

COMPOSITES AND DIGITAL TRANSFORMATION

Pierre Harter

Wichita State University, National Institute for Aviation Research (WSU NIAR)

WSU, NIAR and NIRDT



Pierre Harter
Associate VP Industry and Defense Programs, Research Operations
Director of R&D, National Institute for Aviation Research (NIAR)
Wichita State University (WSU)
pierre.harter@wichita.edu, 316-706-0690

Composites and Transformation

Energy

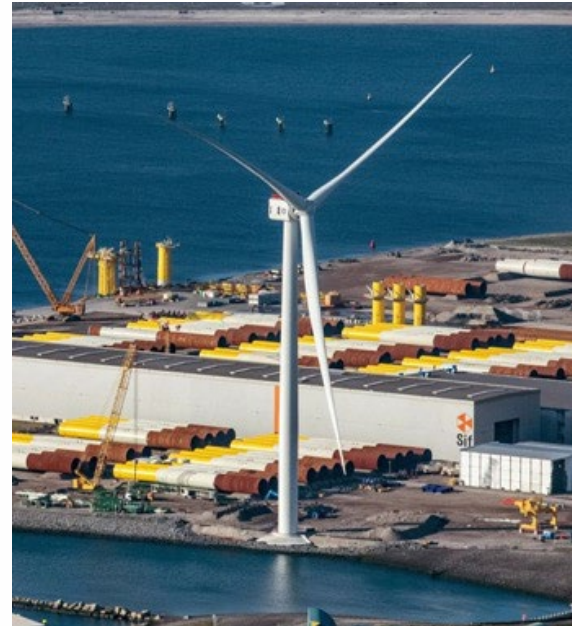
Aerospace and Defense

Transportation

Infrastructure

Sporting goods

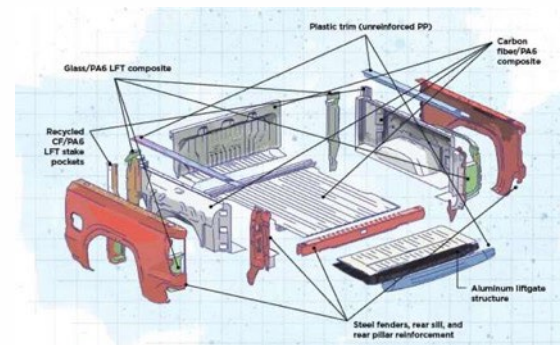
And many others



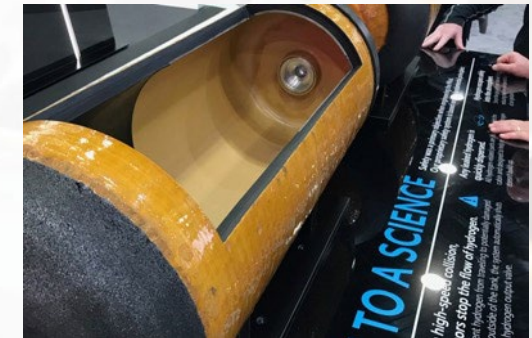
GE Haliade X wind turbine. 220m diameter rotor, 12-MW capacity. Source: GE



Candela Boats Seven speedboat, with electric motor and range of 50 nautical miles. Source: Candela Boats



GMC Sierra Denali CarbonPro SMC pickup box. Source: CW



Cutaway of carbon fiber hydrogen pressure vessel for Toyota Mirai fuel cell vehicle. Source: CompositesWorld (CW)

Composites and Transformation

- Aerospace and Defense
 - Highest value market
 - High-rate, high-volume composites fabrication still a must for next-gen aircraft



Thermoplastic fuselage clip for Airbus A350. Source: CW



Airbus A350 assembly. Source: Airbus



Airbus A320 spoiler, made via RTM in Prestwick, Scotland by Spirit Aerosystems. Source: CW

