-Mor CEO Duggan found the SME team’s insight into the science of flows particularly helpful. “As you might imagine, NASA engineers are very keen on moving air to power spacecraft and rockets.”

Economic Impact
• Helped maintain just over $2 million in sales
• Allowed the company to add or retain 4 to 5 full-time jobs in their Brooklyn factory
• Positioned the company to begin selling their product in more countries around the world, including some of the most populated areas in Asia, India, and the Middle East

SUCCESS
As a result of the consultation, Duggan reported, “We switched our entire production worldwide to a single better performing fan blade. This saves on inventory costs [and] makes the FilterQueen® Defender® better by running quieter and with more airflow.”

“As a small company, we can only afford to do so much research and testing. NASA has so much internal intelligence that can be shared to help us [and it] is much more affordable than us employing an entire R&D team that is going to spend months just learning what NASA engineers already know.”

—Dan Duggan, CEO, Health-Mor
SUCCESS STORIES

Indago—Cleveland, OH

PRODUCT – ArthroFree

ArthroFree is the world’s first fully wireless minimally invasive camera designed for use in endoscopic surgeries. ArthroFree eliminates the wires and cables used in current endoscopic technologies, reducing the time required for setup, takedown, and sterilization while providing significant cost savings.

CHALLENGE

Indago (formerly Infinite Arthroscopy, Inc.) is a medical device company on a mission to create the operating room of the future through smart surgical tools. Indago sought help from NASA subject matter experts (SMEs) to find an effective battery and power management solution for their ArthroFree device.

“One of our fundamental challenges was how to take a hardwired minimally invasive surgical camera and make it battery-powered,” said Indago CEO and cofounder Eugene Malinskiy via email. “Prior to consulting with NASA, we had devised the basic parameters for a battery-powered system; however, there were two aspects that we wanted to improve. First, we wanted to increase the efficiency and capacity of our power system so that the device would last longer on a single charge. Second, we wanted to minimize the weight and size of the battery to improve the device’s ergonomics.”

“The NASA subject matter experts [SMEs] were incredibly knowledgeable and provided deeper insight into the various battery chemistries available to us, as well as their construction, benefits, and limitations.”

—Eugene Malinskiy, CEO and cofounder, Indago

NASA CONNECTION

The Manufacturing Advocacy and Growth Network (MAGNET) introduced Indago to the Adopt-a-City program, a joint effort of the NASA Glenn Research Center, the city of Cleveland, Cuyahoga County, and MAGNET. Adopt-a-City provides up to 40 hours of pro bono assistance from NASA experts to small and midsize manufacturers to help solve technical challenges with a new or existing product. Indago’s three cofounders—Eugene Malinskiy (CEO), Daniel Dudley (COO), and Ilya Malinskiy (Lead Engineer)—were connected with NASA Glenn Research Center SMEs Thomas Miller, Damir Ljubanovic, Raymond Wade, and Daniel Rable. Among the SMEs’ areas of expertise were lithium-ion battery performance and electrical power system design—exactly what Indago needed to address their challenge.

SOLUTION

NASA SMEs helped Indago select a lithium-ion chemistry and zero in on the optimal cell type for their application. One of the battery cells Indago had been considering was currently being used in certain NASA satellites. The SMEs’ familiarity with the cell and its performance, noted Eugene Malinskiy, “allowed us to determine that it was one of the best choices we could make for a battery cell.”

Not only did the consultation allow Indago to identify, test, and select the battery cell that now powers the ArthroFree device, NASA’s insight and expertise also helped Indago significantly advance the hardware design of their power management system. Damir Ljubanovic of Glenn’s Power Management and Distribution Branch analyzed the system’s schematics to find ways to increase efficiency.

“The NASA consultation greatly benefited our company and product,” concluded Malinskiy. “As a small group of engineers with diverse backgrounds, we were able to leverage NASA’s deep expertise to validate our assumptions regarding our battery and power system, while also receiving suggestions on how to improve our designs in the future.”

SUCCESS

ArthroFree has been demonstrated in both benchtop and subsystem settings and is now in the final stages of development. The device is patent pending and is projected to receive FDA approval early in 2020. As for Indago, this Northeast Ohio (NEO) startup continues to gain recognition.

• First NEO company to be accepted in StartUp Health
• First NEO company to receive AngelMD syndicate funding
• First NEO company to join the Medical Technology Enterprise Consortium (MTEC)
• First U.S. company to be accepted in the NXP Single Chip Module i.MX6 Beta development program

Economic Impact

- $5.5 million capital raise completed since participating in Adopt-a-City
- Six full-time jobs and four part-time paid summer internships created
- $500,000 has benefited Northeast Ohio (including investment in engineering, legal, IP, and marketing, and excluding employee salaries)
- Indago has worked with a local contract manufacturer, fulfillment partner, three electrical design firms, and one industrial design firm

“Most satisfying and enjoyable, in my opinion, was the ability to provide guidance on new, innovative ideas that lead to state-of-the-art technology.”

—Damir Ljubanovic, NASA Glenn Electrical Engineer and consultation team member

Digital rendering of prototype ArthroFree handpiece. Courtesy of Indago.

Form factor prototype of ArthroFree handpiece. Courtesy of Indago.

Demonstration of swappable battery as part of ArthroFree handpiece. Courtesy of Indago.
PARTNERSHIPS, COLLABORATORS, AND NETWORKING

Through Strategic Technology Partnerships, NASA engages in regional collaboration and partnership building in an effort to share its expertise with businesses and to participate in regional technology innovation clusters that are in place across the country.

Aerozone Alliance: Berea, Brook Park, Cleveland, Fairview Park, North Olmsted, and Cleveland Hopkins International Airport

City of Cleveland
Cleveland Foundation

Cuyahoga County
Great Lakes Commission
MAGNET (Manufacturing Advocacy and Growth Network)

JumpStart, Inc.
Ohio Development Services Agency
Ohio Fuel Cell Coalition (OFCC)

Society of Manufacturing Engineers
State of Ohio

TechSolve
University of Dayton Research Institute (UDRI)/FastLane

The Water Council (Milwaukee)

Catalyst Connection
Cleveland Engineering Society (CES)
Cleveland Water Alliance

Jobs Ohio
Ohio Aerospace Institute (OAI)
Ohio Federal Research Network (OFRN)

Team NEO
Tech Belt Energy Innovation Center (TBEIC)

U.S. Water Alliance

Learn more about NASA Glenn Strategic Technology Partnerships at https://www.grc.nasa.gov/regecondev/.

National Aeronautics and Space Administration

John H. Glenn Research Center
21000 Brookpark Road
Cleveland, OH 44135
www.nasa.gov/centers/glenn

www.nasa.gov