Soaring High

NORTH CAROLINA'S UNMANNED & AUTONOMOUS SYSTEMS INDUSTRY

Economic Development Partnership
of North Carolina

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Welcome to
North Carolina

With a winning combination of workforce talent and technology innovation, North Carolina is primed to be a leader in the autonomous and unmanned systems industries. Our state has all the components that companies in these industries need to grow and expand. For over 60 years, North Carolina has been home to the Research Triangle Park, a hub for industry and university collaboration. The Park's research and development activity is augmented by a robust defense sector. Three branches of the military – all users of autonomous and unmanned systems – have major presences at Fort Bragg, Camp Lejeune, and Seymour Johnson Air Force Base. Decades of investment in aerospace and related industries have resulted in a highly capable workforce with easily transferable skillsets. North Carolina is a place where autonomous and unmanned systems companies can find workforce talent, innovative research, new industry partnerships, and a friendly business environment.

The state's growing industry presence includes companies like PrecisionHawk, Charlotte UAV, and Primal Space Systems. Many other North Carolina companies are also conducting groundbreaking research in autonomous and unmanned systems, including IBM, SAS, and RTI International. Industry efforts in research and development are supported by a wide array of programs through the state's educational institutions. North Carolina State University serves as a hub for the Federal Aviation Administration's NextGen Air Institute, a center of excellence for unmanned aerial systems. ACCESS Laboratory, hosted at North Carolina A&T University, has recently announced an autonomous systems project sponsored by both GM and SAE. With dozens of companies and research initiatives across the state, North Carolina is poised for future growth in the industry.

North Carolina's unmanned and autonomous systems industry will generate *more than $600 million* in total economic activity by 2025.

About North Carolina

North Carolina is centrally located on the east coast of the United States; 100 million people live within a day's drive of the state. Over 10 million people call the state home, and it's growing fast – the population has increased 6.4% since 2010. Last year, over 80,000 people moved here, the 3rd highest net migration rate in the United States. As the 9th most populated state, it's easy to see why more businesses and people are choosing to move to North Carolina. The economy is growing quickly; total economic output has increased 8% in the past 5 years. That growth is in part due to the state's friendly regulatory climate, low cost of living, and internationally recognized higher education system. And when it's time to play, North Carolina's got you covered. The state's diverse geography and temperate climate ensures access to quality recreational options for both beach-goers and mountain climbers alike.

The Unmanned and Autonomous Industry Ecosystem

A Workforce with Transferable Skillsets

Interconnected Industries Workforce

North Carolina's workforce features all the skillsets needed for autonomous and unmanned systems industries to grow. The multi-faceted needs of the industry require a skilled workforce from multiple sectors like advanced manufacturing, information technology, and defense. Combined, North Carolina is home to 3,045 establishments employing 70,144 people with skillsets that can be utilized by companies in this industry. Our state is a national leader in these allied industries, ranking 9th nationally and 2nd in the southeast for total employment. Employment in this group of interconnected sectors has increased 14% since 2012, which is the 3rd highest growth rate in the nation. In North Carolina, companies in the autonomous and unmanned systems industry can easily find workers with the right skillsets.

