Small Business Innovation Research (SBIR) / Small Business Technology Transfer (STTR)

Innovation in Manufacturing Annual Report Fiscal Year 2017

Section 9(ss) of the Small Business Act, 15 U.S.C. § 638(ss) requires that the annual report contain information about Executive Order (E.O.) 13329. Pursuant to E.O. 13329, Agencies must give priority to small business concerns that participate in or conduct R/R&D "…relating to manufacturing processes, equipment and systems; or manufacturing workforce skills and protection." Each Agency includes in its Annual Report to the SBA a synopsis of its implementation of these requirements. Agencies utilized a variety of approaches in addressing the E.O. 13329 directive. For most, these requirements are assessed within the scope of each Agency's R/R&D needs with tangible numbers of solicitation topics, awards, and dollars. Mechanisms commonly used by Agencies to give priority to manufacturing-related work include: adding manufacturing-related topics in solicitations; requesting in solicitations that proposals address any possible manufacturing-related elements of the small businesses' proposed work, technological approach, delivery or resulting technological applicability to manufacturing processes; and, noting in solicitations that including such elements in proposals may provide a competitive advantage in the award selection process. Additionally, cross-Agency collaborations, targeted outreach efforts, and other Agency-specific activities related to manufacturing contribute to addressing the objectives of E.O. 13329.

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Agency Compliance with E.O. 13329 Encouraging Innovation in Manufacturing

Section 9(ss) of the Small Business Act, 15 U.S.C. § 638(ss) requires that the annual report contain the following information about Executive Order (E.O.) 13329:

(1) A description of efforts undertaken by the head of the Federal agency to enhance United States manufacturing activities
(2) A comprehensive description of the actions undertaken each year by the head of the Federal agency in carrying out the SBIR or STTR program of the agency in support of Executive Order 13329 [note to this section] (69 Fed. Reg. 9181; relating to encouraging innovation in manufacturing)
(3) An assessment of the effectiveness of the actions described in paragraph (2) at enhancing the research and development of United States manufacturing technologies and processes
(4) A description of efforts by vendors selected to provide discretionary technical assistance under subsection (q)(1) to help SBIR and STTR concerns manufacture in the United States; and
(5) Recommendations that the program managers of the SBIR or STTR program of the agency consider appropriate for additional actions to increase the effectiveness of enhancing manufacturing activities.

Pursuant to E.O. 13329, Agencies must give priority to small business concerns that participate in or conduct R/R&D "…relating to manufacturing processes, equipment and systems; or manufacturing workforce skills and protection." Each Agency includes in its Annual Report to the SBA a synopsis of its implementation of these requirements. Agencies utilized a variety of approaches in addressing the E.O. 13329 directive. For most, these requirements are assessed within the scope of each Agency's R/R&D needs with tangible numbers of solicitation topics, awards, and dollars. Mechanisms commonly used by Agencies to give priority to manufacturing-related work include: adding manufacturing-related topics in solicitations; requesting in solicitations that proposals address any possible manufacturing-related elements of the small businesses' proposed work, technological approach, delivery or resulting technological applicability to manufacturing processes; and, noting in solicitations that including such elements in proposals may provide a competitive advantage in the award selection process. Additionally, cross-Agency collaborations, targeted outreach efforts, and other Agency-specific activities related to manufacturing contributes to addressing the objectives of E.O. 13329. Detailed information on the individual Agencies' activities and initiatives is located at https://www.sbir.gov/annual-reports-files.

U.S. Department of Agriculture (USDA)

Outreach

The USDA National Institute of Food and Agriculture (NIFA) administers the USDA Small Business Innovation Research (SBIR) program.

The USDA SBIR program will work closely with the Small Business Administration (SBA) to ensure that upcoming National SBIR conferences highlight the importance of manufacturing to the U.S. economy. In addition, opportunities will be emphasized to submit appropriate R&D proposals to the different USDA SBIR topic areas that deal with manufacturing issues of significance to the mission of the USDA. A similar effort will be made to highlight this focus on manufacturing R&D in talks that are presented at the various State SBIR meetings.

Funding Opportunities

The USDA SBIR program issues a request for application or program solicitation each fiscal year that lists 10 broad topic areas that encompass the full range of research and development priorities for USDA. From the beginning of the USDA SBIR program, topic areas have been discipline-specific, not technology specific. The 10 topic areas contained in the program solicitation are; Forests and Related Resources; Plant Production and Protection – Biology; Animal Production and Protection; Air, Water and Soils; Food Science and Nutrition; Rural and Community Development; Aquaculture; Biofuels and Biobased Products; Small and Mid-Size Farms; and Plant Production and Protection – Engineering. Technology-specific topics such as nanotechnology, biotechnology, information technology, or manufacturing technology are not listed separately, but may be submitted to one of the ten topic areas. Numerous projects in all of these technology areas have been supported and will continue to be supported.

The USDA SBIR Phase I and II Program Solicitation contains a statement that encourages applicants to include Agriculturally – Related manufacturing technology as an area of focus. The inclusion of this statement has resulted in an increase of applications that deal with manufacturing issues that are relevant to the USDA mission and the SBIR topic area.

Award Selection

The USDA SBIR external review panels will be instructed to consider the existence of manufacturing-related proposals as a tie breaker during the evaluation process. When two proposals are considered approximately equal in merit and one proposal has a focus on manufacturing, that proposal will be given priority in both the Phase I and Phase II selection process.

Reporting

As required by the SBIR Policy Directive, the USDA SBIR program will provide manufacturing-related SBIR data in the annual report that is due to SBA by March 15th of each year.

Future Years

USDA SBIR staff will coordinate with SBA and if there are any additional requirements, the USDA will update this plan to accommodate the changes.

Department of Commerce (DOC)

NIST

The NIST SBIR program supports manufacturing-related research projects through its solicitations and awards. In NIST's FY 2017 annual solicitation, 25% of the subtopics were related to manufacturing. NIST made four Phase I and seven Phase II awards that involve manufacturing.

The solicitation included a notice describing Executive Order (EO) 13329 and encouraged innovation in manufacturing by giving high priority, where feasible, to projects beneficial to the manufacturing sector. A Manufacturing-related R&D Emphasis in SBIR web page is available. The NIST SBIR Program Office provides proposer contact and project information to NIST's Manufacturing Extension Partnership (MEP) as authorized by applicants.

NOAA

Like NIST, the NOAA SBIR program supports manufacturing-related research projects through its solicitations and awards. In FY 2017, roughly 10 out of the 19 Phase I awardees provided projects (or some component) related to manufacturing. In addition, the FY2017 SBIR Phase I Solicitation included a notice describing Executive Order (EO) 13329 and encouraged innovation in manufacturing by giving high priority, where feasible, to projects beneficial to the manufacturing sector. Lastly, in order to promote manufacturing in SBIR projects, NOAA utilizes them as tie-breakers during the evaluation of proposal. Per the FY2017 SBIR Phase I Solicitation (Page 40, Section 4.3),"*In the event of a "tie" between proposals, manufacturing-related projects as well as those regarding energy efficiency and renewable energy systems will receive priority in the award selection process."*

Department of Defense (DoD)

Manufacturing Related SBIR/STTR Awards FY17				
Agency	**Dollar Amount Phase I**	**Number of Awards Phase I**	**Dollar Amount Phase II**	**Number of Awards Phase II**
Air Force	$9,968,825	67	$47,792,204	50
Army	$6,739,823	54	$21,656,209	32
CBD	$2,542,926	3	$0	0
DARPA	$5,984,882	38	$34,615,096	25
DHP	$749,718	5	$4,949,634	5
DLA	$2,677,954	23	$12,825,334	13
DTRA	$1,354,210	9	$3,964,646	4
MDA	$3,208,438	29	$20,454,757	20
Navy	$10,474,207	86	$50,620,929	71
OSD	-	-	-	-
SOCOM	$2,516,929	17	$13,037,251	11
DoD TOTAL	**$44,423,483**	**333**	**$212,458,986**	**234**

Innovation in manufacturing, through small businesses, is the key to improving the United States economy. This is why, on February 26, 2004, President George W. Bush enacted Executive Order (EO) 13329, to ensure that Federal agencies properly and effectively assist the private sector in its manufacturing innovation so as to sustain a strong manufacturing sector. EO guidelines state that all government agencies with one or more Small Business Innovation Research (SBIR) programs or one or more Small Business Technology Transfer (STTR) programs give high priority to manufacturing related research and development (R&D) processes, systems, and workforce protection. This includes manufacturing processes, equipment and systems; or manufacturing workforce skills and protection. The DoD SBIR/STTR program has worked to integrate manufacturing related projects into their program since EO 13329 was signed. In the pages that follow please find a full report of the DoD's findings of the implementation of EO13329 across participating DoD components.

