
Centralina Economic Development Commission

Advanced Manufacturing
Recommendations
for an Advanced Manufacturing Center
in the Greater Charlotte Region



July 2007

Centralina Economic Development Commission
1300 Baxter Street – Suite 450 – Charlotte, NC 28235



YORK TECHNICAL COLLEGE



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In Fall 2004, the Charlotte region completed a Comprehensive Economic Development Strategy process. The CEDS report recommended performing a feasibility analysis for an advanced manufacturing center. The Centralina Commission for Economic Development, an organization under the Centralina Council of Governments, procured a grant to fund this feasibility analysis.

Once the funds were established, the Centralina Council of Governments and its partners across the region contracted with CH2M HILL to perform an analysis on the feasibility of an Advanced Manufacturing Center to nurture the growth of advanced manufacturing companies in targeted sectors. CH2M HILL was asked to perform the following tasks:

1. Define "advanced manufacturing" in the Greater Charlotte region including the economic basis and impact, assessment of technologies present as well as resources available to support advanced manufacturing and a gap analysis
2. Identify future industries in advanced manufacturing that should be targeted for competitive growth above and beyond organic growth.
3. Assist in creating a new vision for the future of Advanced Manufacturing in the Greater Charlotte Region and in gaining the support, participation and cooperation from regional stakeholders
4. Formulate a feasibility analysis for an Advanced Manufacturing Center/Program (undetermined) in the Greater Charlotte Region, and identify alternatives for the Advanced Manufacturing Center of Excellence

For the purposes of this analysis, the Greater Charlotte Region is defined as the 12-county region consisting of nine counties in North Carolina (Anson, Cabarrus, Gaston, Iredell, Lincoln, Mecklenburg, Rowan, Stanly and Union, and three in South Carolina (Chester, Lancaster and York). Three reports have been delivered thus far by CH2M HILL:

- "Advanced Manufacturing in the Greater Charlotte Region"
- "Target Industry Analysis"
- "Vioneering Report"

The Vioneering Report is included in the Appendix of this Recommendations Report as it reflects the region's strategic planning for the Center. These reports will guide CH2M HILL's recommendations related to a "center" for Advanced Manufacturing.

Trends for Advanced Manufacturing Companies

What's Driving Advanced Manufacturing Companies?

Manufacturing in the United States is going through a major transformation:

- Outsourcing and off-shoring
- Globalization
- Productivity increases
- Need for Innovation
- Economy is heavily oriented towards services and this will continue to increase
- Supply chain management is more and more crucial

Regional Competitiveness

The Greater Charlotte Region's economy is vibrant, diversified, and thriving. Median household income is higher than the national average and cost of living is lower giving the region a prosperous living environment. Choices are available for living from urban to suburban to rural. The Greater Charlotte Region has embraced a regional approach to economic development, a definite best practice and recommended strategy for success.

Innovative Capacity

Maintaining and growing a region's prosperity requires innovation. Regions have innate characteristics that make them more competitive such as geography, climate, and population. Influences that make regions continuously prosperous involve **innovation** meaning their capacity to foster entrepreneurship, research and training institutions, government involvement (Federal, State, and Local), and entities that cause collaboration. The innovative capacity of the Greater Charlotte Region has some gaps that a focused center could begin to close.

Significance for the Greater Charlotte Region

Advanced manufacturing clusters in the region will thrive where:

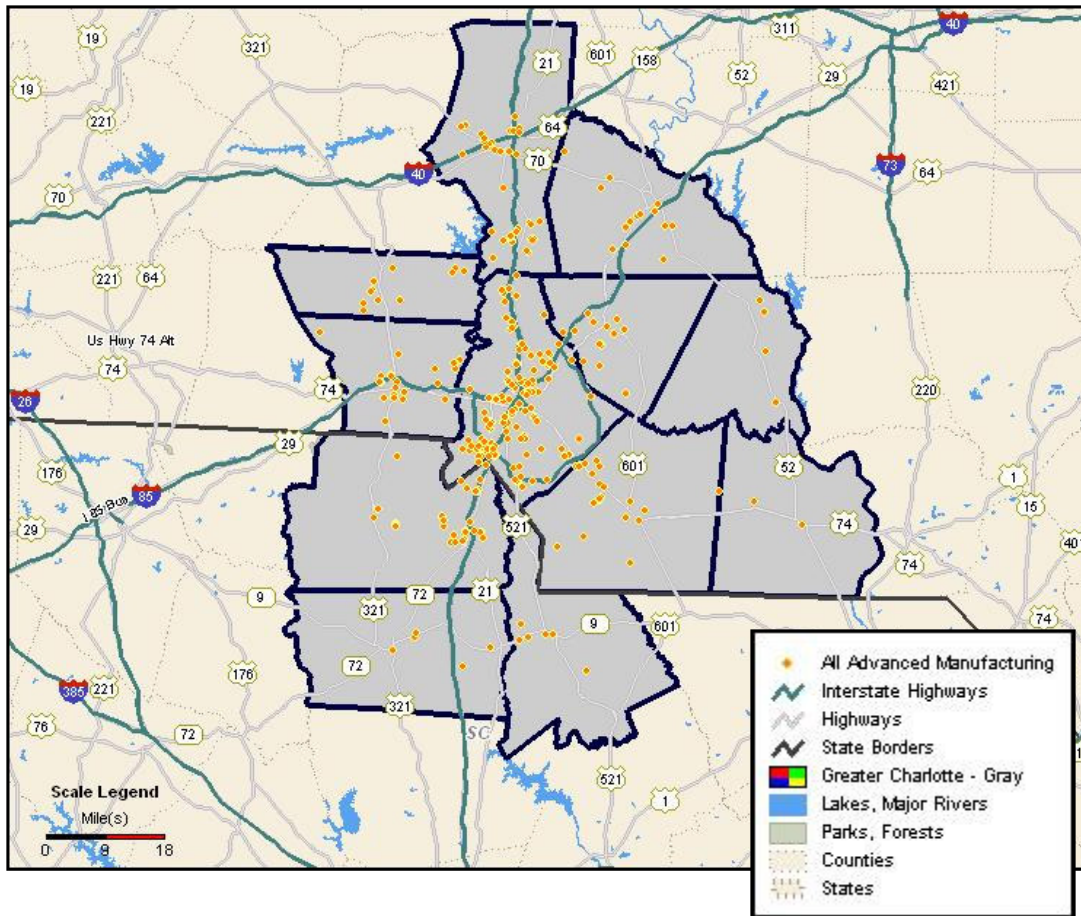
1. A championed and focused strategy is in place that leverages the Greater Charlotte Region's distinctive assets and strengths.
2. Growth happens because it is planned and nurtured with conservation of the region's natural resources and steady infrastructure maintenance and improvement to support the growth.
3. Moving from a focus on cost reduction to one of innovation and discovery. Advanced manufacturing companies in the region need to buy in to the idea of building innovation output as a way of survival in this global economy.
4. Vigilant measure of many regional indicators including regional economic vitality, innovation output, and increases in commercialization.¹

¹ Clusters of Innovation: Regional Foundations of U.S. Competitiveness, Professor Michael E. Porter, Harvard University

Where should emphasis be placed to grow advanced manufacturing in the Greater Charlotte Region?