Aerospace

Information Technology

Advanced Manufacturing

Research & Development

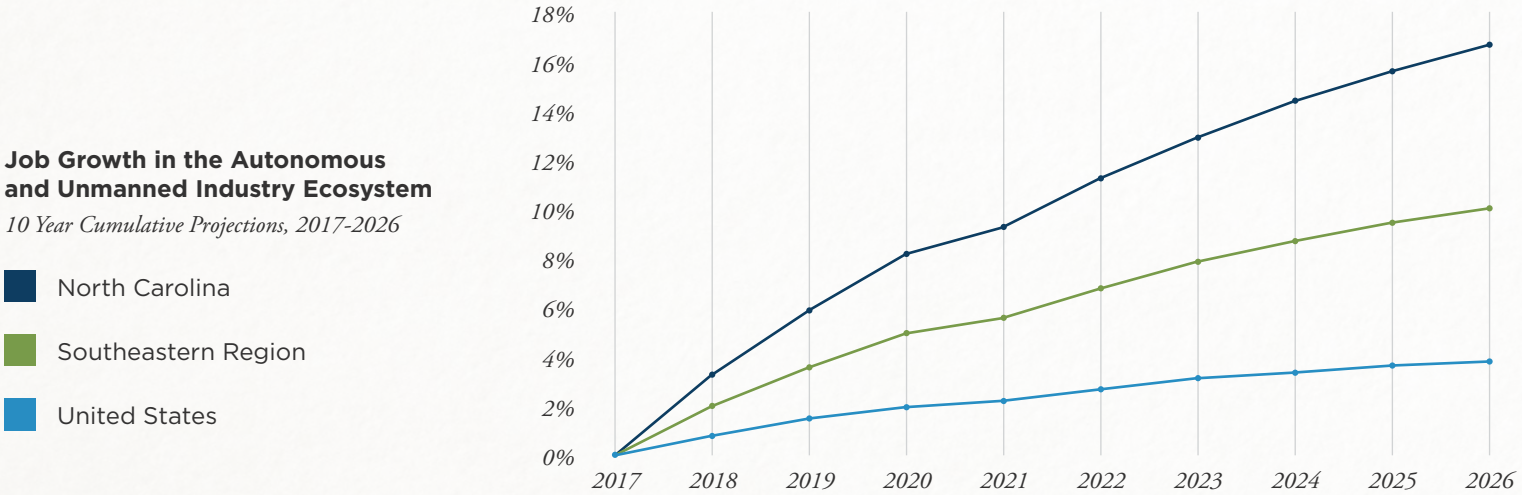
Defense

Robust Future Job Growth

North Carolina is a frontrunner in terms of recent job growth, and that trend should continue for years to come. Looking toward the future, the total number of jobs in the ecosystem will expand at a rapid rate. Third party projections show North Carolina as a national leader in the sector through 2026. Almost 80,000 individuals will work in the ecosystem by 2021, and that number is expected to grow to over 85,000 people by 2026. Workers with skillsets used by the unmanned and autonomous systems industry will grow at a rate that is 4x faster than the national average. Future job growth is a major reason why companies in this industry stay in North Carolina. No matter how much your company may expand, our state's workforce can fit the needs of your business.

Job Growth in the Autonomous and Unmanned Industry Ecosystem

10 Year Cumulative Projections, 2017-2026



EcoPRT, an unmanned vehicle company started at NC State University, is on the cutting edge of research on integrating unmanned systems into mass transport.

North Carolina is home to dozens of companies in emerging technology areas related to unmanned and autonomous systems:

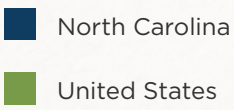
Technology Area	Companies	Location
Additive Manufacturing	Oerlikon	Charlotte
Airborne Networks	Smart Sky Networks	Raleigh
Artificial Vision Systems	Applied Research Associates	Raleigh
Aviation Information Management	Skyward/Verizon, CGH Technologies	Raleigh, Southern Pines
Collision Avoidance	SCHUNK Intec	Morrisville
Data Analytics and Optimization	Geoptic Aerial	Raleigh
Flight Control Systems	LORD Corporation	Cary
Surveillance and Sensors	Go Unamanned	Raleigh, Concord
Unmanned Systems Services	SSI, Constellis	Smithfield, Moyock

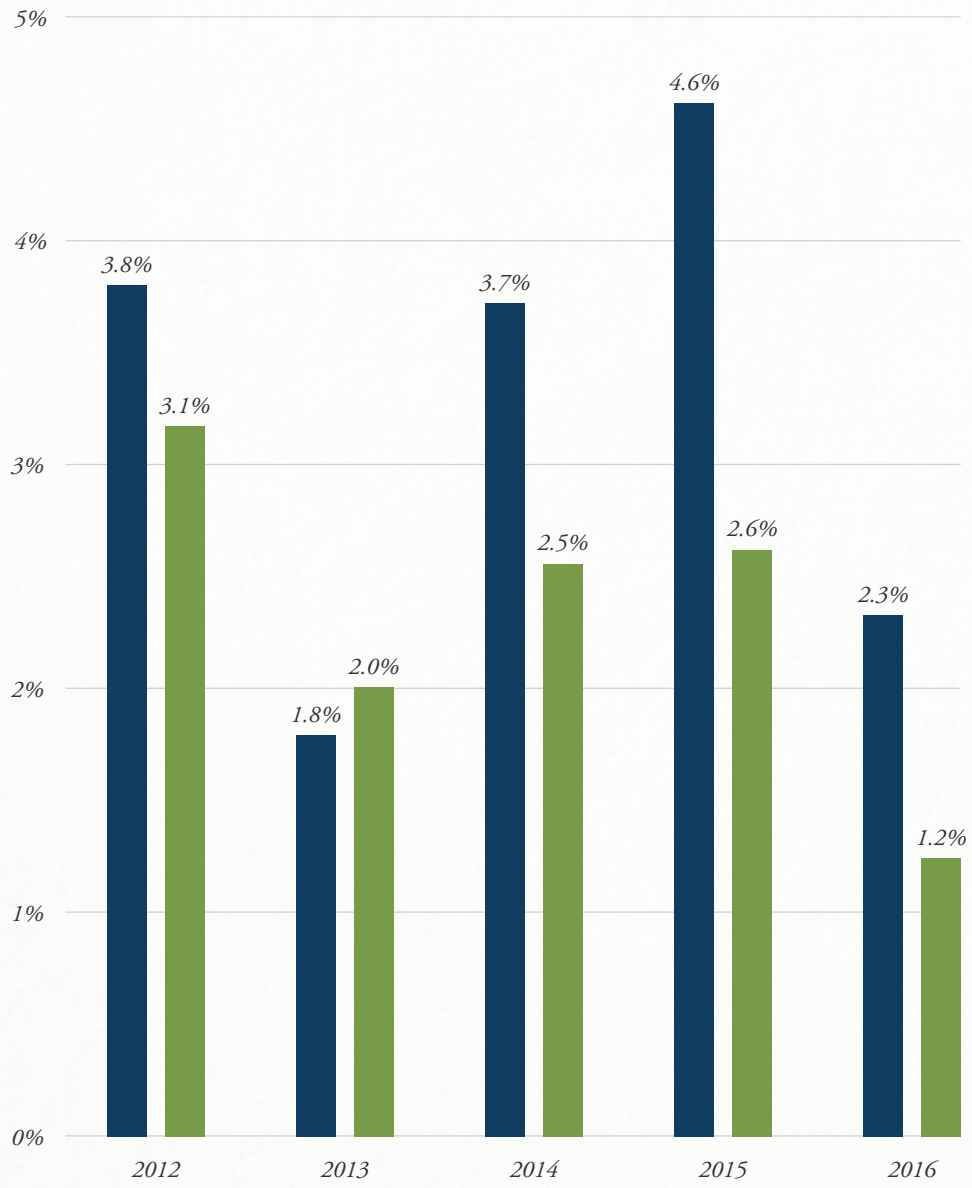
Plentiful Workers in Hard-To-Fill Occupations

