AIAA DEIC

Digital Workforce Development Best Practices

Organizers: Olivia Pinon Fischer (Georgia Tech), John Matlik (Rolls-Royce Corporation)
Moderator: John Matlik

2023 Dayton Digital Transformation Summit
Dayton, OH
Hybrid Event
Thursday May 11th, 2023 / 13:30 – 15:00

Panel Focus & Objectives

Panel Focus

- Discuss workforce development examples, challenges and opportunities to accelerate the upskilling & development of the Digital Engineering savvy workforce needed to respond to the current Customer & Business landscape & needs

Panel Objectives & Themes

- **Best practices:** Present education & workforce development 'best in class' examples and new paradigms for how Academia is helping to both upskill current workforce and equip new/incoming workforce with the needed Digital skills.
- **Digital Engineering Curriculum:** What does a robust curriculum for Digital Engineering look like for current workforce, new workforce, and how this can be robustly trained out? What new roles? How do we evaluate/measure literacy?
- **Challenges & Blockers:** What are the key things that block, slow or prevent robust development & training of the workforce in latest Digital techniques and capabilities? We're teaching "what we know today", but how do we 'future proof'/adapt to new learning?
- **Collaboration Opportunities:** Where might there be opportunities to accelerate digital engineering workforce development together through cross-Industry/cross-Academia partnerships?

Digital Workforce Development - Best Practices

Working Group Objectives & Intent

Objectives

- Document, in a white paper, workforce development examples, challenges/opportunities and recommendations to accelerate the upskilling & development of the Digital Engineering savvy workforce needed to respond to the current Customer & Business landscape & needs

Intent

- Engage with passionate participants from Industry, Government, and academia to build upon the many exchanges we had during both the AIAA panel session by the same title and the USAF DTO Digital Transformation Workshop that took place at SciTech in January

OUR DISTINGUISHED PANEL MEMBERS

Dr. Olivia Pinon Fischer

Chief, Digital Engineering Division
Aerospace Systems Design Laboratory (ASDL)
Georgia Institute of Technology
Presentation: "Georgia Tech ASDL's Grand Challenges"

Dr. Marianna Maiaru

Associate Professor
Department of Mechanical Engineering
University of Massachusetts Lowell
Presentation: "Lessons learned and best practices from the AIAA ICME prize competition"

Dr. Gokcin Cinar

Assistant Professor
Integrated Design of Environmentally-friendly Aerospace Systems (IDEAS) Lab
University of Michigan
Presentation: "x88 and MBSE at the University of Michigan"

Dr. H. Alicia Kim

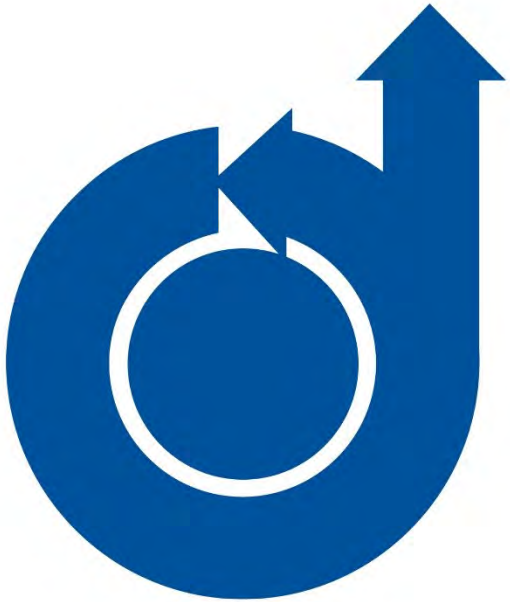
Jacobs Scholar Chair Professor
Structural Engineering Department
University of California San Diego
Presentation: "Challenges Today"

Elizabeth Generas

Program Manager
Workforce Development
Sinclair College
Presentation: "Digital Thread Initiative"

Lori Baukus

Manager of Training Projects, Industry 4.0
Lorain Country Community College
Presentation: "Education at the Speed of Industry: How Community Colleges Train an Advanced Technology Workforce for SMMs"



AMERICAN INSTITUTE OF
AERONAUTICS AND ASTRONAUTICS

Aerospace Systems Design Laboratory's Grand Challenges

Responding to the Challenges, Barriers and Needs for the Development of a Digital Workforce

Olivia Pinon Fischer, Ph.D. (olivia.pinon@asdl.gatech.edu)

Chief, Digital Engineering Division – Senior Research Engineer
Aerospace Systems Design Laboratory (ASDL)
School of Aerospace Engineering | **Georgia** Institute of **Tech**nology

2023 Dayton Digital Transformation Summit | Dayton, OH | May 11th, 2023

Aerospace Systems Design Laboratory

Olivia Pinon Fischer

Responding to the Challenges, Barriers and Needs for the Development of a Digital Workforce

Centers of Excellence

Siemens Invests in Georgia Tech, Launches Center of Excellence for Simulation and Digital Twin

OCTOBER 11, 2021

Preparing the STEM Workforce: from left **Olivia Pinon Fischer**, **Denise Quarles**, **Larry Jacobs**, **Dimitri Mavris**, **Virginie Maillard**, **Barry Powell**, **Dave Rapaport**, **Olivia Kolevich**, and **John Petrillo.**

On October 4, 2021, Siemens Technology and Georgia Institute of Technology officially launched the Center of Excellence for Simulation and Digital Twin. With research at the forefront, engineers, scientists and researchers will work with undergraduate and graduate students to utilize data- and model-driven capabilities to optimize complex infrastructure systems.

The $1.8 million investment from Siemens in Georgia Tech's Aerospace Systems Design Laboratory (ASDL) will prepare students to enter the STEM workforce of the future while improving upon the role of digital engineering for buildings. The initiative will include sponsored research, U.S.-government funded activities, two annual student Grand Challenge projects and four PhD fellowships centered around the use of simulation capabilities. The Center of Excellence will be led by Regents Professor **Dimitri Mavris**, director of ASDL, and by a managing board made up of several Siemens leaders representative of the company's Research, Smart Infrastructure, and Digital Industries Software units.

Dimitri Mavris

"Building upon our decades-long relationship with Georgia Tech, our investment is a step towards having a greater understanding of the challenges we face today and prepare to face tomorrow utilizing digital twins," said **Virginie Maillard**, Head of Siemens Technology US. "We pride ourselves on our involvement with higher education institutions and our master research agreement with Georgia Tech underscores our joint commitment to innovation while simultaneously preparing the workforce of tomorrow."

"We are excited to be part of the new Center of Excellence that Siemens is establishing at Georgia Tech," said Mavris. "Digital engineering is a key thrust for ASDL and this center will allow us to further our research in this area. In partnership with Siemens, we will focus on topics that will engage our students to advance the development and application of simulation and digital twins."