Target industry analysis involves identifying industries that are both desirable and appropriate for a region. CH2M HILL's Target Industry Analysis Model was customized to identify advanced manufacturing industries that warrant focused marketing both inside (retention & expansion) and outside (attraction) the region as high opportunity niches. The map below shows the region with all the companies defined as advanced manufacturers and having 20 or more employees; there are approximately 389 companies in all. There are more than 1,200 companies that self-report as belonging to those primary NAICS defined as advanced manufacturing.

Figure 1: Greater Charlotte Region Map with Advanced Mfg. Cos. with 20 or More Employees



Prosperity happens in clusters brought about by regional competitiveness and innovation capacity. Based on the CH2M HILL Target Industry Analysis the following clusters are suggested for focused business retention, expansion, and new project development. These targeted clusters provide the most potential for creating abundant, well-paying jobs and having a strong economic impact in the region, preferably beyond their direct effect. An advanced manufacturing center can have the highest impact by focusing on these target clusters.

High Priority Clusters

- General Machinery, Equipment and Components Cluster
- Pharmaceutical and Medical Device Manufacturing Cluster
- Automotive/Transportation Cluster
- Telecommunication and Electronic Components Manufacturing Cluster

Medium-Priority Cluster

- Plastics and Rubber Manufacturing Cluster

Low-Priority Cluster

- Metals Forming and Fabrication Cluster

SWOT Analysis of Advanced Manufacturing in the Greater Charlotte Region

This SWOT analysis describes the strengths, weaknesses, opportunities and threats for Advanced Manufacturing present in the Charlotte Region from the perspective of advanced manufacturing firms in the Charlotte region and CH2M HILL's experience with industry and economic development programs.

Manufacturing interviewees were very open and willing to discuss their opinions and operations during the time spent. There is an innate proprietary nature to advanced manufacturing and the interviewing team tried to be very respectful of that.

Throughout the interview process, opportunities for needed services became apparent for a "Center of Excellence for Advanced Manufacturing" in the Greater Charlotte Region. Interviewees have given Charlotte region stakeholders very clear messages about what advanced manufacturing needs are and how to achieve competitive advantage.

What is weighing on the minds of Advanced Manufacturers and how could a center help them?

- Concern about keeping up with technology and staying ahead of their competition
- Imitation of products by competing firms, especially internationally due to patent infringement, copyright violations and basic copying
- Increasing productivity through quality systems like Lean and Six Sigma – but only incrementally – most are dipping their toes in
- The need to reinvest in machinery, hiring more skilled workers and training/retraining employees, and implementing more IT system solutions.
- Need to constantly be on the lookout for new uses for their products and continue to move rapidly from testing to commercial application

- Always considering new technology and its ROI
- Reacting fast enough to customer demands or orders for new products or applications – not doing a lot of proactive new product development.
- The client's needs for R&D whether this means testing, product development, or reverse engineering.
- Finding the right people for the job – highly skilled or other talent level.
- Some need talent internationally and find this particularly difficult.
- Research and development resources need to be very advanced/specific to be helpful, proprietary nature makes partnerships difficult, and often specialized testing facilities is required.
- Always driven by needing more sales and business development
- Government regulations are becoming a big issue in some industries
- Many smaller manufacturer's management are having to wear many hats keeping them from staying up with technology
- Workforce is not considering manufacturing as a career
- Corporate decisions in other places driving the operation
- Need to continue developing clients nationally and internationally, especially in Canada and Mexico
- Worried about the current skill level of workforce with the following issues:
 - ❖ A lack of problem-solving skills
 - ❖ Lack of ability to understand the whole manufacturing process
 - ❖ Having to import high-level talent
 - ❖ Having only a small nucleus of qualified Lean personnel
 - ❖ Incremental nature of productivity increases
 - ❖ Unpredictable nature of demand
 - ❖ Safety restrictions
- Research and development is driven solely by customer demand rather than proactive or disruptive research and development that would cause significant advances or new products
- Not involved in many supply chain partnerships or R&D relationships in the region
- Unaware of existing resources and therefore not engaged in relationships in the region
- Almost 65% of those interviewed said the level of technical training was not outstanding
- Close to 60% of interviewees said that workers in the region did not meet their needs
- About 50% of interviewees stated that employees are not fully prepared to use and implement high-tech equipment in the workplace
- 65% of those interviewed do not work closely with training centers to develop workforce
- Many have never been visited before by someone from the community

What ways do Advanced Manufacturers think an advanced manufacturing center might support technology advanced and prosperity in your business?

- More focus on graduating more skilled people
- Escalate skills training/continuing education

- Focus on specific skills such as: engineering, programming, control and logistics management, procedural technology, and computer modeling
- More hands on training programs at the community colleges
- Raise awareness of existing resources such as training/education grants and tax credits
- Focus more on smaller manufacturers
- Create a robust apprenticeship program
- Provide pre-screening assistance for employees and technologies
- Customize curricula to meet manufacturer needs
- Keep up with new technology trends
- Promote manufacturing careers
- Provide representation of the region's advanced manufacturers at the state and federal level to ensure political agendas are pushing forward
- Have a pool of Lean consultants and other technical people available on a low-fee, short term basis
- Provide a forum for educating companies on resources available to them in the region – a resource clearinghouse

How did economic development, educational, and governmental entities respond to the idea of an Advanced Manufacturing Center?

- Feel very positive and want to be sure that existing programs and resources are integrated and avoid duplication.
- Their vision for the center included:
 - ❖ Providing advanced training
 - ❖ Monitoring trends
 - ❖ Focusing on programs
 - ❖ Clearinghouse for available resources

The economic developers interviewed, see their role in this advanced manufacturing as providing:

- Operational improvement, logistics, strategic planning, KPI Implementation, Lean
- Funding
- Would like to market the center for recruitment

Summary of Best Practices

The following summarizes common best practices among some or all of the best practice examples. Details of each follow this summary.