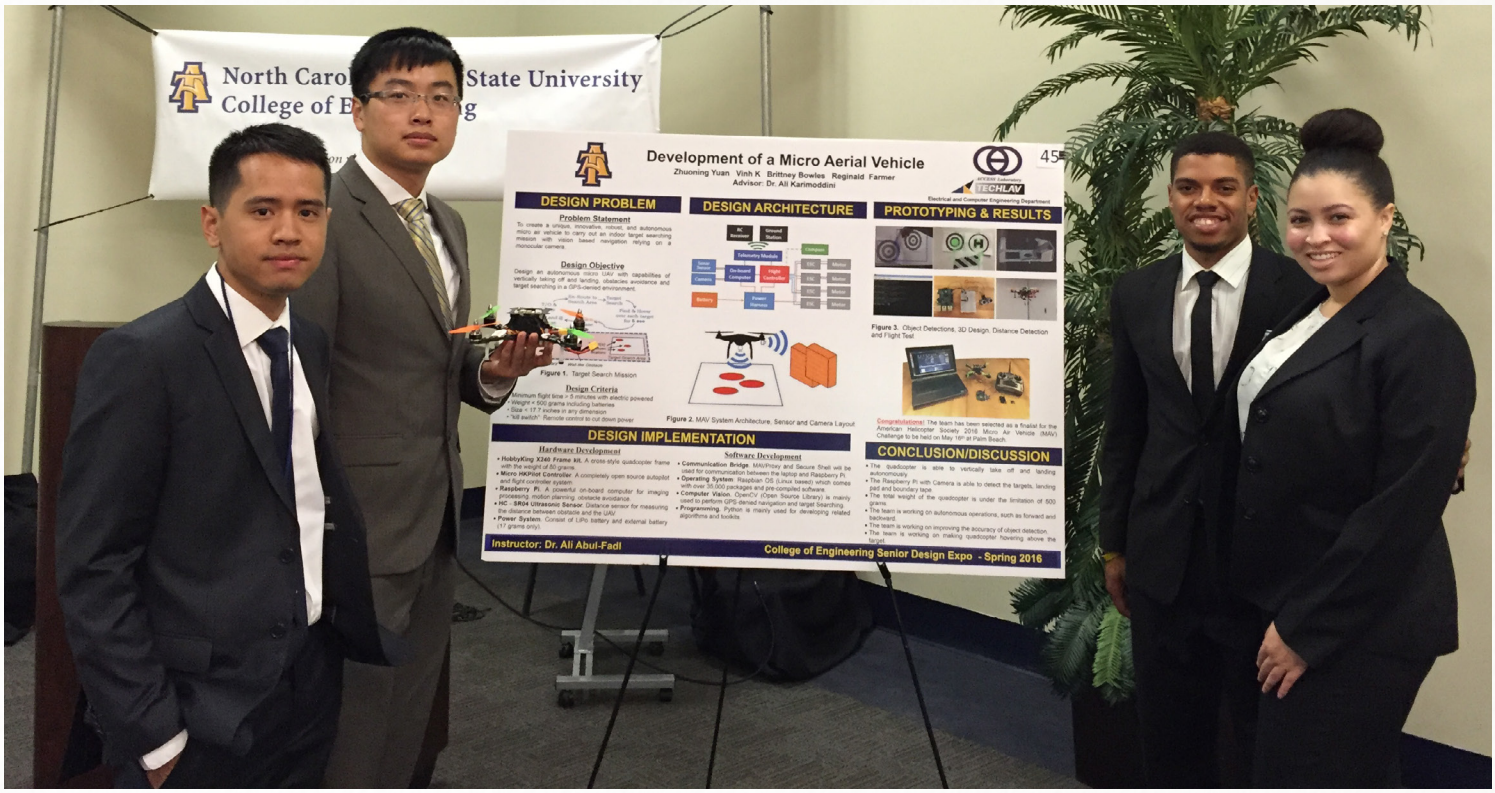
Businesses working with autonomous and unmanned systems employ a diverse array of workers. Many of the "hard-to-fill" jobs for the industry fit into two broad categories. To develop computer and electric systems, the industry benefits from a steady pipeline of workers with skillsets in research and engineering. Equally important is the ability to hire skilled workers in advanced manufacturing to produce parts and end products. North Carolina offers a growing number of people that have these in-demand skillsets. Beyond those employed directly in the autonomous and unmanned industry ecosystem, 191,482 individuals work in technical occupations with high industry demand. Median hourly earnings for these occupations are on average 10% lower in our state compared to the national average. The abundant and affordable supply of workers in these hard-to-fill occupations means the industry will easily be able to fill any job openings they have in North Carolina.

In 2015, North Carolina's educational institutions awarded 25,240 degrees and certificates in areas that are heavily utilized by the autonomous and unmanned systems industry.

Unmanned & Autonomous Systems Ecosystem Technical Occupation Job Growth







Students from NC A&T University's ACCESS Laboratory present research findings on aerial vehicles.

