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## 1. Executive Summary

NCMEP is comprised of a diverse group of stakeholders in North Carolina whose specialties complement one another's efforts to create a stronger, more competitive, and ultimately more prosperous manufacturing base in the state. Current partners include: North Carolina State University's Industry Expansion Solutions (NC State IES), The Polymers Center of Excellence (PCE), The Manufacturing Solutions Center (MSC), The Economic Development Partnership of North Carolina (EDPNC), North Carolina Agricultural and Technical State University's Department of Industrial and Systems Engineering (NCA&T), University of North Carolina at Charlotte's Industrial Solutions Lab (UNCC), the North Carolina Community College System Customized Training unit, East Carolina University's College of Business Department of Professional Programs (ECU), and First Flight Venture Center's Hangar 6.

Established in 1995, the NCMEP has built a strong reputation among small and medium sized manufacturers it serves, largely due to the results (impacts) of the work of each partner, producing bottom and top line results, increased sales and profitability, growth and diversification, development of new programs and processes, and via the creation and retention of jobs in the sector. The NCMEP, like other MEPs across the nation, continues to face new challenges as manufacturing firms adapt to an ever-changing, competitive global marketplace. In response, NCMEP is facing these challenges head on to help the small and medium manufacturers in NC prepare for, and realize the value of smart manufacturing investments.

NCMEP's approach for the next five years is to continue to create innovative solutions centered on manufacturing growth and competitiveness (locally, regionally, and abroad) through technological advancements. NCMEP also has a proven track record of strategically pursuing supplemental federal and non-federal funding opportunities to enhance our impacts to small and medium sized manufacturing firms across the state. NCMEP continues to refine its business model to position itself in ways that maximize impact, meet and exceed program objectives, and generate sufficient fees to meet federal requirements.

Building on past experience, NCMEP has leveraged and expanded partnerships to enhance geographic market penetration and diversification of service offerings to better meet emerging client needs. The NCMEP will transition to a wider range of services based upon feedback obtained from current and potential clients that will require new skill sets of subject matter experts.

Future efforts will increase the competitiveness and productivity of U.S. manufacturing by helping small and medium sized manufacturers in North Carolina improve their production performance and grow their business through innovation in product development and production; raise awareness and an appreciation for the value of manufacturing among key decision makers, policy makers and funders to better position and support our work; continue to support partnerships that enhance the ecosystems we develop; and, pursue opportunities to share best practices as we further develop and define our learning community.

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## Project Narrative

### a. Introduction

Drawing on over 20 years of operation and a portfolio of programs and partnerships that comprise NCMEP, the Center has developed a unique understanding of the manufacturing industry in North Carolina – including its position in the national and global market economy – that is unparalleled by any other organization in the state. The NCMEP business model positions the Center’s partners to target efforts in ways that maximize top and bottom-line growth of Small and Medium-sized manufacturers, while meeting the Center’s strategic goals and objectives, and generating sufficient fees to meet federal match requirements. NCMEP’s approach for the next five years involves continuing to strengthen efforts to become more innovative in the solutions we provide, with specific focus to several opportunity areas within the state’s strong manufacturing sectors (e.g. food manufacturing, aerospace). NCMEP will continue to transition to a wider range of services based upon feedback obtained from manufacturers, including quantitative and qualitative data from surveys, labor market information, and completed projects. Our work over the next five years will require new contacts, new ways of reaching clients and new capabilities in advanced manufacturing technologies. For these reasons, NCMEP has already begun expansion of its partnership network to include new partners: East Carolina University, University of North Carolina Charlotte, and First Flight Venture Center’s Hangar 6 (a 3D printing and fabrication space representing the east, and we will be purchasing a 3D printer for the western part of the state located at the Polymers Center).

In 2018, NCMEP services led to:
Creating <b>1,470</b> and retaining <b>3,837</b> jobs
Increasing our clients’ sales by 500% for a value of <b>\$171,115,881</b>
Increasing new products and processes by 295% for a value of <b>\$144,292,211</b>
Generating cost savings for a value of <b>\$20,283,248</b>

The strength of NCMEP’s business model is grounded in partnerships that span the entire state, reaching both rural and urban communities, as well as outreach to manufacturers of all sizes, including start-ups and very small manufacturers. Since its establishment in 1995, the NCMEP has maintained and expanded its efforts in two-way communication between its partners, economic and workforce development policy leaders, and other stakeholders that support manufacturing subsectors in the state, to deliver the research and technology-driven solutions that respond to the unique needs of a wide range of North Carolina manufacturers.

NCMEP’s robust strength in technical personnel and programmatic resources, full-time field staff (our Trusted Advisors), facilities, and equipment, uniquely position the Center to facilitate the application of new technologies to new or existing products, processes and services further outlined in this proposal. Over its history, the reputation of NCMEP has been understood by our state’s key leaders in various government and not for profit agencies such as the Department of Commerce, the Chamber of Commerce and the NC Community College System, and recent efforts such as the 2019-20 cohort of the NIST MEP Manufacturing Policy Academy, have strengthened these bonds and assisted with building awareness of the impact of our Center to the vitality of NC manufacturing. NCMEP will explore ways to continue this advocacy and awareness-building beyond the initial phase of this work to address our long term goal of being seen as the leader in economic and workforce development for manufacturers in our state.

## **b. Market Segmentation**

Almost twice as much of North Carolina’s aggregate economic output comes from manufacturing as a percentage than that of other states in the nation. North Carolina’s manufacturing output in 2018 was the seventh highest in the nation, at over \$103 billion (18.3% of the state GDP). The total number of manufacturers in North Carolina is just over 10,000 with almost 90% of these establishments employing less than 250 workers and 75% employing less than 50 workers.<sup>1</sup> In 2018, total manufacturing jobs had grown to over 474,811. Employment in NC Manufacturing grew by 5,700 net jobs from January 2017 to quarter 3 of 2019.<sup>2</sup>

<b>Table 1. Manufacturing Establishments by Number of Employees</b>	
0-4:	3,211
5-9:	1,501
10-19:	1,408
20-49:	1,393
50-99:	800
100-249:	655
<b>Total under 250</b>	<b>8,968</b>

<sup>1</sup> According to the most recent data from the Bureau of Labor Statistics, 2018

<sup>2</sup> 2019 NC WIOA State Unified Plan

With these numbers of manufacturers and manufacturing jobs, it is not surprising that the industry remains the top contributor to the state's gross domestic product with close to 95 percent of state exports in goods, totaling \$31 billion in exports in 2018.<sup>3</sup> While North Carolina has experienced losses in manufacturing jobs since 2001, and is expected to continue experiencing job losses through 2026 in legacy industries (textile and furniture), job gains have been experienced in high science, engineering and technical (SET) employment (high-skill industries), which pay significantly more than non-SET jobs in the industry.<sup>4</sup> At the sub-sector level, Food manufacturing, Chemical Mfg and Fabricated Metal Mfg were the top employers in 2017, when the latest data was gathered, and is projected to remain so through 2026.

The NC Jobs Plan 2014-2024 further recommends targeting high-performing industries already committed to our state, focusing on industry clusters that match our workforce with high return rates. The plan targets industry clusters that align with the industries served by the NCMEP which includes Aircraft, Aerospace, Chemicals, Plastics, Metals, Textiles, Furniture, and Automotive. These align with the top industries that the NC Department of Commerce will be focused on for business recruitment, expansion, and strengthening of existing businesses according to the unified plan for NC's Workforce Innovation and Opportunity Act (WIOA) state-level program. Some of these manufacturing sub-sectors are projected to have job growth in 2020: Food, Chemical, Fabricated metal, Machinery manufacturing and transportation equipment manufacturing.<sup>5</sup> While textiles and furniture have experienced declines in the past decade, North Carolina is still dedicated to supporting these industries because there has been stabilization over the past few years and a re-emergence via new markets and business models.