- Energy
 - Wind – Largest market by volume
 - Blade diameter increasing

On-shore

- 2018: 110m
- 2020: 158m
- 2025: 170m



Wind blade layup with balsa core and glass fiber. Source: Aeris Wind Energy



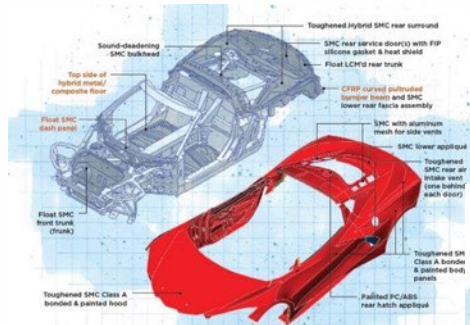
Wind blade mold closing. Source: Aeris Wind Energy



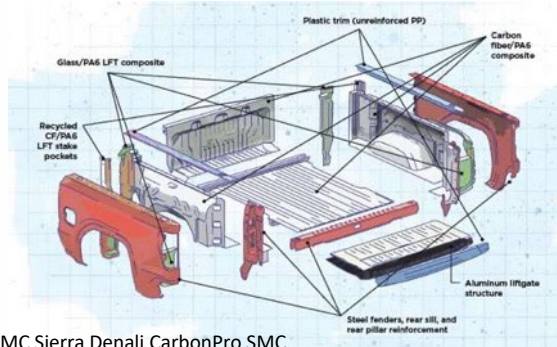
Pultruded carbon fiber spar cap for wind blades. Source: CW

Composites and Transformation

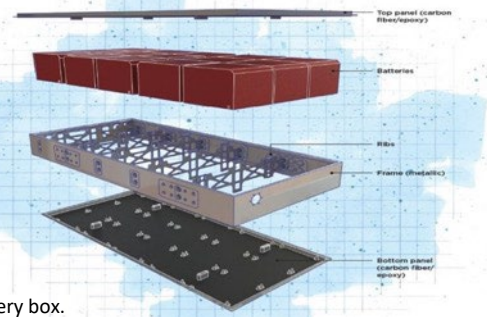
- Automotive
 - Incremental penetration
 - Electric vehicles
 - Hurdles/barriers



2020 Corvette Stingray. Source: CW

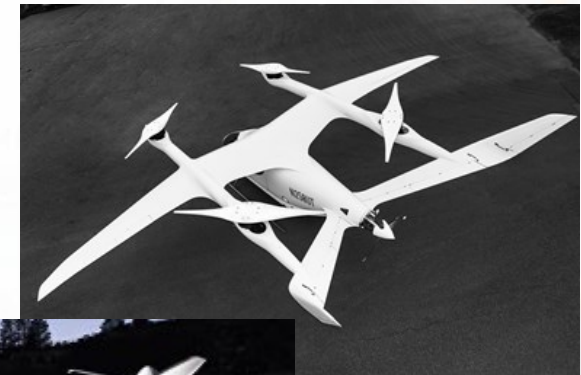


GMC Sierra Denali CarbonPro SMC pickup box. Source: CW



TRB Lightweight Structures battery box. Source: CW

- Advanced Air Mobility (AAM)
 - Emerging market
 - Enabled, in part, by composites



Beta Technologies' ALIA 250C is a piloted eVTOL that seats up to six passengers. Source: Beta Technologies



Joby Aviation's unnamed and autonomous tiltrotor eVTOL seats up to two passengers. Source: Joby Aviation

Source: CompositesWorld, Jeff Sloan
Composites Industrial Revolution Conference 2021

WICHITA STATE UNIVERSITY

Transformation in Progress....



NIAR and NIRD

National Institute for Aviation Research
National Institute for Research and Digital Transformation

“As a core part of the WSU mission, we expect the Innovation Campus to be an economic driver for the region and for Kansas,”
John Tomblin, SVP, Industry & Defense
Wichita State University.

Wichita State University is internationally recognized as the **model for applied learning** and research.

– *WSU Vision*

The mission of **Wichita State University** is to be an essential **educational, cultural and economic driver** for Kansas and the greater public good.