The 4 October launch event was part of a larger kickoff meeting hosted by ASDL on campus that included students interacting with Siemens leaders to discuss the Grand Challenge projects. The two Grand Challenges for academic year 2021-2022 focus on the use of digital twins to explore, optimize and plan infrastructure for buildings, communities and mobility solutions. Using Hartsfield-Jackson Atlanta International Airport as a "living lab," students will investigate the interactions between the airport structure and the surrounding city to make best use of efficient technologies.

Virginie Maillard meeting with ASDL students during the kickoff event.

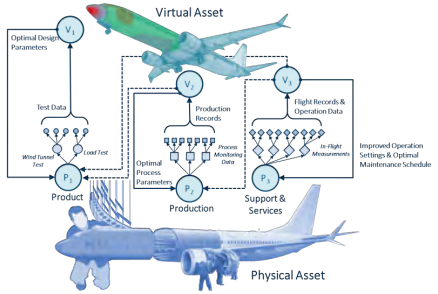
The four PhD fellowship topics of focus include how to better understand and build upon direct human-machine collaboration through AI, investigating a dynamic system-of-systems architecture that scales itself as environments change, exploring technologies for engineering resiliency, self-healing systems, and discovering methodologies for digital twin validation and calibration.

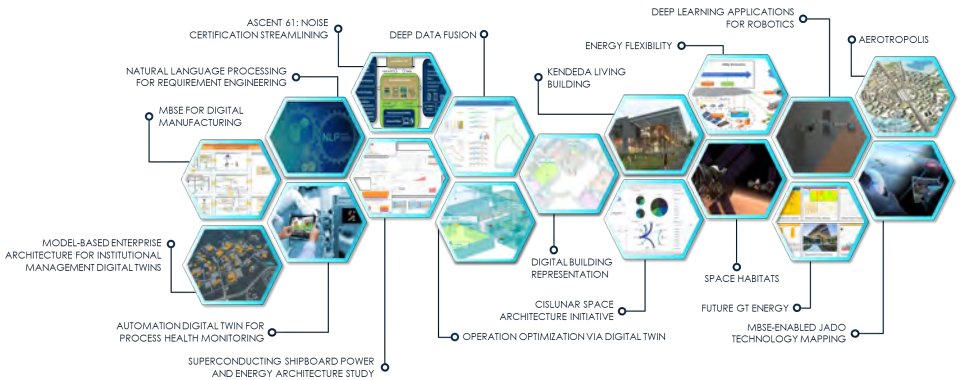
https://ae.gatech.edu/news/2021/10/siemens-invests-georgia-tech-launches-center-excellence-simulation-and-digital-twin

Sponsored Research

Boeing-Georgia Tech Collaboration Still Strong After 10+ Years

Shreyas Melkote and **Larry Schneider**



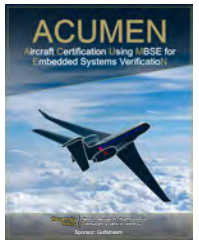


Olivia Pinon Fischer

Responding to the Challenges, Barriers and Needs for the Development of a Digital Workforce

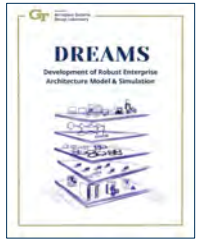
Grand Challenges

DEAL: Digital Enterprise Across the Lifecycle

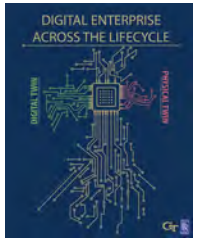


ACUMEN: Aircraft Certification Using MBSE for Embedded Systems Verification

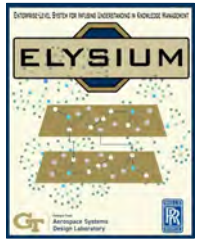
CLOUDS: Contested Logistics Operations under Digital Support



DREAMS: Development of Robust Enterprise Architecture Model & Simulation



DEAL: Digital Thread Proof-of-Concept



ELYSIUM: Enterprise-Level System for Infusing Understanding in Knowledge Management

DEVINCI: Digital Engineering Value in Capturing Information for Reuse

- Part of the ASDL core academic and research methods training for our first-year graduate students
- Projects are divided into two categories: **System of Systems** and **Vehicle Design**
- Conducted over two entire academic semesters (Fall & Spring)
- Broad, open-ended problems related to topics that are current and relevant to the aerospace industry
- Work in close collaboration with industry and/or government experts
- Require
  - Ability to work outside of their comfort zone – most topics are new to the students
  - A very deep understanding of the problem, underlying theory and assumptions
  - Practical implementation of advanced methods and development of decision-support environments


Olivia Pinon Fischer

General Guidelines for Grand Challenges

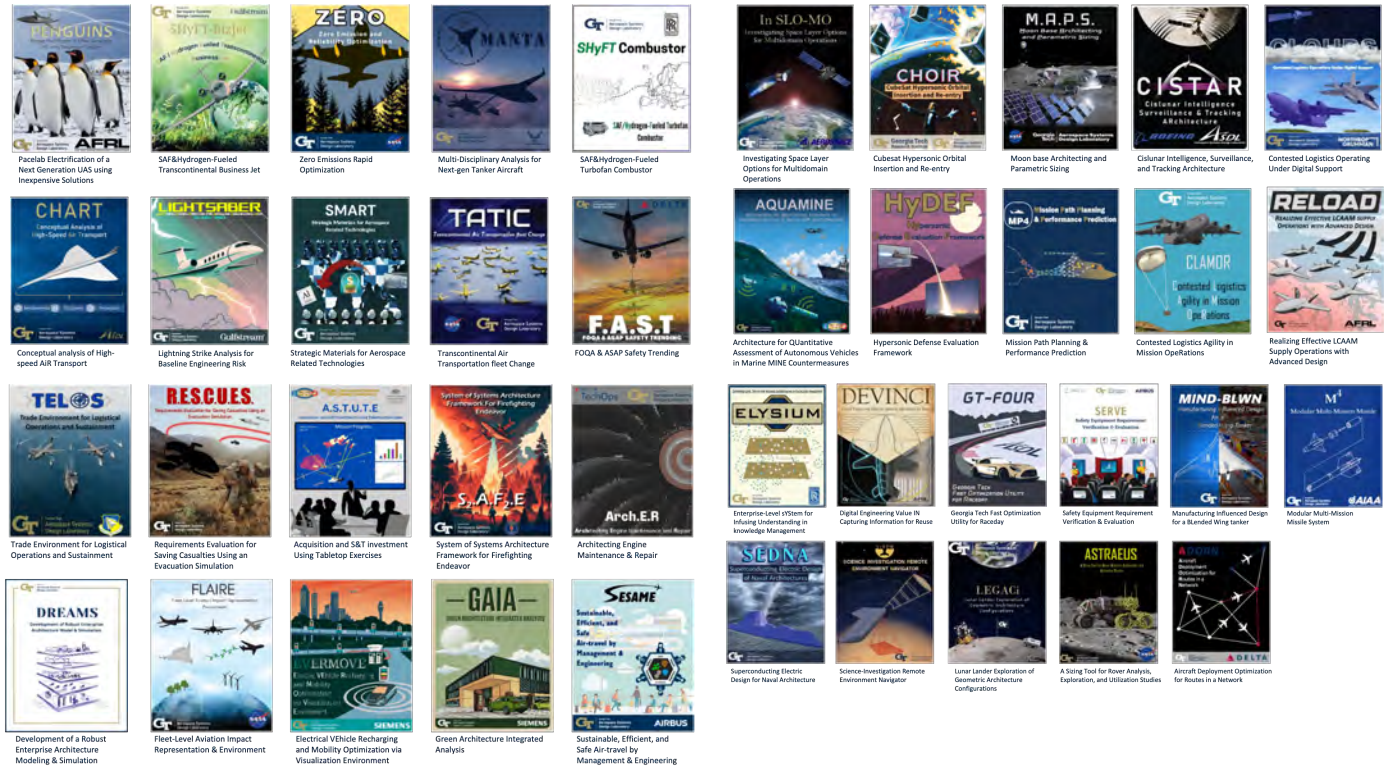
- Emphasize story telling—every story must have a beginning, a middle, and an end
- Make the story interesting and clear
- Formulate the problem clearly:
  - What is the problem to be addressed?
  - What motivates interest?
  - Why is it hard? Why is it important?
  - How is it done today, by whom, and what is wrong with it?
- How do you propose to address it?
- What's the new idea here, and why can we succeed now but not before?
- What recent breakthroughs now make this possible?
- What is your plan and technical approach?
- What are the biggest challenges and why?
- Formulate the Grand Challenge as a decision support problem
- Create an interactive parametric M&S environment to support decision making