NCMEP has been assessing the NC food manufacturing sector and is developing objectives and a 2020-2025 timeline for new product development in this sector. NCMEP has been cultivating new relationships in this area, such as the NC Food Innovation Lab (a partnership between the U.S. Department of Agriculture, NC State University, and the NC Research Campus) and NC State University's Food Safety Education and Training group. We have found through our research in this area, while there is a plethora of resources for large-scale food manufacturers who can afford to hire consultants to guide them through the regulations in this sub-sector, small and medium sized businesses continue to struggle with compliance with federal standards, which is an area that we will focus on in our partnership efforts, along with

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<sup>3</sup> <https://www.nam.org/state-manufacturing-data/2019-north-carolina-manufacturing-facts/>

<sup>4</sup> NC Department of Commerce: Tracking Innovation, NC Innovation Index. 2019.  
[https://files.nc.gov/nccommerce/documents/files/Tracking\\_Innovation\\_NC\\_Innovation\\_Index\\_2019.pdf](https://files.nc.gov/nccommerce/documents/files/Tracking_Innovation_NC_Innovation_Index_2019.pdf)

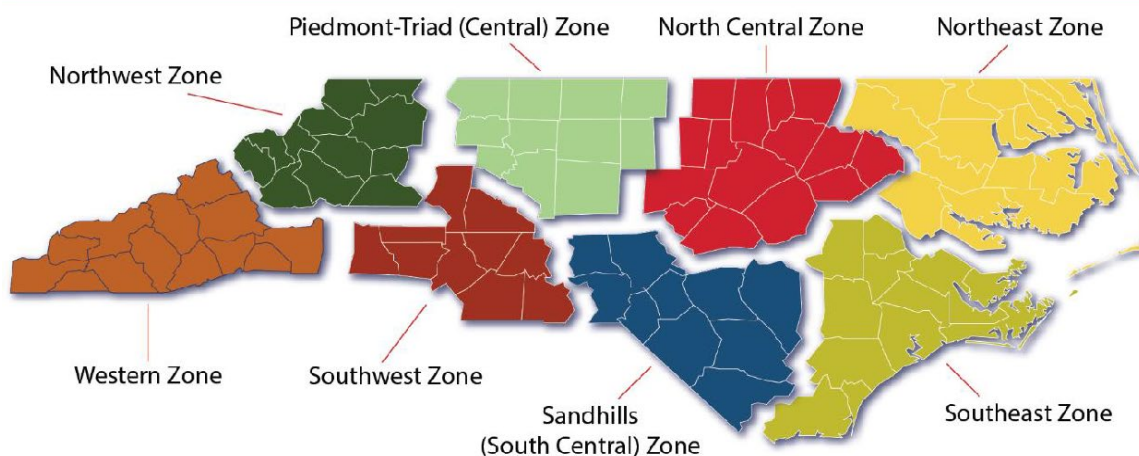
<sup>5</sup> Department of Commerce, LEAD Division.

development of training and our existing product lines for continuous improvement and growth. Food manufacturing is an area in which we expect to see continued growth, and employers have indicated that they choose NC for their facilities due to ready access to skilled labor, proximity to ingredients and materials, and the variety of local and state business incentive programs.<sup>6</sup>

While the manufacturing industry spans the state, regional differences require a more nuanced understanding of economic climates and contexts. There are significant numbers of manufacturing facilities in each of the NC Prosperity Zones with the highest concentrations in the Southwest, Piedmont- Triad and North Central zones. According to the North Carolina Jobs Plan, the state is most effectively segmented into geographic regions called Prosperity Zones (Figure 1). The Prosperity Zones depicted here are aligned with the NCMEP zones described in the Center Strategy section, below.

Western	789
Northwest	979
Piedmont-Triad	2,086
Southwest	2,587
Sandhills	521
North Central	1,836
Northeast	377
Southeast	706

**Figure 1. Prosperity Zones of North Carolina**



### **c. Needs Identification and Service Offerings**

In 2018-19, more than 300 manufacturers were served by the NCMEP. In addition, the Manufactured in North Carolina (MNC) supply chain database currently contains over 1,000 North Carolina manufacturers, half of which have less than 50 employees. Understanding the

<sup>6</sup> NC Food Manufacturing Task Force Report, 2015.

needs of manufacturers in NC is at the heart of the partnerships the Center has formed and services we provide to our clients. We make use of multiple sources of qualitative and quantitative data and information to determine manufacturers' existing and emerging needs and how best to address them. Currently, data underpinning our assessments and evaluations comes from four primary sources: 1) quarterly NIST MEP survey reports; 2) regular face-to-face meetings with current and potential clients; 3) online inquiries; and 4) identifying and aligning with the needs and focus areas of other manufacturing related groups. Secondary sources include surveys administered by the NC Department of Commerce as well as reports produced by the local, state, and federal agencies.

NCMEP independent quarterly surveys provide valuable quantitative and qualitative data and information regarding anticipated future business challenges. Most recently, our clients have told us that product innovation/development, growth opportunities, cost reduction, and employee recruitment are the most pressing challenges they face. Through ongoing strategy development efforts and input from the NCMEP Advisory Board, we have sought funding, or leveraged existing funds, to resource new initiatives that align with our manufacturer's needs. The need for growth opportunities among manufacturers is being explored through various innovation and advanced manufacturing technology initiatives as well as export assistance and workforce development / training programs. To meet needs for cost reduction in manufacturing processes we still turn to our experts in lean manufacturing and industrial engineering projects.

On a daily basis, information is entered into the NCMEP customer relationship management (CRM) database as a result of staff engagements with clients. Via the Trusted Advisor approach, NCMEP staff develop personal relationships and work to tailor services that meet identified needs and, in turn, advance clients' goals. As client opportunities and needs arise, new products are developed. Examples of new products that have been developed, or are currently in development, based on our client interactions and gaps assessments include the following:

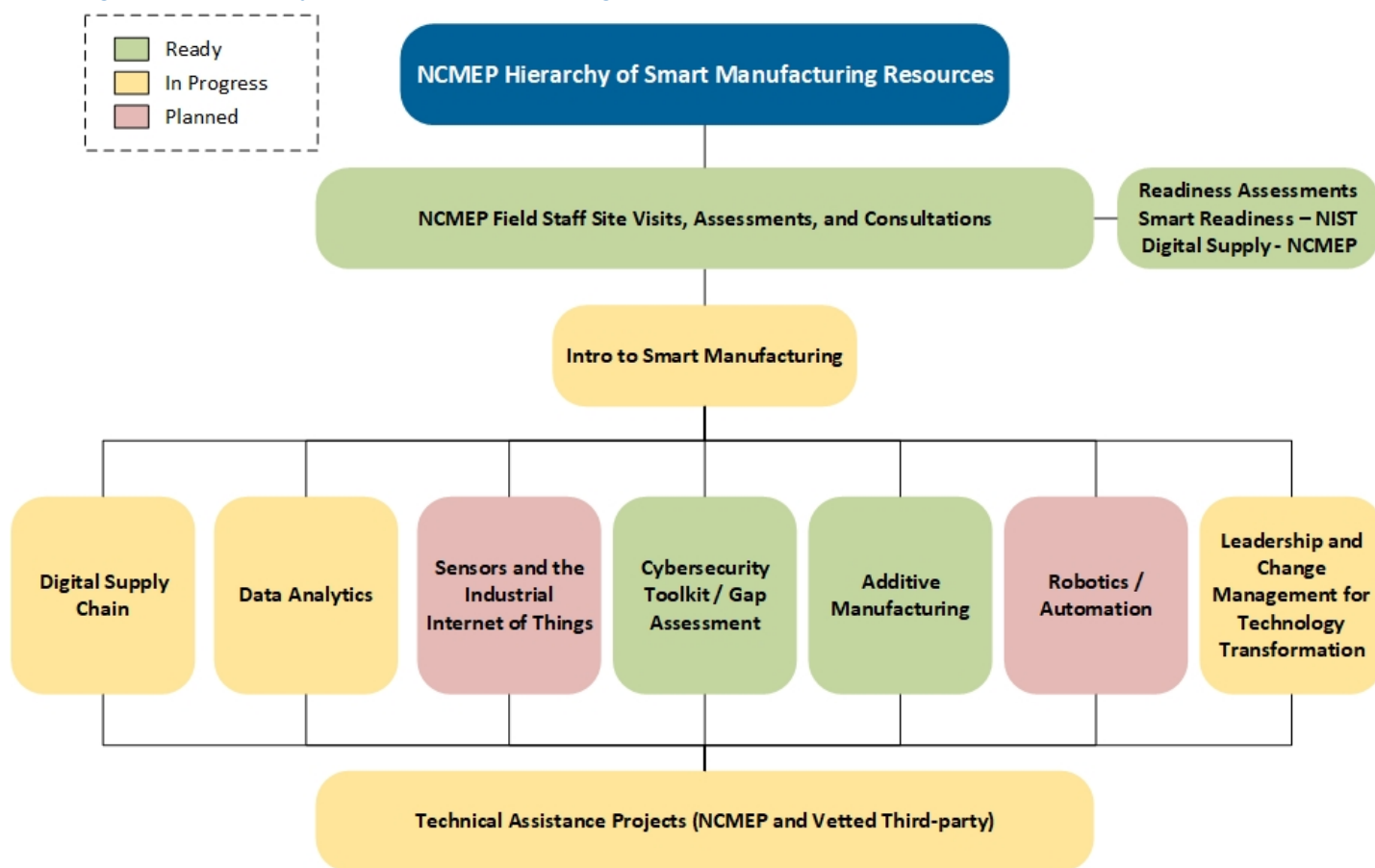
- Development of a Cybersecurity Toolkit (over 50 downloads to date), a Digital Supply Chain online and face-to-face course offering, and a Data Analysis online and face to face course offering developed specifically for small and medium sized manufacturers. These offerings were produced via supplemental grant funding (NIST RCAP and DoD OEA). Plans have been developed to utilize vetted third party services for conducting in depth cybersecurity assessments for SMMs.
- Development of an Introduction to Additive Manufacturing online learning module to help

Small and Medium-sized Manufacturers (SMMs) understand applications of this technology, industry use cases, and future directions / possibilities that can be applied to customers current or future offerings. Provide technical assistance to manufacturers with product development from concept/idea through prototype using NCMEP 3D printing resources.

- Development of a Food Manufacturing support program (currently in planning phase), linking SMMs in this subsector to education, improvement, and innovation opportunities through NCMEP partners and partnerships with our research institutions in the state, while also tapping into other MEP Centers' knowledge and expertise.
- Further development and launch of a Leadership and Organizational Development program for manufacturers. This work will build on our work launched via the RCAP grant *Manufacturing Digital Supply Chain Network*.
- NCMEP will focus on the defense and aerospace manufacturing sectors in support of the state of NC strategies in these sectors, and in collaboration with multiple established state military sector leaders.
- We will continue developing long term strategies in supporting manufacturers seeking to establish long term production of PPE or other products due to our current national dependence of offshore products (Build on COVID-19 project).
- Further development, refinement, and rebranding of our Industry 4.0 materials (including the offerings listed in the first two bullets above) is underway or in the planning stage. We have found that Industry 4.0, as a term, does not resonate with some of our SMMs. Through research and learning from how other MEP Centers are approaching this topic, we have decided that *Smart Manufacturing* will be a more effective way for us to communicate the benefits and potential ROI of manufacturing technology transformation. Beyond Cybersecurity, Additive Manufacturing, Digital Supply Chain, and Data Analytics, future plans include developing materials around Change Management for Technology Transformation, Robotics and Automation, as well as Sensors and the Industrial Internet of Things. See Figure 2 below for a hierarchy of this approach and current status of each. Beyond providing awareness and learning materials for SMMs, we are also planning to provide technical assistance around product development for additive manufacturing in partnership with the FFVC Hangar 6 (~5-10 / year), and will continue to deploy cybersecurity assessments (~12 in depth assessments / year). We will use a suite of assessment tools to determine where a SMM is at on the journey of technology transformation, and along with building additional learning materials (e.g. robotics, sensors) we will also create or refer SMMs to on-site

consultation and technical assistance solutions for these areas (~12 on site consultations / year).

Figure 2. Hierarchy of Smart Manufacturing Resources



### 3. Center Strategy

Table 3 below provides an overview of NCMEP strategies for 2020-2025 as they align to NIST MEP’s high level goals found in the latest NIST MEP Strategic Plan. These strategies highlight both existing efforts that will be continued over the next five years, as well as new and expanded strategies based on market analysis, a focus on new technologies, and/or other needs that we have learned about through our interactions with our client base. A more detailed strategic action plan is under development to operationalize these strategies over the next five years.

Table 3. NCMEP Center Strategy & Alignment to NIST MEP Goals	
<b>NIST MEP Goal</b>	<b>Empower Manufacturers:</b> <i>Assist U.S. manufacturers in embracing productivity- enhancing innovative manufacturing technologies, navigate advanced technology solutions and recruit and retain a skilled and diverse workforce.</i>