– *WSU Mission*



Transformation in Progress....



America's Engineering Hubs: The Cities With The Greatest Capacity For Innovation

OF THE 100 LARGEST U.S. METRO AREAS

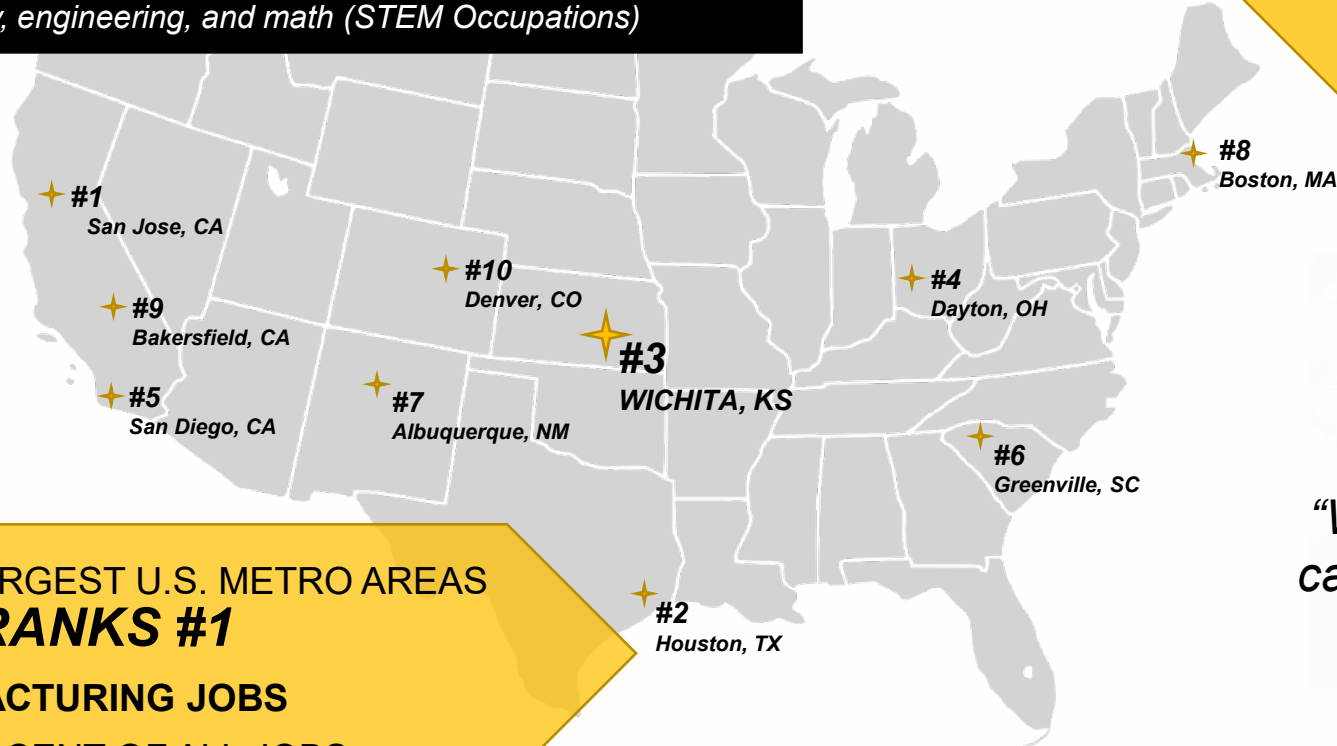
Brookings Institution Rankings

WICHITA RANKS **#1** IN PERCENTAGE OF JOBS INVOLVING Science, technology, engineering, and math (STEM Occupations)

WICHITA RANKS

#3

AMONG METROS FOR HIGHEST CONCENTRATION OF ENGINEERS PER 1,000 EMPLOYEES (22.4 / 1,000)



OF THE 100 LARGEST U.S. METRO AREAS

WICHITA RANKS #1

IN MANUFACTURING JOBS

AS PERCENT OF ALL JOBS

“Where engineers concentrate, we can expect the greatest capacity for innovation.”

