NC STATE UNIVERSITY

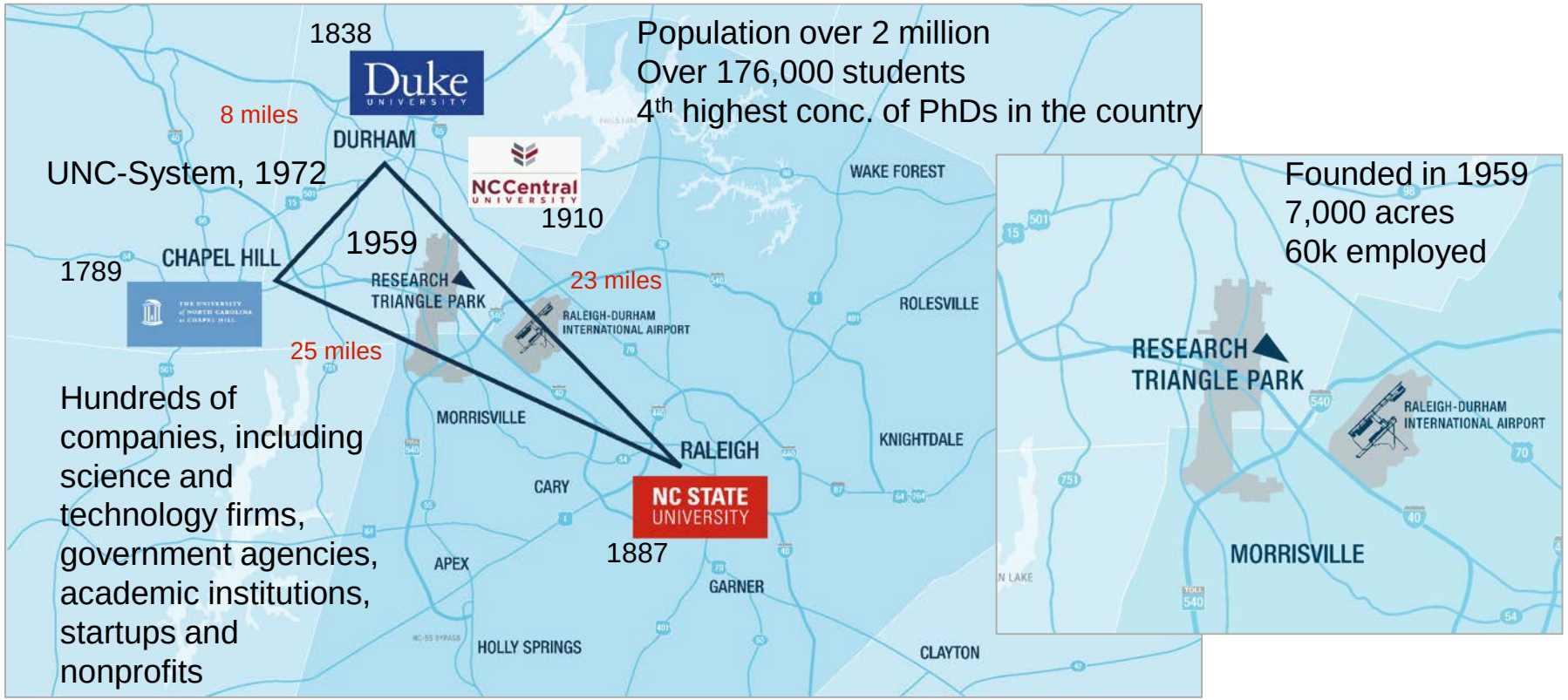
Research and Partnerships Ecosystem – the NC State Experience

