STEAM ENGINE | USA

FINAL REPORT

December 31, 2018

Prepared by

Ninigret | Partners

and New Commons

RHODE ISLAND COMMERCE CORPORATION

ACKNOWLEDGMENTS

The following organizations helped make this project possible. These include:
- RI Executive Office of Commerce
- RI Commerce Corporation
- RI Foundation
- US Department of Defense, Office of Economic Adjustment
- US Economic Development Administration
- URI Polaris MEP
- Rhode Island School of Design
- Bryant University Executive Development Center and Chafee Center for International Business
- Members of the Project's Advisory Council

We would also like to acknowledge the efforts of John Riendeau from RI Commerce Corporation, who facilitated the work of this project.

Additionally many thanks go out to the myriad of participants who agreed to be interviewed, met in discussion groups, provided tours of their businesses or participated in informal brainstorming to help shape the findings and recommendations of this report.

Dedication
Two people who were instrumental to the creation and implementation of STEAMengine passed away in 2018.
- Ray Fogarty, executive director of the Chafee Center for International Business at Bryant University
- A. Ray Thomas, ARay Business Communications

Powered by Commerce RI
- Stefan Pryor, Secretary of Commerce
- Jesse Saglio, President/COO
- John Riendeau, Director of Business Development

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True innovation lies in collaboration, and as we collectively work towards developing the big ideas and big actions that will design the future, this grant offers an exciting opportunity to strengthen the partnership between education, government, and business in our state" — Rosanne Somerson, RISD President

INTRODUCTION

STEAMengine Project Context

In the fall of 2012, the Rhode Island Foundation – the state's community foundation – convened **"Make it Happen"**, a 2-day gathering among diverse stakeholders, aimed at accelerating economic and community development in RI. From "Make it Happen" the Rhode Island Foundation invested in two initiatives that addressed the growth of manufacturing in RI.

The first investment, made in 2013, was $100,000 in the **Rhode Island Manufacturing Collaborative**, a partnership among the Chafee Center at Bryant University, Commerce RI, URI Polaris MEP and the RI Manufacturers Association (RIMA). One of the Collaborative's major efforts was to inventory and profile RI manufacturers with the aim of facilitating joint business ventures for companies in the state. The Collaborative identified and profiled 1,623 manufacturers with 4 or more employees. An online website and database, organized using NAICS codes, was developed for manufacturers to use to do business together. Manufacturer's profiles included contact information, core knowledge and potential partnership opportunities.

The second investment, also made in 2013, was $25,000 to the fledgling **STEAMengine** project, organized by the RI Commerce Corporation. This project's goal was to introduce design thinking to manufacturers. The RI Foundation investment served as match money for RI Commerce to apply for a US Economic Development Administration planning grant, for assisting RI manufacturers in incorporating design thinking in their daily businesses. RI won the grant, kicking off plans to support manufacturers and facilitate the creation of a Design and Manufacturing Center.

Together, STEAMengine and the Rhode Island Manufacturing Collaborative catalyzed change in RI's manufacturing economy, working as overlapping partners.

STEAMengine Project Goals

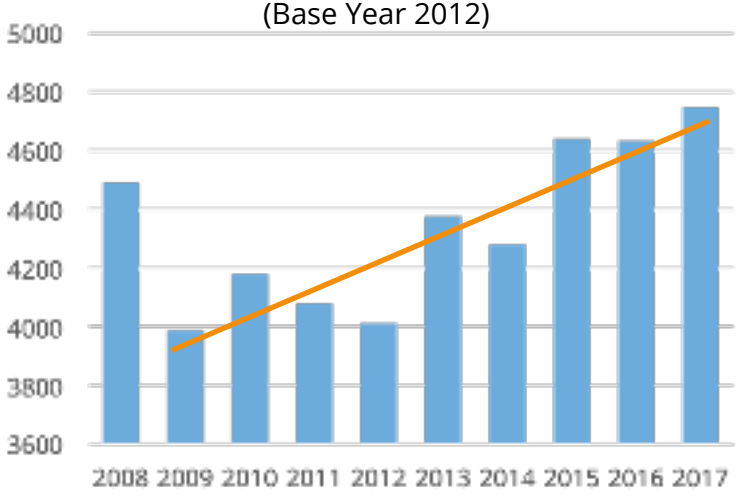
1. Introduce designers to defense manufacturers and manufacturers to designers.
2. Connect defense manufacturers with resources including equipment, maker spaces, collision spaces, resource providers and other needs to promote a network connecting manufacturers and design resource providers.
3. Introduce design thinking to manufacturers and help them to incorporate it into their process and product development.
4. Develop and promote a network connecting manufacturers and design resource providers.

