Technology Asset Grant Program

Letter of Intent

Lead applicant: Sea Air Space Machining & Molding (SAS)

Address: 30555 Solon Industrial Parkway
Solon, Ohio 44139

Project Title: Development, Validation, and Certification of Advanced Metals and Processes used in Metal Additive Manufacturing

Requested Technology Asset Grant funds: $2m

Total Project Cost over a three year period: $8m

Collaborators in Northeast Ohio:

Cuyahoga Community College (Tri-C)

IAM Tech (iAMT)

PCC Airfoils LLC (PCC)

The Technology House (TTH)

University of Akron (UA)

ZIN Technologies (ZIN)

The collaborators have non-binding intentions to develop advanced materials manufacturing processes and training via apprenticeship programs to produce an educated workforce that can sustain this emerging industry. All will have access to the technology, facilities, and information funded through the collaboration.

Intended Use: The intended use of the Ohio Third Frontier Funds requested in this proposal is for the acquisition of capital equipment and building renovations necessary to achieve the goals and objectives of the collaborators.

Problem Statement:

Ohio, commonly known as the nation's industrial capital, has been linked with the manufacturing industry since its birth. Manufacturing has remained the backbone of the Ohio economy from the days of the steel mills through the current re-shoring boom. Manufacturing accounts for nearly 16 percent of the state's total economic output, and employs over 12 percent of the workforce. Within that number, manufacturing accounts for 95 percent of Ohio's exports and manufactured exports support 26 percent of Ohio's manufacturing jobs. Both numbers are expected to double within the upcoming years.

Despite Ohio's strong manufacturing presence, emerging technologies in the advanced manufacturing industry threaten two key Ohio industries. The two industries—medical and aerospace—are essential to Ohio's growth and sustainability. The aerospace industry currently employs over 130,000 Ohio residents, and the medical industry employs over 60,000. These are very different industries today, but are growing more similar in the advent of additive manufacturing.

Currently the medical and aerospace industries are hostage to traditional manufacturing methods, with new products and designs taking longer and costing more to transition from concept to production levels. The longer it takes an industry to get new products to market the more they become at risk for losing market share; a risk that would not only be damaging within that industry but to Ohio's economy as a whole.

The future success and growth within the manufacturing of medical and aerospace products comes from the emergence of new technological equipment to help break out of the traditional manufacturing trends. Additive Manufacturing (3D printing) has the potential to accomplish this, but needs to transition from making prototypes and tooling to final grade production parts. The development of new certified materials and processes for additive manufacturing is key to accelerating development and commercialization of next generation medical and aerospace products, and to support the growth of these industries.

Project Goals and Objectives:

The goal is to enhance the technologies, facilities, and information available at SAS in additive, subtractive, and automated work cells. With these improvements, the facilities will be available to help SAS and its collaborators accelerate development and commercialization of medical and aerospace manufacturing processes and manufactured products. The core of the plan is SAS's manufacturing experience and certifications, including ISO13485:2003 (Medical Devices) and ISO9001:2008+AS9100C (Aviation, Space, and Defense).

Building on this core are the design, engineering, and educational market positions within the aerospace and medical industries of the collaborators, which solidifies the legitimacy of the plan. The following are specific focused aims that will be achieved through the successful implementation of the work plan.

1. <u>Strengthen Ohio industries</u>: The highly technical equipment acquired will provide process-specific solutions for the Ohio medical and aerospace industries to achieve the goal of certifying material and Direct Metal Laser Sintering (DMLS) processes for production manufacturing in additive manufacturing.
2. <u>Competitive advantage for Ohio companies</u>: Developing new materials manufacturing processes supported by advanced manufacturing apprenticeships (AMAs) will draw attention to Ohio and its support of the requirements and demands of the aerospace and medical industries. This project will highlight the state's knowhow and capacity to compete in today's evolving markets.

3. New technology-based products and services: The new manufacturing methods developed through access to the highly technical DMLS equipment and facility provided by the project funds will lead to reduction in production times as well as new product designs.
4. Industry scale: Having multiple disciplines collaborating on the dependent steps and processes associated with additive manufacturing and best in class expertise on specific issues, both for additive manufacturing and workforce development. These benefits will be initially aimed at the aerospace and medical sectors, but would also extend to the many other industries supported by the project collaborators.
5. New jobs: The accelerated production processes for medical and aerospace products will create new jobs—and career paths—and will also support many existing jobs. Designers and engineers will be needed with the skills for modeling, analysis, simulation, and evaluation of new processes and products. With the growth of highly technical equipment will come the need for a highly skilled workforce to operate, repair, maintain, and improve the facilities and equipment. The collaboration with Cuyahoga Community College to develop an advanced manufacturing apprenticeship (AMA) program to help augment their additive manufacturing program will increase the awareness and provide needed workforce development in Ohio. The apprenticeship program will also ensure that Ohio will not face a shortage of skilled labor to operate advanced technical equipment.
6. Investment and return: The combination of new technology and the trained workforce to support it will ensure that Ohio stays at the forefront of all advanced manufacturing opportunities.

Technical and Commercial Aspects and Work Plan:

The project will combine the industry-based knowledge of PCC Airfoils, ZIN Technologies, and University of Akron along with the additive and subtractive manufacturing knowhow of SAS, TTH, IAM Tech and Tri-C.

The goal will be to develop a certified metal-based powder-to-parts solution for additive manufacturing process of DMLS. The development of a certified metal powder will not only accelerate time to market, but also establish these Ohio companies as premier providers of specialty materials and manufacturing within the aerospace and medical communities. It is envisioned that the certification and validation process will be applicable to multiple powder alloys and ceramic materials.