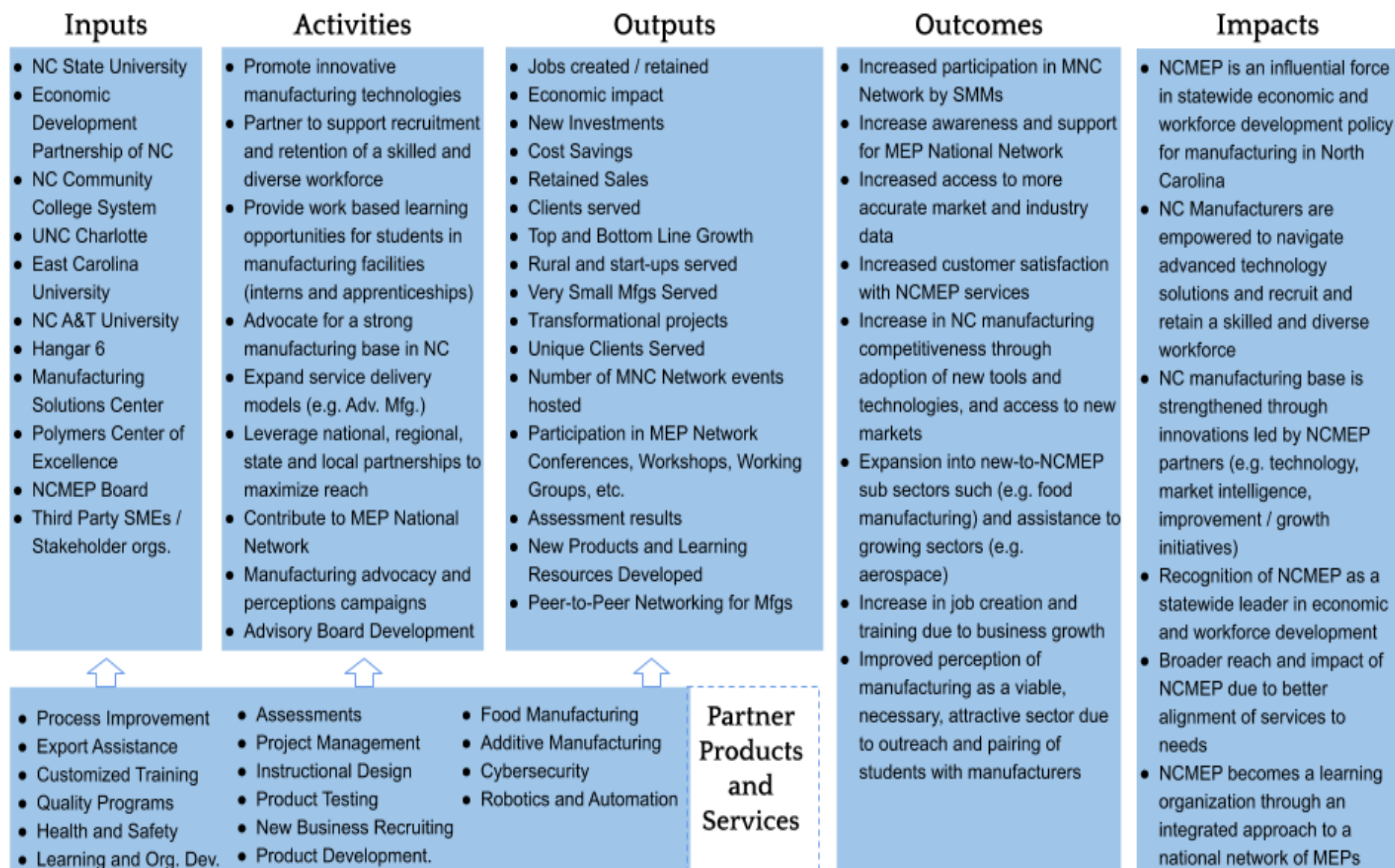
<b>NCMEP Strategies 2020-2025</b>	<p style="text-align: center;"><b><i>Existing Strategies (To be Continued)</i></b></p> <ul style="list-style-type: none"> <li>• <b><i>Trusted Advisor Model:</i></b> Adopted and embedded the Trusted Advisor model in our client relationship management process. Field staff utilize a variety of comprehensive business assessment tools to better understand the unique needs of each SMM they work with (e.g. NCMEP Competitiveness Review, CoreValue assessment, Digital Supply Chain Maturity Assessment). This approach ensures that a solution or referral is properly matched to specific needs.</li> <li>• <b><i>Product Development in Advanced Technology and New Markets:</i></b> Customer listening and needs identification have helped us determine new products and markets to serve. New specialty offerings are being created to meet current and emerging needs, such as advanced manufacturing technologies (Additive Manufacturing, Cybersecurity, Automation and Robotics, IIoT) as well as underserved market segments (Food Manufacturing).</li> </ul> <p style="text-align: center;"><b><i>New &amp; Expanded Strategies</i></b></p> <ul style="list-style-type: none"> <li>• <b><i>Targeted Advocacy for NC Manufacturing:</i></b> Play a larger role in advocating for strengthening manufacturing in the areas of workforce development, economic development, and innovation. NCMEP is involved in the 2019-20 cohort of the NIST Manufacturing Policy Academy, co-leading the effort in partnership with the NC Department of Commerce and Governor's Office. In addition, NCMEP is leveraging awareness and perceptions campaigns that are supported by the Manufacturing Institutes. This work is particularly important, beyond the policy academy, as workforce shortage / difficulties in hiring are consistently reported as top challenges for manufacturers in NCMEP and the NC Department of Commerce surveys. At a local and regional level, our field staff attend local chamber events and working groups to build relationships with other entities that are also involved in supporting and advocating for NC businesses.</li> </ul>
<b>NIST MEP Goal</b>	<p><b>Champion Manufacturing:</b> <i>Actively promote the importance of a strong manufacturing base as key to a robust U.S. economy and protection of our national security interests; create awareness of innovations in manufacturing; create enabling workforce development partnerships to build a stronger and more diverse workforce pipeline; and maximize market awareness of the MEP National Network.</i></p>
<b>NCMEP Strategies 2020-2025</b>	<p style="text-align: center;"><b><i>Existing Strategies (To be Continued)</i></b></p> <ul style="list-style-type: none"> <li>• <b><i>MNC Supplier Database:</i></b> Continue to promote and grow the NCMEP supplier database (Manufactured in NC) as the go-to resource for NC manufacturers to discover ways to localize supply chains through business to business opportunities. MNC receives over 100K visits per year and facilitates close to 3000 inquiries per year between manufacturers.</li> <li>• <b><i>Manufacturing Day:</i></b> Continue to play a leadership role in organizing and supporting activities across the state on Manufacturing Day, helping to highlight the importance, and breadth of manufacturing in our state. Continue to find ways to involve policy leaders in workforce and economic development, business owners, the media, institutions of higher education, K-12 students and members of the general public.</li> <li>• <b><i>Manufacturing Conference:</i></b> Continue to host annual manufacturing conference mfgCON (started in 2016). The event is centered around several themes in manufacturing: sharing tips, tricks and techniques (best practices), success</li> </ul>

	<p>stories from industry leaders, opportunities for networking and peer to peer connections, and the latest technological trends in manufacturing.</p> <p style="text-align: center;"><b><i>New &amp; Expanded Strategies</i></b></p> <ul style="list-style-type: none"> <li>• <b><i>Podcast Series:</i></b> A new podcast series was launched in 2019 and published on all major podcast networks. The podcast is titled “Clocking In: Voices of NC Manufacturing.” The goal of the podcast is to highlight the diversity of manufacturing that occurs in the state, shed light on common issues / trends that our manufacturers face, and gain insight on the future outlook from an economic, workforce, and technological perspective. Fifteen episodes have been aired since September 2019 and they have been listened to 250 times (data last updated January 2020).</li> <li>• <b><i>Peer-to-Peer Network Events:</i></b> The MNC Member Network has recently been revitalized and we continue to look for ways to attract and retain a strong network of participants in all corners of our state. The MNC Member Network is a free membership organization that affords North Carolina’s manufacturers with opportunities to share operational best practices through plant visits and networking sessions.</li> <li>• <b><i>New Sectors / Market Penetration:</i></b> Partnerships are being explored among researchers and research institutes in the state with expertise in Food Manufacturing to help us assist SMMs who are in the food and beverage industry. We also plan to expand our focus on the defense supply chain, building on a foundation from NC State IES’ DOD OEA program.</li> </ul>
<b>NIST MEP Goal</b>	<p><b>Leverage Partnerships:</b> <i>Leverage national, regional, state and local partnerships to gain substantial increase in market penetration; identify mission- complementary advocates to help the MEP National Network become a recognized manufacturing resource brand; build an expanded service delivery model to support manufacturing technology advances.</i></p>
<b>NCMEP Strategies 2020-2025</b>	<p style="text-align: center;"><b><i>Existing Strategies (Continued)</i></b></p> <ul style="list-style-type: none"> <li>• <b><i>Comprehensive Statewide Partnerships:</i></b> Ensure a robust set of client solutions are readily available by connecting and leveraging appropriate new partners. NCMEP has sought partner expansions as a way to serve more clients in diverse regions and areas of expertise, including additive manufacturing (First Flight Venture Center Hangar 6) and business improvement (East Carolina University College of Business).</li> </ul> <p style="text-align: center;"><b><i>New &amp; Expanded Strategies</i></b></p> <ul style="list-style-type: none"> <li>• <b><i>Advisory Board Development:</i></b> Invest time in invigorating and advancing the NCMEP Advisory Board. Find new members to grow the board in size and in the variety of manufacturing backgrounds. Two face to face and two virtual meetings are hosted annually.</li> <li>• <b><i>Partnering with Advocates at Local, State, and Federal Levels:</i></b> Developing better relationships with state and federal legislators through our work with clients who are interested in advocating for NC manufacturing and the role of NCMEP. Ensure participation in meetings facilitated by NC Commerce to develop a statewide economic development strategy for the state as well as workforce development efforts around regional manufacturing clusters.</li> <li>• <b><i>Build Awareness and Leverage Expertise of Manufacturing USA Institutes:</i></b> NCMEP has been involved in several targeted efforts in the past through work</li> </ul>