Mladen A. Vouk
Vice Chancellor for Research and Innovation

V11-19-Feb-22

Ecosystem

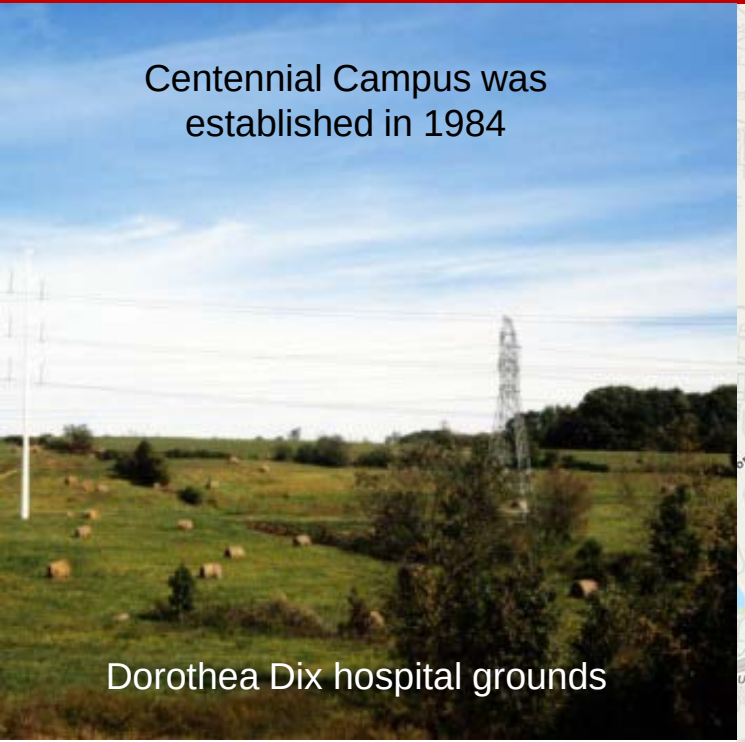
NC State's Location in the Triangle – a Very Research-Rich Region