Procedures and Mechanisms Used to Give Priority to Manufacturing Related Projects

DoD SBIR/STTR releases three solicitations per year; included in these solicitations are topics related to and promoting manufacturing technology. Some examples of

promoting manufacturing related projects by participating DoD components are as follows:

a. The Air Force identifies manufacturing technology as a tie-breaker in solicitations, stating the Air Force will evaluate proposals in descending order of importance with technical merit being most important, followed by the Commercialization Plan, and then qualifications of the principal investigator (and team) and that, where technical evaluations are essentially equal in merit, and the cost and/or price is a substantial factor, then cost to the Government will be considered in determining the successful offeror. The next tie-breaker on essentially equal proposals will be the inclusion of manufacturing technology considerations.

b. The Army collaborates with the U.S. Army Manufacturing Technology (ManTech) Program to integrate and align SBIR efforts directly into ManTech projects. The ManTech Program Management Office (PMO) reviews, evaluates and endorses manufacturing-related topics for manufacturing-relatedness against the following five categories:

1. Core Manufacturing Innovation Topic.
2. Addresses manufacturing process, technique or innovation.
3. Addresses manufacturing development, application, and tools used in advanced processes.
4. Targets manufacturing manufactures for related equipment, systems or production lines.
5. Addresses the affordability, and reproducibility of demonstrated technology.

c. Of specific concern to the Chemical and Biological Defense Program is unit cost of technologies having the potential for distribution to individual Warfighters. Therefore, SBIR topics that address the affordability, producibility, or manufacturing of an innovative technology are of particular importance and given greater priority for inclusion into future SBIR solicitations. CBD SBIR topics are assigned to one of the following seven categories:

1. Research for a process or product that has significant manufacturing implications, although not the sole purpose of the topic.

2. Topic addresses the development or application of advanced technologies for manufacturing processes, tools, and equipment.

3. Topic includes manufacturing issues associated with technology under development.

4. Research Topic that has Product or System Focus, Addressing Manufacturing Aspects of that Product.

5. Primary objective of topic is to develop a system or weapon-specific capability.

6. Manufacturing, producibility, cost and yield are referenced but not the primary objective of the task.

7. Manufacturing-related activities may be part of Phase II.

d. DARPA leverages their Open Manufacturing program to solve this problem by building and demonstrating rapid qualification technologies that comprehensively capture, analyze and control variability in the manufacturing process to predict the properties of resulting products. Success could help unleash the potential time- and cost-saving benefits of advanced manufacturing methods for a broad range of defense and national security needs.

e. DLA seeks drastically lower unit costs of discrete-parts support through manufacturing revolutions that also have applicability to low and high volume production from commercial sales. This will result in an improvement in the affordability of these innovations to DLA and its customers and the development of cost effective methods to sustain existing defense systems while potentially impacting the next generation of defense systems.

Actions Taken Toward Promoting and Supporting Manufacturing-Related Research Projects

DoD continues to take an active approach to promoting and supporting manufacturing-related research projects. This is done through attending outreach event, collaborations with various organizations and offices such as ManTech, etc. Some examples of this promotion are:

a. The Army and Air Force SBIR/STTR programs publish and advertise success stories for outstanding manufacturing related projects. These websites bring together the small business communities, component researchers, Program of Record, prime contractors, and the ManTech community for possible collaboration on new and ongoing SBIR/STTR projects.

b. Transition assistance is offered by various DoD components in support of their manufacturing related projects. Army SBIR/STTR employs transition assistance to firms whose proposals have met and/or exceeded all Army SBIR criteria. Transition assistance is available through Phase II Commercialization Readiness Program (CRP). Similarly, the DARPA Small Business Programs Office has contracted with Strategic Analysis, Inc. Technology Transition and Commercialization team (T2C Team) to implement the Transition and Commercialization Support Program (TCSP). The T2C Team is providing high level review companies' transition and commercialization strategy, transition and commercialization strategy, transition and commercialization planning support, identification and introduction to potential collaborators, potential partners and potential sources of Phase III funding, and identification of thought leadership opportunities.

c. Several components, including Army, OSD, DLA, work closely to incorporate the ManTech program during topic writing and Phase I and Phase II source selection processes.

d. DoD Components regularly participate in manufacturing related conferences including: Beyond Phase II, Defense Manufacturing Conference (DMC), and Nanotechnology for Defense (NT4D). During these conferences one-on-one discussions were conducted between SBIR program personnel and small business representatives to investigate application of their technologies to the mission and requirements of the DoD community.

e. Almost the entire DoD community promotes EO 13329 through posting various links to manufacturing related documents and websites including:

1. The Department of Commerce (DOC) "Manufacturing in America" article.
2. Establishing a link to EO13329 on their respective SBIR/STTR public website.

An Assessment of the Effectiveness of the Actions Taken at Enhancing the R&D of U.S. Manufacturing Technologies and Processes

The DoD is extremely interested in continuing to improve the effectiveness of the R&D of U.S. manufacturing technologies and processes. DoD SBIR/STTR programs are a few of the ways in which the R&D of U.S. manufacturing technologies and processes are successfully enhanced as it represents a direct investment in the development of this essential focus area. Through the advancement of grand ideas, innovative technologies and processes that would never before have been nurtured are discovered and developed, improving U.S. manufacturing's standing throughout the world.

Much of the DoD community conducts internal evaluation to assure topics are apportioned to manufacturing innovation. For example, MDA continues to experience success in soliciting manufacturing technology proposals. MDA's primary focus has been on improved manufacturing of structural components of missiles, manufacturing of light-weight batteries, and manufacturing of focal plane array sensor systems. All developed products are manufactured in the U.S.

Description of Efforts Undertaken by Vendors Selected to Provide Discretionary Technical Assistance to help SBIR/STTR Business Concerns Manufacture in the U.S.

When applicable DoD components makes use of the additional $5,000 dollars allotted per year to SBIR awardees for discretionary technical assistance through contractors with expertise in this area. This caveat can be found in the 2012 SBIR Policy Directive, Amendment III H. Section 9(c).

Recommendations from the Agency's SBIR and STTR Program Manager of Additional Actions to Increase Manufacturing Activities in the U.S.

The DoD recommends utilizing resources available to increase manufacturing activities in the U.S and encouraging organizations to focus on topics that will highlight manufacturing. Closer collaboration regarding topics at the very beginning stages of topic development should kindle an increase in the successful transition of future projects to the commercial market. Further, coordinating activities with manufacturing technology programs already existing within the Services, such as U.S. Army ManTech program must continue. ManTech focuses on transitioning projects from Phase II to Phase III, the ultimate goal of the SBIR program. Some additional component recommendations are as follows:

a. CBD SBIR recommends OSD Office of Small Business Programs continue to facilitate a relationship between SBIR/STTR and the Defense Manufacturing Conference; this is a synergist outreach event that will improve manufacturing opportunities between small businesses and industrial partners.

b. DLA SBIR suggests streamlining the contracting process to increase timely investment in U.S. manufacturing. Long procurement times negatively impact the small business concern's ability to form and maintain commercialization partnerships necessary for manufacturing invests to be successful. Consolidating contracting activities that can focus on understanding SBIR contract awards will expedite manufacturing based awards.

c. MDA states that the key to increasing manufacturing activities in the U.S. is worker productivity. Productivity must exceed the high financial liability of labor overhead to be successful. If we are to make a contribution in this area, some portion of the research budget must be set aside for component design simplification and process automation. Each worker must be empowered to produce products more economically and at a faster rate.

Further, simplified designs will enable faster and more reliable assembly techniques. Relevant systems must also rely on common components for common functions. This will increase the scale of production for individual parts and make manufacturing more economical.

d. Navy SBIR supports providing vendors with training on manufacturing risks and mitigation strategies.

U.S. Department of Education (ED)

The U.S. Department of Education (ED) operates its SBIR program at the Institute of Education Sciences (IES).

The ED SBIR Program uses a contracts mechanism to provide up to $1,050,000 in funding ($150,000 for Phase I; $900,000 for Phase II) to small business firms and partners for the research and development (R&D) of commercially viable education technology products for use by students and teachers in education and in special education settings.

Broadly speaking, ED's SBIR program is designed to support and encourage R&D in manufacturing through "environment or societal, and systems level technologies" (as defined by SBA, 2005). These projects encompass a range of manufacturing topics, such as artificial intelligence, information technology devices, software, systems, devices, and product design.

In 2017, attention was paid in identifying projects that were manufacturing-related. Of the 18 contracts awarded, many are conducting R&D of software and hardware components, which if feasible could potentially be manufactured and commercialized on a broader scale during Phase III of the SBIR program.

Examples of ED manufacturing-related SBIR/STTR projects

> With a 2015 Phase II award, Schell Games is developing Happy Atoms, a set of physical models paired with an iPad app to cover high school chemistry topics in atomic modeling. The modeling set (which is manufactured to bring the product to market) includes individual plastic balls representing the elements of the periodic table. Students use the iPad app to take a picture of models they create. Using computer-generated algorithms, the app then identifies the model and generates information about its physical and chemical properties and uses. The app also informs students if a model that is created does not exist. Happy Atoms replaces or supplement lesson plans to enhance chemistry teaching. The app includes teacher resources suggesting how to incorporate games and activities to reinforce lesson plans and learning. For more information, see: http://ies.ed.gov/funding/grantsearch/details.asp?ID=1598.