2022-2023 System of Systems and Vehicle Grand Challenges

Olivia Pinon Fischer

Themes

- Aerospace System of Systems
- Defense: Mission Planning
- Defense: Affordability
- Defense: Hypersonics
- Digital Enterprise
- Disaster Management
- Space: Planetary Missions
- Space: Cis-Lunar Missions
- Safe and Efficient System Design
- Sustainable Aviation and Cities
- Sustainable System Design
- System Design and Optimization



Olivia Pinon Fischer

Responding to the Challenges, Barriers and Needs for the Development of a Digital Workforce

Grand Challenges

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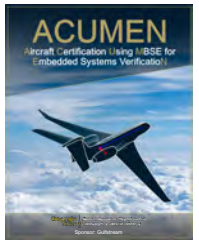

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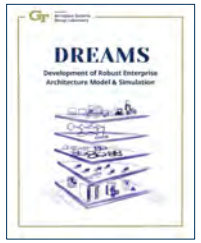

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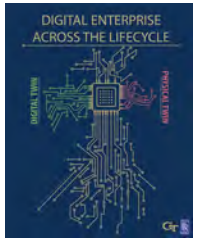

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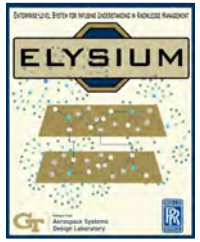

ELYSIUM: Enterprise-Level System for Infusing Understanding in Knowledge Management

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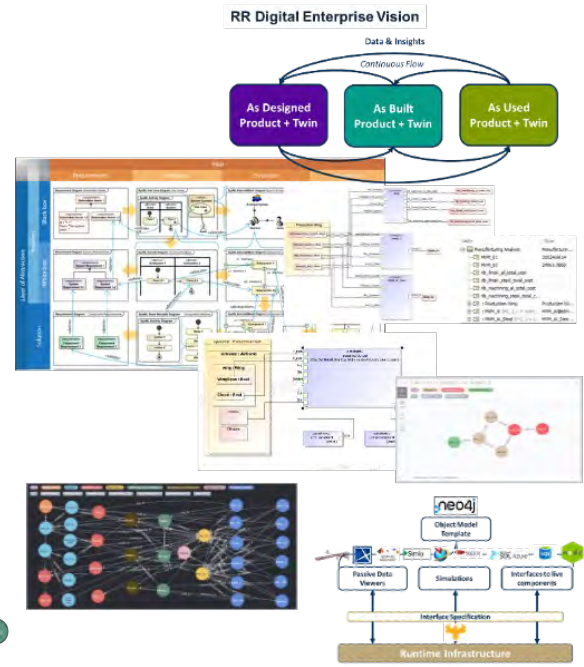
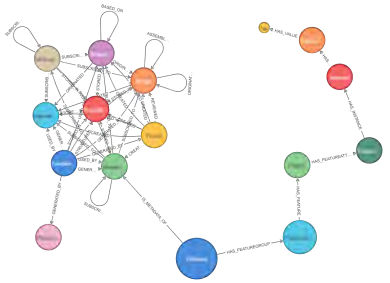
Examples of Recent/Ongoing Digital Engineering Related Grand Challenges

- Digital Enterprise Across the Lifecycle
- Implementing the Digital Thread – A Proof-of-Concept
- JADC2 in a Contested Logistics Environment – The Role of Digital Twins
- Enterprise Big Data
- Demonstrating the Value of Digital Engineering through the Reuse of Knowledge, Models and Data in the Design of Low Cost Attritable Vehicles
- A Methodology for the Definition, Evaluation and Design of an Enterprise for Agility
- …..





Allow students to develop foundational digital literacy, be exposed to digital engineering methods, tools and processes, and increase their understanding of digital systems

Olivia Pinon Fischer

Responding to the Challenges, Barriers and Needs for the Development of a Digital Workforce

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https://ae.gatech.edu/news/2021/10/siemens-invests-georgia-tech-launches-center-excellence-simulation-and-digital-twin

Sponsored Research

Boeing-Georgia Tech Collaboration Still Strong After 10+ Years

Shreyas Mellkote and Larry Schneider

For more than 10 years, the Georgia Tech and Boeing Strategic Technical Universities (STUs) have been training the next generation of technical leaders through a collaboration that develops transformative design and manufacturing technologies as a part of its curriculum. At their annual program review, Nov. 6 and 8, leaders from Tech and Boeing agreed that there's still plenty to do.

"Ultimately, this relationship brings together our need to conduct cutting edge research and our need to develop highly skilled engineers for the future," said **Larry Schneider**, a 1985 graduate of Georgia Tech's Daniel Guggenheim School of Aerospace Engineering and Boeing's vice president for Commercial Airplanes.

"In that regard, we are very happy to work with the All School because the students are so advanced," he said.