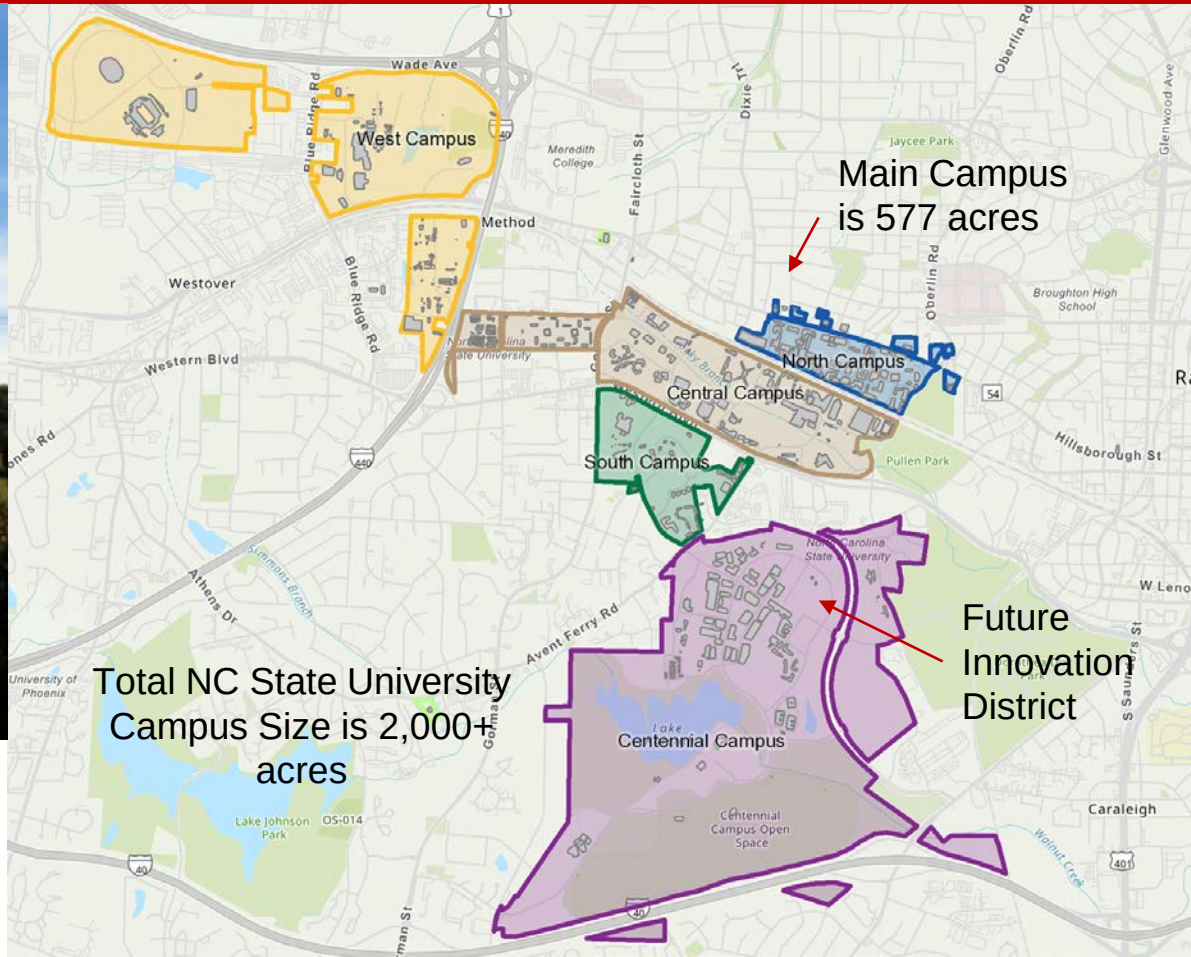
NC State 2022

- A powerhouse in agriculture, sciences, technology & technology transfer, engineering, math, and vet medicine education, research and extension.
- A land grant university with 10 academic colleges representing all major fields, plus Graduate School and University College
- Largest university in North Carolina, with state-wide extension operation (Ag, Eng, Textiles)
- *Money* has ranked (2020) NC State as the best value for students attending a public university in North Carolina

NC State's Campuses



The campus is 1,300+ acres, including our Centennial Biomedical Campus



Centennial Campus (70+:70+)

70+
PARTNERS
across corporate government and nonprofit sectors

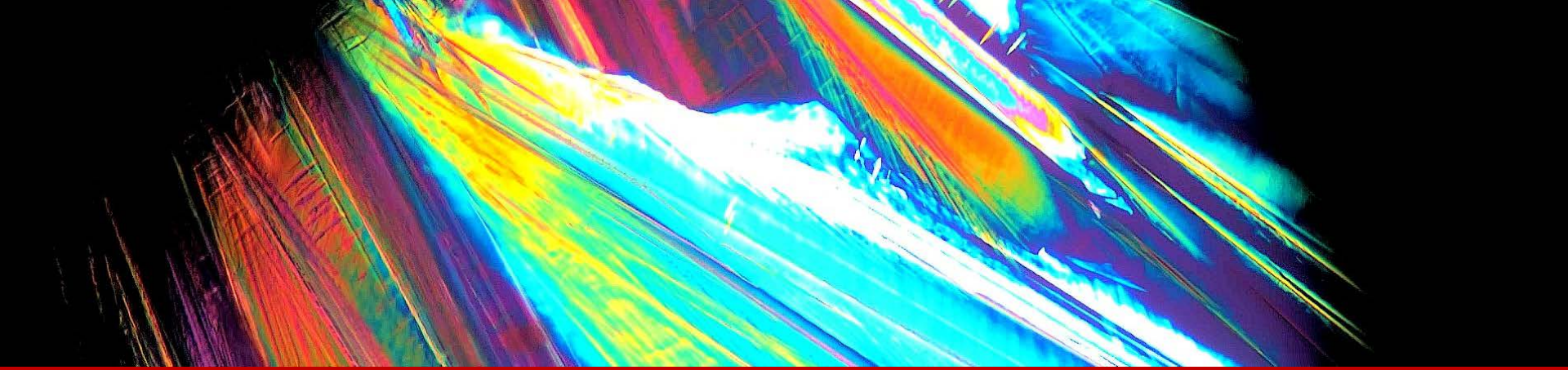
IBM
NATIONAL SECURITY AGENCY
ABB

70+
NC State Research and Academic Units

#7
INDUSTRY
share of funded research
NSF HERD 2020

#2
STARTUPS LAUNCHED
AUTM FY19

TransLōc
LOCUS BIOSCIENCES
LUMEOVA
ecoFIT



Research & Commercialization Highlights FY21

$547+
MILLION
in research expenditures
(Estimated)