In FY2017, ED SBIR implemented the following procedures to give priority to manufacturing related projects:

1) Placed a notice in FY2017 SBIR program solicitations that details Executive Order 13329;
2) Placed a forced-choice question in the 2017 SBIR program solicitations for applicants to indicate (yes or no) whether their proposed project is "manufacturing-related;"
3) Placed language in the solicitation advising potential applicants that ED SBIR offices will give priority to manufacturing-related projects in the event of a tie in the award selection process. (Note: This "tie-breaker" specification allows the ED SBIR program to apply an additional preference without compromising the quality standards or established criteria of the program).

Specific actions ED has taken toward promoting and supporting manufacturing - related research projects

In FY2017, ED SBIR used the following procedures and mechanisms to promote and support Executive Order 13329:

1) Maintained the notice on the ED SBIR website that describes Executive Order 13329, provides a definition of manufacturing-related projects in education, and provides a web-link to the Executive Order;
2) Continued tracking and reporting success stories demonstrating the impact of the SBIR program on manufacturing;
3) Placed a notice in FY2016 SBIR program solicitations on manufacturing;
4) ED SBIR will continue to discuss how to best implement Executive Order 13329 related to manufacturing.

Department of Energy (DOE)

Department of Energy (DOE) has an Advanced Manufacturing Office within the Office of Energy Efficiency and Renewable energy that is specifically focused on reducing the energy consumed in manufacturing industries. Additional manufacturing related projects may be found throughout DOE's R&D programs. More information about the Advanced Manufacturing Office can be found here: https://energy.gov/eere/office-energy-efficiency-renewable-energy

Examples of DOE manufacturing-related SBIR/STTR projects

The U.S. Department of Energy funds the research, development, and demonstration of highly efficient and innovative manufacturing technologies. The Energy Department has supported the development of more than 250 energy-saving industrial technologies that have been commercialized since 1976. The Department is also working to create a network of Manufacturing Innovation Institutes, each of which will create collaborative communities to target a unique technology in advanced manufacturing. The Department's industrial technical assistance efforts are critical to the deployment of existing and future advanced energy efficiency technologies, as well as energy management solutions. This part of the program has delivered technical assistance to thousands of industrial plants, saved industry billions of dollars and cut carbon emissions by millions of tons. With diverse partners, the Department leverages state, utility, and local resources to help manufacturers save energy, reduce climate and environmental impacts, enhance workforce development, and improve national energy security and competitiveness throughout the supply chain.

The Advanced Manufacturing Office (AMO) partners with industry, small business, universities, and other stakeholders to identify and invest in emerging technologies with the potential to create high-quality U.S. manufacturing jobs, enhance global competitiveness, and reduce energy use by encouraging a culture of continuous improvement in corporate energy management.

Investments in Advanced Manufacturing

***Projects**:* R&D that has high impact, uses project diversity to spread risk, targets nationally important innovation at critical decision points, and contributes to quantifiable energy savings.

***Facilities**:* Collaborative manufacturing communities with a shared infrastructure that enable the development and demonstration of advanced manufacturing technologies, provide timely and affordable access at all levels of the manufacturing supply chain, and assist in networking technology experts with established materials and equipment suppliers to help speed the rate of innovation.

***Technical Assistance**:* Driving a culture of continuous improvement in corporate energy management to reduce industrial energy use and encourage wide-scale adoption of technologies such as combined heat and power.

Manufacturing Topics for FY 2017

Below we list the manufacturing topics and subtopics for our two Phase I Funding Opportunity Announcements issued in FY 2017. After each topic title, the DOE program office sponsoring the topic is listed in parentheses.

Phase I Release 1

2. INCREASING ADOPTION OF HPC MODELING AND SIMULATION IN THE ADVANCED MANUFACTURING AND ENGINEERING INDUSTRIES (Office of Advanced Scientific Computing Research)
a. Turnkey HPC Solutions for Manufacturing and Engineering
b. Hardening of R&D Code or Software tools for Industry Use
c. Other
24. NUCLEAR PHYSICS ELECTRONICS DESIGN AND FABRICATION (Office of Nuclear Energy)
e. Manufacturing and Advanced Interconnection Techniques

Phase I Release 2

8. ADVANCED MANUFACTURING (Advanced Manufacturing Office, Office of Energy Efficiency and Renewable Energy)
a. Surface Compatibility of Cellulosic Nanomaterial in Hydrophobic Matrix Materials
b. Intelligent Systems for Materials Discovery
c. Atomically Precise Structures and Devices for Catalysis
18. ADVANCED MANUFACTURING FOR FOSSIL ENERGY TECHNOLOGIES (Office of Fossil Energy)
a. Additive Manufacturing of Extreme Environment Materials for Large Parts
b. Additive Manufacturing for a Complete Solid Oxide Fuel Cell (SOFC)
c. Other (Advanced Manufacturing)
28. HIGH ENERGY PHYSICS DETECTORS AND INSTRUMENTATION (Office of High Energy Physics)
k. Additive Manufacturing
29. ADVANCED TECHNOLOGIES FOR NUCLEAR ENERGY (Office of Nuclear Physics)
g. Advanced Methods for Manufacturing

Environmental Protection Agency (EPA)

Environmental Protection Agency (EPA) submitted its EO 13329 Action Plan to SBA on July 1, 2004 and its first report on March 14, 2005.

Manufacturing-related research and development (R&D) encompasses improvements in existing methods or processes, or wholly new processes, machines or systems. Manufacturing innovation is fostered by research and development of technologies that are aimed at increasing the competitive capability of manufacturing concerns. Four main areas include: (1) Unit process level technologies that create or improve manufacturing processes; (2) Machine level technologies that create or improve manufacturing equipment; (3) Systems level technologies for innovation in the manufacturing enterprise; and (4) Environment or societal level technologies that improve workforce abilities and manufacturing competitiveness.

Examples of Manufacturing-related SBIR Projects

In FY 2017, EPA awarded 16 new SBIR Phase I projects and 6 new Phase II projects. Five Phase I awards and one Phase II award are manufacturing-related awards under E.O. 13329. These awards are for development of plastics to eliminate the use of one or more toxic chemicals in the manufacturing process, reduce the amount of energy used to carry out the manufacturing process, and/or to eliminate one or more toxic pollutants that currently result from the manufacturing process.

The **FY 2017 Phase I awards** related to innovation in manufacturing were:

Contract #	Company	Project Title
EPD17036	**ZILA Works,** Renton, WA	Novel Hempstead Oil-Based Bio-epoxy for the Manufacturing of Sporting Goods
EPD17037	**Instrumental Polymer Technologies, LLC**, Westlake Village, CA	A Green and Unique Thermosetting-Thermoplastic Polycarbonate
EPD17040	**Oceanit Laboratories,** Inc., Honolulu, HI	In-Situ Applied Omniphobic Coatings for Water Pipeline Repair and Retrofitting
EPD17043	**Ecovative Design, LLC**, Green Island, NY	Growth and Fungal Resin Generation for Manufacturing Novel, Formaldehyde-Free Wood Particleboard
EPD17044	**Metna Co.,** Langsing, MI	Zero-Emission Reconstituted Wood Panels for Building Interiors

The **FY 2017 Phase II awards** related to innovation in manufacturing were:

Contract #	Company	Project Title
EPD18008	**Microvi Biotech Inc.**, Hayward, CA	High-Efficiency Nutrient Removal and Recovery for Achieving Low Regulatory Limits

Procedures/Mechanisms Used to Give Priority to Manufacturing-related SBIR Projects

The EPA SBIR Program continues to make manufacturing a priority in its annual solicitations. Manufacturing is very important to the EPA's mission of protecting human health and the environment as it can impact many areas that have large environmental impact including water and energy use,

toxicity, pollution, waste disposal, etc. The EPA considers all of these impacts when evaluating proposals for selection.

SBIR program solicitation includes a “Manufacturing” topic shown below:

Manufacturing

Executive Order 13329 directs the EPA to properly and effectively assist the private sector in its manufacturing innovation in order to sustain a strong manufacturing sector in the U.S. economy. These innovations often involve engineering and technical solutions that make the manufacturing operation and/or the manufactured product both more environmentally and economically sound.

The EPA is seeking the development and commercialization of innovative technologies that, when compared with currently available technologies, have dramatically better performance, decreased cost of production, and reduced environmental impacts in both production and use.

The production, use, recycle/reuse, and disposal of plastic materials and products pose significant environmental and human health problems. The EPA is seeking innovative greener manufacturing of plastics and greener plastic materials and products.