Occupation	2016 Jobs	Projected 5 Year Growth	Hourly Earnings (NC)	Hourly Earnings (US)
Computer and Electric System Skillsets				
Software Developers[1]	28,568	+41%	$46.51	$48.45
Computer Systems Analysts	20,954	+15%	$42.24	$41.25
Electrical Engineers	5,086	+9%	$44.74	$44.71
Computer Hardware Engineers	1,475	+11%	$42.69	$53.72
Aerospace Engineers	806	+16%	$44.14	$51.84
Advanced Manufacturing Skillsets				
Team Assemblers	45,707	+5%	$13.07	$13.98
Inspectors, Testers, Weighers	19,708	+5%	$14.78	$17.31
Electrical Equipment Assemblers	7,368	+6%	$13.37	$14.84
Industrial Engineers	6,996	+8%	$38.40	$40.13
Mechanical Engineers	6,775	+11%	$38.11	$40.19

[1]Includes developers both for software systems and applications.

North Carolina's Talent Pipeline

North Carolina students competing at IEEE Hardware Competition.

In 2016, North Carolina's community colleges awarded 48,860 degrees and certificates related to technical career skills.

In recent years, North Carolina's unmanned and autonomous industry ecosystem has seen significant job growth. This is driven in part by the leadership role taken on by our educational institutions. The state is home to dozens of research initiatives and degree programs that are either directly or indirectly related to the industry.

Colleges and Universities
North Carolina's 53 colleges and universities are churning out educated workers that are eager to put their education and skills to work. We're proud to be the home of three Tier 1 research universities at the University of North Carolina at Chapel Hill, Duke University, and North Carolina State University. Both in the research triangle and beyond, many of the state's colleges feature programs related to the autonomous and unmanned systems industry. ***NC State*** offers numerous degrees that include autonomous systems coursework through the Department of Electrical and Computer Engineering. ***UNC Wilmington's*** graduate degree programs in computer science include a specialization in unmanned aerial vehicles. Multiple universities are engaged directly or indirectly in industry research, including ***UNC Charlotte's Autonomous Systems Lab.***

Community College System
Last year, 133,784 students enrolled in technical programs across North Carolina's 58-campus community college system. With one of the most advanced vocational and technical programs in the nation, the state's community colleges offer industry-relevant degrees and certificates in areas including:

Unmanned and Autonomous Systems: Mechatronics, Autonomous Systems Technology.

Engineering Programs: Automation Engineering Technology, Computer Engineering, Electronic Engineering, and Mechanical Engineering.

Technology Programs: Computer Programming, Information Technology, and Computer Technology Integration.

Industrial Skills Programs: Industrial Engineering, Industrial Management Technology, Industrial Systems Technology, and Manufacturing Technology.

North Carolina students present a drone prototype at the national meeting of the vertical flight technical society.

Concept art for EcoPRT autonomous vehicles.

Cutting Edge

Industry Support & Research Initiatives

North Carolina has many opportunities for autonomous and unmanned systems companies to collaborate with our university system and other key industry players. From computational robotics to driverless vehicles, North Carolina is a leader in initiatives that are core to the autonomous and unmanned systems industry.

In 2015, the Federal Aviation Administration selected North Carolina State University as a Center of Excellence for unmanned aircraft systems. The university will lead other North Carolina educational institutions in joint research efforts to analyze how unmanned aircraft can be safely integrated into national airspace. North Carolina has been a research leader in this area for decades - the Institute for Transportation and Research Education at NC State was chartered in 1978. The Institute is home to the NextGen Aviation Technologies consortium, a collaboration of more than 30 industry and academic organizations that provides practical research for aviation technology development.

Such programs are simply one of a network of research initiatives across the state. NC A&T University operates the Autonomous Control and Information Technology (ACIT) Center and the TECHLAV Center of Excellence in Autonomy. In 2017, the success of these programs resulted in a multi-million dollar federal grant to study unmanned autonomous systems. The Active Robotic Sensing (ARoS) Laboratory, located at NC State, focuses on developing tools for computer vision. Duke University operates a Humans and Autonomy lab that researches autonomous systems including work with Google, Amazon, and multiple branches of the military. Beyond air and ground-based research, Duke University also uses unmanned systems in marine environments along North Carolina's coast.

University-led efforts in this area are bolstered by numerous private sector research initiatives. International companies with a North Carolina presence like SAS, IBM, and NetApp are conducting ongoing research in the areas of robotics and artificial intelligence. RTI International, a leading nonprofit provider of research services headquartered in our state, has recently launched an extensive research program on the commercial use case for drones.

"North Carolina's research capabilities have been prepared for the transition to autonomous transportation and UAS for a long time. Researchers throughout the state have been exploring opportunities to advance the technology in areas like airborne connectivity and safety solutions."

-Kyle Snyder, Director, NCSU NextGen Air Transportation Consortium

Military and Defense
Cluster Advantage

There are seven military installations in North Carolina representing all branches of the military: the Army, Marine Corps, Navy, Air Force, and Coast Guard. Each military installation is nested in a growing network of defense companies. Over 386,000 private sector jobs are supported by the state's military operations. North Carolina's growing defense cluster is funded by billions in government contracts. In 2014, almost $2.5B of prime military contracts were performed in the state.