NATIONAL INSTITUTE FOR AVIATION RESEARCH

WHERE TEST PLANS BECOME RESULTS

WICHITA, KS
LOCATION

\$125 MILLION
YEARLY R&D

1.3 MILLION
SQUARE FEET

SIX WICHITA AREA
LOCATIONS

1986
ESTABLISHED

875
EMPLOYEES

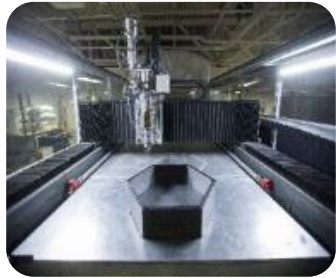
The National Institute for Aviation Research (NIAR) at Wichita State University provides research, testing, certification and training for aviation and manufacturing technologies.

Established in 1985, NIAR has a \$125 million annual budget; a staff of 875; and over one million square feet of laboratory and office space in six locations across the city of Wichita, the Air Capital of the World.

WWW.NIAR.WICHITA.EDU

NIAR LABORATORIES

Additive Manufacturing



Advanced Coatings



Ballistics/Impact



CAD/CAM



CIBOR



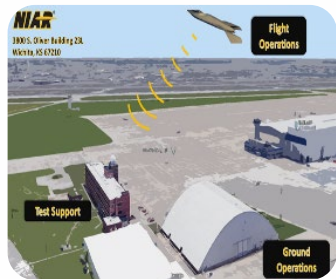
Composites



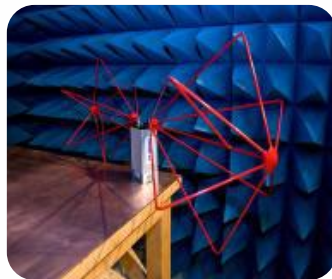
Crash Dynamics



WERX



Electromagnetic Effects



Environmental Test



Full-Scale Structural Test



Mechanical Test



Nondestructive Test



Oil Analysis



Research Machine Shop



Reverse Engineering



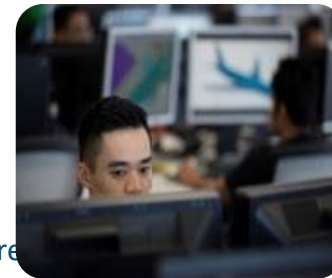
Robotics & Automation



Sustainment



Virtual Engineering



Virtual Reality



Wind Tunnel



R&D RANKINGS

INDUSTRY FINANCED AERO R&D

Source: National Science Foundation Higher Education Research and Development survey 2019



74 MILLION | **WICHITA STATE UNIVERSITY**

8 MILLION | GEORGIA INSTITUTE OF TECHNOLOGY

8 MILLION | UNIVERSITY OF NOTRE DAME

6 MILLION | MASSACHUSETTS INSTITUTE OF TECHNOLOGY

4 MILLION | UNIVERSITY OF MICHIGAN

AERO R&D EXPENDITURES

Source: National Science Foundation Higher Education Research and Development survey 2019