- Member organization models are frequently adopted
- All of the organizations promote technology, growing specific clusters of technology, networking and workforce development
- All of the organizations include "matchmaking" for entrepreneurs, small manufacturers, larger manufacturers, service companies, and funding sources as part of their missions

- Many act as a clearinghouse for resources, training and education
- Identify and further legislative issues that affect manufacturers
- Often charged with management responsibilities for various state programs and/or grants for innovation, entrepreneurship and R&D
- Lean and Supply Chain training and transformation services are commonly offered by these organizations
- Annual reports are published describing the organization's economic impact, status of services, success stories and other data. These annual report elements are gathered on an on-going basis and specific measures and indicators are gathered consistently. Over the course of years, it is possible to see progress and what is working or not
- Programs that specifically assist entrepreneurs with funding, intellectual property, business planning, project evaluation, and resource utilization abound among the best practice examples
- Staff have had successful private sector careers prior to taking leadership roles in these organizations
- Workforce development programs are always associated or directly a part of the organization's mission.
- Some are linked to universities and some are stand-alone organizations – but all are highly built upon connectivity to universities, community colleges, economic development organizations, chambers, and regional companies
- Finance is a very common background for staff. Other staff members commonly include subject matter experts and grant writers.
- Internal and external marketing programs that include newsletters and much wider marketing efforts on behalf of members

Overview of Visioneering

The Centralina Council of Governments, together with their partners, was interested in understanding the perceptions and opinions of the region's stakeholders related to the feasibility of a "center" for advanced manufacturing. No limits or boundaries were placed on this definition and it was assumed that the "center" could be anything intended to support the growth of advanced manufacturing companies in the region. The ideas developed in the Visioneering sessions were unedited and those of the participants, not CH2M HILL.

To accomplish this, a group of professionals formed a team and cast a vision. The team tried to understand the vision elements (via a strengths, weaknesses, opportunities, and threats analysis), and to formulate mission statements with metrics associated. These professionals came from the fields of:

- Manufacturing
- Education
- Economic Development
- Government

- Chambers of Commerce

A Center of Advanced Manufacturing in the Greater Charlotte Region is needed for the following primary reasons:

- To leverage strengths in productivity, profitability, transportation, quality of life, and access to markets and supply chain
- To focus on business retention and expansion activities for advanced manufacturing companies
- To bring innovative technologies, supply chain relationships, and R&D partnerships to the region's advanced manufacturers

Vision elements were prioritized as follows:

- #1 – Business/Supply Chain Expertise
- #2A - Promotion of Professional, Scientific and Technical Educational Paths & Careers
- #2B - Research & Development
- #4 - Financial Expertise
- #5 - Entrepreneurship
- #6 - Legal Expertise

The vision drafted by the group follows:

Build Greater Charlotte Region into the location of choice for existing and new manufacturing companies. Capitalize on the region's diverse and innovative supply base. Capture and commercialize leading-edge technologies to strengthen the regional economy through the coordination of R&D, education, entrepreneurship, business, financial, engineering, and legal activities.

Mission Critical Elements

1. Provide effective environment for integrated supply chain/manufacturing operations.
2. Improve the perception of manufacturing careers through increased education, marketing, and public relations efforts that will ultimately increase the qualified employable workforce
3. Integrate university-based R&D programs into advanced manufacturing base by establishing collaboration among universities/community colleges/economic development agencies/government and other support providers and advanced manufacturing companies.
4. Publicize and educate manufacturers on financial resources and processes.
5. Encourage entrepreneurial growth through building strong networks with combined training and support resources.
6. Develop and maintain a legal support system for advanced manufacturing entities.

The complete Visioning results are attached in the Appendix to this Recommendations report.

What are the most “impactful” activities/services the Center should be involved in for the future of Advanced Manufacturing in the Greater Charlotte Region?

1. First and foremost, the center must work on building supply chain relationships or “matchmaking” among companies located in the region. Many larger manufacturing companies in the region require these relationships from a corporate level and there is nothing currently working effectively in the Greater Charlotte Region to foster these relationships. Supply chain relationship building needs to be done through building regional tools (e.g. web-based database) that are easily accessed, marketing, education, and networking at a minimum.
2. Stakeholders involved in the process held that manufacturing career development/promotion and building regional research and development were of equal priority. Connectivity must be established and firmly rooted among advanced manufacturing companies, universities, community colleges, workforce boards, economic development organizations, governments at all levels, and other supporting organizations.
3. The center must establish meaningful measurements of both regional competitiveness and innovative capacity building. Preparation of an annual report is the minimum with a “State of the Industry Report” on an annual or bi-annual basis being a best practice.
4. The center may want to consider offering consulting services for a fee as well on lean and supply chain management. There is a great need for these types of services in the area however successful transformative work takes time and is expensive. Currently there are many companies “dabbling” in lean practices. It is going to take high-level support for change from within the region’s companies and the development of a high-degree of trust for the services that come out of the center and this will take time.

What are the alternative solutions for a Center of Advanced Manufacturing?

The region could choose to do nothing new and continue on the same path it is pursuing currently. The Charlotte Region has a lot of very positive momentum going on right now within advanced manufacturing and the entire economy. There are good business reasons for companies to choose to locate and expand in the Charlotte region including market access, transportation options, cost of labor, and business climate. The region’s economic development organizations are very aware of their need to increase business retention and expansion efforts and are trying to find ways to make those activities happen. Status quo in the Charlotte Region does not mean stagnant, far from it. North Carolina is one of this country’s top locations for manufacturing companies. Most regions around the country are dealing with workforce development issues, this is not unique to the Charlotte Region. But...is this what the region’s existing companies and stakeholders want? CH2M HILL’s research during this study says otherwise. The region’s advanced manufacturing stakeholders want some proactive solutions and efforts to their struggles with supply chain management, innovation, and workforce development. To do nothing new is one alternative though.

Another alternative is to do a better job connecting resources already present in the region and perhaps initiate a few new programs. New programs needed include “matchmaking” among manufacturing companies and service companies; a program that promotes manufacturing careers and influences students to choose professional and technical educational pathways; and

bring or cultivate technologies ready for application to advanced manufacturing companies into the region. This alternative could be adopted by an existing organization such as the Charlotte Regional Partnership or other economic development organization that serves the region. These programs could be initiated separately within organizations that do similar activities now. For instance, the workforce boards could implement the career and education promotion campaign; the “matchmaking” program could be instituted by the chambers in the region; and perhaps the university could be persuaded to increase its search for technologies that are ready for applied R&D work and increase commercialization activities through connectivity with regional companies.

A “Center for Advanced Manufacturing” could be opened within an existing organization and adoption of all of the recommended programs and elements (recommended above) is another alternative. The supporting infrastructure of an established organization would be there and these programs could be another extension of their mission. The center within the auspices of another organization would always be in competition for resources with the other missions of that organization though.

