

Note: Companies mapped using the following NAICS codes and are indicative of capacity in these industries: **334220:** Broadcasting and Wireless Communications Equipment Manufacturing; **517910:** Other Telecommunications; and **541511:** Custom Computer Programming Services

Performance Materials

Definition: The DoD's goal for performance materials is to create lighter and stronger materials that are used in a wide variety of applications, including defense vehicles, electronic systems, protective gear, and uniforms. Example materials include composites, such as aramid, ultra-high molecular weight polyethylene, and S-2 glass-fiber reinforced polymers; thermoset fiber-reinforced composites for products ranging from body armor to armaments; nanomaterials using carbon nanotubes or nanoparticles for fuel cell catalysts; and multi-functional materials, such as fabrics combined with electronics for heating/cooling of protective clothing as well as "smart" uniforms that can relay data to a centralized network on the battlefield (a strong emerging area with high potential value globally). Metamaterials is a renewed field of interest as well, using plasma and electromagnetic fields to bend light to assist in stealth operations.

Critical skills and education required by companies in this market area include chemical engineering, materials science, chemistry, physics, and polymer processing technicians.

Growth Potential: According to DoD, Defense Supply Center Philadelphia purchased approximately \$2.2 billion in clothing alone during FY 2008. This amount is expected to grow to \$2.8 billion during FY 2009, and increase as the Army and Marine Corps add to their end-strength. According to Vector Strategy, advanced composites and ceramic materials for military ground vehicle armor could represent a \$3 billion opportunity between 2010 and 2015 (inclusive) as these non-metal

performance materials represent a growing share of the total materials required to produce armor for military ground vehicles. Underscoring increased interest in metamaterials, the FY 2009 DoD budget requested \$35 million in plasma and metamaterials research.

Business and Industry Capacity: North Carolina's traditional materials manufacturing industries are a core strength for developing and manufacturing 21st century performance materials for the defense and homeland security industry. Within the industries analyzed for this study, there are more than 100 companies in North Carolina focused on plastics material and resin manufacturing, composites manufacturing, fiber manufacturing, and non-woven and woven textiles. According to *North Carolina Textile Connect* and as of 2006, North Carolina's broader textile industry included more than 1,300 establishments that employed more than 120,000 people in 90 out of 100 counties.

For this study, RTI identified at least five core industries that comprise the Performance Materials market area, and recommended three critical industries for initial supply chain analysis in North Carolina: Nonwoven Fabric Mills, Carbon and Graphite Product Manufacturing (Advanced Ceramics), and Plastics Material and Resin Manufacturing. As of 2007, North Carolina had approximately 35,000 people working in these five industries. Among the three core industries previously listed, the supply chain for Carbon and Graphite Product Manufacturing is significantly larger than the other two core industries when measured by employment and number of establishments. In spite of North Carolina's traditional strengths in textiles and other materials, all three supply chains have development potential, with none of them measuring a link share ratio above 55 percent in the state compared to the nation as a whole.

Many of North Carolina's traditional textiles and materials firms have transitioned to developing products for the military. Examples include PPG Industries, which now provides fiberglass reinforcements for composite materials to the military as well as to defense contractors. Location quotients for traditional textiles, non-wovens, and composites manufacturing are far higher in North Carolina than the national average, with employment in the non-wovens industry growing by 48 percent between 1992 and 2007. Employment has also grown strongly in two other core industries: Plastics Material and Resin Manufacturing (30 percent versus a decrease of 21 percent nationally from 1992 to 2007) and Scientific Research and Development Services (127 percent versus 30 percent nationally from 1992 to 2007).

Underscoring the state's strengths in composites, Spirit Aerosystems will invest \$500 million and create 1,000 jobs to build and operate a Composites Center of Excellence at the North Carolina Global Transpark in Kinston. DSM Dyneema, a Dutch company that produces its patented fiber for use in bullet resistant armor in Greenville, has invested millions in recent years to increase its capacity and employees in North Carolina. Other examples of job creation and new investment include leading defense companies such as BAE Systems Tensylon High Performance Materials, based in Monroe, and VX Aerospace, which operates the company's composites manufacturing facility in Morganton.