With flight operations at every military installation, the defense market for autonomous and unmanned systems is growing fast. Many military units across the 106,262 active duty personnel in the state are heavy users of the industry's products. The Army's Special Operations Command, headquartered at Fort Bragg, is among the largest users of drones in the military. Personnel in light infantry, located mostly at Fort Bragg and Camp Lejeune, are also involved with unmanned systems.

Unmanned and autonomous systems companies are flourishing in a unique ecosystem of military-based collaborative research and development. North Carolina's university system funds over $1B per year in research directly related to defense. Nine state universities have research initiatives related to defense, including collaborations with the Army Research Laboratory and National Security Agency.

Defense businesses in North Carolina enjoy unparalleled support through an array of organizations that work to develop the state's military industry cluster. Organizations that provide assistance include the NC Military Business Center (NCMBC), NC Defense Technology Transition Office (DEFTECH), and the NC Defense Business Association (NCDBA).

"To be successful in the unmanned and autonomous systems industry, companies need to locate in an area with a high-quality workforce with easy access to potential customers. LORD has found North Carolina checks all those boxes and more."

-Becky Williams, President, Aerospace & Defense, LORD Corporation

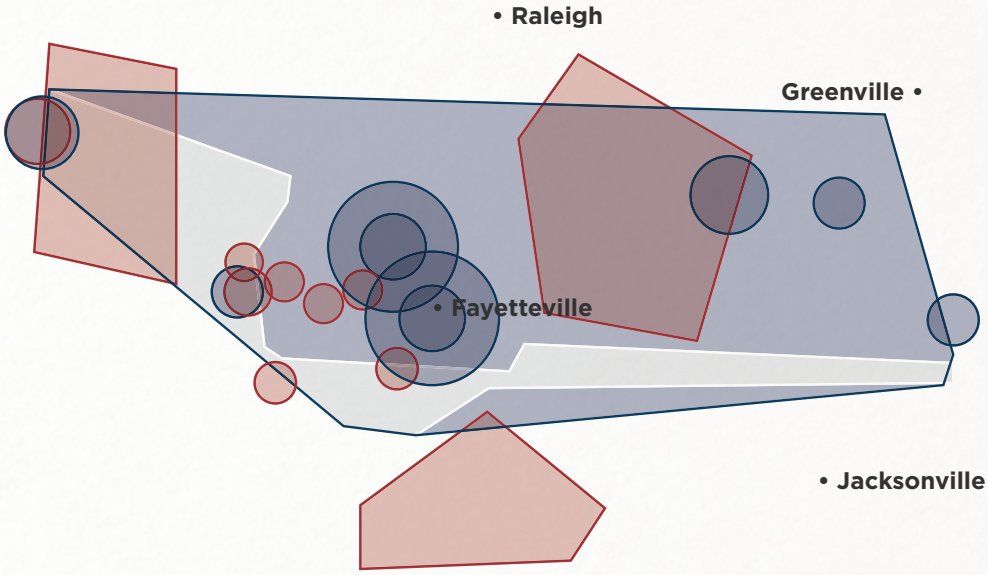
NC's Unmanned and Autonomous Systems Defense Companies

UTC Aerospace Systems
NORTHROP GRUMMAN
CURTISS-WRIGHT
LORD
Honeywell Aerospace
BAE SYSTEMS
DRS TECHNOLOGIES
GE Aviation

Supportive Government Policy

North Carolina is creating a friendly regulatory environment for the operation of unmanned and autonomous vehicles. The state government established an Unmanned Aircraft Systems Program Office in 2014, and since then much work has been done to ease regulatory burdens. For example, unmanned operators no longer require a traditional pilot's license – instead, an unmanned pilot's license is required. Ensuring personnel have appropriate licensing for drones in our state has never been easier. Commercial use of unmanned vehicles has thrived because of this accommodating regulation. Since 2016, North Carolina has issued almost 1,000 UAS permits. According to the state Department of Transportation, levels of commercial drone use in North Carolina are on par with states like New York and North Dakota.

In the air and on the ground, North Carolina leads the nation in creating test sites for users of unmanned and automated systems. The United States Department of Transportation recently named North Carolina as one of ten proving grounds for automated vehicle technologies. And as part of North Carolina's participation in the Alliance of System Safety of UAS through Research Excellence (ASSURE) network, the state has proposed an airspace corridor (AirLab) for automated aviation technologies. With both a military operations area and multiple classes of airspace (C, D, E, and G), the AirLab will support commercial and defense testing of emerging digital aviation technologies.



Stylized depiction of proposed airlab corridor.

"We chose North Carolina because they were the first state to adopt drone regulations, even before the Federal Aviation Administration. The state had the foresight to see drones as data collection tools and could see real value with providing the legal and operational framework behind implementing this technology."

-Brett Smith, CEO, Charlotte UAV

How We Stack Up

Select State-by-State Comparison for the Autonomous and Unmanned Systems

Compared to other states with a large autonomous and unmanned systems presence, North Carolina is an industry leader. Our state offers strong job growth, opportunities to collaborate on industry research, a large potential customer base, and low business costs.

