Innovating The Technology and Workforce of the Future

KSPE-KS Annual Conference – June 13, 2019

Paul Jonas – Director Technology Development

Wichita State University
National Institute for Aviation Research

No restrictions on this briefing.
VISION:
Wichita State University is internationally recognized as the model for applied learning and research.

MISSION:
The mission of Wichita State University is to be an essential educational, cultural and economic driver for Kansas and the greater public good.
WSU’s Culture of Innovation
Generating the technology, workforce and means for industry and innovation to thrive.

The brightest minds and the best technology, working for you to make your business viable.

NIAR Labs and technical experts support innovation by taking the product through the rigors of certification/qualification and to develop the necessary process controls to ensure consistent and predictable transition to production.

US Army CCDC/WSU PIA
Linking NIAR Labs and Industry with US Army Researchers to accelerate new technology
• Technology Development
• Technical Transfer
• Requirements Definition
• STEM and Educational Activities

Where test plans become results

WSU Innovation Campus
Applied Learning Program / Innovation Partners

Pushing the boundaries to accelerate new technologies, advanced manufacturing and developing the skilled workforce we require.
NIAR LOCATIONS

NIAR Headquarters
Wichita State University
1845 Fairmount St, Wichita

Aircraft Structural Test & Evaluation Center
Kansas Coliseum
1229 E. 85th St N, Park City

National Center for Aviation Training
4004 N Webb Rd, Wichita

Electromagnetic Effects & Environmental Test Labs
Air Capital Flight Line
3501 S Oliver St, Wichita
Both the FAA and EASA accept composite specification and design values developed using the NCAMP process.

NCAMP values are published in CMH-17, which NIAR oversees.

NCAMP works with the FAA, DoD and industry partners to qualify material systems and populate a shared materials database that can be viewed publicly. Sharing the data and specification helps industry utilize these materials in a safe and consistent manner.

Expanding footprint to include Non-Metallic Additive Manufactured materials, adhesives, cores, thermoplastics and ceramics.
Unmanned Aerial Systems

- Material Qualification
- Structural Testing
- Human Factors Cockpit Station Design
Commercial Space
New Launch Systems
F-18 Life Extension
Other Teardown Programs

- C-5A Structural Teardown
- F-16C Static Test Article Teardown
- C-130 Center Wing Box Teardown
- B-52 Wing and System Component Teardown
Current Teardown Program - F35
Current Structural Test Programs

MQ-9 Reaper Full-Scale Static/DADT

MQ-4C Triton Full Scale Test
EM Hardening and Protection.

Hardened Casing
NASA Advanced Composite Consortium

TC 1 - Accurate Strength & Life Prediction
- Develop validated strength and life prediction tools with known accuracy for complex composite structures and standardized procedures for their reliable use.

Impact:
- Reduce design iterations
- Reduce validation testing
- Certification: earlier planning and shorter duration

TC 2 - Rapid Inspection & Characterization
- Develop and demonstrate NDE systems and enabling technologies to fully inspect and rapidly disposition findings in complex composite structures.

Impact:
- Increase throughput, better quality control; more information early
- Faster development of inspection
- Enable design for inspectability

TC 3 - Efficient Manufacturing Process Development
- Develop and demonstrate new computational methods to relate manufacturing parameters to defect formation, and connect to commercial design and analysis software to allow structural optimization while resolving predicted manufacturing issues.

Impact:
- Fewer iterations and quality issues
- Greater process control, aides in Production Certification
- Accounting of manufacturing constraints improves preliminary designs, reducing rework

WSU/NIAR Phase II Programs:
1. 2C18 - Progressive Damage Analysis
2. 2C19 - High Energy Dynamic Impact
3. 2C20 - Rapid Tools
4. 2C27 - Laminate Cure Defects Process Model Development
ASTM ADDITIVE MANUFACTURING CENTER OF EXCELLENCE

VISION
The Center facilitates collaboration and coordination between government, academia, and industry to advance AM standardization and expand ASTM and our partners' capabilities.

MISSION
The Center bridges standards development with R&D to better enable efficient development of standards, education and training, certification and proficiency testing programs.
DOD RAPID SUSTAINMENT ACTIVITIES

OVERVIEW SUMMARY

Engineering Support

Tech Data Package

Digital Twin

Support Equipment Maintenance Tooling

“Applied” Readiness & Sustainment

Additive

Subtractive

Replacement Parts

New

Old

Regenerated

New Technology Applications

ETC.