Higher Education Capacity: The strength of this market area in North Carolina includes preeminent R&D and workforce programs. Among the leading resources at NCSU, the Institute for Maintenance Science & Technology at NCSU supports materials projects at Fleet Readiness Center East, aboard Marine Corps Air Station Cherry Point for a variety of vertical lift aircraft. The Thermal Protection and Comfort Center has constructed an 11'x18' fire resistant room to hold Pyroman, which has been used by the Army and Marine Corps to study the impact of intense heat and flames on combat uniforms. The Nonwovens Institute, a part of the College of Textiles also at NCSU, is engaged in R&D for new Army combat uniforms

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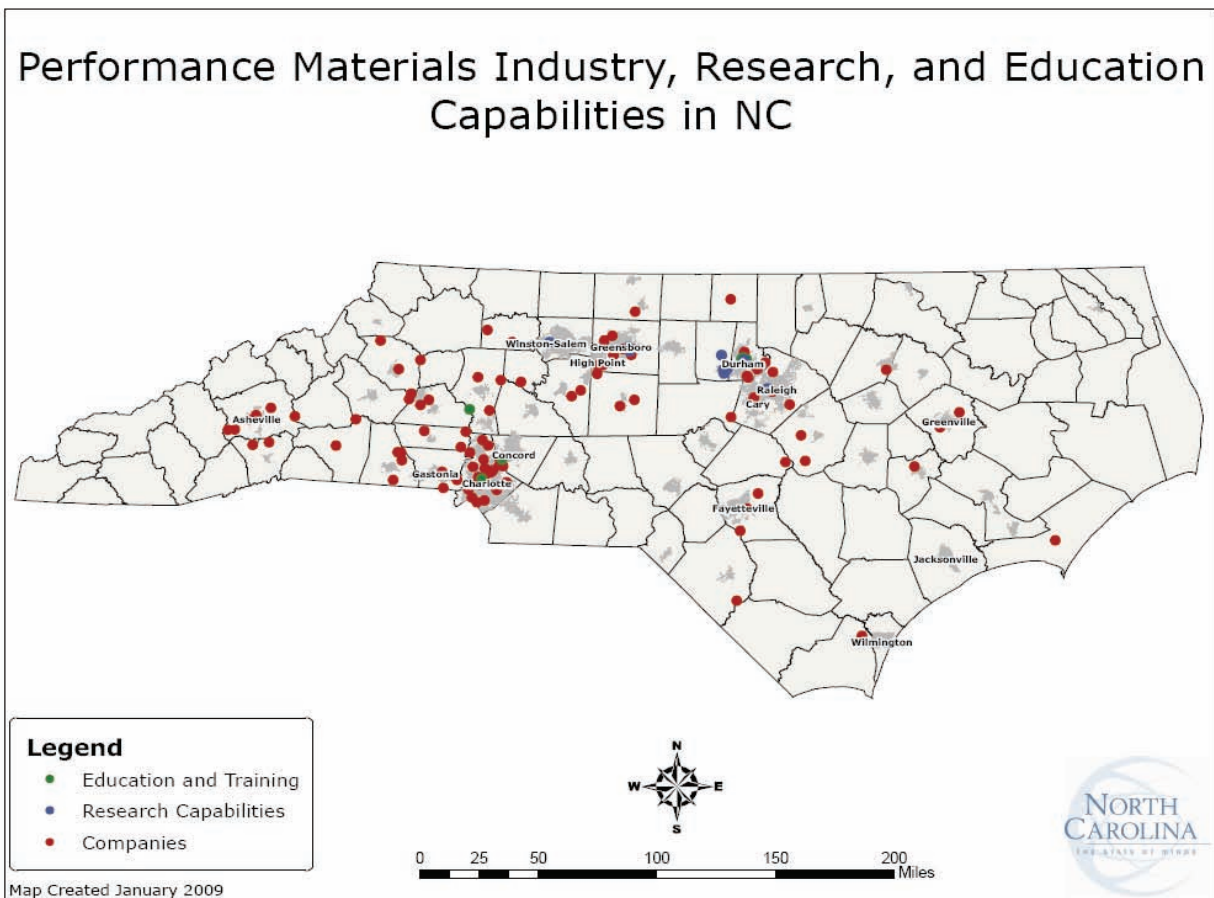
that would help protect against chemical and biological attacks. The Center for Advanced Materials and Smart Structures at NC A&T SU has partnerships with DoD’s Center for Nanoscience and Nanomaterials, the Air Force Research Laboratory, the Army Research Laboratory, and the Office of Naval Research to support ongoing research into advanced materials and coatings. NC A&T SU Center for Advanced Composite Materials currently provides reverse engineering support to MCAS Cherry Point, as well as several aviation companies and major defense contractors. Illuminating an important and growing area of interest for DoD, researchers at Duke University have simulated a device fabricated from metamaterials—which are manmade materials that gain their properties from their structure rather than composition—that they claim can render objects, such as submarines, invisible to sonar.