These considerable improvements should result in the following:

Greener Plastics

Topic Code 2A: Greener Manufacturing of Plastics. Develop for a specific plastic or family of plastics that has significant negative public health and environmental impacts an improved manufacturing process that

(a) eliminates the use of one or more toxic chemicals in the process, (b) greatly reduces the amount of energy used to carry out the process, and/or (c) eliminates one or more toxic pollutants that currently result from the process. Comparison with the currently used manufacturing process and assessing the overall life cycle of the plastic(s) are integral to this topic.

Topic Code 2B: Greener Plastic Materials and Products. Develop for a specific plastic or family of plastics that has significant negative public health and environmental impacts alternative materials and products that (a) do not emit toxic fumes, (b) are not toxic if ingested, (c) rapidly biodegrade in soil and water, and/or (d) are easily recycled and reused. Comparison with the performance and cost of the currently-used plastic materials and products and assessing their overall life cycle are integral to this topic.

Toxic Chemicals

Cleaner Manufacturing of Dyes, Paints and Inks

Polychlorinated biphenyls (PCBs) have extreme environmental persistence, the ability to bioaccumulate, and adverse human health effects (https://www.epa.gov/pcbs). They were used as insulation fluids in electrical transformers and generators, as fluorescent lamp ballast, and in caulk. In 1979 the US banned their production under the Toxic Substances Control Act (TSCA).

PCBs continue to be generated and released into the environment as the unintended by-products of the manufacturing of certain dyes, paints, and inks (http://ehp.niehs.nih.gov/121-a86/).

Studies have detected these PCBs in waterways across the U.S. and attribute their presence to this manufacturing by-product. This pollution source is causing water impairment and resulting in challenges to states and other entities in meeting water quality standards.

The EPA would like to see the development and use of dye, paint, and ink manufacturing processes that do not produce PCBs, as follows.

Topic Code 3A: Cleaner Manufacturing Processes for Dyes, Paints, and Inks. Develop cleaner manufacturing processes for dyes, paints, and inks that do not create unintentional undesirable by-products including PCBs. These proposed processes should also consider other lifecycle impacts of their manufacturing process including toxicity of feedstocks, energy consumption/carbon emissions, and end of life, etc.

Understanding the Chemical Composition of Consumer Products

Understanding human exposure to chemicals is central to EPA's mission of protecting human health and the environment, but the lack of information on chemical safety remains an issue (https://www.epa.gov/chemical-research). In particular, there is a lack of information on exposure to toxic chemicals used in consumer products. This information gap could potentially be addressed through a citizen science approach by helping consumers understand and be aware of the toxic chemicals in the products they consider purchasing and to consider that information in their buying decisions. In order to increase awareness of human exposure to chemicals in consumer products, EPA is looking for:

Topic Code 3B: Novel Technologies to Help Consumers Understand the Chemical Composition of Consumer Products. Development of technologies that could scan product Universal Product Codes (UPC) codes to inform users of what chemicals are in the products that are of interest to health reasons (e.g., allergens such as nuts or chemicals of concern such as food dyes or Bisphenol A (BPA)). The technology could also indicate whether the products fall into certain categories (e.g., "organic" or "safer choice" https://www.epa.gov/saferchoice). The technology could calculate daily exposure based on typical product usage and other information of value to the consumer. The technology should be geared toward priority chemicals of interest to the EPA, which include endocrine disrupting compounds and phthalates. It should also address commercial sectors of interest to EPA, including consumer care products, cleaning products, and food and beverages.

Outreach to promote Executive Order awareness

EPA's SBIR Program has emphasized manufacturing-related topics and priorities at National, regional and state SBIR conferences and webinars. Emphasis has been placed on opportunities for businesses to submit new critical manufacturing technologies that improve both the process efficiency and the environmental impact of the technology. Many of EPA's success stories have been in the area of manufacturing (including multiple Tibbetts awards) and EPA frequently publishes these success stories and other communications pieces on its SBIR website, www.epa.gov/sbir.

Department of Homeland Security (DHS)

The joint DHS FY2017 SBIR solicitation encouraged innovation in manufacturing-related research and development through applicable topics which sought advanced processing, manufacturing processes, equipment and systems, or manufacturing workforce skills and protection. In FY2017, 56 proposals were received in response to the joint DHS SBIR Phase I solicitation. Of these, 15 proposals that were self-identified as being manufacturing related. These 15 proposals were submitted in two of the S&T Directorate topic areas:

Topic Number	Topic Title
H-SB016.1-005	Blockchain Applications for Homeland Security Missions
H-SB017.1-006	Wearable Chemical Sensor Badge

and two of the DNDO Directorate topic areas:

Topic Number	Topic Title
H-SB017.1-008	Accelerated Crystal-Size Scale-Up Development of Thallium-based, High Efficiency, Dual or Tri-Mode Elpasolite Scintillator
H-SB017.1-009	Unattended Radiation Detection System

S&T Directorate SBIR Program:

Of the 9 Phase I proposals submitted to the S&T Directorate's FY2017 SBIR topic areas that self-certified that the efforts were manufacturing related, four contracts were awarded. The contracts were awarded in the following topic area:

Topic Number	Contract Number	Company
Topic 006	HSHQDC-17-C-00043	Design West
Topic 006	HSHQDC-17-C-00042	Morphix Technologies
Topic 006	HSHQDC-17-C-00030	Platypus Technologies
Topic 006	HSHQDC-17-C-00031	TDA Research

DNDO SBIR Program:

Of the 6 Phase I proposals submitted to DNDO's FY2017 SBIR topic area that self-certified that the efforts were manufacturing related, one Phase I contract was awarded under Topic 009:
HSHQDN-17-C-00002 - BlueEyeQ:

Topic Number	Contract Number	Company
Topic 009	HSHQDN-17-C-00002	BlueEyeQ

Department of Human and Health Services (HHS)

Following are examples of projects funded in FY2017 that illustrate the beneficial impact that the Department of Human and Health Services (HHS) SBIR/STTR programs have on U.S. manufacturing.

Examples of HHS manufacturing-related SBIR/STTR projects

Visus Technology, Inc.
241 A Street, Suite 300
Boston, MA 02210
Phone: 1 (781) 313-3424
Web Site: www.visustech.com

Project Title: Indoor Route Modeling and Guidance Method for Visually Impaired Wayfinding
Related Award: 1 R43 EY026837-01A1

Technology Developed: In Latin, the word "visus" (pronounced vy-soos) means "the power of sight." Visus Technology, Inc., was founded for the purpose of developing integrated solutions to improve the quality of life for people with all levels of visual impairment. With this in mind, we have developed VelaSense® – a novel software system that eliminates the need for separate devices for reading, socializing, identifying unfamiliar objects, or navigating outdoor or indoor environments. We envision our revolutionary software solution as also being of benefit to people who have cognitive impairments like dyslexia, Alzheimer's disease and other processing disorders, people with motor control deficits, vestibular and other balance disorders, and even sighted individuals for visual enhancement and guidance technologies. In the United States alone, over 15,000,000 people have vision loss ranging from mild to moderate to complete blindness. This means that a significant number of American citizens require assistance of one sort or another in order to be able to fully participate in activities that the rest of us simply take for granted.

Sample6 Technologies, Inc.
The Yard, Suite 6001
120 St. James Avenue, Floor 6
Boston, MA 02116
Phone: 1 (844) 726-7536
Web Site: http://www.sample6.com

Project Title: Adaptation of an Enrichment-Free Listeria Diagnostic to Food Matrices
Related Award: 2 R44 AI131952-02

Technology Developed: Our mission is to bring food safety into the 21st century. We do this through two complementary approaches: Firstly, we aim to be the central hub for all food safety-¬related data and value¬-added analytics; secondly, we aim to establish the world's fastest pathogen testing method for both on-¬ and off-¬site use.

Chimera BioTechnology, Inc.
28761 Via Buena Vista
San Juan Capistrano, CA 92675

Phone: 1 (949) 370-2477
Web Site: www.chimerabiotech.com

Project Title: Chimeric FVIIA
Related Award: 1 R43 HL127753-01

Technology Developed: Chimera BioTechnology is a development stage company advancing a novel hemostatic agent to treat surgical- and trauma-related bleeding. By eliminating the binding to blood components that can promote thrombosis, our proprietary agent is envisioned to address the unmet medical need for a safe hemostatic agent that can be administered intravenously early in the treatment of a wide variety of uncontrolled surgical- and trauma-related bleeding events to prevent life-threatening blood loss and improve clinical outcomes. Our mission is to enable treatment options for managing uncontrollable surgical- and trauma-related blood loss to improve clinical outcomes.

