Final Performance Progress Report
Reporting Period: January 1, 2013 to December 31, 2015
Date of Submission of Report: March 30, 2016

Federal Agency/ Organization Element:	DOE/EERE/ Office of Advanced Manufacturing Program (AMO)
Award Number:	DE-EE0006027
Project Title:	Greater Philadelphia Advanced Manufacturing Innovation & Skills Accelerator
Project Period:	January 1, 2013 – December 31, 2015
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Executive Summary

The Accelerator has given the DVIRC an opportunity to get involved in areas of a small and medium-sized manufacturing business that MEP centers typically do not get involved in—the areas of technology development and technical issues.

Over the course of the project we've come to gain some valuable insights into the market challenges of SMEs, and the market challenges an MEP (such as DVIRC) faces as it seeks to work more deeply and at faster pace on the technology-related aspects of a manufacturing business. For example, while most companies can quantitatively justify investing in an ERP system or a new piece of production equipment, SMEs often struggle with formulating a return-on-investment for advanced technologies. As another example, bringing advanced technology to a company through the individuals interested in the technology (such as engineers or technicians) is not the way to go; as with many MEP services, we need to get to the CEO. And even then, there is a strong reluctance to let outsiders in to these often proprietary areas of the business.

As a result of our work in this area, we are now looking more closely at how CEOs that DO invest in advanced technologies justify the investment or make the investment decision. We've learned about some of the internal constraints in SMEs that need to be kept in mind as projects get defined and executed—where technical personnel often hinder conversations in this arena rather than contributing value to them.

We've gained exposure to a new suite of public and private assets that can help us with this work, such as universities and agencies such as NASA. We have also developed relationships with design/engineering companies that can help us as we move more deeply into this area of a company,. Still, defining a technical project takes a huge amount of effort and resources and, once undertaken, has a much longer time trajectory than typical MEP projects.

DVIRC field staff and content experts have learned more about assessing a company's technical assets, broadening our view of the business to go beyond what they make or what NAICS code they have…to better understand their capacity, capability, and expertise, and to learn more about THEIR customers. Knowing more about the markets they serve can often provide insight into their level of technical knowledge and sophistication.

Finally, in the spirit of realizing the intent of the Accelerator we strove to align and integrate the work and activities supported by the five funding agencies to leverage each effort. To that end, we include in the Integrated Work Plan a graphic that illustrates that integration.

What follows is our summary report of the project, aggregated from prior reports.

Project Goals/Objectives
Broadly, the Accelerator sought to achieve two primary objectives:

1. Increase growth in the business value of an SME by accelerating the rate at which they identify and commercialize new product, process, or service innovations and by rapidly developing the engineering, technical, and managerial talent necessary to capture the full value of advanced manufacturing technology, and
2. Decrease the inherent risk and historical roadblocks associated with the development and commercialization of new innovations through the integration and systematic organization and deployment of the region's educational, technical, business and financial assets, both public and private.

DOE's AMO funding was directed at putting in place the scientific & technical wherewithal required to identify, transfer, and commercialize new advanced manufacturing methods and technologies, which came in the form of a Technical Director which DVIRC hired and who managed this aspect of the Accelerator to provide the following services:

- Identify and establish close relationships with the area scientific and technical assets in an effort to develop conduits that uncover the specific needs of the Accelerator's SME clients, and connect them with focused, high-value solutions from that asset base;
- Identify and establish partnerships at the federal laboratory level to develop conduits to connect scientific and technical development activities within the Accelerator to leading-edge sources of advanced manufacturing technology and expertise;
- Establish protocols and mechanisms to ease the identification, licensing, and adoption/distribution of intellectual property between sources of technology such as federal laboratories or universities and the end-user SMEs; and,
- Serve as the Accelerator's technical expert, participating in the development and commercialization of innovations that incorporate advanced manufacturing technologies.

Background
We were clear in our application that the transportation cluster would be our **initial** focus, and that Composites and 3D Printing would be our **initial** technology foci. Transportation was selected because of a strong and growing manufacturing presence in the production of commercial merchant marine tankers, commercial and military rotorcraft, and advanced railcars. While these OEMs expressed initial interest in the overall project, it became clear that their own interests understandably superseded those of the project as they were working in the two technology areas.