	with embedded staff within PowerAmerica, CESMII, and NIIMBL. In the future, we will tap into broader efforts and lessons learned across the MEP National Network around this area.
<b>NIST MEP Goal</b>	<b>Transform the Network:</b> <i>Maximize MEP National Network knowledge and experience by operating as an integrated National Network; increase efficiency and effectiveness by employing a Learning Organization platform; and create a resilient and adaptive MEP National Network to support a resilient and adaptive U.S. manufacturing base.</i>
<b>NCMEP Strategies 2020-2025</b>	<p><b><i>Existing Strategies (Continued)</i></b></p> <ul style="list-style-type: none"> <li>• <u><i>Client Engagement Approaches:</i></u> Continue participating in Trusted Advisor and client assessment conversations with other MEPs (e.g. GenEdge) to share best practices.</li> <li>• <u><i>Salesforce Lessons Learned and Use Cases:</i></u> Continue to provide demonstrations and knowledge sharing to individual Centers regarding our use of Salesforce as a client relationship management tool. Stay involved in the Salesforce user group on MEP Connect and at conferences.</li> <li>• <u><i>MEP National Network Working Groups:</i></u> Continue our active participation in MEP National Network working groups such as the Industry 4.0 Working Group and the Food Industry Working Group.</li> </ul> <p><b><i>New &amp; Expanded Strategies</i></b></p> <ul style="list-style-type: none"> <li>• <u><i>Knowledge Sharing and Collaboration Opportunities:</i></u> Continue to find ways to collaborate with other MEPs on grants (e.g. RCAP) and sharing approaches to addressing emerging technologies via conferences and Center-to-Center networking (e.g. Industry 4.0 topics, Cybersecurity toolkits, Leadership and Organizational Development for Manufacturing).</li> </ul>

The NCMEP logic model (see Figure 3) depicts our strategy and outlines the (causal) relationships between the elements of the program. The model describes the resources that have been established to drive a set of activities to be implemented to accomplish our stated outputs, outcomes and expected impacts. The model is the foundation for a robust operational plan to be supported by a formative and summative evaluation plan, whereby corrective actions can be taken, as needed.

Figure 3. NCMEP Logic Model



NCMEP organizes interpersonal networks and utilizes technology to “develop data as a service for competitive advantage” while “supporting organizational and system learning through identification and communication of best practices, information exchange and peer learning groups.”<sup>7</sup> NCMEP deploys engagement specialists into North Carolina manufacturing businesses daily from the statewide offices of NC State IES, EDPNC, and the NCCCS Customized Training unit. Product development and business management expertise is referred to PCE, MSC, First Flight Venture Center’s Hangar 6, UNCC Industrial Solutions Lab, and ECU’s Department of Professional Services.

The roles and responsibilities of these trained professionals fulfill the specific funded interests of NIST, as well as complementing the partner’s missions. NCMEP programs effectively support North Carolina’s manufacturers’ agility, innovation and competitiveness in a broad and diverse range of industry sectors. NCMEP also facilitates and accelerates the transfer of manufacturing technology in partnership with industry, universities and educational institutions, state government, NIST and other federal research laboratories and agencies.

The NCMEP strategy rests on our Trusted Advisor client engagement model that ensures our interactions with clients are focused on first understanding their unique needs, then creating solutions and building new markets with a key outcome being long-term financial strength and competitiveness of NC SMMs. The goal of NCMEP under this plan is to ensure that manufacturing leaders over the next decade will consistently embrace techniques of continuous innovative thinking and practice as a way to achieve new standards of business stability in an ever-changing, competitive global marketplace. The institutional visions and missions of NCMEP partners are aligned and our strategies are complementary. They will provide a focus on the supply of adequately prepared workforce from which our clients will be able to employ.

## 4. Business Model

### a. Approach to the Market

The NCMEP Business Model has been amplified by the development of new partnerships and programs since our 2015 Center renewal. We have deployed new methods for enhancing opportunities for transformation projects, evaluations, and benchmarking, grounded by our adoption of the Trusted Advisor approach to client engagement. As referenced in our Business Model schematic (Figure 4), we begin our process through our ***Advocacy and Program***

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<sup>7</sup> System Strategic Plan: Making an Impact on U.S. Manufacturing: MEP, NIST: 2014-17


**Awareness** efforts, which includes our annual mfgCON conference for manufacturing, peer-to-peer networking events, and Center marketing (including web and social media presence). NCMEP continues to use social media to engage with its clients and partners and to conduct market research via Facebook, Twitter, LinkedIn, and blog accounts. These tools have proven useful to spread awareness of manufacturing and promote NCMEP led events such as Manufacturing Day activities in the state. Lastly, our recent involvement in the NIST Manufacturing Policy Academy has been a contributor to strengthening the presence of NCMEP as a statewide leader in supporting manufacturers among other state among the workforce, economic, and policy leaders involved.

We rely heavily on our Trusted Advisor model in our **Client Engagement and Assessment** process to get a clear picture of each of our clients' needs through regular plant visits, assessments, and online inquiries. We have been increasingly reliant on the use of various business assessments to help us gauge where a company is at in their journey, which could be along a number of focus areas such as business drivers, technology readiness, and policies and behaviors that support those. Our work has been in partnership with several MEP Centers (e.g. SCMEP, MassMEP) that have helped guide and implement/refine the assessments we use. Our program field staff work directly with local manufacturers, economic development agencies, trade associations, and community resources to engage manufacturers at their place of business.

The statewide NCMEP alliance-based program provides **Technical Assistance and Referrals** for innovative, custom solutions across a vast array of manufacturers throughout the state. Through leveraged partnerships at the state, regional, and local levels, NCMEP positions manufacturers for business growth, new product development, improvement of daily operations, and job creation.

The NCMEP partners keep track of client and project data and information in our CRM tool (Salesforce). We regularly review dashboards and reports to engage in **Center Impact Analysis and Strategy Development**. Through an ongoing cycle of Plan-Do-Study-Act, we use our experts in market research and evaluation to lead strategic discussions on new products and services and shared learning that lead to continuous improvement of Center operations.

Figure 4. NCMEP Business Model

High Level Process	Activities / Events / Services	
 <b>Advocacy and Program Awareness</b>	<ul style="list-style-type: none"> <li>• Showcase Events</li> <li>• Promotions</li> <li>• Web / Database Management</li> </ul>	<ul style="list-style-type: none"> <li>• Conferences and Network Events</li> </ul>
 <b>Client Engagement and Assessments</b>	<ul style="list-style-type: none"> <li>• Public Interest Sessions</li> <li>• Plant Visits</li> <li>• Assessments</li> <li>• Online Inquiries</li> </ul>	<ul style="list-style-type: none"> <li>• Facilitated Business Discussions</li> </ul>
 <b>Technical Assistance and Referrals</b>	<ul style="list-style-type: none"> <li>• Complimentary Assistance</li> <li>• Continuous Improvement</li> <li>• Supplier Enhancement</li> <li>• Research and Development</li> </ul>	<ul style="list-style-type: none"> <li>• Market Deployment</li> <li>• Applied Engineering</li> <li>• Workforce Dev/Training</li> <li>• Expansion and Exports</li> </ul>
 <b>Center Impact Analysis and Strategy Development</b>	<ul style="list-style-type: none"> <li>• Survey Process</li> <li>• Stakeholder Scoring</li> <li>• Market Research</li> <li>• Strategic Planning</li> </ul>	<ul style="list-style-type: none"> <li>• New Product / Service Dev.</li> <li>• Ongoing Evaluation and Assessment</li> </ul>

## **b. Products and Services**

To support manufacturers' strategic development and improve the production and engineering systems that strengthen competitive positions within supply chains, NCMEP has developed a range of products and services. These products and services address top and bottom-line improvements that are appropriate for both small and medium-sized manufacturers across our state. NCMEP experts share industry experience in knowledge areas including, but not limited to: process optimization; ISO systems and quality management; workplace health and safety; environmental sustainability; energy and water use; research and development; industrial engineering; business expansion; international trade; workforce training; leadership and culture transformations; and innovation and growth strategies.

To meet manufacturer's unique needs outside of the scope of the NCMEP collective expertise, NCMEP is in a unique position to facilitate matches between manufacturer's and universities, community colleges, and other partnering organizations that can address those specific needs.