Procedures and mechanisms HHS has used to date to give priority to manufacturing-related projects

HHS SBIR/STTR announcements encourage development of new technologies as well as application of existing technologies. When appropriate, plans for manufacturing and clinical evaluation of developed technologies, drugs, devices and innovative approaches should be included in the application.

a) HHS released in the ***NIH Guide for Grants and Contracts*** several funding opportunity announcements (FOA) for manufacturing-related research:

NIH Funding Opportunity Announcement (FOA):

SBIR Phase IIB Bridge Awards to Accelerate the Development of Cancer Therapeutics, Imaging Technologies, Interventional Devices, Diagnostics, and Prognostics Toward Commercialization (R44)

http://grants.nih.gov/grants/guide/rfa-files/RFA-CA-16-008.html

This solicitation includes broad topic areas for HHS that is considered relevant to manufacturing-related R&D. Additional solicitations were issued as noted below:

Announcement Number	Title
PA-17-067	Tools for Clinical Care and Management of Alzheimer's Disease (AD) and its Comorbidities (R43/R44)
PA-17-147	Development of Highly Innovative Tools and Technology for Analysis of Single Cells (R43/R44)
PAR-17-199	Development of Appropriate Pediatric Formulations and Pediatric Drug Delivery Systems (R43)

b) Manufacturing-related SBIR/STTR research projects funded in FY 2017 awards (422 records) that were made in response to these solicitations and in response to the Omnibus SBIR/STTR Program Solicitations are appended to this report.

January 2017 SBIR/STTR Program Solicitations - Included within an IC's topic listings, topic areas specific to manufacturing-related areas in the PHS Omnibus Solicitation of the NIH, CDC, and FDA SBIR/STTR Grant Solicitation.

Specific actions HHS has taken toward promoting and supporting manufacturing - related research projects

HHS has focused on the following procedures and mechanisms to give priority to manufacturing-related SBIR/STTR projects.

- **Ongoing**: Outreach to raise awareness of **Executive Order 13329** to the small business research community - Ongoing as part of presentations to small business applicants across the United States.

- **Ongoing**: Promoting the manufacturing initiative through conferences, road tours, meetings, and website notices.

- **Ongoing**: Tracking and reporting success stories on the NIH SBIR/STTR Program website https://sbir.nih.gov/ that show the impact of the SBIR/STTR program on manufacturing. See *SBIR and STTR Success Stories*.

National Aeronautics and Space Administration (NASA)

National Aeronautics and Space Administration's (NASA) SBIR/STTR commitment to American manufacturing is demonstrated to be both ongoing and significant, and is expected to continue in the future. The programs support the research and technology needs of the Agency's Mission Directorates – Science, Human Exploration and Operation, Aeronautics Research, and Space Technology. These needs include searching for novel concepts and advanced capabilities at ever improving levels of efficiency.

SBIR/STTR Manufacturing Related Project Examples

New topics in NASA's solicitation for Phase I awards in FY 2017 that have future application to NASA' s mission needs, but also call out the need for advanced manufacturing related technology (including the development and production of new materials) included:

Topic Number	Topic Title
A1.01	Structural Efficiency-Tailored Airframe & Structures
A1.03	Low Emissions Propulsion and Power-Turboelectric and Hybrid Electric Aircraft Propulsion
A1.04	Aerodynamic Efficiency-Active Flow Control Actuators and Design Tools
A1.07	Propulsion Efficiency-Propulsion Materials and Structures
H10.01	Advanced Propulsion Systems Ground Test Technology
H10.03	Cryogenic Purge Gas Recovery and Reclamation
H3.04	Logistics Reduction
H4.02	Small, Accurate Oxygen Compatible Gas Flow Meter for Suit Operations
H4.03	Sensors to Measure Space Suit Interactions with the Human Body
H5.01	Mars Surface Solar Array Structures
H5.02	Hot Structure Entry Control Surface Technology
H7.01	In-Space Manufacturing of Electronics and Avionics
H7.02	In-Space Manufacturing of Precision Parts
H9.01	Long Range Optical Telecommunications
H9.02	Intelligent Communication Systems
H9.04	Advanced RF Communications
H9.05	Transformational/Over-the-Horizon Communications Technology
S1.01	Lidar Remote Sensing Technologies
S1.02	Technologies for Active Microwave Remote Sensing
S1.03	Technologies for Passive Microwave Remote Sensing
S1.04	Sensor and Detector Technology for Visible, IR, Far IR and Submillimeter
S1.05	Detector Technologies for UV, X-Ray, Gamma-Ray and Cosmic-Ray Instruments
S1.06	Particles and Field Sensors and Instrument Enabling Technologies
S1.07	In Situ Instruments/Technologies for Planetary Science
S1.08	Surface & Sub-surface Measurement Systems
S1.09	Cryogenic Systems for Sensors and Detectors
S1.10	Atomic Interferometry
S1.11	In Situ Instruments/Technologies for Ocean Worlds Life Detection
S2.01	Proximity Glare Suppression for Astronomical Coronagraphy
S2.03	Advanced Optical Systems and Fabrication/Testing/Control Technologies for EUV/Optical and IR Telescope
S2.04	X-Ray Mirror Systems Technology, Coating Technology for X-Ray-UV-OIR, and Free-Form Optics

S3.02	Propulsion Systems for Robotic Science Missions
S3.04	Guidance, Navigation and Control
S3.06	Thermal Control Systems
S3.07	Slow and Fast Light
S3.08	Command, Data Handling, and Electronics
S4.04	Extreme Environments Technology
T1.01	Affordable Nano/Micro Launch Propulsion Stages
T11.02	Distributed Spacecraft Missions (DSM) Technology Framework
T12.01	Advanced Structural Health Monitoring
T12.02	Technologies to Enable Novel Composite Repair Methods
T12.03	Thin-Ply Composites Design Technology and Applications
T12.04	Experimental and Analytical Technologies for Additive Manufacturing
T13.01	Intelligent Sensor Systems
T4.02	Regolith Resources Robotics - R^3
T8.02	Photonic Integrated Circuits
Z1.01	High Power, High Voltage Electronics
Z10.02	Methane In-Space Propulsion
Z10.03	Nuclear Thermal Propulsion (NTP)
Z2.01	Thermal Management
Z3.01	In-Situ Sensing of Additive Manufacturing Processes for Safety-Critical Aerospace Applications
Z3.02	Advanced Metallic Materials and Processes Innovation
Z4.01	In-Space Structural Assembly and Construction
Z5.02	Robotic Systems - Mobility Subsystems
Z7.02	Deployable 3D Woven Thermal Protection Materials
Z7.03	Deployable Aerodynamic Decelerator Technology
Z8.01	Small Spacecraft Propulsion Systems
Z8.02	Small Spacecraft Communication Systems
Z8.04	Small Spacecraft Structures, Mechanisms, and Manufacturing
Z8.05	Small Spacecraft Avionics and Control
Z9.01	Small Launch Vehicle Technologies and Demonstrations

Full Descriptions of these subtopics can be found at:
https://sbir.nasa.gov/solicit/58007/detail?data=ch9&s=58000
https://sbir.nasa.gov/solicit/58007/detail?data=ch9&s=58001

Phase I awards associated with these subtopics are listed below:

Proposal Title	Contract#	Firm Name
+500C Hi-Rel Rad Hard, Rugged Modulator	NNX17CP32P	Chronos Technology (Div. of FMI, Inc.)
2 Micron Wavelength Coherent Universal LIDAR With Adjustable Resolution and Sensitivity	NNX17CL58P	Discovery Semiconductors, Inc.
3D Manufacturing of Integrated Heat Exchangers	NNX17CM46P	Polaronyx, Inc.
3D Nano-Epitaxial Lateral Overgrowth (nano-ELOG) of Large Area, Highly Efficient, and Flexible Multijunction Solar Cells for Space Applications	NNX17CC60P	MicroLink Devices, Inc.
3D Polar Woven Deployable Skirt with Integrally Woven Attachment Features	NNX17CA53P	T.E.A.M., Inc.