As the Accelerator evolved, projects emerged with companies outside of the initial cluster, involving technologies beyond 3D Printing and Composites.

The Accelerator leveraged the combined funding of the 1) the Economic Development Administration (EDA) to organize and network the transportation cluster, promote technologies including both additive and composites manufacturing, and integrate a regional public and private service provider network, 2) the Employment and Training Administration (ETA) to provide training in both additive and composites manufacturing to both manufacturer and engineering students, 3) the National Institute of Standards and Technology (NIST) to provide a structured client engagement process to facilitate rapid innovation through advanced manufacturing adoption within small manufacturers, and 4) the Small Business Administration (SBA) to enable outreach to firms within disadvantaged and underserved communities.

Once the platform for program execution was established in year one, our work plan called for repeatable activities that would help us achieve our goals in years two and three, as outlined in our Task Schedule.

A summary of accomplishments in our main task areas follows.

Technical Director

The Technical Director position was filled on May 10, 2013. For the first year, this position was supported through a sub-agreement with Penn State University. After the first year, the Technical Director became part of DVIRC's staff and remained on staff until December 2015. The position was eliminated due to our inability to generate sufficient revenue from technical services to cover the position.

Establish working partnerships with regional S&T assets

Over the course of the project, linkages were established with the following regional S&T assets:

- Philadelphia University
- University of Delaware Center for Composites Materials
- Next Fab
- Prism Engineering
- Penn College of Technology
- Advanced Plasma Solutions
- Onexia
- EFE Labs

Establish linkages with DOE & other federal S&T assets
Over the course of the project, linkages were established with the following federal S&T assets:

- America Makes
- Naval Sea Systems Command (NAVSEA)
- Naval Surface Warfare Center (Aberdeen)
- Naval Air Systems Command (NAVAIR)
- National Aeronautics and Space Administration (NASA)
- Oak Ridge National Laboratory
- National Institute of Standards & Technology (NIST)

Provide technical development & oversight over strategies & execution of client engagements
A summary if provided below.

Provide the technical development and oversight for the commercialization strategies and initiation of:

1-2 Innovation Engineering Management System (IEMS) projects
(1) Rebling Plastics IEMS project – completed
(2) Rusmar project – completed
(3) Lambert Spawn project– completed

1-2 Business Growth Services (BGS) projects
(1) Waco project - completed
(2) Triumph Controls project – completed
(3) Container Research Corporation project - completed
(4) EFE Labs project - completed
(5) US Axle project – completed
(6) Schramm project – completed
(7) Rebling project - completed

1-2 Supply improvement projects
[1] Twelve supply chain projects completed and one continuation project with ESCO.

(2-5) RD&D projects
[1] Silicon Power Corporation project initiated in August, 2014. Was to be an 18 month project to help the company commercialize its high-power semiconductor products. Project started but was put on hold due to other circumstances in the business.
[2] Dunmore Corporation project was initiated in December, 2014. This was a Technology Driven Market Intelligence (TDMI) project for 12 weeks to explore market size and landscape of LNG vessels that include tanks, containers, Dewars, vacuum insulated jackets, etc. This project was completed in May 2015.

[3] Addaero Corporation—Another TDMI for metal 3D printing. Proposal accepted in June 2015 and project completed.
[4] Atlas Hobbing—TDMI for market potential and competitive landscape for their fuel spill prevention product. Proposal accepted in August 2015 and project completed.
[5] Dunmore Corporation follow-on proposal for identifying issues with delamination of their film and a composite. Dunmore decided to go directly to project partner University of Delaware Center for Composite Materials.
[6] Ehmke Manufacturing accepted a proposal for market research for diversification and work tarted in October 2015.
[7] PetroMar also accepted a proposal for market research and work is underway.

A brief summary of the most recent projects that were getting underway or being completed at the end of the grant period is offered below to provide a sense of the range and diversity of technical challenges facing SMEs

1. A company that makes electronic devices for refrigerant identification had a need to quicken product development since their core product line was starting to lose revenue. Their engineers had not come close to meeting their forecasts for new/advanced products and their latest forecast was over two years from the original forecast. They wanted to discuss how to improve their process, including supply chain and outsourcing.