MANUFACTURING

Economic Snapshot of RI Manufacturing Sector and RI Defense Cluster

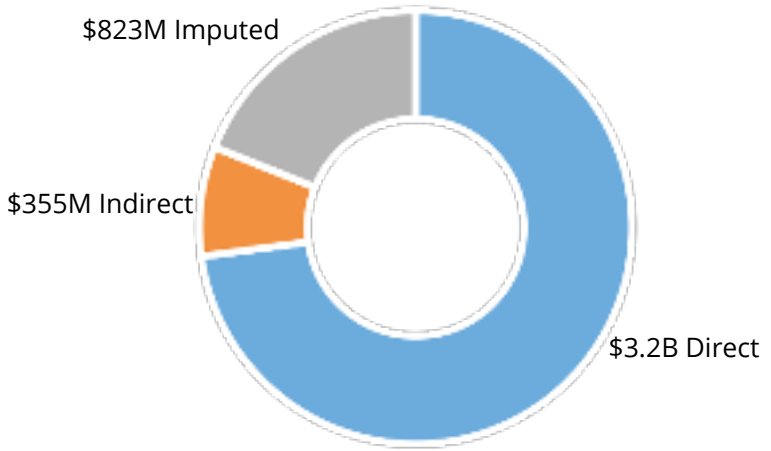
RI Manufacturing

Real GDP Trend ($000,000)
(Base Year 2012)



RI Defense Cluster

Economic Impact 2016
$4.3B



Overall Manufacturing

1,623 manufacturers in RI with four or more employees

40,300 manufacturing employees

8.3% non-farm employment in RI (2017)

Defense Manufacturing

220 defense-related manufacturers

5,300 defense manufacturing jobs

13% of RI manufacturing employment

Source: Data year 2017 based on NAICS & BEA State GDP estimates. Defense manufacturing based on SENEDIA estimates & STEAMengine survey, employment estimate does not reflect 2018 announced hires at EB and Raytheon

IN RHODE ISLAND

There are three major factors impacting manufacturing in RI...

The Nature of RI Manufacturing

Manufacturing in RI is diverse, producing a variety of goods through a range of processes and materials.

Most are small job shops, contracted to produce pieces/parts from a specification (military or commercial).

Some companies have experimented with 3D printing, making innovation not a priority, but a necessity in maintaining a technology edge over competition.

Other companies are moving upstream, making larger assemblies or developing finished manufactured products to differentiate themselves from their competition.

Capabilities

RI has a highly skilled and experienced manufacturing base across a range of materials - particularly in metals, composites and textiles.

The industrial professional / technical community has international reach, with expertise across a range of products, materials and processes.

Higher education institutions have a range of facilities and programs that can support the breadth of RI's manufacturers, providing technical skills to a range of manufacturing occupations.

State Culture

The small geographical size of RI (37 by 48 square miles) is an advantage for networking, partnership building and doing business.

RI remains a manufacturing state and manufacturing is a key economic anchor of the state's middle class there is an opportunity to continue to play that role.

Design, craftsmanship and "making" are a part of the heritage of the state.

EVOLUTION OF STEAMENGINE

STEAMengine Phase I

Since the initial investments that catalyzed RI manufacturing in 2013, Department of Defense Office of Economic Adjustment (DoD OEA) investments have significantly impacted the growth of both the general and defense-based RI manufacturing economy.

STEAMengine Phase I took place in 2014 and focused on the collection of data and analysis of risks and opportunities in support of the development of an economic diversification strategy. Findings were presented to our defense companies through a final report entitled, "STEAMengine USA Final Report – Year 1. The report outlined how we:

- Developed a strong network of interested stakeholders.
- Designed and piloted a program of Design Readiness Assessments for defense-related manufacturers.
- Developed an innovation strategy to facilitate increased technology commercialization.
- Developed a framework to train all levels of defense workforce in design thinking.
- Modeled a shared space for use by industry and partners.
- Provided strategic communications to internal and external stakeholders.

These tasks allowed RI Commerce to develop a thorough strategy to support our defense manufacturing industry and communities that led to the writing of the Phase II grant request.

Task 1: Develop a network of stakeholders was critical in allowing STEAMengine to reach out to manufacturers, researchers, government and public private partnerships that shared a common goal in demonstrating design thinking and its implications for business growth. This information was used in all remaining tasks to create a culture of innovation.

Task 2: Design Readiness Assessment

STEAMengine Phase I began with the identification and completion of Design Readiness Assessments (DRA) on 20 manufacturers. Manufacturers needed at least ten percent of their revenue in defense, and be mostly located in RI - although a few were located in Southern New England, fostering a regional approach to the future of manufacturing. The DRA's were completed by November 30, 2015 and a summary report was written. Fourth Economy Consulting of Pittsburgh served as the Phase I project manager.

Task 3: Develop an Innovation Strategy

The STEAMengine USA website was established to house these resources and provide information on design for manufacturing. Databases included RI manufacturers, designers, machinery available for sharing, and educational programs.

Task 4: Develop a Framework to Train the Defense Workforce

This framework was established through a Request for Information (RFI) with proposals from RI School of Design Executive Education (RISD EE) and Bryant University.

Task 5: Model a Shared Space for Use by Industry and Partners

Robust discussions led to the considerations of several business models to assess the feasibility of opening a physical center.

Task 6: Provide Strategic Communications to Internal and External Stakeholders.

A survey was distributed to populate an online directory of equipment and resources available to other manufacturers.

Additionally, Phase I yielded numerous lessons to apply in developing a phase II DoD application:

- Provide more time to engage in the DRA process.
- Identify and allocate financial resources to implement the priorities in the DRA recommendations.
- Engage in a deeper immersion in design thinking and practices.
- Bring manufacturers into a product development process.
- Implement a certificate of training program with RI Higher Education Institutions.

EVOLUTION OF STEAMENGINE

STEAMengine Phase II

As a result of these lessons learned in Phase I, in the spring of 2016, Commerce RI was awarded a DoD OEA Phase II contract. The four tasks were delivered from the spring of 2016 to September of 2018.