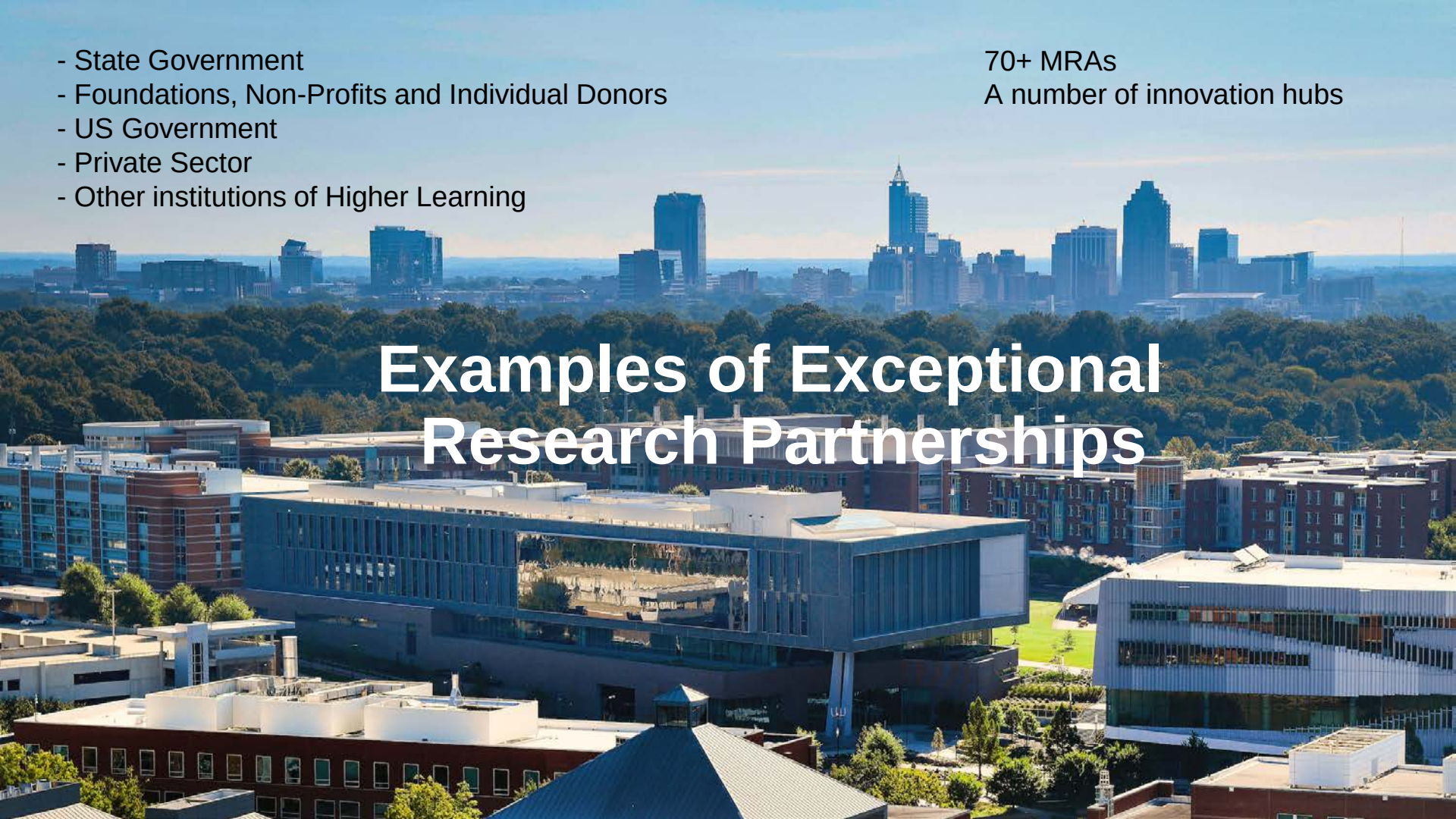
$1.64
BILLION
in proposals submitted

$383
MILLION
in sponsored research awards

20
STARTUPS LAUNCHED
using NC State IP
$5.9M in royalties

Entrepreneurship and Innovation

- Top 10 in commercialization by AUTM metrics
- NC State is ranked No.1 in the Southeast and No. 15 in the nation for both undergraduate and graduate entrepreneurship programs by The Princeton Review and *Entrepreneur* magazine for 2022.
- Chancellor's Innovation Fund, Daugherty Fund, and Wolfpack Investor Network provide seed funding for innovative research with strong marketplace potential
- Training - NC State leads the $15M NSF I-Corps Mid-Atlantic Regional Hub which helps faculty with 9 partnering universities learn how to commercialize technology



- State Government
- Foundations, Non-Profits and Individual Donors
- US Government
- Private Sector
- Other institutions of Higher Learning

70+ MRAs
A number of innovation hubs

Examples of Exceptional Research Partnerships

Plant Sciences Building

Plant Sciences Initiative

- To establish the world's premiere plant sciences enterprise, by **working with partners** to accelerate discovery, talent development and applied solutions that solve agricultural challenges through **interdisciplinary team-based science**.
- Hundreds of grad students will help work on these important projects that will bring economic gains to our state and help drive solutions to more sustainably feed our planet.
- Science Platforms
  - Plant improvement, Data-driven plant science, Resilient agricultural systems

- Collaborative Crop Resilience Program (CCRP) funded by the Novo Nordisk Foundation is a $30 million project over six years. Project focuses on microbial interactions with wheat in order to make crops more resilient against environmental stresses while reducing the need for chemical treatments and irrigation.