2. A company that is an innovator in heavy-gauge plastic thermoforming, using both traditional vacuum forming and advanced pressure forming techniques, was interested in exploring 3D printing to shorten their time for prototyping low volume tooling. A meeting was set up to discuss this potential application.

3. A company that makes a Portable Emergency Ventilator (PEV)—a life supporting device which provides positive pressure breathing in emergency situation— needed sourcing assistance. The PEV is a contamination free resuscitator that eliminates mouth-to-mouth procedures while permitting lifesaving treatment for shock, cardiac arrest, smoke inhalation, drowning, drug overdose, convulsions and other respiratory traumas. The company was looking for a domestic manufacturer to license the technology and make the device, and expressed an interest in research to determine the market landscape and potential market. We passed along the specifications to 4 companies in the region.

4. A company that designs and fabricates a diverse range of technical fabric products for the Defense Industry, Commercial OEMs and a host of industrial applications was interested in market diversification. They also wanted to determine the competitive landscape and explore new technology to advance their product base, looking to execute their brand and market their products. We provided a scope of work for this effort that was accepted by the company. A project was started in November 2016.

5. A company with core technology in sensors for downhole data logging and measurements for the oil & gas industry and growth has been depressed due to decline in oil prices. They have significant scientific talent in the sensor area and software applications and are looking to diversify outside the oil & gas industry. They have limited marketing and required outside resources to generate leads in different markets where their core technology can be applied. A proposal for market diversification and topline growth support was accepted.

6. A company that makes solid state switches, pulse power for high voltage, high current applications needed a new customer base to obtain a larger share of its current market. Markets identified were oil and gas drilling, water treatment and air purification. We prepared a technology needs assessment and met with the company to explore lead generation work. A proposal was written and submitted

7. An R&D company that makes specialty reactive materials for the aerospace and defense industry that relied solely on SBIRs to generate revenue was looking to move products from prototype to small scale manufacturing. Hit hard by government cutbacks, they sought market diversification assistance. Exploratory meetings were held

8. A metal 3D printing company for the aerospace and defense industry needed to expand its current markets and better understand the state of the 3D market. Their expertise is in design and rapid turn- round of 3D-generated metal product. They wanted to expand outside the aerospace and defense markets to the industrial and medical areas. We successfully initiated a project to determine the market landscape and find leads for future work. The project was completed in December 2016.

Budgetary Information: Task Schedule and Project Spend Plan

Table 1A—Task Schedule

Task #	Task Title or Brief Description	Task Completion Date				Task Progress Notes
		Original Planned	Revised Planned	Actual Complete	% Complete	
1	Establish & support technical director position	4-30-13	6-30-13	6-30-13	100%	Technical Director position to be filled on May 10, 2013
2	Establish working partnerships with regional S&T assets	6-30-13	6-30-13	6-30-13	100%	Key partnerships identified for budget period 1 are in place
3	Establish linkages with DOE & other federal S&T assets	9-30-13	12-31-13	6-30-13	100%	Progress establishing Army and Navy lab relationships. DOE AMO outstanding.
4	Establish draft strategy for technology transfer & intellectual property management	12-31-13		12-31-13	100%	Note: to be established on client specific & need basis
5	Provide technical development & oversight over strategies & execution of client engagements	12-31-13		12-31-13	100%	Note: continuous activity
6	Establish technology transfer/ commercialization plans for all client engagements of task 5	12-31-13		12-31-13	100%	Note: continuous activity
7	Provide technical leadership, support & content development for 6 TAEs on AM or composites	12-31-13		12-31-13	100%	
8	Project Management	12-31-13		12-31-13	100%	Note: continuous activity
9	Establish additional working partnerships with regional S&T assets	12-31-14		12-31-14	100%	Prism Engineering and University of Delaware added
10	Establish an additional linkage with (1) DOE & other federal S&T asset	12-31-14		09-30-14	100%	NAVSEA & NAVSES at Philadelphia Navy Yard; Army Research Lab
11	Provide technical development & oversight over strategies & execution of client engagements	12-31-14		12-31-14	100%	Note: continuous activity
12	Establish technology transfer/ commercialization plans for all client engagements of task 11	12-31-14		12-31-14	100%	Note: Plan developed for ARPA-E project with Silicon Power
13	Provide technical leadership, support & content development for 6 TAEs on AM or composites	12-31-14		12-31-14	100%	
14	Project Management	12-31-14		12-31-14	100%	
15	Establish additional working partnerships with regional S&T	12-31-15		12-31-15	100%	Added Onexia, Advanced Plasma Solutions and EFE