STEAMengine Phase II goals were implemented as three major tasks:

Task 1: Develop the Innovation Center for Design and Manufacturing (ICDM)
The ICDM was intended to create a physical center, located in Providence, RI to accelerate job and company formation. A membership entity, the Center would provide access to equipment and maker and collision spaces for manufacturers and resource providers to meet and work together, with a concierge who would direct manufacturers to the right resources. TECH Shop was selected as the preferred provider. STEAMengine withdrew its interest in the TechShop model in June of 2017 as it considered its business model too costly to operate. TechShop filed for bankruptcy in November of 2017,

STEAMengine considered a "marketplace" as a network of places throughout the state and elsewhere, hoping that it would achieve the same goals the original concept of a physical center was intended to serve.

Design Catalyst LLC/Clear Carbon & Components

Task 2: Infuse Design Thinking and Practices Among RI Manufacturers Through a Multi-level Program (Levels 2.1, 2.2 and 2.3)
The Manufacturing Innovation Challenge (MIC) focused on capacity-building and implementation for manufacturers and was managed by URI Polaris MEP. Operating from June 2016 to May 2018, it consisted of two components:

- Level (2.1) Completion of 30 assessments with RI defense manufacturers (formerly the DRA)
- Level (2.2) Guiding 29 implementation projects with companies that completed the MIC assessment. The second component focused on investing resources to implement the priorities determined in the MIC assessment. (See appendix for details on the MIC process).
- The Chafee Center provided significant support in the implementation of Level 2.2 projects, working with five companies on implementing international marketing and sales (one of the MIC identified priorities) and re-conceptualized the supply chain component of the MIC assessments.

Outcome: The implementation of 39 projects, focused on the priorities established in the assessment. The priorities included: strategic planning, product development, (including parts and assemblies), and sales and marketing. For 18 of the 30 Phase II companies, there was a total increase of $15 million in company revenue, representing a 12:1 return on the DoD investment. Individual companies each had their own successes, as outlined in Real World Impacts.

Level 2.3: Design Catalyst LLC
In 2016, the RI Commerce Corporation contracted with Design Catalyst LLC, a partnership among practitioners from the faculty at Brown and RISD, to undertake a well-defined set of activities to implement with three companies. These activities formally constituted a new program that was created and known as Level 2.3 – a deep dive. The program ran from Spring 2016 through Spring 2018, and helped three RI defense manufacturers collaborate with designers to diversify their portfolio of products and/or services. This intensive, hands-on learning experience was divided into four phases: Investigation, Ideas Creation, Prototyping and Market Readiness. Each phase identified a clear goal and ended with a specific deliverable. The three companies that participated were: Clear Carbon & Components, Mearthane Products Corporation and TEAM, Inc.

Outcome: Each of the three companies developed new products and in one case, Clear Carbon & Components, established a new business and product line under the name Clear Carbon Interiors, producing high-end furniture for yachts and back-yard decks

Task 3: Develop "Hands on" Design Curriculum
Two higher education institutions, Bryant University and RISD, were contracted to provided design education services.

Bryant University EDC (Executive Development Center)
In the spring of 2016, Bryant offered DTC 102 - Design Thinking Certificate, a deeper immersion in design thinking. "Design thinking" offers a unique approach to the world of design and is based on the premise "fail sooner to succeed faster" and "is a core axiom in the field of innovation design," a process attributed to David Kelley, founder of IDEO. Bryant's program consists of a series of workshops aimed at providing an innovative and contemporary approach to the world of design.

Upon completion, manufacturers learned how to:

- Conduct observations of users in their natural environment to understand opportunities for new product development or enhancements.
- Study extreme users as part of the insight-generation phase of design thinking.
- Conduct effective brainstorming sessions with a team of individuals/experts in manufacturing and design.
- Engage in effective and rapid low-fidelity prototyping as well as small-scale experiments to test their ideas, learn, and adapt.
- Analyze strategic design initiatives for benchmarking best practices.
- Implement a pilot program for applying design thinking to their own work.

Outcome: Design Thinking is now a regular feature among course offerings through the Bryant University Executive Development Center. It will be offered in April and June of 2019.

RISD Executive Education (RISD EE) Design for Manufacturing Innovation Certificate Program
This program aimed to introduce design thinking as part of the design process to RI manufacturers. Designed and delivered by RISD, it was offered three times between September 2016 and January 2018. After the first offering, the program was strengthened, deepened and shortened, ultimately becoming a blend of preparation at each company with intensive workshops before meeting with the cohort. A final project was required from each company.

The curriculum included:

- Concept visitation/drawing and communicating
- Design thinking
- Design intelligence: nexus of creativity and business
- End user and opportunity insights
- Materials exploration, systems and digital integration
- Introduction to product design
- Collaboration and co-creation
- Value chain/optimizing partners
- Facilitating design
- 3D modeling and prototype

Outcome: Twenty seven (27) leaders from twenty (20) companies participated in the RISD program, resulting in a new cohort of practice within the RI manufacturing sector. 76% of participants indicated that their work was different as a result of the program, with notable increases in design knowledge and awareness, and design leadership across their companies.

Task 4: Promote Design Thinking Among RI Manufacturers
A communications program was organized and implemented to promote design thinking and applications among RI manufacturers, including upgrading the STEAMengine website. In addition, a design education benchmarking study was performed and outlined on pages 24 and 25 of this report.