Boeing leaders gathered at Georgia Tech's Fuller E. Callaway, Jr. Manufacturing Institute (IPRI) to review the progress made by the teams of Georgia Tech research researchers who have been working with Boeing engineers on more than a dozen projects over the past year. Overseeing the two-day meeting were G-TM associate director **Shreyas N. Mellkote** and Boeing associate Technical Fellow **Howard Appelman**. Joining them were faculty from Georgia Tech's College of Computing, the Institute for Robotics and Intelligent Machines (IRIM), and the schools of Aerospace, Mechanical, Material Science, and Industrial Engineering.

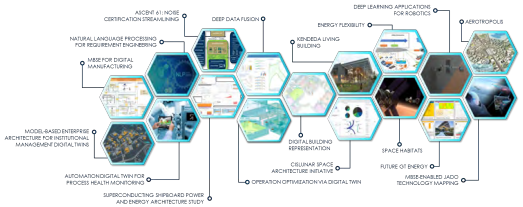
The projects range in consistency and goals, but are generally focused on developing next-generation manufacturing technologies, including design, automation, materials and systems integration.

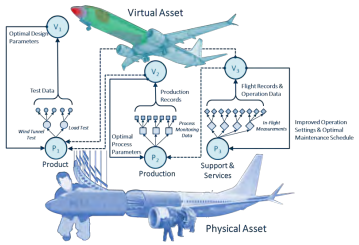
Olivia Pinon Fischer, a research faculty in the Daniel Guggenheim School, said her team's project, *Future Factory Manufacturing and Supporting Applications for Equipment and Process Health Monitoring*, has been working on the development of digital twins – virtual representations of physical assets that integrate data-driven and physics-based models to help assess machine health and optimize operational throughput on the factory.

"While our approach this year was incremental on a machine here at Georgia Tech, we hope to be able to transition this capability to Boeing machines in the near future," she said.

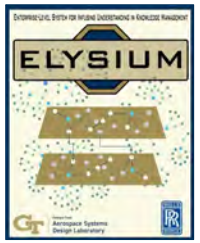
"Meanwhile, our students are getting the experience of working on a problem that is very relevant to this industry right now and they are gaining the experience of explaining their work not only to subject matter experts, but to executives as well."

https://ae.gatech.edu/news/2018/11/boeing-georgia-tech-collaboration-still-strong-after-10-years





Grand Challenges



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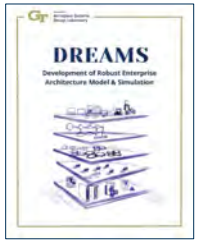

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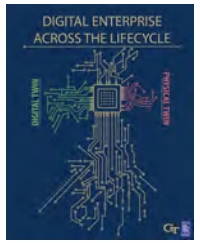
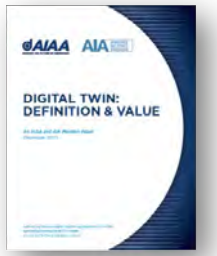


DEAL: Digital Thread Proof-of-Concept

IoWT: Internet of Warfighting Things

Involvement in Professional Societies & Working Groups



https://www.aiaa.org/advocacy/Policy-Papers/Institute-Position-Papers

https://www.aiaa.org/resources/digital-twin-implementation-white-paper/

ASSESS

NAFEMS

AIAA
SHAPING THE FUTURE OF AEROSPACE

digital twin CONSORTIUM

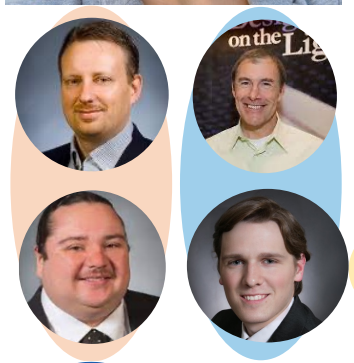
Professional Master's in Applied Systems Engineering (PMASE)

Georgia Tech
Aerospace Systems Design Laboratory

ICME of Advanced Composites

iComp^2 Research Group @ Umass Lowell – Specialized in Process Modeling and ICME

We bridge material science and computational mechanics to establish material-processing-property relations in advanced composites.



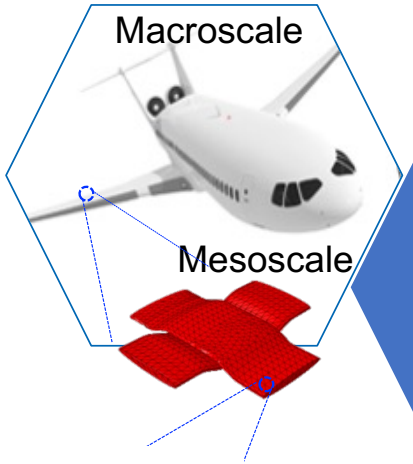
Aurora FLIGHT SCIENCES
A Boeing Company

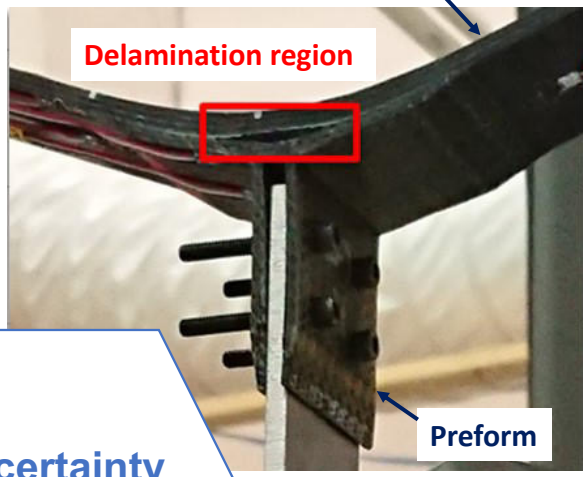
1885

NASA

~10 Students

NASA Award #: 34082





Our team demonstrated a new ICME platform to re-design the Aurora's D8 Y-joint

- **Performance:** Pull off load-to-weight improvement of 43%
- **Cost:** Manufacturing cost reduction of up to 17%
- Return on investment as high as 200:1