Equipment and Facilities: The funds will be used for the modernization of an existing structure, the acquisition and installation of sophisticated additive, subtractive manufacturing equipment along with advanced automation and support equipment.

Critical to Advancing: The equipment is available but technical barriers lie in lack of certification and validation methods when additive manufacturing equipment is used for production parts.

Barriers Overcome: The barriers will be overcome through the use of new equipment combined with the unique skills, competencies and knowledge gained from each collaborator:

Sea Air Space Machining & Molding (SAS), a woman-owned small business, offers a variety of advanced machine shop services, including electrical discharge machining (EDM) and 5-axis high speed machining. SAS holds ISO 9001:2008+AS9100C certification (an aerospace industry quality standard), ISO13485:2003 certification (the standard for a comprehensive management system for the design and manufacture of medical devices), and

Nadcap (National Aerospace and Defense Contractors Accreditation Program) certification for non-conventional machining.

PCC Airfoils LLC manufactures complex highly technical investment castings for turbine engine applications used in commercial jet engines, military jet engines, helicopters, and industrial gas turbines.

ZIN Technologies is an experienced developer of ground and flight systems for manned and unmanned aerospace applications, and is ISO and AS9100C certified to develop and deliver aerospace and medical flight hardware along with industry expertise in developing certification and validation processes and procedures. ZIN has recently initiated a foothold in additive manufacturing through IAMT, a wholly-owned DLMS company.

The Technology House (TTH) is a leading provider of product engineering, computer-aided design and manufacturing (CAD/CAM), product development, and rapid prototyping services, as well as production manufacturing of custom plastic, urethane, and metal mechanical components. TTH has been at the forefront of the additive manufacturing community since 1996. This integrated approach to design, prototyping, and production allows customers to bring their concept to the market faster and more cost-effectively than other pathways.

IAM Tech (iAMT) is one of the 1st high temperature Metals and Ceramics service providers in the nation, and has the ability to deliver from design to prototype to production.

The University of Akron (UA) a founding member of the National Additive Manufacturing Innovation Institute (NAMII), presently known as America Makes, a public-private partnership with members from industry, academia, government, and workforce development in Ohio, Pennsylvania and West Virginia. In addition, several engineering faculty are currently serving on the Advanced Manufacturing Partnership Steering Committee 2.0 (AMP 2.0), a working group of President Obama's Council of Advisors on Science and Technology (PCAST). In both of these roles, UA has access to a large network of information, partners, and resources in additive manufacturing technology.

Cuyahoga Community College (Tri-C) offers employee training programs, professional development, life-long learning opportunities, and community service programs. Tri-C workforce solutions are dedicated to enhancing economic growth and the quality of life in Northeast Ohio.

Management: The collaborators will establish and share, based on equity participation, a portion of daily management. They will be active participants in the development of new materials and processes based on their field of expertise.

Commercial Maturity of the Technology and Market Acceptance

The technology requested is relevant to the growth of the U.S. economy. DMLS processes have provided advanced materials research and development since 1989 and the emergence of this technology has begun to change the way industry views manufacturing. With the expiration of several key patents, the medical and aerospace industries have begun to adopt this technology to help develop new and innovative products. The freedom of design has never been greater. This technology will rapidly increase over the coming years, and can provide Ohio the opportunity to be the leader in advanced manufacturing within the United States.

Projected Impacts:

These impacts are projected following the acquisition of new equipment and facilities:

The team, with experience and certifications in production manufacturing across a number of industries, will develop agile manufacturing metrics and processes using the acquired equipment. No longer held to traditional manufacturability, the new equipment will help production adapt faster to customer's needs and help get products to market faster. The end result will be a new and efficient manufacturing industry in Ohio.

The Ohio medical device industry will be able to utilize additive and subtractive manufacturing in combination to help bring products to market faster and eliminate inefficient time spent on traditional manufacturing methods.

Aerospace engineers will be able to develop new products based on optimized design and new certified materials. Additive manufacturing, focusing on DMLS, allows development of lighter, more efficient designs and part, which in turn increases overall value. Designers can begin to eliminate the waste out of parts, as they don't have to design products for manufacturability.

Aerospace and medical companies can accelerate their product to market time with the development of specialty based powders for additive manufacturing processes. The components made with these processes will be production grade parts therefore eliminating the traditional route of manufacturing typically involving many steps in processing operations to a part.

The University of Akron Engineering Department will work with SAS and its collaborators with the DMLS process. The University of Akron will help with the definition, modeling, and simulation of the sintering process so that the metal parts can be certified as production parts.

The effect of this equipment will not only affect the medical and aerospace industries but all manufacturing industries that face challenges of bringing their product to market faster. This will help Ohio secure a stronghold on a process that can be utilized by any and all industries.

There will be a need for a skilled workforce to help operate and run the highly technical equipment. With the additional collaboration from Cuyahoga Community College, an aggressive apprenticeship program will enhance a stagnant manufacturing workforce through training in CAD and CAM software, computer hardware, and new advance manufacturing equipment and processes.

Sustainability

SAS and its team of collaborators will invest the required cash cost share in technology, marketing, knowledge and business development to ensure product development and marketability within the aerospace and medical industries. The team's established infrastructure and market positions—i.e., human resources, sales, project management, training, and aerospace/medical products—provide a sustainable set of factors that are key to successful growth. Focusing on development of materials specific to additive manufacturing for the innovation of new products, processes, and automation, while using the most advanced technology, will attain a level of world class manufacturing and increased market share in Ohio.