The final alternative and CH2M HILL’s recommendation is that a new organization be chartered wherein the staff that work there wake up every morning with the burning desire to make the Greater Charlotte Region’s advanced manufacturing companies more prosperous and innovative. The staff would work to make connectivity with other supporting resources a top priority and be a constant advocate for advanced manufacturing in the region.

The CH2M HILL study team recommends that the Centralina Economic Development Commission and its Advisory Committee move forward with the development of a Center for Advanced Manufacturing. All of the work completed thus far points positively toward the need and viability of such a center to foster prosperity in advanced manufacturing in the Greater Charlotte Region. It should be emphasized that all of the best practices examples have distinct organizations that foster advanced manufacturing and/or technology. Additionally, the advanced manufacturing companies that were interviewed for this study indicated that they are not currently receiving these types of services in the region alleviating the concern that there might be duplication of effort.

There is a high degree of interest in having a center that focuses on advanced manufacturing companies in the Greater Charlotte Region. This was demonstrated through the responses in interviews and the results of the Visioneering session as well as the continued history of recommendation for this type of supporting organization. The need exists evidenced by the gaps in partnering relationships, dissatisfaction with the current status of the workforce, innovative activity and overall connectivity among support organizations within the region. Currently, there is no one organization that wakes up every business day and looks for ways of building prosperity among the advanced manufacturing target clusters through closing these gaps.

Guiding Principles

- The Center should be a separate organization with its own identity and Board of Directors with connectivity to the universities, community colleges, public school systems, government programs (at all levels), economic development organizations, and other appropriate support/networking organizations.
- The Center should focus first and foremost on finding qualified, experienced (with a successful track record), and dedicated leadership/management (both paid and volunteer).
- The Center should focus on a few core competencies and should not duplicate what other regional organizations are doing bearing in mind the priorities coming from the Visioneering sessions.

Core Competencies

1. Supply Chain relationship development needs to be a primary core competency.
2. Promotion of manufacturing careers and scientific/technological education path choices to support manufacturing.
3. The Center should stimulate innovation in the Charlotte region's advanced manufacturing clusters by matching them with licensable technologies and assisting in the commercialization of those resulting products. These technologies may come from within the region or developed outside the region.
4. Develop a core competency in finance as it relates to manufacturing and its capital needs.

Grants, contracts for services, membership fees, and fee for services are all viable options for funding for a Center for Advanced Manufacturing. Most of the economic development organizations interviewed said they would contribute to an advanced manufacturing center as it would benefit the whole region and would be a significant marketing asset. The best practices examples are all receiving a mix of revenue types that seem to be readily available.

Initial Operating Scenario

<u>Initial Staff Members and Proposed Salaries:</u>	Low	High
President/CEO	\$100,000	\$150,000
Director of Programs/Grants/Contracts	\$80,000	\$100,000
Director of Membership	\$50,000	\$75,000
Director of Marketing/Public Relations	\$75,000	\$85,000
Marketing Assistant	\$40,000	\$50,000
North Regional Representative	\$50,000	\$75,000
South Regional Representative	\$50,000	\$75,000
Administrative Assistants (2 @ \$30,000 each person)	\$60,000	\$70,000
<u>Subtotal</u>	<u>\$505,000</u>	<u>\$680,000</u>
<u>Benefits @ 30%</u>	<u>\$151,500</u>	<u>\$204,000</u>
Total for Staff	\$656,500	\$884,000

Start-up Costs

Building (20,000 SF) – ½ for Incubator Space 5 Yr. Lease (\$19-22/SF):	\$76,000	\$88,000
or		
New Building 20,000 SF - \$100/\$120 SF Furniture/Technology	\$2,000,000 \$150,000	\$2,400,000 \$200,000

Start-Up Programs

Supply Chain Partnerships	\$1,000,000	\$1,500,000
Website		
Networking Events		
Marketing		
Manufacturing Career Development/Promotion	\$2,000,000	\$3,000,000
Marketing		
Networking/Connectivity Events		
Programming		
Technology Commercialization	\$2,000,000	\$3,000,000
Research and Development		
Technology Transfer/Commercialization		
Networking/Connectivity		

Revenue:

Grants/Contracts	\$4,000,000	\$6,000,000
Memberships/Fundraising	\$1,000,000	\$1,200,000

This scenario represents the center's operation after a period of at least two to three years given the right staff and winning grant opportunities. In order for the region's manufacturers to fully buy-in, the product/services will need to be high-quality and the networking opportunities more robust and worthwhile than any before. Nationally renowned speakers and business people will need to be recruited to influence. Networking opportunities will need to have measurable results. Marketing and financial talent needs to be top-notch and focused on Advanced Manufacturing.

Performance Measures

CH2M HILL recommends that the Center for Advanced Manufacturing begin an annual measuring process or support the measuring of the following:

Regional Economic Indicators:

- Employment Growth – Rate of employment growth – overall and by cluster
- Unemployment – Percentage of people unemployed
- Average Wages – Payroll per person – overall median wage, by occupation, and by cluster
- Wage Growth – Growth rate for payroll per person – overall median wage, by occupation, and by cluster
- Cost of Living Index
- Exports – value of manufactured and commodity exports per worker
- Productivity – overall productivity, by occupation, and by cluster

Innovation Output Indicators:

- Patents – number of institutional patents – both public and private, and individual patents
- Company formations – number of incorporations, survivability rates, and retention rates
- Venture capital investments
- Initial Public Offerings
- Fast Growth Firms – measure the number of Fortune 500 companies in the region, measure the growth/productivity of identified baseline companies, and identify gazelle firms and their progress

In addition, programmatic goals and achievement measurements will need to be tracked both for funding sources and for marketing purposes.

Advanced Manufacturing Center Feasibility Analysis – Visioneering Report

February 2007

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Introduction

The Centralina Council of Governments, together with their partners, was interested in understanding the perceptions and opinions of the region's stakeholders related to the feasibility of a "center" for advanced manufacturing. At this point in the planning process, no limits or boundaries were placed on this definition and it was assumed that the "center" could be anything intended to support the growth of advanced manufacturing companies in the region. The ideas presented in the following sections are unedited and those of the participants, not CH2M HILL.

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- * Education
- * Economic Development
- * Government
- * Chambers of Commerce

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- * To bring innovative technologies, supply chain relationships, and R&D partnerships to the region's advanced manufacturers

Background Information Provided to Visioneers

The following information was given as background information for the team of people that participated. Most of the information gathered in earlier tasks of this project was not presented in order to NOT burden the participants with pre-conceived ideas and block the creative process.

Only a little information was given so that the stage could be set for further discussion among the Visioneers.