- NC State part of the program is led by Amy Grunden, William Neal Reynolds Distinguished Professor of Plant and Microbial Biology.

- There is also another NNF project - a five-year, $27 million collaborative project between NC State, BTEC, and the Technical University of Denmark in the domain of advanced Biomanufacturing led by NC State's BTEC in Engineering.

Dr. Jacob Jones (Materials Sciences)

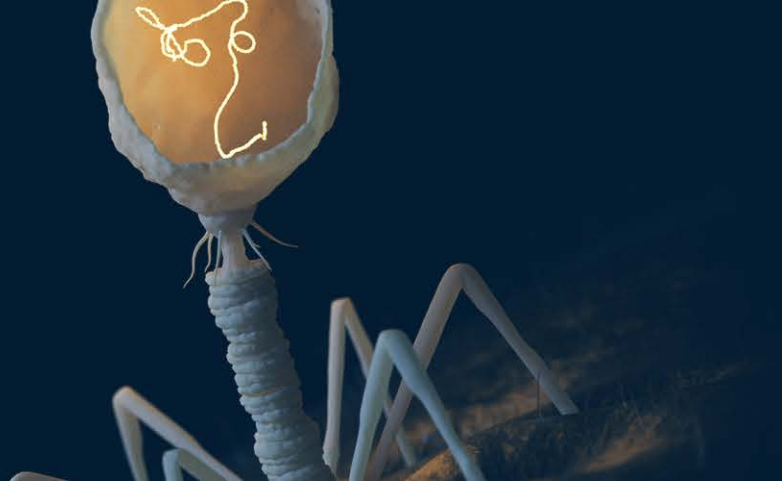
Dr. Ross Sozzani
(Plant Sciences)

Collaboration of six colleges, PSI and industrial partners

The $25 M NSF STEPS science and technology center to find ways to reduce dependence on mined phosphorus and how much phosphorus leaches into the soil and water *(increase sustainability, reduce harm using interdisciplinary convergence research)*

Locus Biosciences

https://www.locus-bio.com/



Revolutionizes Treatment of Bacterial Disease

Novel CRISPR-Cas3 technology (Drs. Rodolphe Barrangou and Chase Beisel) for genome editing was funded by Chancellor's Innovation Fund in 2014 and has put NC State on the map for cutting-edge CRISPR technology. This precision medicine startup formed in 2016. It has just successfully completed Phase 1b clinical trial for a product targeting E. coli UTIs.

Recent deals:

- $12.5 million partnership with the global non-profit, Combatting Antibiotic-Resistant Bacteria Biopharmaceutical Accelerator (CARB-X).
- A contract with Johnson & Johnson worth up to $818 million.
- $144 million dollar partnership with BARDA, a government agency established to aid in securing the U.S. from influenza, pandemics and emerging infectious diseases.

U.S. and State Government Partnerships

- USDA, Animal and Plant Health Inspection Service, APHIS
- USDA, Agricultural Research Service
- NC Wildlife Resources Commission (Building)
- Centennial Campus Middle School (Wake County, DPI)
- NC State Climate Office (State of NC)
- NOAA National Weather Service
- DoD – Laboratory for Analytic Sciences
- …

Laboratory for Analytic Sciences (LAS)

- Academic-industry-government collaboration applying data science methodologies in pursuit of solving national security challenges.
- A long-term research partnership funded by the National Security Agency, a member of the U.S. intelligence community.
- Focused on projects where collaboration allows for the rapid prototyping of solutions through the application of the latest analytics research.

2022 LAS Collaborators

Academic Institutions

Industry & National Lab Partners

LAS Collaboration with College of Design

- LAS has established an annual collaboration with the College of Design where Masters of Graphic Design students participate in a nine-week design studio
- This year's topic considers how to integrate artificial intelligence into the workflows of intelligence analysts
- Government staff create user scenarios, identify analysts to interview, find data, and provide ongoing feedback to the students.
- Previous design concepts have sparked new R&D efforts at LAS and with the government sponsor.