180 MILLION | UTAH STATE UNIVERSITY

163 MILLION | GEORGIA INSTITUTE OF TECHNOLOGY

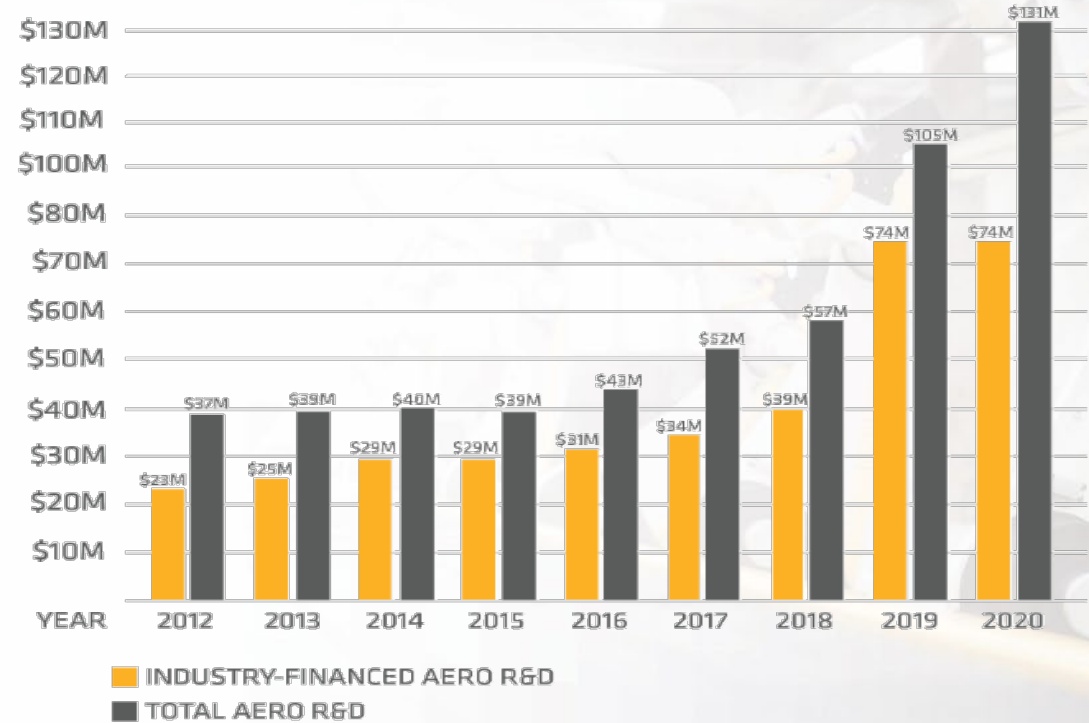
121 MILLION | JOHNS HOPKINS UNIVERSITY



105 MILLION | **WICHITA STATE UNIVERSITY**

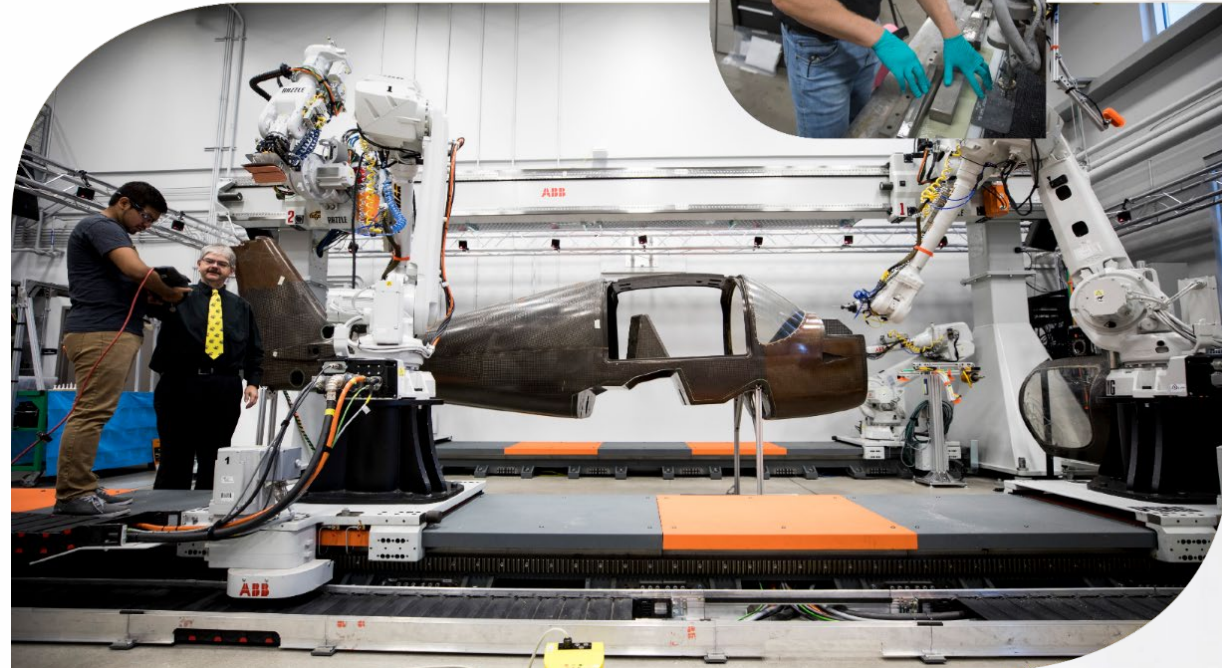
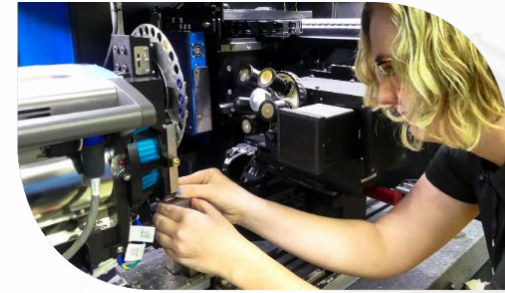
89 MILLION | UNIVERSITY OF COLORADO BOULDER