The scope of the project was defined and it was emphasized that the scope had been designed with the following guiding principle in place:

“It’s all about the technologies”

The scope for the entire project included the following:

- Define “Advanced Manufacturing” in the region
 - Advanced mfg. base
 - Assessment of technologies
 - SWOT analysis (>50 regional interviews)
 - Resources assessment
 - Best practices
 - Gap analysis
- Advanced manufacturing target industries analysis
- Visioneering
- Feasibility Analysis of the Vision

CH2M HILL defined Advanced Manufacturing using a rigorous quantitative analysis. The index was based on criteria for industries in manufacturing NAICS (31-33) and included:

- Advanced Skill Occupations
- Productivity Growth
- High-Technology Product
- Regional Productivity Growth

Fifty (50) industry sectors were defined as “Advanced Manufacturing” sectors. Thirty-six (36) advanced manufacturing sectors are present in the region having greater than 100 employees. These 36 sectors were then further researched to identify the associated technologies.

A Target Industry Analysis was completed with the following results:

- High Priority Clusters:
 - General Machinery, Equipment & Components
 - Pharmaceutical & Med Device/Supply Mfg
 - Automotive/Transportation
 - Telecommunications & Electronic Components
- Medium Priority Clusters:
 - Plastics & Rubber Manufacturing
- Low Priority Clusters:
 - Metals Forming & Fabrication

Many of the targeted industries share technologies and this can be further built upon. These technologies include:

- Lean Practices
- Six Sigma
- Advanced Robotics

- Computer Control Systems
- Computer Numerical Controlled Machines (CNC Machines)
- Computer-Aided Design (CAD) and Modeling (CAM) 2-D and 3-D
- Virtual Product Testing
- Clean Rooms
- Machining
- Microfabrication
- Advanced Fuel Technologies

The common use of these technologies was further confirmed by the Visioneers in the manufacturing sectors.

Employment by Industry

Employment information for the Charlotte Region compared to the Pittsburgh MSA was given to drive home the point that there are significant numbers of people employed in the Part B & C Manufacturing sectors (where most advanced manufacturing resides). The comparison to Pittsburgh shows that there are significantly more people employed in that region in advanced manufacturing and innovation plays a role as represented by the large numbers of professional, scientific, and technical services people present in Pittsburgh.

NAICS 2 digit	NAICS Descriptions	Charlotte Region	Pittsburgh
31	Manufacturing Part A	38,027	8,453
32	Manufacturing Part B	42,938	33,059
33	Manufacturing Part C	62,188	78,128
31-33	All Manufacturing	143,153	119,640
48	Transportation and Warehousing Part A	36,605	46,602
49	Transportation and Warehousing Part B	11,823	12,355
48-49	All Transportation and Warehousing	48,428	58,957
51	Information	30,736	31,300
52	Finance and Insurance	70,425	75,082
53	Real Estate and Rental and Leasing	46,743	45,960
54	Professional, Scientific, and Technical Services	65,817	103,918
55	Management of Companies and Enterprises	27,961	16,113
56	Administrative, Support, Waste Mgt & Remediation	88,210	79,121
61	Educational Services	13,614	57,255
62	Health Care and Social Assistance	85,817	201,629
71	Arts, Entertainment, and Recreation	23,722	30,187
72	Accommodation and Food Services	73,821	97,013
81	Other Services (except Public Administration)	67,886	89,409

Number of Patents

Numbers of patents granted in a state is just one indicator of that state's ability to be innovative. Ohio and Pennsylvania have a much higher number patents granted per capita than does the southern states. North Carolina is improving.

State	Number of Patents Since 1977	2000 Census	Patents / Capita
North Carolina	33,423	8,049,313	0.004152
South Carolina	12,769	4,012,012	0.003183
Pennsylvania	87,169	12,281,054	0.007098
Virginia	24,823	7,078,515	0.003507
Ohio	85,995	11,353,140	0.007575
Georgia	25,129	8,186,143	0.00307

Projected Growth by Employment

Advanced manufacturing sectors are projected to see growth in the next five years and the service sectors that bring about innovation are expected to grow by double-digits. This projection is made with the assumption that nothing will be done differently than what is happening currently.

NAICS 2 digit	NAICS Descriptions	Charlotte Region
23	Construction	7.5%
31	Manufacturing Part A	-15.8%
32	Manufacturing Part B	1.9%
33	Manufacturing Part C	1.0%
31-33	All Manufacturing	-3.2%
51	Information	10.1%
52	Finance and Insurance	5.3%
53	Real Estate and Rental and Leasing	9.0%
54	Professional, Scientific, and Technical Services	14.1%
55	Management of Companies and Enterprises	7.3%
56	Administrative, Support, Waste Mgt & Remediation	19.5%
61	Educational Services	14.3%
62	Health Care and Social Assistance	14.8%
71	Arts, Entertainment, and Recreation	13.4%
72	Accommodation and Food Services	8.1%
81	Other Services (except Public Administration)	9.1%

Top 20 Manufacturing Industries in the Region by Employment

The point was made to the Visioneers that advanced manufacturing plays a significant role in the Top 20 manufacturing industries in the region.

NAICS	Industry Description	Employment	Advanced Mfg
31311	Fiber, Yarn, and Thread Mills	8,590	
33441	Semiconductor and Other Electronic Component Manufacturing	6,744	x
31321	Broadwoven Fabric Mills	7,084	
32311	Printing	5,579	
32619	Other Plastics Product Manufacturing	4,352	
33612	Heavy Duty Truck Manufacturing	4,282	x
32221	Paperboard Container Manufacturing	3,874	
31331	Textile and Fabric Finishing Mills	5,062	
31412	Curtain and Linen Mills	3,755	
33639	Other Motor Vehicle Parts Manufacturing	3,681	x
31161	Animal Slaughtering and Processing	2,805	
33329	Other Industrial Machinery Manufacturing	3,028	x
33712	Household and Institutional Furniture Manufacturing	2,718	
33911	Medical Equipment and Supplies Manufacturing	2,670	x
32621	Tire Manufacturing	2,520	x
32721	Glass and Glass Product Manufacturing	2,550	x
31181	Bread and Bakery Product Manufacturing	2,377	
31222	Tobacco Product Manufacturing	2,544	
32522	Artificial and Synthetic Fibers and Filaments Manufacturing	2,521	x
33531	Electrical Equipment Manufacturing	2,216	x

Identified Strengths of the Region

More than 50 interviews were completed with advanced manufacturing companies and economic developers in the region. They identified the following as strengths.