### **NCMEP Partner Highlight: NC State University Industry Expansion Solutions (IES)**

The Extension Operations Unit has ongoing, strong success with engaging, assessing, and improving the competitiveness of the state's SMEs manufacturing facilities. The IES network of experienced business advisors (i.e., Regional Managers) and technical specialists has efficiently and effectively served the state's SMEs with leading-edge programs over time providing unique solutions that support profitable growth. Through NCMEP, IES led the first coordinated state efforts to provide lean manufacturing services to smaller manufacturers in North Carolina. As the lean six sigma methodology has become more mainstream, IES approaches are now more transformational with clients offering comprehensive culture-focused solutions to ensure long-term business results.

IES also provides leadership in statewide SME focused projects leading to quality management system certification. Since 2000, IES has worked with more than 250 manufacturers assisting with quality management system services leading to new sales, retained sales and cost savings. Retained expertise related to sustainability services is an additional strength of IES support for manufacturing. Environmental, health, and safety has been a core competency of the unit for more than 15 years and IES is well recognized as an independent advisor around state and regulatory requirements.

NCMEP has recently put forward increased effort in developing more robust awareness / online learning materials and training for our field staff in smart manufacturing technologies that are aligned with NIST MEP's Areas of Focus for Manufacturing Innovation.

NCMEP's supplier database **Manufactured in North Carolina (MNC)** system provides opportunities for companies to more fully develop their supply chains and identify potential buyers for their products. Launched in 2011 as an online supplier database, the MNC program introduces the capabilities and innovations of the state's small manufacturers to business-to-business national and global markets and provides targeted, small and rural manufacturers with the following tools and resources: **A free Web presence**; Internet

exposure of small, rural manufacturers to the state, national and global markets; Expert content creation and editing that uses search engine optimization best practices; One-on-one instruction so manufacturers can revise and maintain their own content

The MNC database has grown to over 1,400 companies and we are discovering many new client opportunities as state manufacturers complete site registrations. We anticipate the site to be an important part of our lead generation for our new clients and clients served metric. The site attracts over 100,000 visitors a year and on average, 3000 company inquiries are routed through the site. Many times, a company's profile on the site ranks higher in a Google search than the company's own website.

NCMEP partners and economic development groups market MNC to manufacturers with some requiring enrollment in MNC before they will work with a client. MNC is currently being used to help groups source manufacturers that could make PPE during the COVID-19 pandemic and has been used in prior natural disasters to help identify manufacturers that could make pallets and boxes for product delivery.

#### **NCMEP Partner Highlight: The Manufacturing Solutions Center**

The Manufacturing Solutions Center (MSC) is an innovative and major business unit with a precise mission: to help US manufacturers increase sales, improve quality and efficiency to create or retain jobs. The MSC accomplishes its mission through five broad areas of expert assistance to manufacturers of any size. Those areas are (1) **engineering** (2) **product development** (3) **training** (4) **testing and quality assurance**, and (5) **marketing**. Among many direct services provided to manufacturers in these areas, the MSC: improves products through research and development, including reverse engineering; creates prototypes, including 3D rapid prototypes in a variety of materials; analyzes new materials to enhance structure and products; tests products for reliable content and quality; helps entrepreneurs launch new products; sources products to US companies from customers looking for Made In USA products; provides guidance for implementation of new 21st century manufacturing technologies; provides hands-on support for international marketing, sales and military procurement; designs and creates photo-realistic renderings and visualizations for marketing; and, advocates on behalf of industry and manufacturers.

MSC provides manufacturers problem-solving expertise in all areas of manufacturing, whether at its facilities, on-site. Significantly, the MSC is a fully-equipped, ISO/IEC 17025 certified testing and calibration facility that provides extremely timely and reliable results to manufacturers. MSC is certified to conduct chemical, microbiological, thermal, and mechanical tests on a wide variety of materials including textiles, plastics, metals and furniture and its components. The capabilities of the MSC and its partners have resulted in outreach and services provided throughout the state and nation, and to foreign countries that do business with United States manufacturers. In the twelve-month period between July 1, 2013 and June 30, 2014, the MSC provided direct services to over 173 NC manufacturers and businesses and 511 total companies in almost 50 North Carolina counties, 40 states and the District of Columbia.

#### **NCMEP Partner Highlight: The Polymers Center of Excellence**

PCE provides technical assistance to the polymers processing industry by assisting in the development of emerging technologies and facilitating economic development, while working to

address environmental issues. The Center focuses on polymers processing, taking new polymer concepts and ideas into commercial products via the use of state-of-the-art equipment, then sharing these manufacturing techniques through workforce training programs. PCE also works to deliver to industry commercialized and recycled products that often include wood or other natural products.

PCE's Materials Science Department provides the evaluation of synthetic materials for research, quality and sustainability purposes. A new feature that we have developed recently is known as "Rheotens," which enables one to evaluate whether a polymer can be stretched, and if so, how much. It becomes valuable in coating and thermoforming applications. Recently we were able to help a NC-based company develop new compounds that stretched better over a substrate material using our Rheotens, thus lowering costs and improving the product.

A company came to PCE for compounding trials of their idea of creating a wood /resin hybrid compound. The principal advantage of combining the two materials was that it was possible to incorporate into recycled-content olefin wood products that would otherwise go into landfill. The resulting compound had improved physical properties as well as lower cost than one based on the olefin alone. The Center was able to make a compound from this material and then make sample film that was converted into bags. Initial tests show that these bags start decomposing within a few months of discard into a compost pile.

PCE has the capability to manufacture pre-production work for these new polymer concepts that PCE aids in developing. PCE provides customers with the ability to manufacture large test sample runs. A good example of this is an automotive carpet manufacturer that was studying the feasibility of using certain fillers for their carpet backing. The study required large-scale production for their samples, which PCE provided. The company was understandably reluctant to utilize a production line to develop their samples, so they turned to the Center for that task, which save them days of lost production. A unique feature of PCE is the ability to take a new concept for a compounded polymer resin system, produce it in small quantities on a small twin screw extruder, injection mold it, and evaluate the properties, all of which can be done at the Center, sometimes in a day.

#### **NCMEP Partner Highlight: North Carolina Agricultural and Technical State University**

The NCA&T State University's college of engineering has a long and distinguished tradition of excellence in engineering and computer science education; and the faculty and students are conducting pioneering research focused on creating globally-relevant solutions and on providing advanced methods and products for improving quality of life.

NCA&T is particularly proud of being the home of the National Science Foundation's Engineering Research Center for Revolutionizing Metallic Biomaterials which conducts collaborative research in the areas of biomedical engineering and nano-bio applications in partnership with an international collaboration of universities.

In its commitment to NCMEP, it is expected that all NCA&T projects will be in the areas served by the Industrial and Systems Engineering (ISE) department including: process improvement, ergonomics, in-plant logistics, and layout. The ISE department has a long-standing capstone senior design project requirement for all BSISE students.

Each year, this new program will complete projects from local industry around the Piedmont-Triad Prosperity Zone. Undergraduate and graduate engineering students will be available as an on-going resource in order to provide these creative projects for very small manufacturers. Students will also benefit from the professional development helping to ensure the valuable

experience needed for a career in engineering. Typical projects will tie the work to a course and faculty from the department will serve as the Advisors for individual projects. The course begins with a set of deliverables and ends with a project presentation by the student team to the industry sponsors.

**NCMEP Partner Highlight: University of North Carolina at Charlotte (UNCC)**

NCMEP activities at UNCC will be managed by the staff of the Industrial Solutions Lab (ISL) who meet with companies on a regular basis to discuss participation in the Senior Design Program. Senior Design Projects are worked on as part of a two-semester required academic class (one semester for Civil Engineering) for all Engineering undergraduate students. The program strives to replicate an industry project experience for our students as close as possible in an academic setting. Projects are developed based on engineering needs of the partner companies and ISL strives to deliver value to these companies from the work that the student teams do during the two semesters.