	NC	GA	ND	NY	OH	VA
Defense Employment						
Security & Defense Cluster[1]	246,511	283,223	18,962	324,038	189,163	388,090
Direct Military Employment	129,923	94,210	11,114	57,234	36,017	140,363
Labor Environment						
Manufacturing Unionization[2]	1.8	3.0	9.0	11.5	14.3	6.1
Industry Ecosystem[3]						
2012-2016 Job Growth	+14.4%	+5.6%	-4.0%	+0.1%	+11.4%	-9.5%
2016-2021 Estimated Growth	+13.9%	+8.9%	-2.4%	+2.2%	+10.0%	-0.2%
Research & Development[4]						
Private Research Spending	$2.82B	$1.95B	$222M	$5.64B	$2.16B	$1.38B
Federal Research Spending	$310M	$268M	$27M	$195M	$705M	$2.65B
Business Rankings						
Total State & Local Tax Burden[5]	#1 (Tied)	#8	#51	#43	#11 (Tied)	#11 (Tied)
Best States for Business[6]	#2	#7	#8	#24	#11	#6
Business Climate[7]	#2	#1	Unranked	#24	#3	#6

[1]Measured via Purdue University's Security and Defense cluster, includes 36 total industries.

[2]The percentage of workers in a state that are unionized within private manufacturing industry. Union Membership and Coverage Database, 2016.

[3]Percentage increase in the total number of jobs in the unmanned & autonomous industry ecosystem from 2012 to 2016 and projected job increases from 2016 to 2021. EMSI, 2017. Includes industries in information technology, analytical instruments, aerospace, defense, and research.

[4]Total Business Spending and Total Federal Spending, National Patterns of Research & Development Spending, National Science Foundation, 2015

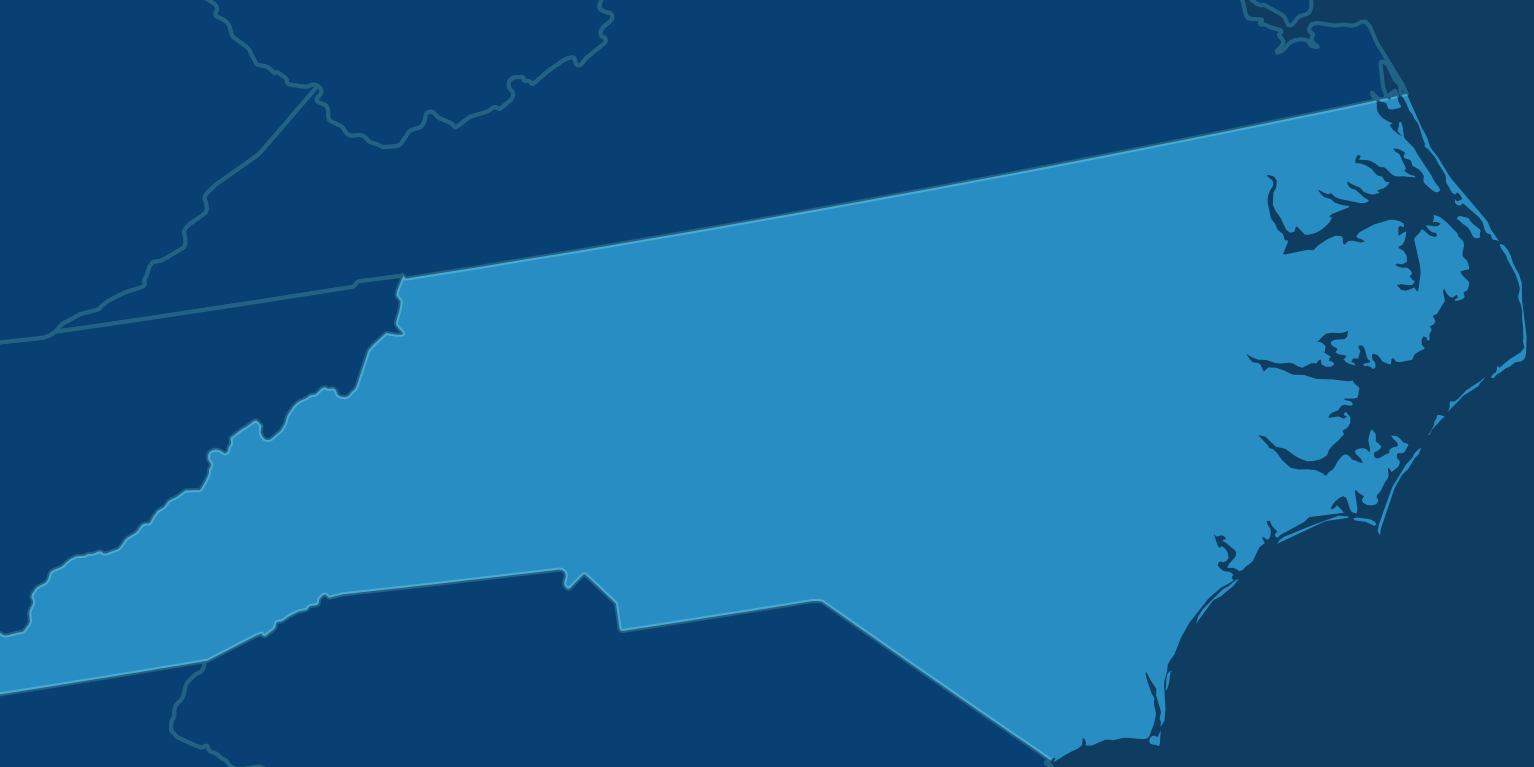
[5]Business Taxes as Share of Total Taxes in Private Sector GSP, Total State and Local Business Taxes Report, EY and COST, 2016.

[6]Forbes, 2016.