Laser Paint Removal

Composite Repair

Robotic Match Drilling
Recent awards …

- Department of the Navy: $7.0 M
- Department of Defense: $10 M
- United States Marine Corps: $5 M
- Federal Aviation Administration: $10 M
- U.S. Department of Homeland Security: $500k
- United States Army: $33 M
- NASA: $5 M
- United States Air Force: $25 M
Digital Data Creation and Integration

Creation of digital models from drawings and the integration of existing digital models into an updated format.

Reverse Engineering

Provides the ability to create a digital representation of a component as in use. Allows for scanning, conforming of parts and then creation of digital models.

Platform Capabilities

Provides a uniform interface and platform for data creation, data collection, configuration control and data analytics.
Brookings calls South Central Kansas the **MOST MANUFACTURING-SPECIALIZED REGION IN THE UNITED STATES** with 17.7% of regional jobs in manufacturing, more than half of which are engaged in making some of the world’s most sophisticated aircraft.

OF THE 100 LARGEST U.S. METRO AREAS

**WICHITA RANKS #1 IN MANUFACTURING JOBS AS PERCENT OF ALL JOBS**

**WICHITA**

**RANKS #1**

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

ADVANCED INDUSTRY HOTSPOT RANKED

**#3 NATIONALLY**

**HIGHEST CONCENTRATION of aerospace manufacturing employment IN THE NATION**
America's Engineering Hubs: The Cities With The Greatest Capacity For Innovation

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

WICHITA RANKS #3 AMONG METROS FOR HIGHEST CONCENTRATION OF ENGINEERS PER 1,000 EMPLOYEES (22.4 / 1,000)

WICHITA STATE UNIVERSITY #1

Aerospace Engineering – Industry Funded

WICHITA STATE UNIVERSITY #7

Engineering – Industry Funded

WICHITA STATE UNIVERSITY #2

In percentage of industry funding nationally among Universities with over $50M in research expenditures
In the past, every 10 to 12 years, there was a major up and down cycle in aerospace.

Currently, we are in the 17th consecutive year of an up cycle.

Air traffic is growing at about 7% per year.

Today, if you look at every airplane flying in the commercial fleets around the world, 26,000 aircraft. In the next 20 years, we are going to build 40,000 more.

(Announcement on December 6, 2017)

A capital investment totaling $1 billion over the next 5 years in Wichita, KS.

1,000 jobs.
Increasing Pressure facing the Aerospace & Defense Industry

Growing Complexity of Programs

- How do I design the best experience to meet customer expectations while managing complexity and cost?

Evolving Work Force

- How do I evolve my business model and workforce to better compete in new and existing markets to generate new sources of revenue?

Record Setting Production Rates

- How do I optimize production rates to meet the increasing aircraft demand while creating a much more flexible factory?

Innovate with Flat Budgets

- How do I drive down costs while accelerating innovation to with new entrants and technologies coming into the market?
Approximate time for new graduate to become productive in an industry position - Applied Learning Model

- Traditional Education (without Co-Op): 24 months
- Traditional Education (with Co-Op): 18 months
- Proposed Innovation Campus Model: 10 months

In the current economic climate, most companies will tend to outsource this work instead of investing in new talent due to this amount of time.

Dependent on the amount of time engaged in internship (can be as short as 3 months).
- There are 10 megalopolis located in the U.S.
- **I-35 is a key corridor for Wichita State University**
ECONOMIC DRIVER

SHOCKER CITIES

KEY
- Out of State Tuition
- Current Shocker City
- Current Shocker Select
SHOCKER CITIES

PREVIOUS SHOCKER CITY POPULATION

- State of Kansas: 2.9 million
- Kansas City Metro (Missouri Side): 1.2 million
- Tulsa: 1.0 million
- Oklahoma City: 1.3 million
- Dallas/Ft. Worth: 7.1 million

13.5 MILLION

RECENTLY ADDED SHOCKER CITY POPULATION

- Denver: 2.9 million
- St. Louis: 2.8 million
- Houston: 6.7 million
- Waco: 136,000
- Killeen-Temple: 74,500
- Austin: 2.1 million
- San Antonio: 2.6 million