WSU R&D EXPENDITURES | 2012-2020

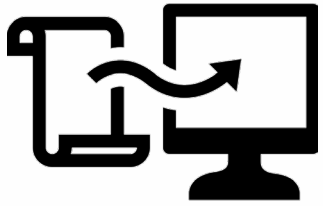


Areas of Expertise

ADDITIVE MANUFACTURING/PROTOTYPING
ADVANCED COATINGS
BALLISTIC AND IMPACT DYNAMICS
CAD/CAM
COMPOSITES/ADVANCED MATERIALS
CRASH DYNAMICS
DIGITAL TWIN DEVELOPMENT
ENGINEERING DESIGN/MODIFICATION
ENVIRONMENTAL/ELECTROMAGNETIC TEST
EMERGING TECHNOLOGIES
EXTENDED REALITY
FLIGHT SIMULATION
FLIGHT TEST/CERTIFICATION
FULL-SCALE STRUCTURAL TESTING
NONDESTRUCTIVE TEST
MECHANICAL TEST
MRO
REVERSE ENGINEERING
ROBOTICS/AUTOMATION
SUSTAINMENT
TRL DEVELOPMENT
VIRTUAL ENGINEERING



Digital Transformation



“**Digitization** is the process of changing from analog to digital form...”*

- Information



Source: <https://www.i-scoop.eu/>

“**Digitalization** is the use of digital technologies to change a business model and provide new revenue and value-producing opportunities...”*

- Processes



Source: <http://images.centerdigtaled.com/>

Digital Transformation fundamentally changes the way an organization operates. Cultural transformation that embraces adaptability and enables change.

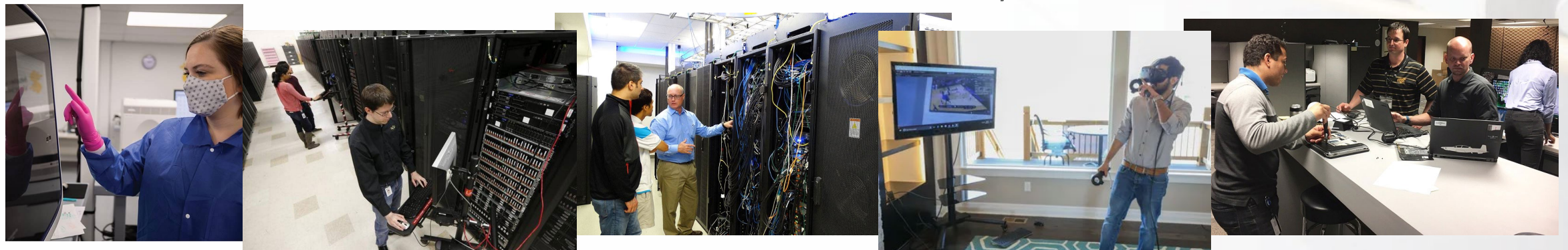
- Cultural change, business creation

*[Source: Information Technology \(IT\) Glossary - Essential Information Technology \(IT\) Terms & Definitions | Gartner](#)