REAL WORLD IMPACT

Successes

From assisting start-up launch to redesigning production processes and the creation of internal 'design centers' within existing manufacturers, the STEAMengine project has seen numerous successes.

Company Name: Clear Carbon Interiors
Success Metric: Creation of new company.

A composite company, *Clear Carbon & Components (C_3)* has historically worked on boats and built and sold highly sought-after Chellos. *Clear Carbon* participated in the year-long **Design Catalyst Program** where it developed a "new company" within it. *Clear Carbon Interiors* builds composite-based outdoor furniture such as chairs and tables for back-yard decks and boats. The products are sleek, arresting designs that blend manufacturing practices with design thinking and applications. It is a product-based company, vital to growing the future of the RI economy.

Company Name: Navatek
Success Metric: Improved design and production process.

Navatek develops and sells inflatable woven fabric boats as part of its larger boat manufacturing activities. Navatek's **RISD** experience brought about two major changes: (1) their process for developing inflatables became more human- and customer-centered. Naval Undersea Warfare Center communicated to Navatek the constraints facing the DoD and helped determine a better collaboration methodology. (2) Navatek connected with RISD-trained designers, hiring a full-time in-house designer to create a design thinking-based process that allows for examination of a range of options, rather than jumping to a manufacturing solution, which had been the company's primary approach previously. Navatek now plans to expand the use of design thinking company-wide.

Company Name: VR Industries
Success Metric: Improved customer attraction and retention.

VR Industries produces circuit boards. As a result of their **RISD** experience, the company created a dedicated space internally to serve existing and prospective customers, called the **Customer Innovation Center**. The Center aims to: convert prospects into customers, design cost control/reduction means through process improvements rather than beating down the suppliers, and foster collaboration and design thinking with its physical environment, by creating spaces that allow lots of back and forth communication throughout the process. Ultimately, the Center will become a maker space that will attract the future VR workforce with specialized tools, including CAD and 3-D printers.

*"After completing the **RISD** program, Hope Global is putting design thinking into practice: We visited an automotive OEM customer to get them to demonstrate how we use Hope Global products. We noticed extra steps the customer was taking, which led us to conceptualize and prototype dozens of new fasteners using 3D printing and we re now on the brink of commercializing a new, more complete solution."*

— Carlos Neves, former Director of Engineering, Hope Global

Company Name: Apogee Precision Parts
Success Metric: Customer retention and increase revenue

Apogee is a highly specialized metal stamper. Their STEAMengine experience focused on formal market research and prospecting methodology. In the course of this project Apogee discovered that they were at risk of losing one of their key customers - who represented 10% of the company's annual revenue. They were able to turn this customer around. Using engineering-driven market research Apogee identified a new adjacent market. They are now self-funding, with a projected 15% increase in revenue.

Company Name: EVAS
Success Metric: Creation of a succession plan and strategic market plan

This family-owned business provides technology to assist blind and hard of hearing individuals. This project achieved two parallel objectives: a succession plan and a strategic market plan. The succession plan focused on the transition of the company from an aging founder, the father, to his daughter. Two significant resources were leveraged: the RI Commerce Corporation Cluster grant and participation, by the daughter, in the Goldman Sachs 10,000 Small Businesses growth program.

Company Name: Walco
Success Metric: Improved workflow and scheduling

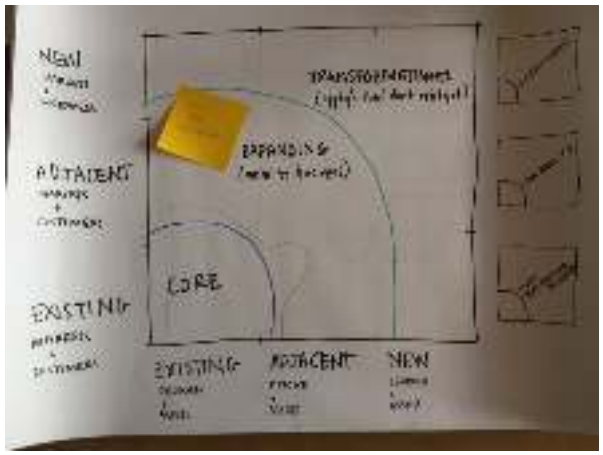
Walco optimizes rotating electro-mechanical apparatus and automated process equipment. The STEAMengine project identified and assessed problems with process flow and scheduling that created a growing backlog that was straining customer relationships. Walco created, with the help of a consultant, new work cells and a streamlined process. Management identified new leaders on the shop floor including one who has brought order to the scheduling process. The project will save the company $40,000 - a 3:1 return on the initial $12,800 investment by STEAMengine.