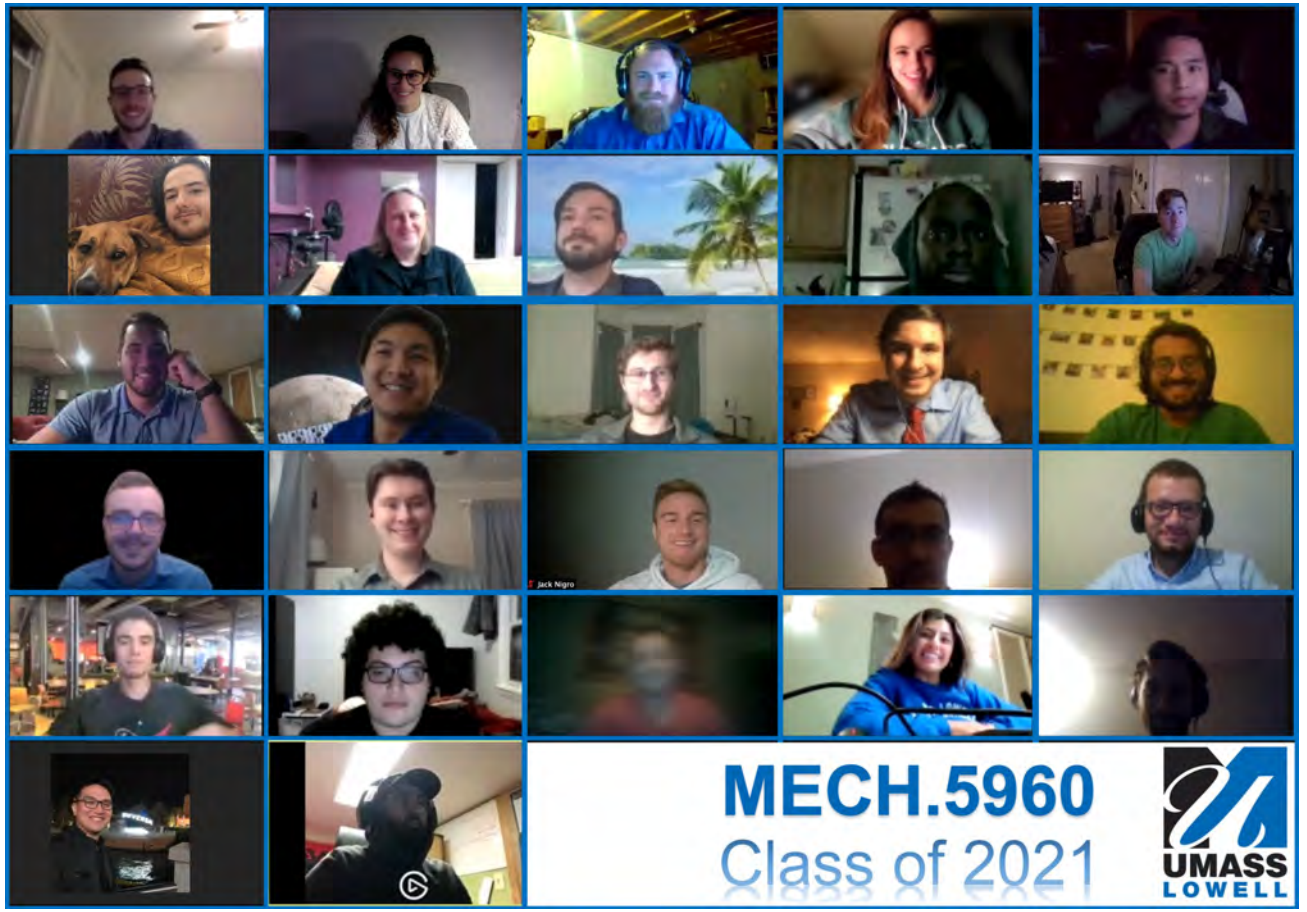
ICOMP2

UMASS LOWELL

AIAA Prize 2022 & ICME Class

We were awarded the 2022 AIAA ICME Prize

60+ Students worked on our ICME project at UML over 2 years



Spring 2021 Class was invited to present to a virtual seminar at NASA Glenn on Dec 9 2021

ICOMP2

UMASS LOWELL

Hearing from the Students…

The ICME project gave students a strong feel of what working as part of a real multi-disciplinary engineering team is like

A shared, class-wide project objective required student groups working across the design length scales to collaborate and establish an interconnectivity amongst each other's goals. As opposed to traditional class projects, the ICME project encourages consideration for the "big picture" in engineering design

Michael O.

Within project groups, students were assigned a length scale. They were given the task of learning the fundamentals associated with their assigned scale, as well as how it related directly to the design case. When collaborating as a class, groups focused on what was needed as an input/output between other groups and how to facilitate transfer and communication of the relevant data. These key aspects of the ICME project led to a unique, dynamic, and interesting project for students to experience over the course of a semester

ICOMP2

UMASS LOWELL

Hearing from the Students…

I've learned how to work collaboratively within an interdisciplinary team containing a multitude of perspectives

The novelty of the project forced me to think more critically

Kalima B.

I learned how to approach a project by breaking it down into smaller parts; determining milestones to achieve the end goal

Hearing from the Students…

It was interesting to learn how a project of such magnitude was planned, managed, and executed to completion by a multidisciplinary team of industry professionals, research scientists, experimentalists, and peers where everyone brought a unique perspective to the discussion all the while focusing on the big picture

The experience I have gained through is project has made me a better researcher and engineer, who can not only work in a multidisciplinary team but also lead and manage projects

Sagar S.

I mentored graduate students and learned the importance of teamwork, leadership, task delegation, time management, and critical assessment of results

Working in a large team taught me the importance of systematic data management for the smooth exchange of information

Hearing from the Students…

I learned how to communicate your work in an effective manner. I am a computational modeler, so I learned how to communicate and work with experimentalists to tailor my modeling work accordingly. Always look at the bigger picture of the project and be flexible to change your when necessary

I learned the need for strategic planning and efficient execution of work based on inputs from experimentalists, industry professionals, and researchers, as everyone have a different way of thinking based on their professions

Sagar P.

Working with students, I learned a lot about mentorship, time management, and careful assessment and critical review of their work

All these things combined make me an all-around engineer who can not only plan and execute the plan efficiently but also can effectively communicate it to the audience

ICOMP2

UMASS LOWELL

Hearing from the Students…

Being a team lead for a subgroup of students contributed to the development of my project management skills. Having to organize and divide tasks and building blocks for a 2-year project showed me a smaller-scale project management version of how a project in the aerospace industry can be developed and carried out for several years. All those skills acquired make me a better and more well-rounded engineer