[7]Site Selection, 2016.

"Sierra Nevada Corporation is proud to be part of North Carolina's growing unmanned and autonomous systems cluster. We've found the state offers companies in this industry all the components they need to succeed: a low cost of doing business, innovative research and development opportunities, and a world-class talent pool."

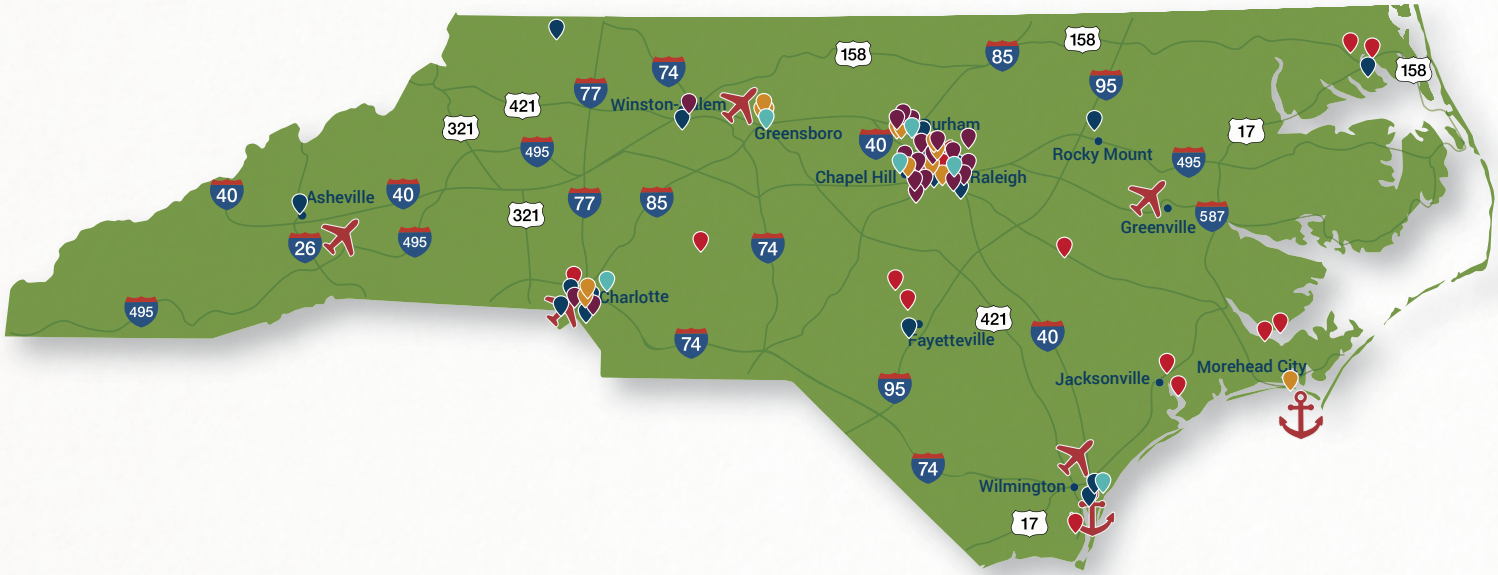
-Ralph Pollitt, Senior Vice President, Sierra Nevada Corporation



"Duke University has been spearheading Department of Defense research efforts looking at how to make more robust and secure autonomous systems, especially in the area of human-autonomy collaboration in the detection and mitigation of cyberphysical system hacking attacks."

-Dr. Missy Cummings, Director of Humans and Autonomy Lab, Duke University

North Carolina's Unmanned and Autonomous Systems Asset Map



Military Installation	Name	Location
	Air Base – National Guard	New London
	Air Base – National Guard	Charlotte
	Air Station at Cherry Point - Marines	Havelock
	Air Station at New River - Marines	Jacksonville
	Aviation Logistics Center – Coast Guard	Elizabeth City
	Camp Lejeune - Marines	Jacksonville
	Elizabeth City Air Station – Coast Guard	Elizabeth City
	Fleet Readiness Center East - Navy	Cherry Point
	Fort Bragg - Army	Fort Bragg
	Military Ocean Terminal - Army	Sunny Point
	NC Joint Force Headquarters – National Guard	Raleigh
	Pope Field – Air Force, Army	Fayetteville
	Seymour Johnson – Air Force	Goldsboro

Defense Contractors	Name	Location
	AECOM – Drones, Unmanned Vehicles	Morrisville, Garner, Charlotte, Raleigh, Wilmington, Winston-Salem
	Chemring Detection Sensors – Unmanned Vehicles	Charlotte
	Curtiss-Wright – Drones	Charlotte
	DRS Solutions – Autonomous Systems, Drones	Elizabeth City
	GE Aviation – Autonomous Systems, Drones	West Jefferson, Asheville, Wilmington, Durham
	Honeywell Aerospace – Drones, Autonomous Systems	Rocky Mount
	LORD Corporation – Drones	Cary
	Sierra Nevada – Drones	Fayetteville
	United Technologies – Drones	Charlotte