Industry Partnering
Basic Research
Applied Research
Translation
Manufacturing

- NC State’s partnership with BASF has resulted in more than 100 funded research projects, nine patents and dozens of students hired.

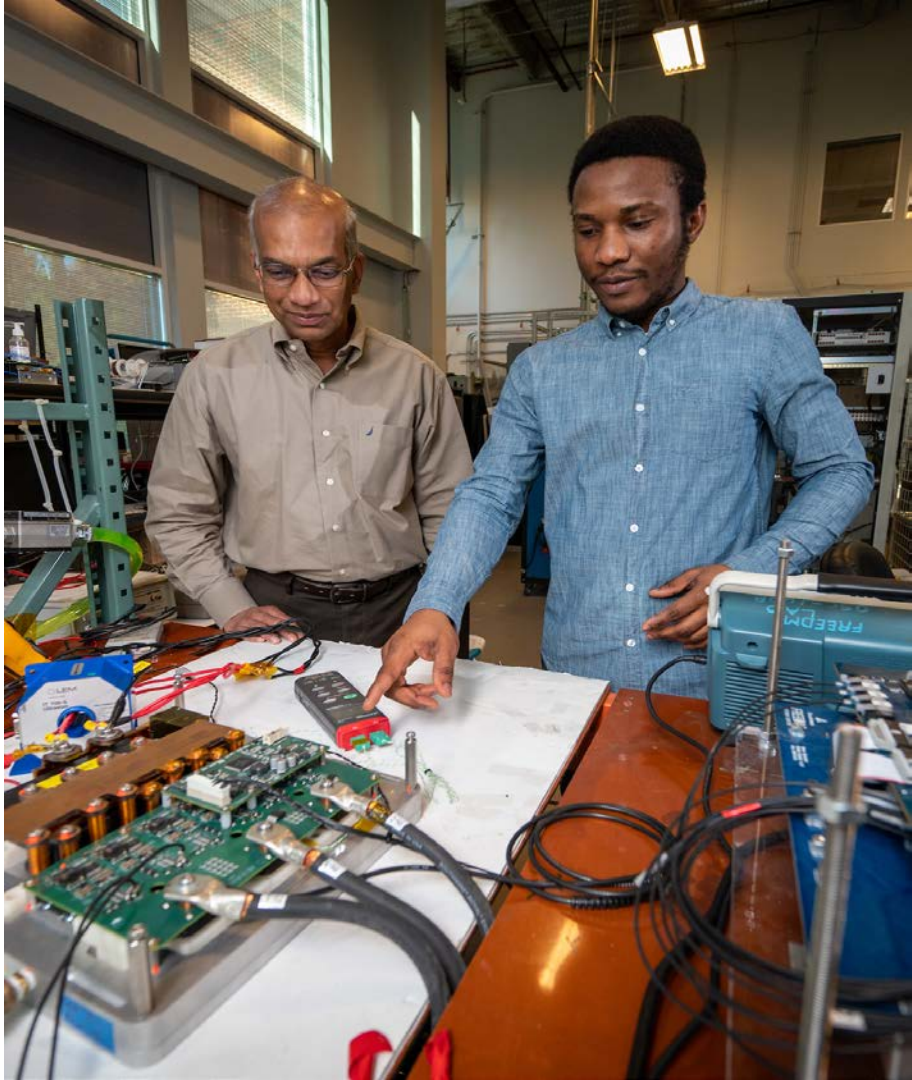
- Engagement with faculty and students across several disciplines including College of Agriculture and Life Sciences, College of Sciences, College of Engineering and College of Veterinary Medicine.

- Three decade collaboration has yielded breakthroughs in cloud computing, advanced analytics, cybersecurity, renewable energy, advanced networking and healthcare IT.
- Opened IBM Education Innovation Center on Centennial Campus in 2016.
- In 2018, NC State was selected to host the first university-based IBM Quantum Computing Hub in North America.

- First industry partner to co-locate on Centennial Campus in 1990.
- Founding industry sponsor of NC State's FREEDM Center.

"Another reason for ABB to call Centennial Campus home is access to talent. NC State graduates top-notch engineers."

– Dr. Elio Périgo
Principal Scientist and University Collaboration Lead,
ABB Inc.