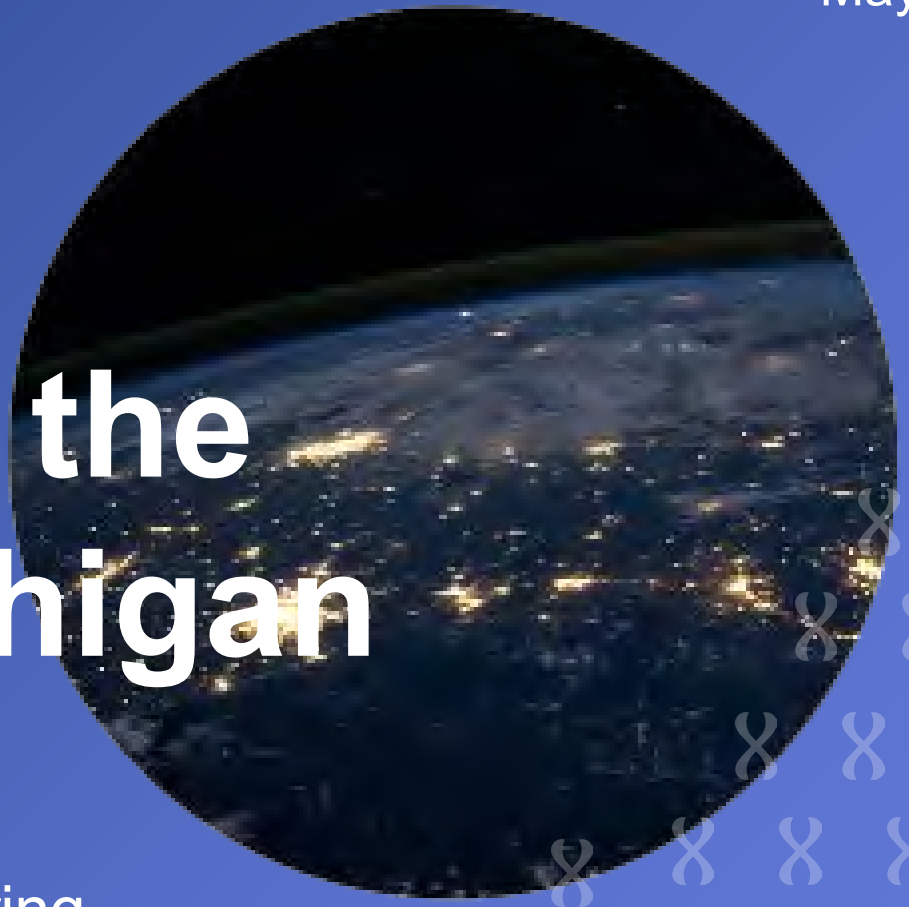
Working with people from the industry step by step from the start of the project to end, educated me about the engineering process followed by aerospace companies. It is hard – almost impossible- to gain intuition and perspective toward how realistic a design can be for a certain application through a traditional course, and implementing projects like the ICME prize project into the coursework is a great benefit!

Evgenia P.

Collaborating with people from different disciplines taught me how important it is to be able to understand and communicate findings between people with different background

Through the ICME prize project, I had the opportunity to work on a real-life aerospace project which would have not been able otherwise in my university curriculum. It taught me to use the theories learned in courses on a real engineering problem

May 11, 2023



x88 and MBSE at the University of Michigan

Dr. Gökçin Çınar

Assistant Professor of Aerospace Engineering
Director, **I**ntegrated **D**esign of **E**nvironmentally-friendly **A**erospace **S**ystems (IDEAS) Laboratory
University of Michigan
Email: **cinar@umich.edu**
Web: **gokcincinar.com**

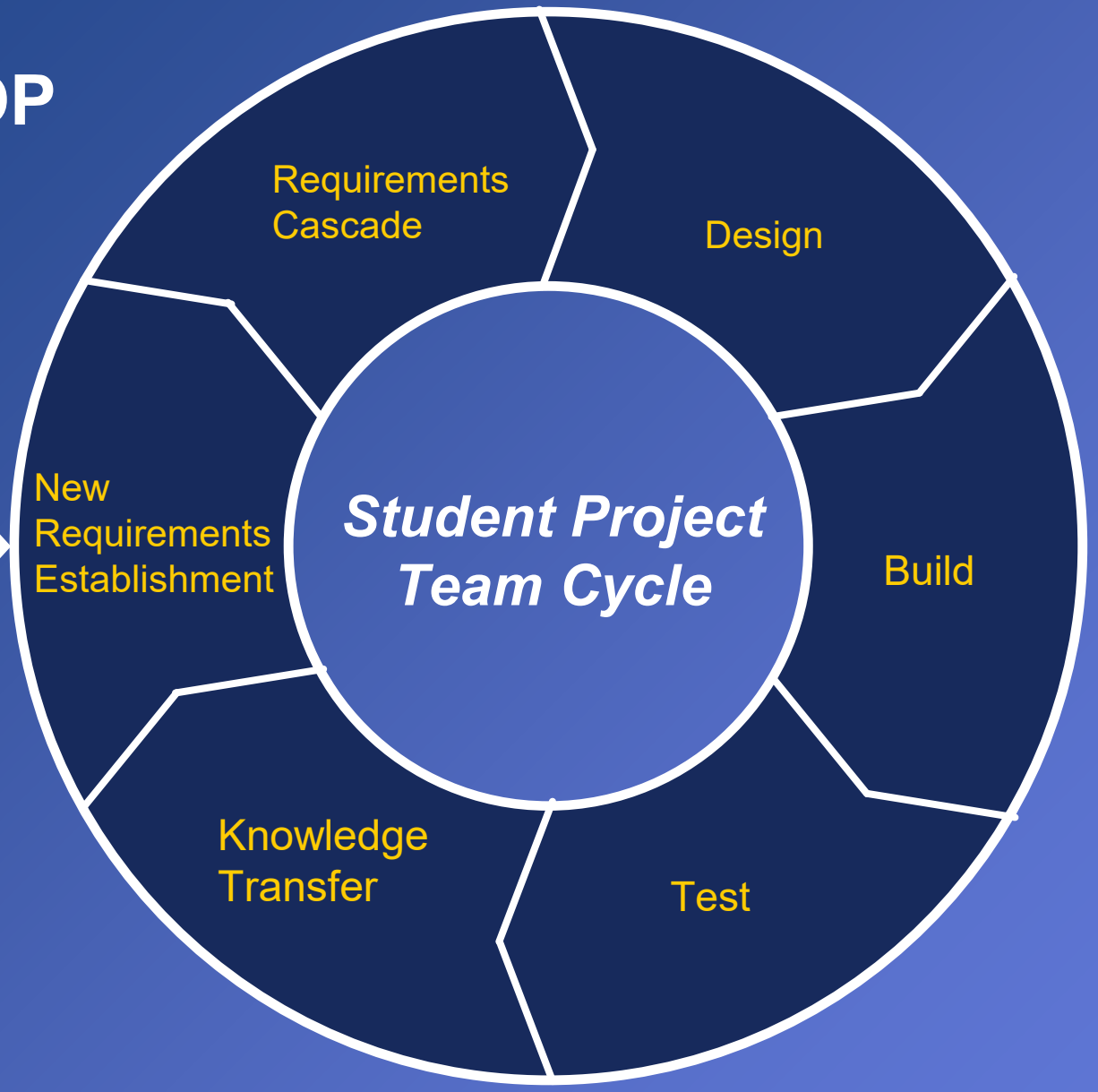
The Systems Engineering Practices Opportunity