Research Support		
	Duke Marine Ecology Unmanned Systems Facility	Beaufort
	Duke Humans and Autonomy Lab	Durham
	Duke Robotics Group	Durham
	NC A&T ACCESS Laboratory	Greensboro
	NC A&T Autonomous Control & IT Institute	Greensboro
	NC A&T TECHLAV	Greensboro
	NCSU Active Robotic Sensing (ARoS) Lab	Raleigh
	NCSU Institute for Transportation Research & Aviation	Raleigh
	NSA Laboratory for Analytic Sciences	Raleigh
	RTI International Drone Research	Durham
	TCOM Manufacturing, Production and Test Facility	Elizabeth City
	UNC Chapel Hill Computational Robotics Group	Chapel Hill
	UNC Charlotte Autonomous Vehicles Lab	Charlotte
	UNC Charlotte CORE Lab	Charlotte
	US Army Research Office	Durham

Industry Company		
	Automated Insights – Machine Learning	Durham
	Cloudadic – Artificial Intelligence, Machine Learning	RTP
	Charlotte UAV – Drones	Charlotte
	EcoPRT – Autonomous Vehicles	Raleigh
	Garmin – Unmanned Vehicles	Cary
	Hawkeye Global - Drones	Winston-Salem
	IBM – Robotics	RTP
	Intel – Artificial Intelligence	Cary
	Kitware – Artificial Intelligence, Machine Learning	Carrboro
	NetApp – Artificial Intelligence	RTP
	PrecisionHawk – Drones	Raleigh
	Primal Space Systems – Autonomous Vehicles	Raleigh
	Prsonas – Artificial Intelligence	Durham
	SAS – Robotics	Cary
	Sense Photonics – Autonomous Vehicles	Durham
	SuperDroid Robots – Robotics	Fuquay Varina
	Transbotics – Autonomous Vehicles	Charlotte

Universities		
	Duke University – Robotics Coursework	Durham
	NC A&T – Robotics Coursework	Greensboro
	NC State – Autonomous Systems Coursework	Raleigh
	UNC Chapel Hill – Robotics Coursework	Chapel Hill
	UNC Charlotte – Robotics Coursework	Charlotte
	UNC Wilmington – Unmanned Vehicles Coursework	Wilmington

State-Level Taxes and Incentives

North Carolina's targeted, performance-based incentive programs complement an already competitive business cost structure.

Job Development Investment Grant (JDIG):
JDIG is a performance-based, discretionary incentive program that provides grants to new and expanding businesses to help offset the cost of locating or expanding a business facility. Companies can qualify based on the project location, number of jobs, and average wage. The grant amount is based on a percentage of the personal income tax withholdings associated with the new jobs. For high-yield projects that invest $500+ million and create 1,750+ jobs, JDIG can provide a grant worth up to 100% of personal income tax withholdings for 20 years. JDIG awards are cash grants that can be used for any purpose.

North Carolina's robust incentive programs are designed to fit the needs of the unmanned & autonomous systems industry.

One North Carolina Fund (OneNC):
OneNC is a discretionary cash-grant program that allows the Governor to respond quickly to competitive job creation projects. Awards are based on the number of jobs created, level of investment, location of the project, economic impact of the project, and the importance of the project to the state and region. Local governments at the project location are required to match a portion of any award. Funds may be used for installation or purchase of equipment, structural renovations, and construction or improvements to utility lines in new or existing buildings.

Workforce Development (NCWorks):
NCWorks is a free, customized job training and recruiting program for new and expanding businesses. NCWorks offers comprehensive training via the state's extensive catalog of community college programs as well as customized curricula tailored to address the specific needs of the industry. Since inception, this program has trained nearly 37,000 employees from 861 companies across the state. 92% of these companies have been advanced manufacturers.

Sales Tax Exemptions
Purchases of machinery and equipment for use in manufacturing are exempt from North Carolina's sales and use tax. Purchases of equipment used for research and development by companies in the physical or engineering research sectors are also exempt from this tax.

Low Cost, Pro-Business Climate

Why Nothing Compares

From a low cost of doing business to a growing defense cluster, North Carolina offers everything the unmanned and autonomous systems industry needs to prosper. Putting down roots in North Carolina means coming to place that's known for being affordable, innovative, and truly open for business.

3% Corporate Income Tax
We have the lowest corporate income tax rate in the nation. In 2018, we'll fully phase in single sales factor apportionment.

4.75% Statewide Sales & Use Tax
Local governments may charge an additional 2 - 2.75%. Sales tax exemptions are available for manufacturing and research.

Low Industrial Property Taxes
Third party studies show North Carolina has some of the lowest effective property tax rates the region for businesses.

STEM Degrees
North Carolina's educational institutions award 42,948 STEM degrees and certificates each year.

College-Educated Population
About 29% of our state's population above age 25 holds a bachelor's degree or more, one of the highest rates in the region.

Computer and Math Occupations
The number of North Carolina residents working in computers or mathematics is expected to grow 22% in the next 10 years.

Low Unionization
North Carolina has one of the lowest rates of union membership in the United States.

Affordable Utilities
North Carolina's industrial electricity rates run nearly 8% below the national average.

Low Cost of Living
People who live in our cities enjoy a cost of living well below the national average.

Military Customer Base
North Carolina has the third largest number of active duty personnel in the nation.

Robust Defense Cluster
Over 10 years, the number of jobs in the state's security and defense cluster will grow by 15%.

Defense Research Support
NC's public universities engage in over $1B of defense related research every year.

"What makes North Carolina unique is the diversity of research programs at the state's universities, successful established relationships with major government funding agencies, and close coordination with local and national industries."

-Dr. Ali Karimoddini, ACCESS Laboratory Director and TECHLAV Deputy Director, NC A&T University

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