LESSONS LEARNED

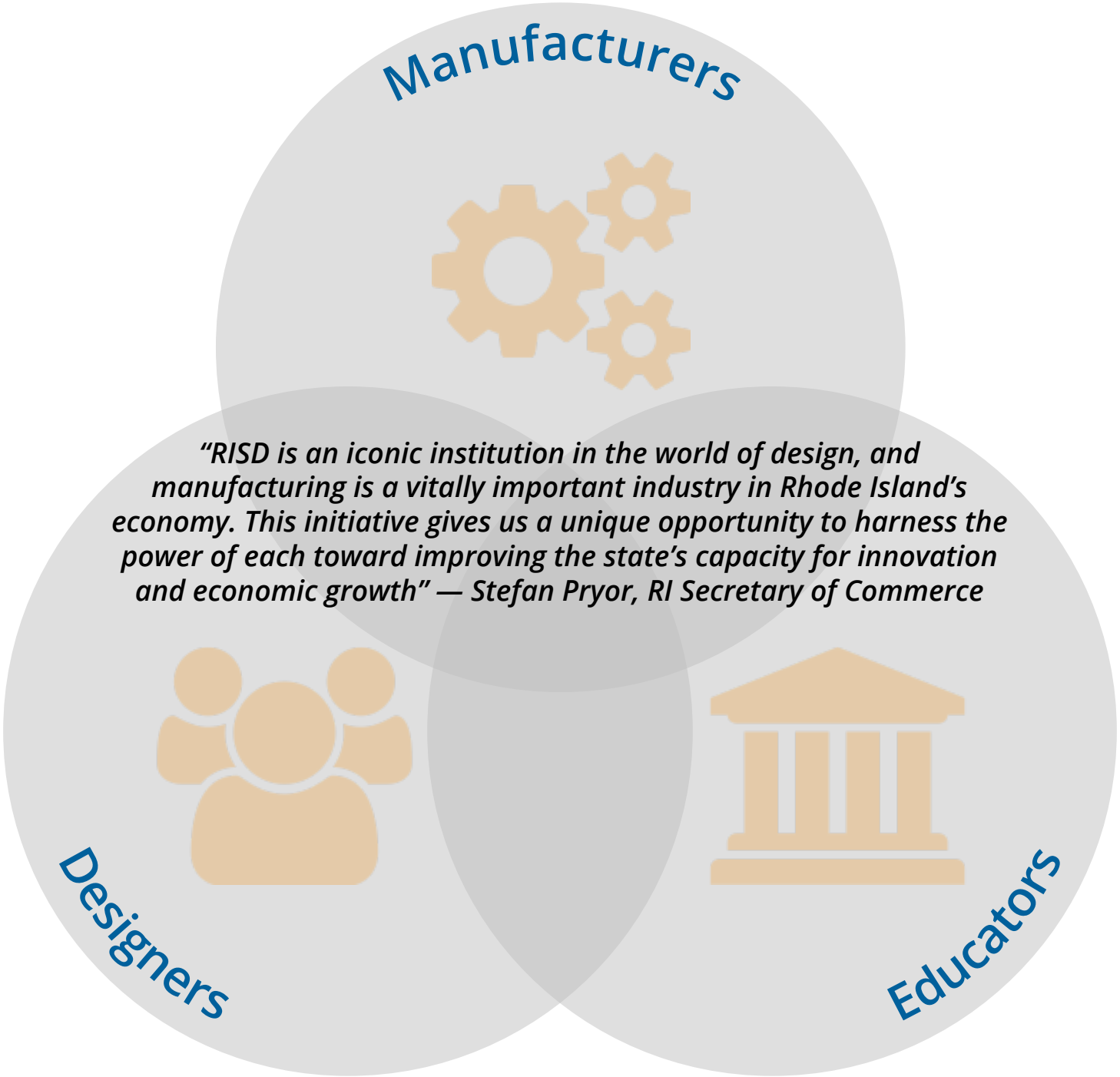
Through the STEAMengine process, there were several important issues that came to the forefront that are a critical part of continuing the transformation of manufacturing in RI. It is important to consider the interrelated issues of manufacturing technological change and the cultural factors that impact the ability to adjust to change.

Process & Technology: Manufacturing is Changing
All growing manufacturing sectors require significant use of technology in product development and systems to innovate and increase productivity. Manufacturing is entering the fourth industrial revolution where automation, data exchange and the "internet of things" are the driving forces to supply chains and distribution systems. All of these factors may dramatically alter manufacturing in terms of process, working capital, supply chain management and production lot sizes. For many of RI's manufacturers, their role in the supply chain can have a dramatic impact on their businesses. However, through the STEAMengine process (enabled by the DOD grant) there were several important learnings. Companies that went through the DRA and MIC processes came to understand and value the role of design thinking in their product and market development, and how that pertains to operations. However, only a small subset of companies could be supported through the process. When manufacturers are engaged in sustained dialogue, they understand the power of focusing on the future. Sustaining the dialogue is critical.

Cultural: Not Everyone Will Be Ready or Want to Change
Change, particularly behavior change, has been identified as a multi-step process. While it was clear that companies exposed to this program derived substantial value, there were relatively few applicants – 4% of the manufacturing base. The fact is some Rhode Island manufacturers are interested in innovation, and some are not. Some companies will want to pursue higher value added activities while others will continue to "make to print." Both options are fine. However, growing manufacturing requires focusing on helping the innovators get traction. Accordingly, manufacturing in RI must be assessed on what it is and not readily compared to other states. Rhode Island strengths need to be amplified and promoted; it's limitations understood and managed.



RISD EE DfMI program


Manufacturers
"RISD is an iconic institution in the world of design, and manufacturing is a vitally important industry in Rhode Island's economy. This initiative gives us a unique opportunity to harness the power of each toward improving the state's capacity for innovation and economic growth" — Stefan Pryor, RI Secretary of Commerce
Designers
Educators

MOVING FORWARD

Guiding Principles for Sustainability
Based on the experience supported by this grant, STEAMengine can play a critical role in helping manufacturers shape the future of their industry.