NIRDT Laboratories



- Ennovar Institute of Emerging Technologies and Market Solutions
- Technology Training Team
- Cybersecurity and Forensics Research Group
- Molecular Diagnostics Laboratory
- Shocker Career Accelerator
- Wichita State University Digital Transformation Initiative founded by Ennovar in 2014
- Formally established as a National Institute in 2020
- 4 locations in Wichita
- 232 Employees
- \$20.5M Yearly R&D



Wichita State University Innovation Campus



Wichita State University
NATIONAL INSTITUTE FOR RESEARCH
AND DIGITAL TRANSFORMATION



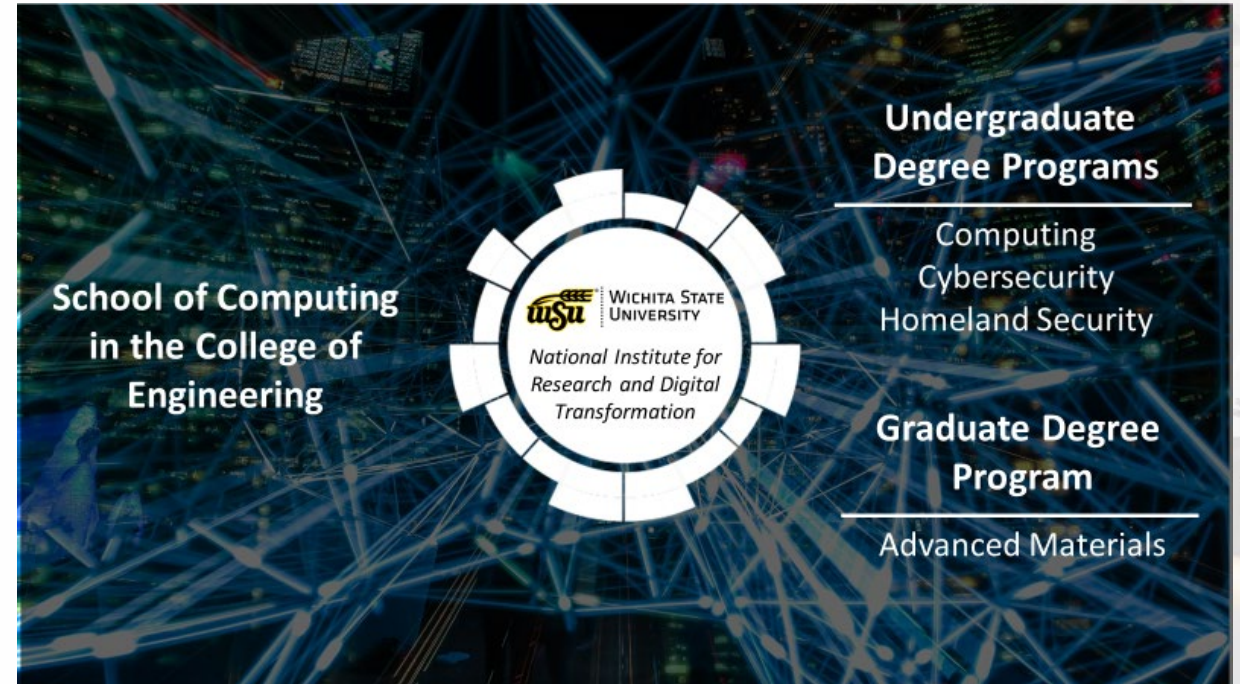
The Smart Factory at Wichita TSF@W

Current Partnerships on Innovation Campus



Support Businesses: Talent Pipeline

- Digital Transformation
 - New graduate degrees:
 - Business Analytics – W. Frank Barton School of Business
 - Data Science – College of Engineering
 - Mathematical Foundations of Data Analysis – Fairmount College of Liberal Arts and Sciences
 - New undergraduate degree
 - Applied Linguistics — Fairmount College of Liberal Arts and Sciences