3D Printed Silicon Carbide Scalable to Meter-Class Segments for Far-Infrared Surveyor	NNX17CM29P	Goodman Technologies, LLC
A Flexible Cognitive Architecture for Space Exploration Agents	NNX17CA59P	TRACLabs, Inc.
Adaptive Laser Sintering System for In-Space Printed Electronics	NNX17CM41P	Optomec Design Co
Additive Manufactured Very Light Weight Diamond Turned Aspheric Mirror	NNX17CM27P	Dallas Optical Systems, Inc.
Additively Manufactured Bimetallic Combustion Chambers for Small Launch Vehicles	NNX17CM18P	Arctic Slope Technical Services
Additively Manufactured Multi-Material Insert	NNX17CL81P	Parabilis Space Technologies, Inc.
Additively Manufactured, Thermally Stable Telescope Mirror Substrates	NNX17CM17P	Arctic Slope Technical Services
Advanced Athermal Telescopes	NNX17CM60P	The Peregrine Falcon Corporation
Advanced Ignition System for Hybrid Rockets for Sample Return Missions	NNX17CP73P	Ultramet
Advanced Mars Water Acquisition System	NNX17CC70P	Pioneer Astronautics
Advanced Superconducting Rotors Coils for Turboelectric Aircraft Propulsion	NNX17CC50P	Hyper Tech Research, Inc.
Battery-Powered Process for Coating Telescope Mirrors in Space	NNX17CP75P	ZeCoat Corporation
Bifunctional Membrane for High Energy, Long Shelf Life Li-S Batteries	NNX17CC64P	Navitas Advanced Solutions Group, LLC
Ceramic-Metal Interfaces by Functional Grading	NNX17CC48P	Glacigen Materials, Inc.
Compact Integrated DBR Laser Source for Absorption Lidar Instruments	NNX17CL82P	Photodigm, Inc.
Controlled Stagnation Radiator	NNX17CJ27P	Paragon Space Development Corporation
Crystal Growth of New Radiation Detector Materials in Microgravity	NNX17CM50P	Radiation Monitoring Devices, Inc.
Damage Tolerant Composite Systems for Spacesuits	NNX17CJ22P	Maher & Associates, LLC
Deployable Ka/W Dual Band Cylindrical Parabolic Antenna Including Feed Support Structure	NNX17CP53P	MMA Design, LLC
Electromagnetic Characterization of Advanced Composites by Voxel-Based Inverse Methods	NNX17CL99P	Victor Technologies, LLC
Engineered Alloy Structures by Friction Stir Reaction Processing	NNX17CM62P	Transition45 Technologies, Inc.
Essential Silicon Carbide Based Integrated Circuits for Extreme Environments	NNX17CC31P	AYMACS, Inc.
Evaluation of Multifunctional Radiation Shielding Material Against Long Duration Space Environment - Utilization of MISSE-FF	NNX17CL63P	Geoplasma, LLC
Expandable Habitat Outfit Structures	NNX17CM42P	Paragon Space Development Corporation

Flexible High-Efficiency Solar Panels for SmallSats and CubeSats	NNX17CC61P	MicroLink Devices, Inc.
Flexible Polymer Sensor for Space Suits	NNX17CJ29P	Somatis Sensor Solutions
Flexible, Phase Change Fabric for Deployable Decelerators	NNX17CL87P	S. D. Miller and Associates, PLLC
Game-Changing Photovoltaic Flexible Blanket Solar Array Technology with Spectrolab Flexsheets	NNX17CC39P	Deployable Space Systems, Inc.
H2/He Separation System	NNX17CS16P	TDA Research, Inc.
High Capacity Multi-Stage Scroll Compressor for Mars Atmosphere Acquisition	NNX17CP22P	Air Squared, Inc.
High Power Ga2O3-Based Schottky Diode	NNX17CG70P	Structured Materials Industries, Inc.
High Response Control Valve	NNX17CJ37P	WASK Engineering, Inc.
High Watts Per Kilogram - Advanced Integration and Heat Management Solar Array Technology (HaWK-AIHM)	NNX17CM38P	MMA Design, LLC
Impact Resistant Composite Structures for Space Suit Applications	NNX17CJ17P	Composites Automation, LLC
In-Line Inspection of Additive Manufactured Parts Using Laser Ultrasonics	NNX17CM31P	Intelligent Optical Systems, Inc.
In-Situ Sensing of Additive Manufacturing Process for safety-Critical Aerospace Applications	NNX17CM15P	Alpha STAR Corp
Industrial Crystallization Facility for Nonlinear Optical Materials	NNX17CA37P	Made in Space, Inc.
InGaAs Photomultiplier Chip Photon Counting Array for 1550 nm Operation	NNX17CG49P	LightSpin Technologies, Inc.
Integrated Powerhead for Methane Propulsion Systems	NNX17CC82P	TGV Rockets, Inc.
Interchain Transesterification as a Solid-State Composite Welding Mechanism	NNX17CL40P	ATSP Innovations
ISRU CO2 Recovery	NNX17CC81P	TDA Research, Inc.
ISS Multi-Material Fabrication Laboratory using Ultrasonic Additive Manufacturing Technology	NNX17CM63P	Ultratech Machinery
Layer Topographic Mapping (LTM) for L-PBF Process	NNX17CM28P	Flightware, Inc.
Lightweight Electrical Power Cable Production	NNX17CC80P	Structured Materials Industries, Inc.
Low AC-Loss Superconducting Cable Technology for Electric Aircraft Propulsion	NNX17CC51P	Hyper Tech Research, Inc.
Low Cost Corrosion and Oxidation Resistant Coatings for Improved System Reliability	NNX17CC44P	Faraday Technology, Inc.
MakerSat	NNX17CA57P	Tethers Unlimited, Inc.
Manufacturing Decision Tree Model Optimization for Finishing Additive Manufactured Components	NNX17CP39P	Faraday Technology, Inc.

Manufacturing For Design of Titanium Alloys	NNX17CL98P	Transition45 Technologies, Inc.
Meso-Scale Ericsson Power Generation System	NNX17CC53P	Inventherm
Metal Advanced Manufacturing Bot-Assisted Assembly (MAMBA) Process	NNX17CM58P	Tethers Unlimited, Inc.
Miniaturized Spacecraft Platform for Command, Data Handling and Electronics	NNX17CG52P	Microelectronics Research Development Corporation
Mission-Enabling Photovoltaic Flexible Blanket Solar Array with SNC/SJ Surface Mount Technology	NNX17CC38P	Deployable Space Systems, Inc.
Model Inversion	NNX17CL94P	Texas Research Institute Austin, Inc.
Modeling and Controls for Synthetic Jet-Based Active Flow Control	NNX17CL28P	Actasys, Inc.
Modules and Software for Free-Flying Robots	NNX17CA29P	Energid Technologies
Monolithic Chip-Integrated Absorption Spectrometer from 3-5 microns	NNX17CA44P	Omega Optics, Inc.
Multifunctional Self-Aligning Reversible Joint using Space-Qualifiable Structural Fasteners	NNX17CL54P	Cornerstone Research Group, Inc.
Next-Generation Deformable Mirrors for Astronomical Coronagraphy by Utilizing PMN-PT Single Crystal Stack Actuators in integration with Driver ASIC	NNX17CP52P	Microscale, Inc.
Novel Sorbent to Remove Radioactive Halogens and Noble Gases from NTP Engine Exhaust	NNX17CS17P	TDA Research, Inc.
Novel Spider 3D Woven Seamless ADEPT Aero-Shell	NNX17CA19P	Bally Ribbon Mills
Novel, Functionally Graded PIP Coating System for Hot Structures	NNX17CL34P	Allcomp, Inc.
Polymer Coating-Based Contaminant Control/Elimination for Exo-S Starshade Probe	NNX17CP62P	Photonic Cleaning Technologies, LLC
Pre-Collimator Chemical Milling for X-ray Telescopes	NNX17CM37P	Mindrum Precision, Inc.
Quantum Effect Materials and Devices for Future Communication Systems	NNX17CC63P	Nanosonic, Inc.
Radiation Tolerant 35% Efficient Phosphide-Based 4-Junction Solar Cell with Epitaxial Lift-Off	NNX17CC59P	MicroLink Devices, Inc.
Rapid Fabrication of High Stability Optical Mirror Blanks	NNX17CM53P	Soter Technology, LLC
Regenerators for 10 Kelvin Cryocoolers	NNX17CP28P	Atlas Scientific
Reversible Adhesion Concept for In-Space Assembly	NNX17CL41P	ATSP Innovations
Robot Application Development Using a Library of Reactive Control Actions	NNX17CJ35P	TRACLabs, Inc.
Silica-Silica Mirror Substrate Fabrication Technology	NNX17CM35P	Mentis Sciences, Inc.
Silicon Carbide Gate Driver	NNX17CC84P	UNITED SILICON CARBIDE, INC.

Single-Process, Unitized, Composite Fuselage	NNX17CL53P	Cornerstone Research Group, Inc.
SmallSat Stirling Cryocooler for Earth Science and Interplanetary Exploration	NNX17CP74P	Wecoso, LLC
Software and Tools for Electronics Printing in Space(STEPS)	NNX17CM56P	Techshot, Inc.
Solid State Non-powder Process for Boron Nitride Nanotube Metal Matrix Composite	NNX17CL39P	ATS-MER, LLC
Solid State Oxygen Concentrator and Compressor	NNX17CJ31P	Sustainable Innovations, LLC
Space Flight of Ultra-Low Noise Quad Photoreceivers for Laser Interferometric Gravity Wave Detection	NNX17CL57P	Discovery Semiconductors, Inc.
Spacecraft Cabin Air CO2 Recovery	NNX17CM55P	TDA Research, Inc.
Technology Development for High-Actuator-Count MEMS DM Systems	NNX17CP76P	Boston Micromachines Corporation
The Automated X-Link for Orbital Networking (AXON) Connector	NNX17CL91P	Tethers Unlimited, Inc.
The Vulcan Advanced Hybrid Manufacturing System	NNX17CM34P	Made in Space, Inc.
Thermal Insulator for a Venus Lander	NNX17CP69P	TDA Research, Inc.
Thermoplastic Forming of Bulk Metallic Glasses for Precision Robotics Components	NNX17CP68P	Supercool Metals, LLC
Ultra-High Energy Density, High Power and High Efficiency Nanocomposite Capacitor for Aerospace Power System	NNX17CC72P	Powdermet, Inc.
Ultra-Lightweight MG Syntactic for Insulation in Extreme Environments	NNX17CP33P	Cornerstone Research Group, Inc.
Ultra-Narrow Bandpass Filters for Long Range Optical Telecommunications at 1064nm and 1550nm	NNX17CP58P	Omega Optical, Inc.
Wearable Personal Hydrazine Monitoring System	NNX17CJ36P	Warner Babcock Institute for Green Chemistry
Weaved Distributed Plastic Optical Fiber Sensor (DIFOS) SHM system	NNX17CP64P	Redondo Optics, Inc.