	assets					Labs as new partners along with Penn College of Technology.
16	Establish an additional linkage with (1) DOE or other federal S&T asset	12-31-15		01-31-15	100%	Met with NASA Goddard and NASA headquarters – bringing NASA capabilities to companies in the region. Met with Oak Ridge national Laboratory tech 3D large area expert.
17	Provide technical development & oversight over strategies & execution of client engagements	12-31-15		12-31-15	100%	Note: continuous activity
18	Establish technology transfer/ commercialization plans for all client engagements of task 17	12-31-15		12-31-15	100%	Note: continuous activity; Assisted local company to explore commercialization of its technology with NASA
19	Provide technical leadership, support & content development for 6 TAEs on AM or composites	12-31-15		12-31-15	100%	Note: continuous activity; At Manufacturing Summit, keynote speaker demonstrated AM techniques.
20	Project Management	12-31-15		12-31-15	100%	Note: continuous activity

Table 2A—Project Spend Plan:

Project Spend Plan							
Quarter	**From**	**To**	**Estimated Federal Share of Outlays***	**Actual Federal Share of Outlays**	**Estimated Recipient Share (Cost Share) of Outlays***	**Actual Recipient Share (Cost Share) of Outlays**	**Cumulative Actual Outlays (Federal + Recipient)**
	Start	1/1/2013	Note 1		Note 1		
FY13Q1	1/1/2013	3/31/2013	$0.00	$0.00		$15,920.00	$15,920.00
FY13Q2	4/1/2013	6/30/2013		$22,330.10		$6,382.37	$44,632.47
FY13Q3	7/1/2013	9/30/2013		$44,975.20		$14,946.54	$104,554.21
FY13Q4	10/1/2013	12/31/2013		$39,796.70		$27,818.88	$172,169.79
FY14Q1	1/1/2014	3/31/2014		$40,327.74		$6,566.68	$219,064.21
FY14Q2	4/1/2014	6/30/2014		$59,847.71		$614.57	$279,526.49
FY14Q3	7/1/2014	9/30/2014		$45,981.92		$0	$325,508.41
FY14Q4	10/1/2014	12/31/2014		$49,890.32		$19,359.66	$394,758.39
FY15Q1	1/1/2015	3/31/2015		$40,342.25		$4,096.52	$439,197.16
FY15Q2	4/1/2015	6/30/2015		$33,472.34		$0	$472,669.50
FY15Q3	7/1/2015	9/30/2015		$39,696.97		$7,583.67	$519,950.14
FY15Q4	10/1/2015	12/31/2015		$33,338.75		$9,211.11	$562,500.00
Totals				**$450,000.00**		**$112,500**	
Approved Budget			**$450,000.00**		**$112,500.00**		**$562,500.00**

* Updated quarterly

General Note: DOE Laboratory partner spending should not be included in the above table. If a DOE Laboratory is a partner, report their spending and spend plan information in the table below (use separate tables if multiple DOE Laboratories are involved).
General Note: The information in this table should be consistent with the information provided in section 10 of the quarterly federal financial report (SF425).
Note 1: Leave blank. Only the actual DOE/Cost Share amounts spent are needed.
Note 2: Amount for this quarter and subsequent quarters should be updated every quarter with due care. Estimates need to be provided for the entire project. If spending for a given quarter is different than estimated, then the remaining quarter's estimates should be updated to account for the difference. Total DOE and Cost Share amounts should be the same as the Award amount (see Note 3).
Note 3: Enter approved Federal and Non-Federal Share from approved award documents. Total estimated spending should equal the approved budget when totaled for the entire project period.