In the Spring 2020 semester, the program had 99 projects active and 70 of these projects were supported financially by an industry partner. Most of the industry participants tend to come from large companies who can afford the participation fee. In the past, the participation fee has been a barrier to participation. The program will support more smaller company participation allowing for reduction in their program fees.

As small and medium size companies provide many engineering jobs, the use of the program in this way would allow us to expose students to small/medium companies that they might otherwise not get to experience. This effort could lead to more participation by not only smaller companies but also disadvantaged/minority and women owned manufacturers.

**NCMEP Partner Highlight: Economic Development Partnership of North Carolina (EDPNC)**

The Economic Development Partnership of North Carolina (EDPNC) leads the state's manufacturing business recruitment and expansion efforts. Statewide developers offer comprehensive facility location services from initial contact through site location to future growth and expansion. The Partnership's International Trade group provides expert assistance to North Carolina manufacturers seeking overseas market opportunities.

EDPNC's Existing Industry Program is one of the largest statewide retention and expansion efforts in the nation, with a team of industry specialists making more than 1,000 personal visits with the owners, presidents and plant managers of existing industries in the state each year. Located in offices throughout the state, Existing Industry Specialists are dedicated to building long-term relationships with North Carolina's existing companies.

Each year, Existing Industry Specialists prioritize visits based on employment, industry sector (i.e., with a focus on manufacturing-related companies) and strategic importance to the local economy. Existing Industry Specialists work closely with companies to provide support from local, state, federal and non-profit agencies to encourage growth and keep companies productive and globally competitive. This translates directly to both job retention and job creation while contributing to an increase in capital investment through the purchase of more efficient equipment.

EDPNC's International Trade Division has experts around the world focused on helping manufacturers thrive in North Carolina. Through two domestic and six foreign office locations, it provides expert assistance to North Carolina manufacturers seeking overseas market

opportunities. EDPNC's experienced and multilingual International Trade Managers offer quality assistance and advice on exporting and specialize in specific industry sectors. These Managers consult with North Carolina manufacturers and help evaluate opportunities as the companies enter unfamiliar global markets. Specific services provided include: Advocacy: Provide assistance with foreign government restrictions, difficult trade regulations, policies or standards; Market Entry Strategy: Help North Carolina manufacturers identify distribution channels for their products and understand the best way to approach a new market; and, Market Intelligence: Provide companies with information on the international market climate, including economic, social and political data.

### **NCMEP New Partner Highlight: East Carolina University**

The new partnership with East Carolina University will be organized around two main task areas: (1) **Marketing of services to eastern NC manufacturing companies:** This task will be led by the College of Business (COB) associate dean of research and faculty development (ADR) and the COB director of professional services and research (DPSR). COB has a long history completing small projects for businesses throughout the region. The goal will be to identify projects that fit within one or more of COB's business disciplines—accounting, finance, hospitality, management, management information systems, marketing, and supply chain management—and or within one of the areas of the College of Engineering and Technology's (CET) engineering disciplines —biomedical, bioprocessing, electrical, environmental, industrial and systems, and mechanical. Marketing efforts will include (a) updating marketing materials for manufacturing projects and services, (b) planning the annual goals, and (c) continuing the marketing of faculty services for manufacturing projects. The marketing manager will have primary responsibility for recruiting and securing manufacturing projects from North Carolina manufacturing operations. It is expected that the ADR will average five contacts each month and secure an average of three projects per semester; and, (2) **Completion of secured projects:** This task will be led by the ADR, the DPSR, and relevant COB and CET faculty members. It is expected that most projects will be in the discipline areas served by the six departments in COB. However, working with non-paid consultants consisting of CET's director of strategic initiatives and the director for the Center of Innovation, other projects may be completed within the six engineering disciplines housed in CET. Projects may be completed as faculty consulting/training projects or as semester-long course projects for undergraduate and/or graduate students. Such projects have been secured each semester in recent years and specific faculty members serve as both advisors and consultants to the course projects.

### **NCMEP New Partner Highlight: First Flight Venture Center's Hangar6 Rapid Prototyping Shop**

The NCMEP project with First Flight Venture Center's Hangar6, Rapid Prototyping Shop, will be organized under two main task areas: (1) **Marketing of Services and Partnership to NC Manufacturing Companies:** This task will be led by the First Flight Program Director, and will include establishing and maintaining promotion of Hangar6 as an NCMEP partner, providing communication to existing and new clients of the benefits of the partnership, and working with the qualified manufacturers for their support in completing economic impact surveys regarding their projects with Hangar6 to ensure the continuation of funding. Typical companies that currently participate in Hangar6 projects tend to be smaller start-ups or developing manufacturing businesses. Most companies need access to the design skills and advanced rapid prototyping equipment as they work to iteratively solve product development and manufacturing problems. First Flight will leverage the NCMEP program to continue to target and

served this underrepresented group of important NC manufacturing companies, and (2) **Program Training and Projects:** The Hangar6 Rapid Prototyping Program assists product development projects with a focus on additive manufacturing and rapid prototyping for various types of companies with the majority being involved in manufacturing in NC. This project addresses a need for educating and assisting smaller NC manufacturers with development of ideas into viable new products through training on design and development and production of preliminary product solutions for evaluation and testing. The NCMEP project, will include ongoing training of NC State Industry Expansion Solutions extension specialists to assist in their marketing and identifying potential customers of additive manufacturing development projects. Additionally, 1-3 annual client projects presented by NC State discovered manufacturing companies may be completed through the coordination of technical assistance and equipment resources by Hangar6 during this pilot period. Also qualified client projects identified and completed by existing Hangar6 clients will be submitted to NCMEP for inclusion in partnership metrics and client economic impact survey.

### c. Partnership Leverage and Linkages

Listed below in Table 4, are the activities, events, or services with which each NCMEP partner is involved. In addition to the partners listed below, a major focus of NCMEP has been to align our efforts with other MEP Centers via formal projects such as the MEP Digital Supply Chain Network, and through informal collaboration including sharing of information and best practices. The intentional and ongoing collaboration of NCMEP partners with other MEP Centers is a key component in the NCMEP strategy to further integrate and leverage the MEP Center network to maximize top and bottom-line growth of Small and Medium-sized manufacturers.

<b>Table 4. NCMEP Partners Linkages to Business Model Activities</b>				
<b>NCMEP Partner</b>	<b>Activities/Events/Services</b>			
	<b>Advocacy and program awareness</b>	<b>Client engagement and assessments</b>	<b>Technical assistance and referrals</b>	<b>Center Impact Analysis and Strategy Development</b>
NC State University Industry Expansion Solutions (IES)	Showcase events, Promotions; Facilitated business discussions, Management of Conferences and network events, Web/database management	Public interest sessions, Plant visits, Assessments, Online inquiries	Complimentary assistance, Continuous improvement, Supplier enhancement, Applied engineering, Workforce development/training	Survey process, Stakeholder scoring, Market research, Strategic planning, New product/service development
North Carolina Community College System (NCCCS) – Customized	Networking, Promotions, Attendance at Conferences and Events, Web Presence	Plant Visits, Customized training, Apprenticeships	Complimentary assistance, Continuous improvement, Workforce development/training	Survey Process, Workforce Development