For STEAMengine to have a lasting impact on the Rhode Island manufacturing economy, the project's momentum needs to be maintained. To maintain its momentum, the STEAMengine project will need a sustainable model. To sustain STEAMengine the model will need to move from a funded, top down program to a bottom up manufacturing sector driven "ecosystem."

Based on the experience of STEAMengine the following guiding principles should be followed:

- Focus on flexibility to accommodate the variety of different materials, manufacturing processes, and roles in the supply chain.
- Make STEAMengine adaptable and scalable, allowing it to grow in response to changes in demand.
- Let manufacturers self-select in or out of the network based on their needs and priorities.
- Create and support continued dialogue between RI manufacturers and the ecosystem.
- Keep overhead low or able to be spread across other programs and services.

These guiding principles have been translated into four sustainable strategies.

Black Flamingo by Design Catalyst LLC/Clear Carbon & Components

Sustainability Strategies

The following four sustainability strategies are intended to keep the STEAMengine moving beyond the DoD resources that were previously allocated to it:

Strategy One: Create a Resilient and Robust Manufacturing Ecosystem.

A more robust economic ecosystem will help sustain RI manufacturers by providing access to more resources, more people and new innovations. With the goal of resiliency in mind, manufacturing community-building efforts should cater to the production entrepreneur (the start-up) and the value-added manufacturer, and should focus on the creation of a network of resources and connections (the ecosystem) rather than a singular one-size fits all physical space.

These networks can provide opportunities and access to:

- "Collision spaces" for designers, educators, manufacturers, and professional service providers to come together.
- Discovery events where manufacturers can expand their networks.
- Leveraging existing maker spaces and prototyping shops for physical product development.
- Engage the next generation of manufacturers by providing education to high school students how to use manufacturing tools.
- A more involved and integrated community that lives both online and in person.

Strategy Two: Encourage Skill Development through a Diverse Educational Offering

Giving manufacturers the intellectual underpinnings has been shown to be valuable in helping support ongoing process improvement and product development techniques. However, these "design thinking" professional development programs should be diversified, in order to support the diversified market need, while still reflecting the mission, values and brand of the institution. In addition, Design for Manufacturing and Design for Assembly (DfMA) techniques should be added to the repertoire of offerings. Program design needs to focus on the "student", rather than the "educator", and likewise, any public funding of skill development should also be focused on the company/individual, rather than subsidizing the institution. By allowing student demand to determine curriculum/program structure, institutions will find the "sweet spot" where substantive curriculum and value to manufacturers is balanced with price.

Strategy Three: Promote Innovation in Manufacturing Practices, Processes & Materials

Not every manufacturer is an innovator, but spreading the culture of innovation to those manufacturers is possible as evidenced by the STEAMengine process. Continued competitiveness of RI's manufacturing base will require keeping up to date with latest in management thinking as well as technological developments. A proposal has been brought forward for funding by RI's Innovation Campus bond program by a consortium of manufacturing groups and higher education institutions for a virtual Innovation Campus focused on design, manufacturing and advanced materials.

In addition, Commerce RI, Polaris and other RI manufacturing groups should work to actively link RI manufacturers with national centers such as America Makes, Lightweight Innovations for Tomorrow (LIFT), Institute for Advanced Composites Manufacturing Innovation (IACMI), Digital Manufacturing and Design Innovation Institute (DMDII) among others, that are related to the materials that are prevalent in the state's manufacturing base. Leveraging this expertise and their test bed facilities will help RI manufacturers on a cost effective basis, network and innovate with leading thinking on additive manufacturing, advanced materials, digital manufacturing, and other advanced manufacturing issues.

Strategy Four: EcoSystem Needs to Operate Regionally

While the small geography of RI makes networking, partnership building and doing business easy, it is also limiting particularly for professional/technical service providers. The RI manufacturing ecosystem cannot survive if limited to the state's borders. The market geography should, at a minimum, include Connecticut and Massachusetts to provide an addressable market that can support the professional and technical ecosystem required to keep the STEAMengine concept alive.

"...That they may successfully apply the principles of Art to the requirements of trade and manufacture."
- from RISD enabling legislation,1877

STEAMENGINE'S FUTURE

STEAMengine Program

STEAMengine will continue to focus on developing and maintaining a virtual network / connection resource implemented through the revamped website. Direct programs will be in the hands of the various participants in the pilot phase and supported by the needs and demands of the marketplace. These specific initiatives are described below.

Providence Design Catalyst

The Providence Design Catalyst is an accelerator program aimed at design firms. Firms can receive up to $35,000 in seed capital. The design of the program reflects the learnings of the Design Readiness Assessment process

Advanced Materials Innovation Center for Design & Manufacturing

This consortium is led by URI Polaris MEP and included the University of Rhode Island, Roger Williams University, Rhode Island School of Design, AS220, International Yacht Restoration School (IYRS), DESIGNxRI. The Center will do the following:

- Identify and grow industry resources for the advanced materials industry.
- Host a collision and design thinking space where composite and textile focused people convene.
- Maintain R&D and incubator facilities.
- Support applied research and proof of concept.
- Host session on industry trends and focus on in demand topics.
- Develop a program that engages college students in the region to allow for textiles and composites exploration.
- Utilize specifically designed programming to educate and encourage a culturally diverse population of students and faculty to explore industries supported by materials, textiles and composites.
- Collaborate with local STEAM initiatives.
- Support a robust marketing strategy.