17.3 MILLION

30.8 MILLION

TREATED AS KANSAS RESIDENTS

ECONOMIC DRIVER
I-35 CORRIDOR STRATEGY

• Enrollment has increased along the I-35 corridor by close to 200% since 2014 (average increase of 30% per year):
AIRBUS on Innovation Campus

- 300 engineering, support personnel, students
- Recent NIAR/Airbus Projects:
  - Recurring composites and manufacturing training for Airbus employees
  - Full-scale structural testing of an A350 XWB pylon structure in NIAR’s Aircraft Structural Test and Evaluation Center
Experiential Engineering Building

3D Experience Center

MakerSpace

#wsuinnovation

The Advanced Manufacturing center integrates the technology into the Manufacturing and the Workforce with the Standards necessary for our new products.

- Members of the National Manufacturing Institutes
- Lead Several FAA Centers of Excellence
- Lead Many Standards Development Activities
  - ASTM, SAE, RTCA
- Develop and Teach Industry Level Classes
The Goal: “Print” a system leveraging MRAM

Enabling Multiple Robots to Perform the Right Task at the Right Time

WSU Innovation
We Are Here

Multifunctional (Ex. Functional antenna w integrated bracket)

Design For Additive Process (Ex. Bracket)

1-1 Parts (Ex. Bracket)

Sub System Consolidation (Ex. Antenna w ducting system and associated bracketry)

Vehicle System (Ex. Vertical stabilizer with integrated components)

Vehicle level design approach taken for Stratasys/Aurora demonstrator aircraft.
THE ARCHITECTURE
HYBRID, SCALABLE, FLEXIBLE, EXTENSIBLE

Additive Manufacturing
- Liquifier Extrusion
- Screw Extrusion
- Continuous Fiber
- Metals

Secondary Processing
- Milling & Drilling
- Cutting
- Welding
- Sanding
- Painting

In-line Inspection
- Metrology
- Thermography

Motion
- Tilt/Rotary Table
- Linear Rail
- Gantry
- Cradle
HYBRID COMPOSITE STRUCTURE

- Example: Aerospace UAV Wings
  - Continuous fiber skin
  - Chopped fiber core, attachment features, wire routing

Leverage Compatible Resin Chemistry & Fibers
HYBRID METAL/COMPOSITE STRUCTURE

Example: Automotive Seat Frame
- Continuous fiber composite shell
- Chopped fiber reinforced rib stiffeners
- Metal substructure and supports

Source: Composites World
CAMISMA PROJECT
Johnson Controls

Today: Composite Layup and Hybrid Thermoforming & IM

Source: Composites World
PARTNERSHIP II

A Partnership with the U.S. Army
U.S. Army Combat Capabilities Development Command (CCDC)

- 10,000 Square Feet
- Occupancy Jan. 2019
RETAIL & SERVICES

Shocker Store >>
This offshoot of WSU’s main bookstore will feature WSU clothing, sports memorabilia and other gift items in an easy-to-access location.

Meritrust >>
Serving Kansans since 1935, Meritrust offers a comprehensive array of financial services backed by friendly, best-in-class service.

Fuzzy’s Taco Shop >>
COMING IN 2019—Texas-based Fuzzy’s Taco Shop has a cult-like following nationwide for its Baja tacos, monster burritos and frosty beverages.

Starbucks >>
Full-service location offering signature coffee drinks, food and pastries. Amenities include a drive-thru and outdoor seating area.
HYATT PLACE

- 64,000 square feet
- ~100 rooms
- Bar, meeting spaces, indoor pool, fitness center
- Groundbreaking early spring 2019
- Opening early 2020
PARTNERSHIP BUILDING 3

- Starting construction soon
- Completion late Fall 2019
Our Future

• Innovation is the fundamental driver to advanced manufacturing and the jobs they produce
  • New technologies and adaptation of existing technologies are occurring at record pace
  • Recognize that the next transition will involve merging of multiple technologies through a digital thread
  • The transformation will affect all industries & all aspects of design and manufacturing

• The changing technologies will continue to change the expectations we place on our products and the people making them.
  • Todays success is tomorrows standard
  • Tomorrows designs will be not be built and assembled like we do today.

We must change to change the future
Thank you...