Phase II awards made in FY 2017 associated with subtopics solicited for Phase I in FY 2016 include:

Proposal Title	Contract#	Firm Name
Loop Heat Pipe Manufacturing via DMLS for CubeSAT Applications	NNX17CM09C	Advanced Cooling Technologies, Inc.
Empirical Optimization of Additive Manufacturing	80NSSC17C0018	Universal Technology Corporaration
Reclaimable Thermally Reversible Polymers for AM Feedstock	NNX17CL05C	Cornerstone Research Group, Inc.
NONA Repair of Composite Structures	80NSSC17C0031	Cornerstone Research Group, Inc.
Ultra-Compact Transmitter for Space-Based Lidar	80NSSC17C0029	Fibertek, Inc.

Integrated Optical Transmitter for Space Based Applications	80NSSC17C0036	Freedom Photonics, LLC
Integrated Sensors for the Evaluation of Structural Integrity of Inflatable Habitats	80NSSC17C0019	Nanosonic, Inc.
Novel Hybrid Propulsion System for Sample Return Missions	NNX17CP14C	Parabilis Space Technologies, Inc.
Fiber-Based Adsorbents Tailored for PLSS Ammonia and Formaldehyde Removal	NNX17CJ09C	Serionix
High Frequency Reflective Mesh for Small Aperture Antennas	NNX17CP01C	Tendeg, LLC
Metal Matrix Composite Enchanced Aluminum Structures	NNX17CL27C	Touchstone Research Laboratory, Ltd.
Bulk GaN Schottky Diodes for Millimeter Wave Frequency Multipliers	NNX17CP06C	White Light Power, Inc.

Specific actions NASA has taken toward promoting and supporting manufacturing - related research projects

In further support of manufacturing related efforts, NASA's Space Technology Mission Directorate (STMD) continues to invest in lower Technology Readiness Level (TRL) development of enhanced and novel manufacturing processes and tools. Manufacturing remains critical to all NASA missions and STMD utilizes the SBIR/STTR program as one mechanism in achieving manufacturing affordability for complex components for our missions as well as providing an avenue for small businesses to push the envelope in developing multifaceted and critical materials and manufacturing tools and processes.

By leveraging NASA's in-house capabilities, industry has the opportunity to develop and use facilities and expertise as testing grounds and pathfinders for many of NASA technological needs.

NASA's SBIR/STTR programs fulfill mandated requirements encouraging innovation in manufacturing. The annual Solicitations include the following text: This solicitation complies with Executive Order 13329 (issued February 26, 2004) directing Federal agencies that administer the SBIR and STTR programs to encourage innovation in manufacturing related research and development consistent with the objectives of each agency and to the extent permitted by law. In response to this Executive Order, NASA encourages the submission of applications that deal with some aspect of innovative manufacturing technology. If a proposal has a connection to manufacturing this should be indicated in the Part 5 (Related R/R&D) of the proposal and a brief explanation of how it is related to manufacturing should be provided.

National Science Foundation (NSF)

SBIR/STTR Manufacturing Related Project Examples

CycloPure, Inc.
701 GardenView Ct., Ste19
Encinitas, CA 92024-2464
Award Title or Description: SBIR Phase I: Porous Cyclodextrin Polymers: A Sustainable and Highly Effective Platform for Water Treatment

Abstract at Time of Award
The broader impact/commercial potential of this Small Business Innovation Research (SBIR) project is to remove organic pollutants using newly developed adsorbent materials derived from cyclodextrins. The chemical contamination of water resources due to agricultural, industrial, and human activities is known to have adverse effects on the environment, especially aquatic ecosystems, and human health. Currently utilized adsorbents, particularly activated carbons, typically have limitations in removing micropollutants effectively at environmentally relevant concentrations, ranging from parts per trillion (ppt) to parts per billion (ppb). This project will focus on the fundamental development and manufacture of polymer adsorbents from building blocks derived from corn starch that rapidly sequester many pollutants more effectively than activated carbons. These polymers exhibit tiny pores and high surface areas, and are structurally programmable to target specific contaminants and separation challenges. Current water filtration systems found in homes, hospitals, industrial settings, and municipal wastewater treatment sites will benefit from these activities. This SBIR Phase I project will develop a sustainable materials solution to address the problem of emerging organic contaminants in water. Promising materials are derived from a cyclodextrin monomer and a crosslinker, which react to provide a rigid porous network. Materials derived from this approach remove contaminants from water more effectively than leading adsorbents, such as activated carbons. Previously, initial polymers were prepared at laboratory scales in relatively low yields. The objective of this proposal is to develop polymerization conditions that provide high yields and are amenable to large-scale manufacturing processes, while maintaining the pollutant removal performance of the polymer. This objective will require a systematic study of reaction conditions to minimize side reactions and maximize polymerization efficiency. Structural characterization using various spectroscopies and porosimetry will be used to evaluate the polymerization process as a function of the reaction conditions. The polymer's ability to bind pollutants will also ensure that improved yields still maintain performance. Determining the optimal polymerization conditions and processing protocols will be critical for validating the technical feasibility of the proposed porous cyclodextrin polymer and will also be criteria for the success of this SBIR Phase I project.

Computational Textiles, Inc.
54 Willow Ave
Little Compton, RI 02837-1532
Award Title or Description: SBIR Phase I: Weft: Simulation Software for Textile Design and Manufacturing

Abstract at Time of Award

The broader impact/commercial potential of this Small Business Innovation Research (SBIR) Phase I project is to revolutionize the way that woven textiles are designed and manufactured. The textile industry is currently organized around fixed catalogs of fabrics, with significant barriers to the introduction of new products, including limited access to industrial equipment. The project will create Weft, a new web-based design system and marketplace organized around a user-friendly online tool for designing and previewing woven textiles. Anyone can log in, design fabric based on their own graphics and images, order it to be produced in any quantity, and offer it for sale in the Weft marketplace. Weft's fluid digital manufacturing flow can spark a revolution analogous to desktop publishing: any designer with an idea can rapidly and easily turn it into fabric. Smaller projects become possible; larger projects are done faster and better; and customization becomes commonplace. Furthermore, reimagining textile production can revitalize the US textile industry, shifting from old-fashioned mass production to a nimble, customized market that rewards manufacturers and designers with flexibility, technical skills, and proximity to the end-user. This Small Business Innovation Research (SBIR) Phase I project will commercialize NSF-funded research on realistic rendering of textiles. A core technology of Weft is its unique visualization technology, which lets users see the exact appearance of their designs in advance, with full confidence that they will receive fabric that looks just like the visualization they saw on their screen. Research has developed a pipeline for fabric rendering based on scanning the detailed arrangement of fibers in small samples of cloth, then using optical simulation to compute the flow of light through fabric woven in any pattern and with any combination of colors, thereby predicting the exact appearance. The simulation results are realistic and accurate, but the technology has only been demonstrated for one particular type of fabric, and computation times are too long for interactive use. As part of developing the technology for deployment in a web application available to the public, the project will adapt the existing technology to (a) work for a variety of fabrics beyond the one type demonstrated in research, and (b) produce results, under the particular conditions needed for the design tool, at interactive speed.