- * Transportation
- * Quality of Life
- * Market and Supply Chain Access
- * Labor Cost
- * Workforce Training Capacity
- * Utilities

Our definition of Advanced Manufacturing further identified the following strengths:

- * 24/50 Advanced Manufacturing sectors have a strong presence in the region
- * 25/50 Advanced Manufacturing sectors have a productivity advantage because they are located in the Greater Charlotte Region
- * 28/50 Advanced Manufacturing sectors have a profitability advantage because they are located in the Greater Charlotte Region

Identified Weaknesses of the Region

The interviews also identified the following weaknesses:

- * Full adoption of Lean/Quality systems is lacking
- * R&D Partnerships are not being made
- * Use of R&D Tax Credits is relatively low
- * Labor Quality & Availability are concerns of the region's employers at all skill levels
- * Employers in the region do not feel that the workforce is Tech- Ready
- * There are not many Apprenticeship Programs
- * Manufacturing Career Development is not being done
- * BRE – Focusing on Sm & Med Sized Cos. is under-funded and staffed and these companies are not being serviced by local economic developers
- * Advanced manufacturing companies in the region do not have a good level of knowledge of regional resources

The Visioneering process was utilized to identify important issues and ideas, develop the vision, mission and metrics for an entity or system of programs that support innovation related to advanced manufacturing in the Greater Charlotte Region. This report documents all of the information generated during the session.

Overview of Visioneering

Visioneering sessions involved a structured set of exercises conducted over two 3 ½ hour sessions (February 5 - 6, 2007) with Greater Charlotte Region professional participants facilitated by CH2M HILL (the Team). These exercises included Visioneering brainstorming activities, Visioneering Worksheet exercises and group presentations, as well as finalizing a vision to guide the region. Six (6) Element Groups were formed on both days to focus on one of six elements from the vision:

- * Business Expertise
- * Financial Expertise
- * Legal Expertise
- * Entrepreneurship
- * Promotion of Professional, Scientific and Technical Educational Paths & Careers
- * Research & Development

Visioneering brainstorming activities were utilized to capture ideas from the cross-functional representation of the region for application to the project. On Day 1, cards were used to document the strengths, weaknesses, opportunities and strengths discussed and developed by the Team. On Day 2, an affinity diagramming exercise was used to identify various mission elements that would support the realization of the vision.

On Day 1, information collected on the cards was used to conceptualize the existing state of each vision element in the region. Element Groups were able to collect the best ideas from the brainstorming activity in order to develop a Visioneering Worksheet that reflected the SWOT analysis for each element.

On Day 2, a Visioneering brainstorming activity was utilized using an Affinity Diagram for each vision element to gather ideas on mission factors that would achieve the vision. Again, the Element Groups collected the best ideas from the brainstorming activity and developed a Visioneering Worksheet that included mission statements, goals, and metrics for each element.

Details of the described process including the back-up data are included in the following sections of this report.

Visioneering

Day One Visioneering Participants

Kimberly Herndon	Development Coordinator	York Technical College	Rock Hill, SC
Steve Killian	Director of Planning and Economic Development	City of Kings Mountain	
John Miller	President/Sourcing Engineer	Miller Machine & Design	Charlotte, NC
Virgil Cox	Dean, Engineering and Industrial Technologies	Gaston College	
Joe Keith	Dean, East Campus and Textile Technology Center	Gaston College	Belmont, NC
Heath Love	Manager, Rock Hill Plating	Tyco Electronics	Rock Hill, SC
Joel Randolph	VP, Business Development	Randolph & Son Builders Inc.	
Dirk Zikeli	CEO	Chiron America	Charlotte, NC
Stuart Wasilowski	Dean of Workforce Development and Continuing Education	South Piedmont Community College	Monroe, NC
Andreas Thurner		Blum, Inc.	Stanley, NC
Fran Perez-Wilhite	Military Business Coordinator	NC Military Business Center	
Marc Tarplee	Associate Vice President, Industrial and Engineering Technologies	York Technical College	Rock Hill, SC
Harold Shapiro	Executive Director	Catawba Regional Council of Governments	Rock Hill, SC
Mark Farris	Director	York County Economic Development Board	Fort Mill, SC
Robert Glen		Streamliner Enterprises, LLC	Huntersville, NC
Paul Simpson	Manager, Core Operations	Tyco Electronics	Rock Hill, SC



Day Two Visioneering Participants

Kimberly Herndon	Development Coordinator	York Technical College	Rock Hill, SC
Steve Killian	Director of Planning and Economic Development	City of Kings Mountain	
John Miller	President/Sourcing Engineer	Miller Machine & Design	Charlotte, NC
Vail Carter	Business Services Coordinator	Centralina Workforce Development Board	Charlotte, NC
Robert Avossa	Chief of Staff	Charlotte-Mecklenburg Schools	
Brian Francis	Director, Manufacturing & Business Retention	Charlotte Chamber of Commerce	Charlotte, NC
Steve Nye	Marketing Director	Gaston County Economic Development Commission	Gastonia, NC
Jerry Saunders	Business Retention & Expansion	Cabarrus Regional Partnership	Kannapolis, NC
Bion Schulken	Manufacturing & Technology Counselor	Small Business and Technology Development Center	Charlotte, NC
Don Shivers	Sr. VP of Operations	SYSCO Food Systems	Concord, NC
Dr. Gary Teng	Director, Engineering Management Program and Center for Lean Logistics & Engineered Systems	The University of North Carolina at Charlotte	Charlotte, NC
Dr. James Cuttino	Director	NC Motorsports and Automotive Research Center	Charlotte, NC
Jim Todd	Plant Manager	Pass-Seymour/Legrand	Concord, NC
Joe Price	Customer Service	Duke Energy	
Barry Matherly	Executive Director	Lincoln Economic Development Association	Lincolnton, NC
Terry Mayes	Industrial Extension Specialist	NC Industrial Extension Service	Charlotte, NC
Ernie Giavedoni	Vice President of Plant Operations	DNP Ims America Corp.	Concord, NC
Nick Bishop	Alderman	Town of Spencer	Spencer, NC
Michael Sandel		Oiles America	Concord, NC
Ha-Tran Viet		Oiles America	Concord, NC
Chad Ray	Associate Dean, Engineering and Information Technologies	Central Piedmont Community College	Charlotte, NC
Johnnie Wallace, Jr.	Executive Director	Eastside Community Development Corporation	Charlotte, NC
Keith Klopp		Mooresville Economic Development Commission	Mooresville, NC

Visioneering

Jeff Young	Director, Business & Neighborhood Services Department	City of Concord	Concord, NC
Sabrina Knouse	Director of Human Resources	SYSCO Food Systems	Concord, NC
Melanie O'Connell Underwood	Executive Director	Mooresville Economic Development Commission	Mooresville, NC



Day One: Visioneering Brainstorming Exercise and Group Presentation

The objective of the Visioneering approach is to provide a process to collect ideas, to document the ideas, and to develop concepts for the future-state vision. Without this approach, many seemingly small concerns or factors that could contribute to the improvements are often overshadowed and or overheard by more pressing or obvious problems.