The consortium submitted a $3.4M request to Rhode Island's Innovation Campus program. It was named a finalist but was not selected in the initial round. The consortium intends to resubmit with some refinements in the next round of campus funding.

RISD Executive Education

RISD is in the process of redesigning its executive education program based on the several different approaches to design thinking curriculum for manufacturers during the STEAMengine process. The new executive education studio concept should be launched sometime in 2019.

Polaris Design

URI Polaris MEP is adding marketing innovation and design to its Fee for Service consultative program. These services will reflect the learnings from the Design Readiness Assessment and the MIC process. The staffing for these projects will be through the consultative network developed by Polaris.

Mearthane Products Corporation

STEAMENGINE

A Successful Demonstration of the Value of Piloting an Initiative

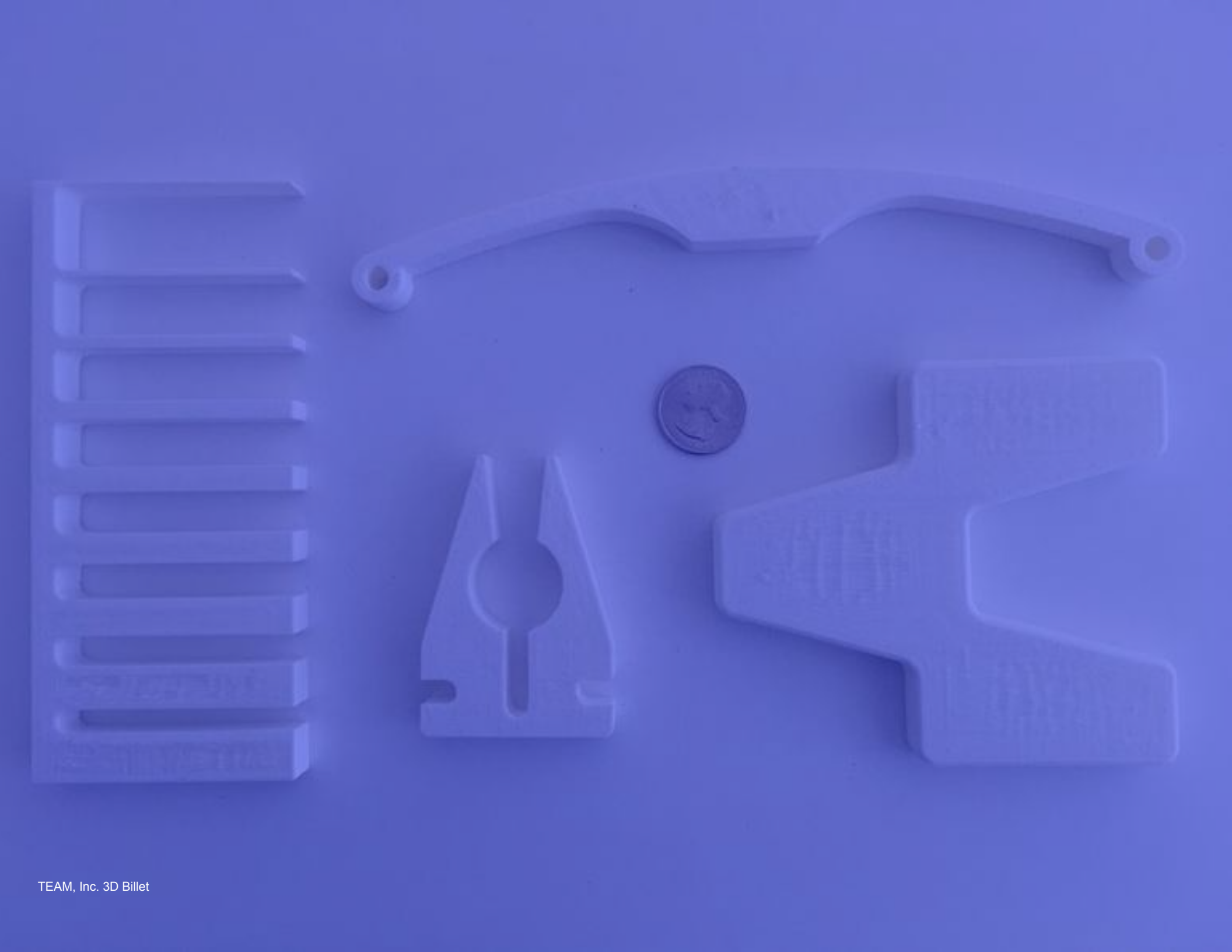
The DoD supported STEAMengine Initiative has been ground-breaking for manufacturing in RI. Its intent was to be transformative for RI's defense manufacturers. It reached much deeper into the RI economy. Never have designers, manufacturers, educators and professional service providers engaged each other with this level of intensity and intentionality. Many possibilities and partnerships have been seeded and come to fruition. More continue to unfold.

STEAMengine was a pilot initiative and as a pilot, some things worked, and some did not.