UNC-CH and NCSU offer a baccalaureate and graduate degree programs in material science. NCSU’s College of Textiles graduated 163 students alone in FY2008 in focus areas including textile engineering and fiber & polymer science.

Within the community college system, many campuses offer training programs related to materials and advanced machining, including Wilkes County Community College, which supports the Northwest North Carolina Advanced Materials Consortium, and Lenoir County Community College, which operates the Advanced Machining Training Center. Additionally, Catawba Valley Community College hosts the Center for Emerging Manufacturing Solutions, which provides education and training related to 21st century manufacturing technologies, including for performance materials.

Snapshot: Performance Materials Industry Cluster Analysis

Core Industry	Employment (2007)	Employment Growth (since 1992)	Avg. Annual Wage (2007)	Value Added LQ (2006)	Employment LQ (2007)
Plastics Material and Resin Manufacturing	1,319	30%	\$56,160	0.52	0.71
Nonwoven Fabric Mills	3,089	48%	\$46,696	7.19	6.98
Carbon and Graphite Product Manufacturing	584	-48%	\$40,300	2.30	2.46



Note: Companies mapped using the following NAICS codes and are indicative of capacity in these industries: **313230:** Nonwoven Fabric Mills; **325211:** Plastics Material and Resin Manufacturing; **335991:** Carbon and Graphite Product Manufacturing. NAICS codes used to identify North Carolina performance materials companies were geared toward the DoD's current advanced materials interest areas, primarily composites and nanomaterials. Companies on the list included those working with polymers, carbon products, and nonwovens, but not those in metals, metal fabrication, or traditional woven mills. While the total number of companies does not appear to be numerous, a comparison of states shows that North Carolina is third in the U.S. in the total number of companies within the NAICS codes used for performance materials.

RESET Support Activities

Definition: RESET encompasses maintenance, refurbishment, recapitalization, and supply activities to restore military operational units to a desired level of readiness for future missions. RESET thus includes vehicle component supply, vehicle manufacturing, and armaments—ground and mobility armor manufacturing and components supply. RESET also includes maintenance, repair, and parts replacement for aircraft, ground vehicles, munitions, communications and electronic equipment, and other equipment and supplies needed by the military.

Critical skills and education required by companies engaged in this market area include technicians skilled in aircraft and automotive parts repair; electrical, mechanical, chemical, and computer engineering; computer programming and operation; materials science; supply chain and logistics management.

Growth Potential: As a result of sustained military operations in Iraq and Afghanistan, the Army and Marine Corps predict annual RESET costs will continue to total \$13 billion for the Army and \$5 billion for the Marine Corps annually for as long as operations continue, and for two to three years thereafter.