The Montalvo Corporation
50 Hutcherson Dr.
Gorham, ME 04038-2645
Award Title or Description: SBIR Phase I: Modular Tensioning Cartridge

Abstract at Time of Award
This Small Business Innovation Research Phase I project will develop a disruptive tow tension control technology specifically designed for the unique processing variables of composite material manufacturing to solve the limiting factor of tension control the industry currently faces. In composites manufacturing multiple materials with different tensile strengths and elasticity are combined to make a stronger product, and the lack of affordable tension control has up to this point limited the speed and quality of finished products within the industry. By controlling tension there are fewer gaps, uneven tows, and breaks, resulting in higher quality end product and reduced scrap rates. The composites industry is forecasted to grow at a 7% compound annual growth rate to $10.9 billion in 2018 despite these manufacturing limitations. By removing the limiting factor of tension control it is estimated that production could expand 15%-25%, increasing the growth of this industry even further. With composites' primary and growing role in renewable energy, aerospace, construction, automobiles, pipe and tank, and consumer goods, a manufacturer's ability to remove limitations to effectively meet demand without sacrificing quality will be critical. Expanded productivity will allow for greater innovation with composites within existing industries and promote their use in new industries. The intellectual merit of this project centers on determining the feasibility of a Modular Tensioning Cartridge for composites manufacturing. The objectives of this project are 1) to determine if tension can be

controlled near or at zero, 2) to achieve miniaturization of the unit for multiple use applications, and 3) to determine cost targets and economic feasibility. Research will be conducted to develop a load cell (sensing unit) capable of detecting minor (gram) changes in output in relation to key considerations of beam loading and sensing capability, through testing of multiple design, shape, and material combinations. Further research and testing will be conducted to discover heat dissipation requirements, fuzzing risks and solutions, and determine design and material requirements in order to achieve proper miniaturization of the full unit. Final research will be conducted to validate the economic value proposition of the unit to customers based on unit quality, size, performance, and service life in relation to cost and additional output/productivity generated. The team will determine the viability of load cell technology as a sensing device, and the combination of materials and design that will meet sizing, performance, and cost requirements.

SinWaves, Inc.
1109 Heatherstone Way
Sunnyvale, CA 94087-1621
Award Title or Description: SBIR Phase I: Wireless Driver Alert System; A Vehicle to Roadside Unit Communication System

Abstract at Time of Award
Broader impact/commercial potential of this Small Business Innovation Research (SBIR) Phase I project is summarized as follows. (1) Social impact: Transportation is the bloodstream of this nation with its level of importance being second to water. This country's roadways are public use and the PI's proposed technology is aimed at maintaining a fair and unbiased information infrastructure that satisfies the needs of both automotive and government agencies to fulfill their roles in public use and safety. (2) Commercial impact: The ability for vehicles to identify roadside regulations and guidance will provide several beneficial factors that will help alleviate driver distraction while aiding in additional cognitive awareness and safety. Additionally, wireless capable road signs can provide additional resources than their static counterparts that will make them more attractive and cost effective to their responsible entity/agency. (3) Technical impact: The project pushes the abilities of ultra-low powered devices to extend the idea of location services, thus location dependent information is stored at its source producing almost instantaneous availability. The proposed project is working on further advancing and refining a small electronic device with wireless capabilities known as a roadside unit to meet the regulations of the United States Sign Council (USSC) motorist reaction distance for visual street cues to facilitate safe vehicle responses. Satisfying this requirement involves a novel communication protocol structured around efficient message transmission at ultra-low operating power to quickly detect and respond to moving vehicles with minimal energy usage. The projects communication protocol is designed to use minimal power while maximizing the amount of data throughput to ensure an operational lifespan of a battery powered device for a minimum of 10 years while achieving significant transmission distance. Because roadside infrastructure is standardized there is an opportunity for advanced data management techniques to simplify data transmission and decoding. The proposed system integrates and enhances the current vehicle-to-vehicle (V2V) communication platform by offering another layer of sophisticated physical object identification. As vehicles take on autonomous responsibilities, they'll need reliable, accurate, and authenticatable information about their surroundings with enough notice to facilitate safe responses.

PolySpectra, Inc
2342 Shattuck Avenue
Berkeley, CA 94704-1517

Award Title or Description: SBIR Phase I: Modular Manufacturing - Democratizing Functional Materials Printing

Abstract at Time of Award
This SBIR Phase I project will research and develop new functional materials for advanced additive manufacturing. The goal of this project is to develop high performance materials for light activated 3D printers. If successful, this will enable new tools for manufacturing and research. Applications of this project would enable affordable, waste-free, and energy-efficient manufacturing with the goal of lowering the barriers to innovation. polySpectra has developed a new class of modular 3D printing resins, capable of manufacturing production quality parts with tailored geometry and chemical functionality in a single step. This process is called functional lithography - it unlocks the ability to simultaneously define the form and function of advanced materials. The application of functional lithography to additive manufacturing enables production-ready parts to be directly 3D-printed, whereas existing materials can only make prototypes, mock-ups or toys. The goal of this project is to discover and develop new materials using functional lithography, to push the limits of the materials that are available in additive manufacturing.

3DEO, Inc.
14000 Van Ness Ave Ste C
Gardena, CA 90249-2942
Award Title or Description: SBIR Phase I: An Affordable Metal Additive Manufacturing Machine

Abstract at Time of Award
This SBIR Phase I Project aims to tackle the two greatest barriers to technology adoption associated with metal additive manufacturing (AM) - cost and quantities. Current metal AM platforms use expensive core components and consumable materials in high-priced machines that produce 99.9% dense parts. The proposed project introduces a lower performance, affordable stainless steel additive manufacturing technology that will be capable of satisfying the vast majority of customer needs for industrial grade stainless steel parts. The vast majority of the market simply cannot afford to take advantage of AM benefits due to the high costs associated with current technologies. This proposal re-examines the material performance, machine cost and reliability requirements necessary for a novel metal AM system. The goal of the proposal is to allow an estimated 50,000+ American manufacturers to capitalize on the benefits of AM and compete to win in an ultra-competitive, highly globalized manufacturing industry. Furthermore, the proposed invention of a low-cost machine allows for unprecedented scalability in metal AM, allowing smaller manufacturers to compete with the resources of large conglomerates. This research has broad implications in many industries and is considered to be fundamentally enabling for the growth and prosperity of American manufacturing. The proposed project re-examines the need for high technology, high cost core components in currently available commercial metallic AM machines. Through an innovative deconstruction of the inkjet print head-based, binder jetting process, a method for producing metal end-use parts has been created. The proposed process is based on a novel combination of two low cost and established technologies. The creation of a robust prototype with this novel method is a highly challenging, multi-faceted project involving key advances in materials science through the development of a novel binder system compatible with the new process as well as a fundamental evaluation and improvement of material properties of the as-built parts. In addition, re-designed sintering cycles and development of software prediction algorithms to anticipate shrinkage characteristics will be core challenges to overcome in order to achieve the tight tolerances manufacturing partners require. As such, these challenges will require tight cross-disciplinary

collaboration for a meaningful outcome. The ultimate goal of the proposed research is to fabricate powder metallurgy parts of adequate structural integrity to satisfy industrial end-use requirements.

Procedures and mechanisms NSF used to give priority to SBCs that participate in manufacturing-related projects; and, Specific actions taken toward promoting and supporting manufacturing-related projects:

For more than fifteen years NSF has explicitly included manufacturing as one of its top-level solicitation topics. The current topic with a sole focus on manufacturing is entitled Advanced Manufacturing and Nanotechnology. Subtopics in this area feature manufacturing processes, machines and equipment and manufacturing modeling and simulation. Other sub-topics with a strong connection to manufacturing innovation can be found in most of our other topic areas, including the Advanced Materials, Semiconductors, Chemical Technology, Biological Technology, and Robotics areas.

In these solicitations NSF has considered the ability of a project to promote American manufacturing as a key factor in making funding decisions. Maintaining of a strong American manufacturing base, and the creation of American manufacturing jobs are goals that are aligned with NSF's Broader Impacts merit review criterion. An earlier SBA analysis of NSF SBIR/ STTR awards showed that ~28% of the NSF awards had a manufacturing innovation component when processing was considered along with materials development. In FY 2017, the NSF SBIR/STTR Program made 116 awards that specifically focused on manufacturing innovations.

Department of Transportation (DOT)

In FY 2017, the U.S. Department of Transportation (DOT) report on Encouraging Innovation in Manufacturing, as required by Executive Order 13329 (see Section 9 of the Policy Directive) include:

FY 2017 Outreach

The U.S. DOT SBIR Program Office discussed manufacturing topics during briefings and one-on-one meetings conducted at the National and Regional SBIR conferences. The SBIR Program Office also informs prospective DOT awardees of the assistance available through NIST's Manufacturing Extension Partnership (MEP) Program and the USA National Innovation Marketplace. On the USDOT's SBIR website we have a section entitled "Manufacturing-Related R&D Emphasis in SBIR".

FY2017 Award Selection

In FY 2017, DOT awarded a 3 manufacturing-related SBIR Phase I and 1 Phase IIB contracts:

- Intelligent Automation, Inc.- "Methods for Remanufacturing Creosote-Railroad Ties" – Phase I.
- Nanosonic, Inc- "System and Supply Chain for Recycling Lithium-ion batteries in the Transportation System" – Phase I.
- Navitas Advanced Solutions Group, LLC- "System and Supply Chain for Recycling Lithium-ion batteries in the Transportation System" – Phase I.
- Koo & Associates International- "Welding High Performance Bridge Steel with a Pulsed Energy Source" – Phase IIB.

FY2017 Tracking and Reporting of manufacturing-related SBIR awards

USDOT asks every offeror if their proposal is manufacturing related and also asks every topic author if their topic is manufacturing related. We track these responses in our online proposal system and our award tracking system.