The Nonwovens Institute: Partnering with Industry to Build Facilities

- **Understand What's Needed:** Understanding how partner needs dovetail with educational needs
- **Develop a Sustainable Business Model:** Working with vendors to develop a sustainable business model
- **Ensure Operational Staffing with Know How:** Ensuring that there is both the staff and the expertise to operate the machinery and facility.
- **Ensure Ability to Support and Expand the Capability:** Designing facilities and support systems to anticipate future needs and expansion opportunities.
- **NWI Facilities Examples Include Major Nonwoven Platforms:** (1) Spunbond/Hydro Lab, (2) Meltblown Lab, (3) Staple Lab, (4) Filtration Lab, and more (>$60MM in assets).

The Nonwovens Institute: Partnering with Industry via 5 Pillars

Knowledge Creation	Workforce Development	Testing and Fabrication	Product Development	Product Incubation
Funded by Member Dues	**Funded by Course Fees**	**Funded by Sponsor**	**Funded by Sponsor**	**Funded by Sponsor**
• Materials • Extrusion • Engineered Structures • Micro & Macro Modeling • Sustainability	• Nonwovens Products & Processes • Fiber Extrusion • Spunbond & Meltblown • Filtration & Separation • Characterization Methods • Product Development	• No Student/Faculty Involvement • Research Staff Only • Confidential • Sponsor Defines Protocol • Simple Agreement with No IP Terms	• No Student/Faculty Involvement • Research Staff Only • Confidential • Follow Stage Gate Process • IP Terms Defined • Option to License IP Generated	• Non-Profit Affiliate Entity of NC State • Commercialize Technologies • Limited Basis Manufacturing • Identify Commercial Partners • Help Build New Facilities • Transfer Technology to Clients
4 Patents 250+ Alumni	**300+ Professionals Trained Annually**	**200+ Companies Served Annually**	**80+ Patents Most Commercialized**	**3 Products Incubated 4 Being Qualified**
TRL 1-4		**TRL 4-6**		**TRL 7-9**

Investments and Returns

Office of External Affairs, Partnerships and Economic Development
Office of Research and Innovation
Real Estate

Economic Driver

- $6.5+ billion annual economic impact in North Carolina, equivalent to the creation of 92,000 new jobs -need to check on the number!!
- Support regional economic development – recent announcements from Apple, Google, FUJIFILM Diosynth
- Research partnerships with the City of Raleigh and Town of Cary (e.g. AERPAW)


Things to Come

Engineering North Carolina's Future

4,000 More Students

$20 Million for Faculty and Staff

$30 Million for Facility Upgrades

Centennial Campus Innovation District

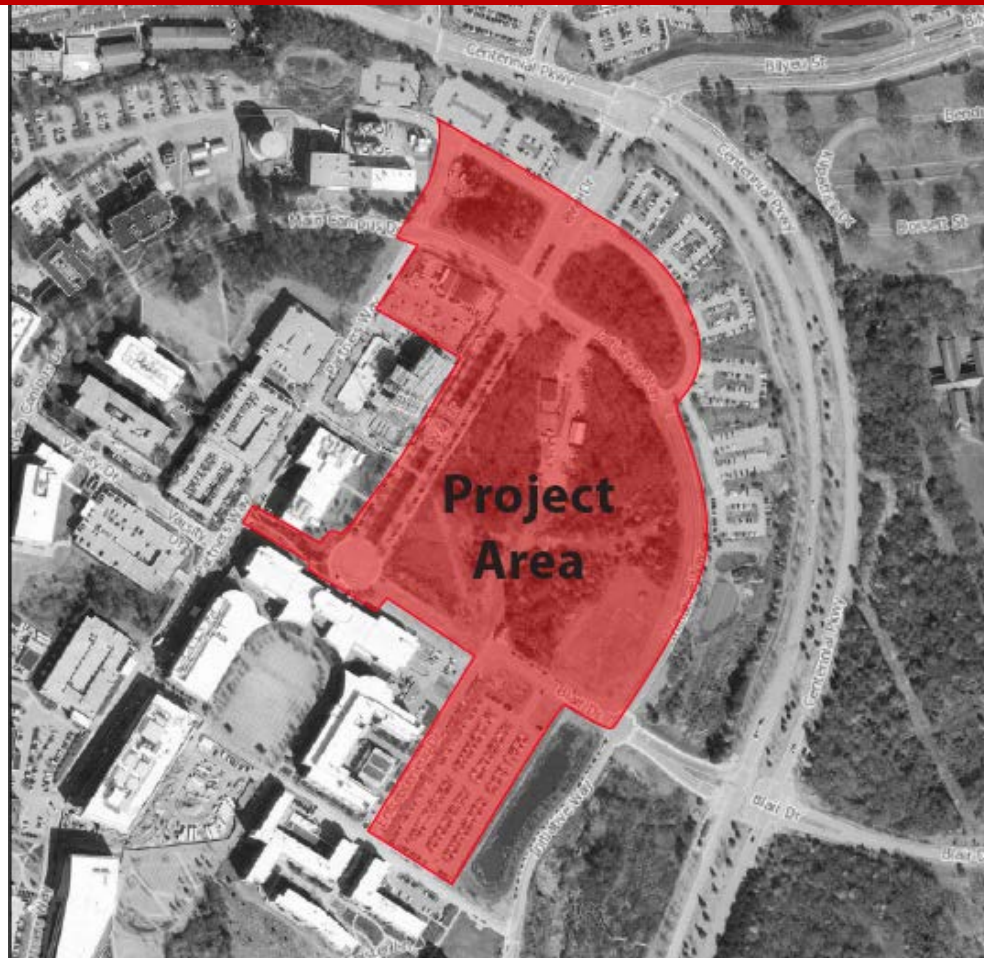
- We are in the **formative planning stage** of the development of ~to deliver an **urban, mixed-use Innovation District** on Centennial Campus.
- Project leverages strong investment in **applied sciences** and extensive experience in **public/private partnerships** to **continue the evolution of Centennial Campus as a 21st century learn, live, work and play environment** that promotes its **academic and research mission**, leverages its knowledge economy, and fosters an innovation ecosystem.