Source: NASA Marshall Space Flight Center in Huntsville, AL - 6th floor, building 4203 elevator

x88 TRANSFORMATION

CLOSED LOOP

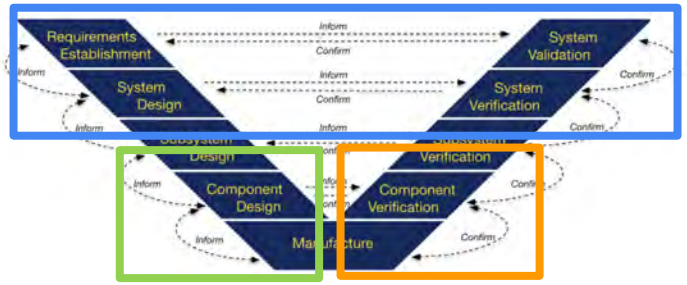
Competition Committee Rules & Regulations



Team Competes with Verified and Validated Design

x88 COURSE OUTLINE

488 students will mentor and coach 288 and 388 students



AEROSP 488 (Jr/Sr) (4)
Product Development Leadership

Systems Engineering	Financial Budgets	Ethics & Culture, DEI	Effective Executive Presentations
Complex Project Management	Cost/Profit	Knowledge Capture	Delivering at Milestones
Team Leadership	Giving/Receiving Feedback	Selecting & Grooming Future Leaders	Servant Leadership & Empathy

AEROSP 288 (Soph/Jr) (3)
Fundamentals of Product Development

Model-Based Systems Engineering (MBSE)	Conducting Effective Design Reviews	Manufacturing Process/Material Selection
Basic Project Management	Technical Presentations	Geometric Dimensioning & Tolerancing (GD&T)
FMEA/DVPR/Risk Management	Team Dynamics, DEI	Technical & Cost Budgets

Intro to Quality Engineering	Statistical Modeling	6σ Root Cause Analysis Deep Dive
Physical Testing Methodologies	Model/Testing Correlations	Multi-Criteria Decision Making
Design of Experiments	Managing Product Variability	Field Validation/ Flight Testing

AEROSP 388 (Soph/Jr) (4)
Aerospace Tools & Methods (MBSE)

September | **October** | **November** | **December** | **January** | **February** | **March** | **April** | **May**

New Requirements Establishment → *Requirements Cascade* → *Design* → *Build* → *Test* → *Knowledge Transfer*

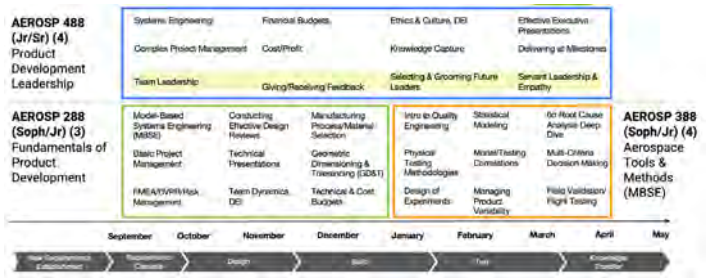
x88 MBSE Lab Thread

	1. Requirements	2. CAD	3. Simulation (CFD, CAE)	4. Manufacturing	5. Statistical Modeling	6. Multi-Domain Systems	7. Programming & Controls
Digital	Analyze drone example in Siemens SMW. Create testbench requirements cascade in Capella	Design propeller and shaft assembly in Siemens NX	Star-CCM+ and Ansys Discovery used to calculate aero pressures. Resultant forces into NASTRAN for structural analyses	Tool cutter paths created in NX. Injection mold vs. 3D printing inflection point calculated	Create design of experiments. Perform basic multivariate statistics, analysis of variance, and regressions	Model propeller, shaft, battery, & microcontroller system and perform power simulations	Model controls for propeller system and program microcontroller to execute them
Physical	N/A	Generate G-Code and 3D print propeller model	Verify forces and loading on a thrust test stand. Perform wind tunnel corroborations of CFD calculations	Demo die-locked part and mold-tool best practices	N/A	Build and test microcontroller and propeller system	Flash code to microcontroller and test control system

288 388

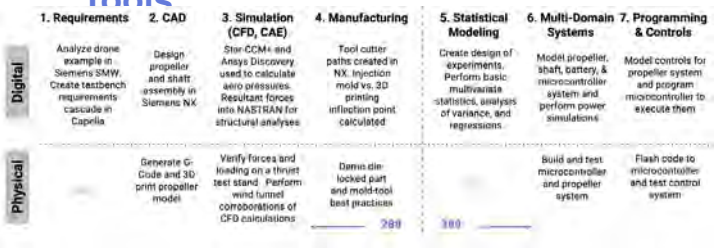
Students learn MBSE in a controlled series of experiments on a relevant system before application on their own craft.