Training Program				
The Manufacturing Solutions Center	Promotions, Attendance at Conferences and Events, Web Presence	Online inquiries, Plant visits	Research and Development, Market deployment, Applied engineering, Workforce development/training, Expansion and exports	Survey process, New product/service development
The Polymers Center of Excellence	Promotions, Attendance at Conferences and Events, Web Presence	Online inquiries, Plant visits	Research and Development, Applied engineering, Workforce development/training	Survey process, Market research, New product/ service development
North Carolina Agricultural and Technical State University	Promotions, Attendance at Conferences and Events, Web Presence	Plant visits	Continuous improvement, Research and Development, Workforce development/training	Survey process
University of North Carolina at Charlotte (UNCC)	Promotions, Attendance at Conferences and Events, Web Presence	Plant visits	Product Development, Workforce development/training	Survey process
Economic Development Partnership of North Carolina (EDPNC)	Networking, Promotions, Attendance at Conferences and Events, Web Presence	Assessments	Complimentary assistance, Market deployment, Expansion and exports	Survey process, Market research
East Carolina University	Promotions, Attendance at Conferences and Events, Web Presence	Plant visits	Continuous improvement, Supplier enhancement, Market deployment, Applied engineering	Survey process
First Flight Venture Center's Hangar6 Rapid Prototyping Shop	Promotions, Attendance at Conferences and Events, Web Presence	Online inquiries	Research and Development, Applied engineering, Workforce development/training	Survey process, New product/service development

#### **d. Performance Measurement and Metrics**

##### **NCMEP Goals for day-to-day management**

NCMEP monitors several metrics for day-to-day management and decision making. We have ongoing tracking mechanisms for metrics we need to achieve and compare our goals vs. actual results achieved for the fiscal year. This allows us to course correct if needed. The chart below

demonstrates what we are expected to achieve and what we have achieved through an aggregate of each quarter.

<b>Table 5. High level MEP Metrics</b>		
<b>Category</b>	<b>Impact Measure</b>	<b>Metric</b>
Surveyable Interactions	Mfg. Clients Served / \$M Fed	>230
Surveyable Interactions	New Mfg. Clients Served / \$M Fed	>91
Economic Impact	Client New Sales	>\$47 million
Economic Impact	Client Retained Sales	>\$110 million
Economic Impact	Client New & Retained Jobs	>1575
Economic Impact	Client New Investment	>\$47 million
Economic Impact	Client Cost Savings	>\$22 million

Additional NCMEP performance metrics are outlined below. Note that our internal goal for Survey Completion Rate and Percent Quantified Impact is higher than the minimum set by MEP and monitoring these numbers allows us to again course correct. For example, last year, after several quarters of a lower survey response rate, we addressed our response rate through outreach to our staff and partners to ensure that they understood the importance of the response rate and additional training on how to prepare a client to respond to the survey.

<b>Table 6. High-level Survey Response and Impact Results</b>			
<b>Category</b>	<b>Impact Measure</b>	<b>Metric</b>	<b>Score</b>
MEP Survey	Survey Completion Rate	90%	91%
MEP Survey	Percent Quantified Impact	>=80%	82%

NCMEP also has established annual economic impact targets for partners and the actual metrics achieved during the fiscal year. While the majority of partners will meet or exceed their goals, we constantly work with them to strengthen their survey preparation processes and to achieve a better understanding of the requirements of the survey. We will also be amending their requirements to include metrics around clients served.

<b>Table 7. Targets for NCMEP Partners</b>		
<b>Partner</b>	<b>Clients Served Target</b>	<b>Economic Impact Target</b>
EDPNC	>40	\$100million
NCWorks/NCCCS	>60	\$125million
NCA&T	>4	\$200,000
CVCC/MS	>10	\$15 million
PCE	>30	\$30 million
IES	>80	\$80 million
UNC Charlotte	>6	\$200,000
ECU	>6	\$200,000
FFVC Hangar 6	>5	\$150,000

NCMEP's Salesforce system is an integral part of the Center's performance management. Each project is entered into Salesforce, and all SRAs are required to do this. Through our Salesforce

integration with MEIS, we have been able to streamline reporting processes and allow all SRAs and NCMEP staff visibility into all parts of the reporting process from initial project entry, project submission, survey data confirmation, survey response status and ultimately, survey results. NCMEP's submitted projects and survey results are visible on each account in the system, allowing staff to quickly see if an account has had a submitted project and subsequent survey results.

We are also working to develop a NCMEP dashboard in Salesforce that will be visible by all of the partners. One of our major projects with Salesforce is to implement the client served calculation so that we can help the entire Center understand where we stand with clients and new clients served, forecast our likely rolling 4-quarter number and begin to course correct if our numbers are lacking.

## 5. Qualifications of Applicant and Program Management

**Phil Mintz** is the executive director of NC State University Industry Expansion Solutions (IES) and director of the North Carolina Manufacturing Extension Partnership (NCMEP). His role at IES is to lead the College of Engineering extension services program which leverages engineering solutions and best practices to help NC businesses and individuals compete through training and coaching. Serving as the NCMEP director since 2011, Phil drives outreach to NC manufacturers, builds relationships with federal and state leaders and coordinates efforts to drive profitable manufacturing growth in the state. Phil has over 35 years of manufacturing and engineering experience, including 10 years as an IES regional manager and specialist in quality management and Lean Six Sigma services. Before joining IES, he held posts as an industrial and systems engineer and engineering cost specialist for organizations including the US Navy Procurement Office in Norfolk, VA; Lockheed-Martin Engineering and Sciences Company at NASA Langley Research Center in Hampton, VA and Westinghouse Electric Corporation's Electronic Systems Division in Baltimore, MD. Phil has a B.S. degree in engineering operations from North Carolina State University and an M.S. in industrial engineering from North Carolina A&T State University.

**Fiona Baxter** is the associate executive director for NC State Industry Expansion Solutions (IES) and the assistant director of the NC Manufacturing Extension Partnership. She provides leadership in several areas including the IES Evaluation Center which conducts performance evaluation, research, planning and assessments for both educational and workforce development programs. She also directs and oversees all activities associated with planning, pursuing, securing and managing external grant awards to support and enhance the organization's strategic goals. Fiona has extensive experience in developing, securing, managing and evaluating grants and in strategic planning and assessment. She holds a Ph.D. in public administration from NC State University and a M.S. in anthropology from East Carolina University.

**Madelene M. Brooks** is the financial manager for the North Carolina Manufacturing Extension Partnership (NCMEP) Center. This position is responsible for all financial activity pertaining to the grant. It includes review of all grant and contract agreements, policies and procedures, and timetables. The financial manager's role includes sub-award monitoring, and working closely with program and project personnel to establish budgets, and grant records. Madelene monitors grant expenditures to ensure compliance with University financial policies and procedures, agency regulations and governmental uniform guidance (OMB 2CFR 200). The financial

manager is responsible for presenting financial information for semi-annual financial reports, monitoring monthly budget to actual expense, grant closeouts and the reporting process. Madelene has a B.S. in Accountancy and a Master's in Public Administration from University of North Carolina at Wilmington.

**KeAnne Hoeg** is manager of market research and reporting at NC State Industry Expansion Solutions (IES). Her group is responsible for managing required reporting to stakeholders, several internal applications, including the Salesforce CRM system, the Manufactured in North Carolina supply chain website, data visualization and data mining. Prior to moving into market research at IES, she worked in IT and marketing as a web developer and social media manager. KeAnne has a B.A. in English from Meredith College and an MLS in library science from UNC-Chapel Hill.

**Barbara Williams** is the Associate Executive of Director of Field Services and provides strategic direction to the field operations staff who engage clients and provide technical services. Barbara is also responsible for engaging university, state and national leaders in economic development and business growth opportunities and serves as a key liaison for stakeholders of state and federally funded programs. Barbara's role includes leadership of the statewide client development team and the technical specialization programs including process optimization, quality management systems, industrial engineering, performance excellence and technology management. Barbara is a senior facilitator with over 23 years of manufacturing and engineering experience with 19 of those years directly related to training, auditing and implementing quality management systems (ISO 9001, AS 9100, etc.). Barbara has served companies in the metal fabrication, industrial painting, rubber products, medical/industrial gases and textiles industries. Barbara has a B.S. in mechanical engineering. She is a trained auditor in ISO 9001 and AS9100D. She holds certifications as an ASQ certified quality auditor (CQA), an exemplar global Quality Management Systems lead auditor (QMS-LA) and as a PLEXUS Quality Systems trainer for ISO 9001 and ISO 14001.