The cards and rotation system through the elements provided a creative vehicle for capturing ideas - allowing brainstorming to move ahead while insuring that all ideas will receive appropriate attention.

Strengths, weaknesses, opportunities, and threats were identified for each of the six (6) vision elements. The Element Groups summarized and presented their best ideas to the whole team. Finally, the whole team voted on the six vision elements to give priority order to the elements. The results for Day One follow here in prioritized order:

#1 Business/Supply Chain Expertise SWOT

Strengths:	Weaknesses:
<ul style="list-style-type: none"> • Good financial resources • Transportation • Warehousing • Consignment* • Joint Venturing/Partnering* 	<ul style="list-style-type: none"> • Cost driven • Availability • Information systems – sharing/tie-ins • Lack of collaborative network
Opportunities:	Threats:
<ul style="list-style-type: none"> • Incentive packages to companies w/local suppliers • Alliance/info sharing (local business and universities/CC) • Local suppliers provide timeliness, lower operating costs • Trading company model • Give suppliers a reason to locate in the area • Help local suppliers better understand their competition overseas and how to compete 	<ul style="list-style-type: none"> • Low cost labor countries (offshoring) • Small companies have a hard time networking and building relationships (too busy for chamber meetings) • Local workforce skills • Lack of reliable business from cyclical businesses • Lack of <i>quid pro quo</i> after emergency is fulfilled locally • Fear of sharing/collaboration

*Consignment and Joint Venturing/Partnering was considered a strength where it exists. This group pointed out that there was not a lot of this type of partnering happening in the region.

#2A – Promotion of Professional, Scientific & Technical Careers SWOT

Strengths:	Weaknesses:
<ul style="list-style-type: none"> • Community Colleges & Universities • Scholarships available • Private industry is willing to co-finance training • Increasing demographics 	<ul style="list-style-type: none"> • High school graduates not encouraged to seek technical careers • Not measuring success by job placements • No visibility of available training and education • Manufacturing careers not attractive
Opportunities:	Threats:
<ul style="list-style-type: none"> • Develop core courses at Community College • North Carolina Research Center • Local university/business partnerships • Networking/information sessions 	<ul style="list-style-type: none"> • Lack of retention/brain-drain • Lack of technical curriculum in schools • Lack of science and tech investment in public schools • Job losses • Move to service economy • Lack of cooperative and intern programs



#2B – Applied Research and Development SWOT

Strengths:	Weaknesses:
<ul style="list-style-type: none"> • Diverse technologies w/in Greater Charlotte Region • Quality Programs – 6 Sigma / Lean utilized on front end of product lifecycles • University of North Carolina - Charlotte R&D for precision machining 	<ul style="list-style-type: none"> • Lack of visibility for applied R&D from area colleges/universities • Charlotte Region is not R&D friendly (perception) • Applied R&D not supported by regional governments across boundaries – AKA “dotted line” gets in the way
Opportunities:	Threats:
<ul style="list-style-type: none"> • Develop local research center • Develop partnerships between industry and all levels of education • Consider apprenticeship program implementation • National Lab/Defense Dept – partnerships for tech transfer • R&D Partnerships between businesses 	<ul style="list-style-type: none"> • Loss of expertise to research centers across country • Loss of funding to other regions (research centers) • Concern that sharing R&D results in loss of trade secrets • Staying ahead of the competition



#4 – Financial Expertise SWOT

Strengths:	Weaknesses:
<ul style="list-style-type: none">• Plentiful capital• Diverse industry base• Charlotte Region is 3rd Largest Financial Center in the US	<ul style="list-style-type: none">• Lack of investment in local manufacturing• Lack of local understanding of pro forma process and analysis• Financial professionals do not focus on applying funds to manufacturing operations
Opportunities:	Threats:
<ul style="list-style-type: none">• Develop venture capital for R&D• Develop financial expertise by all players• Better R&D tax incentives• Streamline and promote existing programs	<ul style="list-style-type: none">• Hesitancy of private capital – investments in R&D are hard to secure



#5 – Entrepreneurship SWOT

Strengths:	Weaknesses:
<ul style="list-style-type: none"> • Pockets of conducive environment • Local expertise • Good distribution system • Local Community College, University and Continuing Education • Critical mass in certain industries • Information & help available • North Carolina Research Center • Chamber & Government 	<ul style="list-style-type: none"> • Lack of venture capital available • Education assistance not being used • No entrepreneur center/culture education • Lack of support services • Lack of financial understanding for entrepreneurs • Need trained and qualified employees • Little patience for entrepreneurial process – no turn-key company
Opportunities:	Threats:
<ul style="list-style-type: none"> • Biz-hub connect w/entrepreneurs • Niche market in Motorsports and medical equipment • New people coming into labor force • Spin-offs from existing industries/companies • Incubators 	<ul style="list-style-type: none"> • Fear of failure – Negative mindset • Overseas competition • Government regulations • Uncooperative culture • Inability to sustain entrepreneurial companies thru early years of growth • Liability/Insurance costs



#6 – Legal Expertise SWOT

Strengths:	Weaknesses:
<ul style="list-style-type: none"> • Plentiful local expertise for small businesses • Abundance of law firms for intellectual property (patents) • Larger firms with national connections 	<ul style="list-style-type: none"> • Availability of affordable counsel and guidance for small companies • Non-metro area legal support • Legal threats to small companies • Lack of legal visibility re: Advanced Manufacturing issues • Focus on product not process
Opportunities:	Threats:
<ul style="list-style-type: none"> • Legal intern programs with local manufacturing firms • Develop local alliances (legal documentation) for local companies funded locally (consortium) • Educate local law firms re: Advanced Manufacturing opportunities – innovation/tech transfer 	<ul style="list-style-type: none"> • Sustainable Advanced Manufacturing activity • Far too many firms vying for business (esp. urban areas) • Can get into serious problems without legal counsel • Protection of intellectual property (esp. international export)



Day Two: Affinity Diagram Brainstorming Exercise, Element Group Work and Group Presentation

Day Two began with the same background information given the first day and a review of the SWOT analyses completed on Day One. The affinity diagram allows Visioneers to let their thoughts flow freely as they roam and rotate around the six element areas. The objective of this exercise was to capture creative thought related to mission components for each vision element that would support achievement of the vision.

After the brainstorming activity was accomplished the element groups decided they could be most productive within the timeframe by staying together and formulating metrics. A Visioneering Worksheet was used for each element group to present their thoughts related to mission statements and/or goals and the metrics they felt would measure success most effectively.