GROWING & DIVERSIFYING ECONOMY

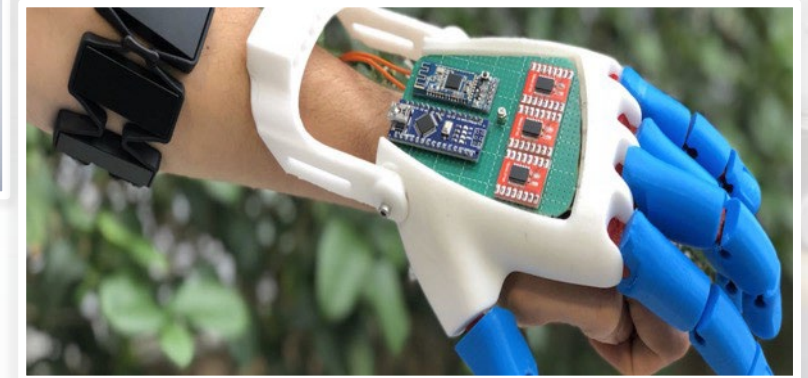
Preparing our students for the jobs of today + tomorrow



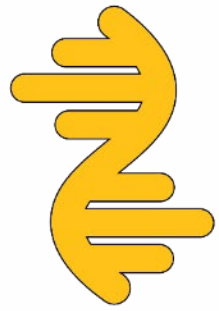
National Institute
for Research and Digital
Transformation



SMART
Manufacturing



Health Sciences
and BioEngineering



Molecular Diagnostics Laboratory WICHITA STATE UNIVERSITY



COVID-19 Tests Resulted
Oct. 19 2020 - April 21 2021
130,000+
Increasing weekly by 5,000 tests

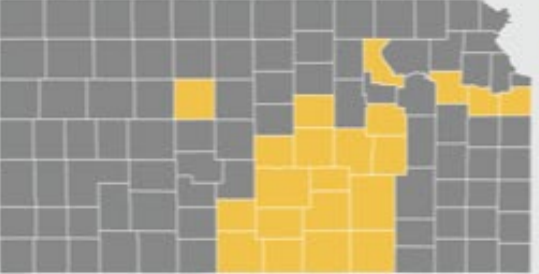
240,000
Test Kits Assembled & Distributed
42,000+ | **153,000+** | **38,000+**
Nasopharyngeal | Saliva | Oropharyngeal

 **Molecular Diagnostics Laboratory**
 WICHITA STATE UNIVERSITY
Wichita.edu/mdl



2500+
Registered Users Trained as Specimen Collectors
All Data as of April 21, 2021

The WSU MDL has tested Kansans in... **74** **Kansas Counties**



600+ *Partner Testing Locations in...* **21** *Counties*

26
Wichita State Students Hired into Interdisciplinary Applied Learning Roles
 **WICHITA STATE UNIVERSITY**

WSU, NIAR and NIRDt and YOU

Current Partnerships on Innovation Campus

Logos of various industry partners including ECG, Boeing, Dassault, Deloitte, Textron, Hexagon, Airbus, Stratasys, Spirit, NetApp, Wichita, Turkish Aerospace, Youth Entrepreneur, Martin, FirePoint, GoCreate, and Intel.

School of Computing in the College of Engineering

Undergraduate Degree Programs
Computing
Cybersecurity
Homeland Security

Graduate Degree Program
Advanced Materials



DIGITAL TRANSFORMATION

WICHITA STATE UNIVERSITY
NATIONAL INSTITUTE FOR RESEARCH AND DIGITAL TRANSFORMATION

Imagine the possibilities. How can you join the transformation?

Contact:

Pierre Harter, pierre.harter@wichita.edu, 316-706-0690



Thank You