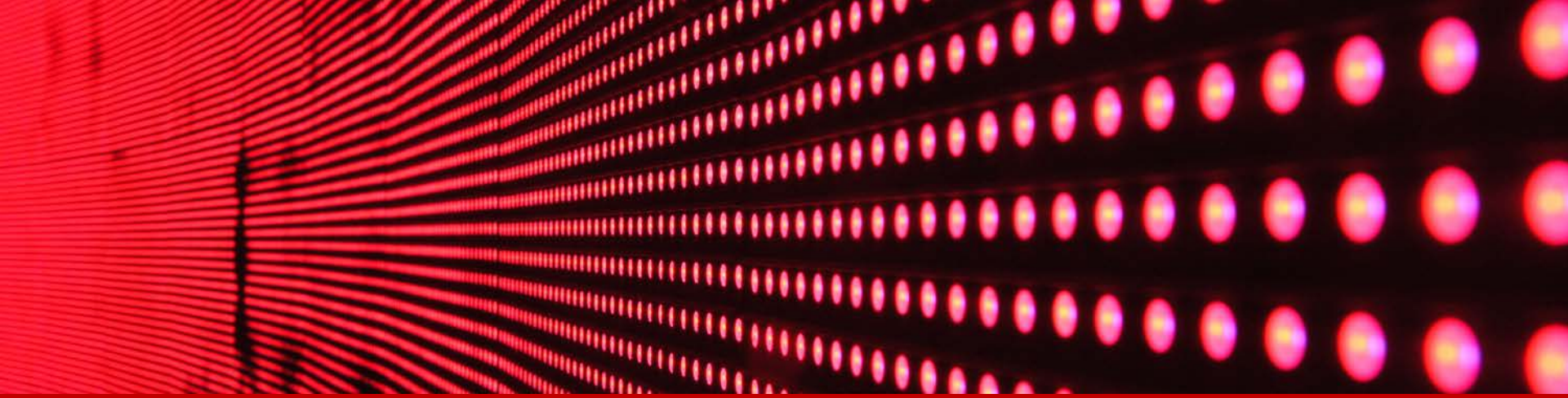
Centennial Campus Innovation District Location

Property includes ~32 acres of **Centennial Campus land west of Centennial Parkway, north of the Oval and east of the Plant Sciences Building**

Land is controlled by the **Endowment Fund of North Carolina State University**

Expected to be **implemented in a phased manner** over the coming decade, or more





Academics

- The Genetics and Genomics Academy leverages collaborations across all life sciences research and training at NC State University to enhance our understanding of the genetic and genomic underpinnings of life on earth, sustain biodiversity, and enhance social equity.

- The Data Science Academy will enhance the infrastructure, expertise and services needed to more effectively drive data-intensive research discoveries, enhance industry partnerships, and better prepare all of our graduates to lead in a data-driven economy.


THANK YOU