The Element Groups summarized and presented their best ideas to the whole team. The results for Day Two follow here in prioritized order:

#1 Business/Supply Chain Expertise

Mission Statement
Provide effective environment for integrated supply chain/manufacturing operations.
Mission Elements (from Affinity Diagram)
<ul style="list-style-type: none">• Get NC/SC top brass talking about mutual benefits. Focus on MSA resources not regional or state resources• Companies must network to solve common problems• Link logistics industry to manufacturing industries• Create an advanced manufacturing consortium.<ul style="list-style-type: none">· Maximize logistical loads from private fleets• Create a business/supply chain "university" that would delineate the available players and processes. Any qualifying group could meet at the "U"• Regional clearinghouse of what companies are involved with – "what" quality/Lean processes and the type of training they are utilizing• Enhance infrastructure, i.e. roads, communication, regulations• Define and describe local supply chain• Develop offshore partnerships• Educate public schools, community colleges & universities on needs of work force (skills, knowledge, specifics)• Promote innovation "Open for Business" program at UNC-C• Accounting relationship – commercial ready to ensure payment• Database of business expertise within industry and experts at community colleges/universities
Metrics
<ul style="list-style-type: none">• Revenue Increase• Schedule compliance – on-time goals• Number of multi-state joint projects• Increase in university/business applied research projects• Increase in university/business R&D and commercial incentives

#2A – Promotion of Professional, Scientific & Technical Careers

Mission Statement

Improve the perception of Advanced Manufacturing careers through increased education, marketing, and public relations efforts that will ultimately increase the qualified employable Advanced Manufacturing workforce.

Mission Elements (from Affinity Diagram)

- Increase middle school and high school activities to attract students to advanced manufacturing opportunities and educate partners and school personnel on Advanced Manufacturing careers
- Improve and expand dual enrollment opportunities and articulation agreements with post-secondary educational institutions (2+2+2 Bridge Programs)
- Establish internship/apprenticeship/co-op opportunities and hands-on (applied) experiences – some of which might be paid to encourage time spent
- Implement salary incentives for faculty and teachers in technical/STEM curriculum areas (CAD, Drafting, etc.)
- Regional databank of what companies are involved in “what” quality/lean programs & training
- Continue to develop technical training opportunities and programs (on and off site) with joint support from both industry and education for hands on training experiences
- Combine business and management degrees with some area of technical training.
- Develop teacher job shadowing with advanced manufacturing companies
- Support summer entrepreneurial programs

#2A – Promotion of Professional, Scientific & Technical Careers (continued)

Mission Elements from Affinity Diagrams (continued)

- Implement concepts of lean into grade school curriculum
- Improve marketing efforts on available programming
- Educate parents about manufacturing careers – overcoming bias and perceptions of instability
- Make manufacturing jobs appealing to creative class
- Focus on the student's value to the community rather than student scholarships
- Market region to graduating seniors in top engineering schools
- Collaborate with National Engineers Week (PENC)

Metrics

- Applications for technical training from high school students - Number of 2+2+2 programs and enrollment data
- Number of collaborations developed and number of students in co-op/intern/apprenticeship programs and number of industries offered
- Create marketing plan/program – measure amount of public relations exposure (news articles, presentations, seminars, job fairs)
- Scholarship \$\$ presented
- Number of school with career path programs into advanced manufacturing
- Number of existing workforce trained in advanced manufacturing and placed in advanced mfg. jobs
- Number of parents contacted



#2B – Applied Research and Development

Mission Statement
<p>Integrate university-based R&D programs into advanced manufacturing base by establishing collaboration among universities/community colleges/economic development agencies/government and other support providers and advanced manufacturing companies. in providing programs and assistance to advanced manufacturers and promote and market these services</p>
Mission Elements (from Affinity Diagram)
<ul style="list-style-type: none">• Provide programs and assistance to advanced manufacturers and promote/market these services• Have colleges work directly with media and R&D centers and get the word out.• Establish closer connections between college labs and advanced manufacturing industries• University must be more aggressive in outreach• Connect local companies & UNC-C with DoD R&D opportunities• Expand UNC-C areas of expertise• Network on R&D needs so that grant \$s can more effectively be sought• Expand existing SBIR/STIR Services to promote federal agency/small business R&D• Expand R&D and commercialization services available through SBTDC• Create opportunities for ongoing dialogue with similar technologies to foster ideas for R&D
Metrics
<ul style="list-style-type: none">• Number of new patents, applications, and new technologies formed with joint effort of UNC-C and regional advanced manufacturing companies• Number of project developed with the advanced manufacturing sectors (ration & number)• Percentage of patents that result in a new technology put into manufacturing processes in the region

#4 – Financial Expertise

Mission Statement
Publicize and educate manufacturers on financial resources and processes
Mission Elements (from Affinity Diagram)
<ul style="list-style-type: none">• Identify and create a network of manufacturing savvy “funders” to include: banks – private investment – peer to peer – community – venture capital• Develop simple manual of venture and angel investor criteria• Develop process to facilitate connection of funding and users• If a person has an order – the financial resources are available• Financial expertise should be available in all counties – or all counties should be trained on where to go to get expertise
Metrics
<ul style="list-style-type: none">• In 2 years, survey manufacturers to determine the number that have problems with terms, conditions, and availability of financing in region



#5 – Entrepreneurship

Mission Statement
Encourage entrepreneurial growth through building strong networks with combined training and support resources
Mission Elements (from Affinity Diagram)
<ul style="list-style-type: none">• One-stop shop - Working with regional resources, develop a mentorship/support program by September 1, 2007• Develop a marketing campaign to showcase available resources for entrepreneurs by September 1, 2007• Entrepreneurship courses with degree credit• Develop a clearing center for disseminating information to various parties• Encourage spin-offs applications from healthcare and motorsports• Link existing resource via a virtual incubator model• Forum to connect entrepreneurs with funders• Develop a reliable sales channel through a hub focus
Metrics
<ul style="list-style-type: none">• Measure participation first year and yearly participation after with increasing goals• Increase in % of resources used compared to previous year.



#6 – Legal Expertise

Mission Statement
Develop and maintain a legal support system for advanced manufacturing entities in the Charlotte Region.
Mission Elements (from Affinity Diagram)
<ul style="list-style-type: none">• System will provide a clearing-house (central point source) for information on advanced manufacturing issues, listing of law firms that specialize in advanced manufacturing topics, and provide continuing education opportunities• Pro-bono services through coordinating agency• Partner with other local companies to drive down legal costs/fees• Create a primer or guidebook for most common needs• Have law school (public or private) create & host website
Metrics
<ul style="list-style-type: none">• Offer free hours at a consortium of expert lawyers in getting legal advice for advanced manufacturing companies• Perform service utilization/satisfaction surveys – quarterly• Partnering with international law firms to trade services helping companies on both sides with exchange of business setup – getting through legal questions• Number of companies who join the group/number of times the services are utilized - Work with local law schools/creation of list• Monitor total #visits, requests for information, and new links added, to the website