Like most transformational efforts, flexibility and adaptability to changing circumstances and the realities of the marketplace are necessary requirements to build a viable and sustainable initiative. STEAMengine's pilot programs have done just that:

- The program concept moved from pursuit of a physical concept to the adopting a virtual, network driven model.
- The manufacturer / designer program interactions were adjusted to reflect the needs and abilities of the manufacturers.
- Education and skill development curriculum around design thinking were refocused on key concepts and skills delivered across a timeline that better met the speed of business.
- Fostering interactions and sharing insights across the manufacturing and design community which heretofore were limited and opportunistic are now viewed as critical.

STEAMengine provided a valuable catalyst and allowed the RI defense manufacturing and design community a vehicle through which to learn how to work together. Moving forward, as the program elements stand on their own, the learnings and connections made through the STEAMengine process will continue to have a major impact on RI's manufacturing sector.



TEAM, Inc. 3D Billet

APPENDICES

Program Reports

Final program reports associated with STEAMengine can be found at http://steamengineusa.com. These include:

- URI Polaris MEP: Manufacturing Innovation Challenge, a Business Development Opportunity for Rhode Island Manufacturers
- Design Catalyst Final Report
- RISD Executive Education: Design for Manufacturing Innovation
- TechShop Providence RI Market Assessment 2017

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Bryant University Executive Development Center, Design Training Certificate (DTC 102)

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Joe Cacciola, (formerly of) Fusion Design
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Design Education Benchmarking Study

Ninigret Partners completed a benchmarking study of 15 top educational institutions and their product/industrial design and design oriented executive education offerings. Research consisted of a comprehensive review of each school's website to identify which institutions offered product/industrial design programs and how those programs were structured. The initial list of peer institutions included:

- MIT
- Parsons School of Design
- Pratt
- Stanford
- Carnegie Mellon
- Georgia Institute of Technology
- California College of the Arts
- Savannah College of Art and
- College of Creative Studies
- Design (SCAD)
- Rochester Institute of Technology
- Harvard
- Yale
- Princeton
- Cranbrook
- California Institute of the Arts (CalArts)

Product/Industrial Design

Of these institutions, four were eliminated because they did not have a strong a product or industrial design-oriented program: the art programs at Yale, Princeton, CalArts, and Cranbrook all focus on fine or performing arts, with minimal attention to design.

Of the remaining institutions, nine have product or industrial design programs either as an undergraduate program, graduate program or both. Two institutions have programs that relate to product/industrial design: Harvard has a graduate program in Design Engineering and MIT has a graduate program in Integrated Design and Management.

Executive Education

Nine of the benchmarking institutions have Executive Education programs that tie into their design curricula. Detroit's College of Creative Studies does not have an executive education program per se, but does have a graduate program in Integrated Design. MIT and Georgia Tech house their executive ed programs within their business schools, while Stanford, Carnegie Mellon and Harvard house them within their respective design schools. Parsons, SCAD and Yale house their executive ed programs in their own centers or schools: Parsons in their School of Design Strategies, SCAD in their Collaborative Learning Center and Yale in their Center for Engineering Innovation and Design.

The executive education programs at Parsons, MIT, Stanford, Yale and the College of Creative Studies are all geared mainly towards individuals, while the programs at Carnegie Mellon, Georgia Tech, the California College of the Art, SCAD and Harvard also have programs geared towards organizations or corporations. The programs intended for organizations are generally custom-designed.

The price range and time frame for executive education programs geared towards individuals vary widely, ranging from as little as $900 for a one-day program to $72,000 for 22 months. Program prerequisites vary, but in general, applicants are assumed to be mid-level professionals and have some previous higher education.

Design Research

Nine of the institutions had some sort of design research program, generally structured as research studios in partnership with a corporate sponsor. Georgia Tech and Harvard, most notably, have a number of design labs geared towards looking at specific innovations, including interactive product design, urban design, body scans, etc.

Past corporate sponsors for these programs include:

- Samsung
- Phillips
- New England Aquarium
- Intel
- MasterCard
- General Motors
- Clorox
- SF Opera
- Cybex
- LA Department of Public Social Services
- US Airforce
- Penske
- GM
- Bosch
- Volkswagen
- Levis
- Hewlet Packard
- Google
- Coca-Cola
- Fox Sports
- Reebox
- Shinola

Comparative Institution Design Programs

Institution	Product / Industrial Design Program?	Executive Education?	Fees	Timeframe	Requirements
RISD	Yes	Yes	Free for qualified manufacturers		
MIT	Yes	Yes	$4k	2 days	professional experience
Parsons The New School for Design	Yes - both	Yes	($58K - $72K)	18 - 22 month	3-5 years professional experience
Pratt	Yes	No, but design research program			
Stanford	Yes	Yes	$12k, $16k and custom	3-5 days, custom	varies
Carnegie Mellon	Yes – both	Yes	custom	custom	varies
Georgia Institute of Technology	Yes	Yes	varies	varies	varies
California College of the Arts	Yes	Yes	custom	custom	custom
Savannah College of Art and Design	Yes	Yes	varies	varies	varies
Rochester Institute of Technology	Yes	Yes			
Harvard	Yes	Yes	$900 - $40K	1 day to 1 month	varies
Yale	No	No	n/a	n/a	n/a
Princeton	No	No	n/a	n/a	n/a
Cranbrook	No	No	n/a	n/a	n/a
Cal Arts	No	No	n/a	n/a	n/a
College of Creative Studies	Yes	Yes, part of integrated design masters	$47K	2 years	bachelors degree