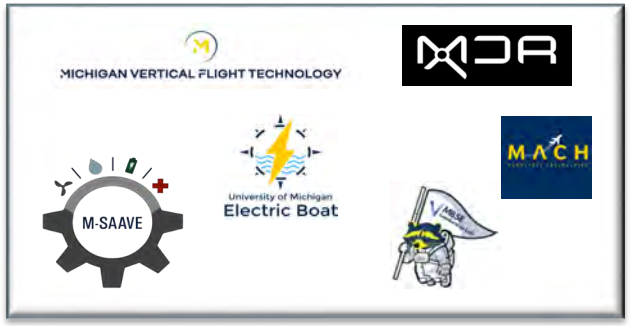
Student Projects in x88



Systems Engineering Processes

Systems Engineering Tools

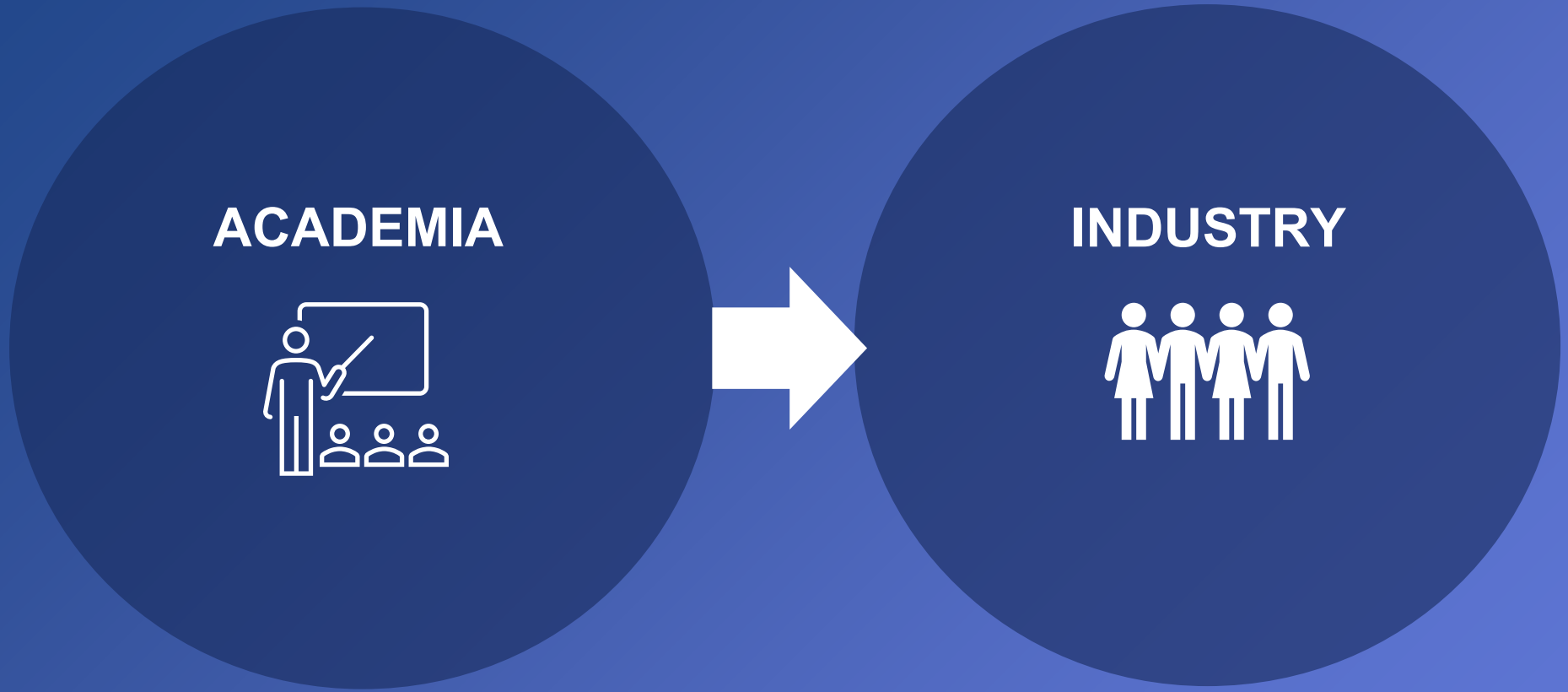




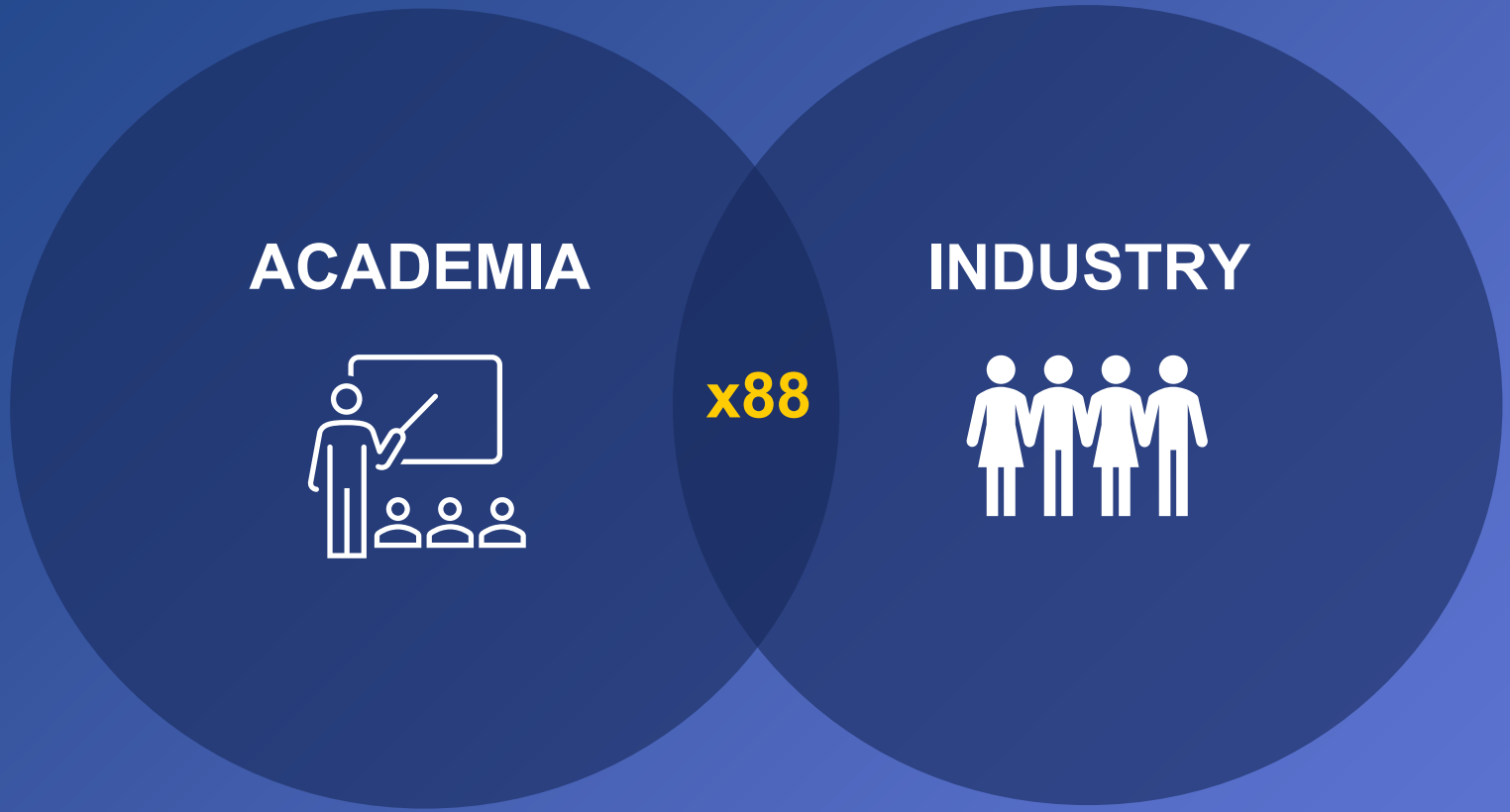
- All students participate in group projects
- Systems Engineering processes and MBSE tools taught to inform students how to execute their projects
- 488 students will take leadership roles in their project groups
- Gateway Reviews by corporate partners

EDUCATIONAL TRANSFORMATION

Traditional model



Transformational model



INSTRUCTIONAL TEAM

Our Team - Faculty

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Master of Engineering Program

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Education at the Speed of Industry: How Community Colleges Can Help Small to Medium Manufacturers Fill the Workforce Gap for Advanced Manufacturing

Lori Baukus, Director of Training, Education, & Outreach

ARCTOS

Applied R&D for Enduring Advantage

ARCTOS Snapshot

ARCTOS® is a leading Small Business provider of digitally-integrated technologies and agile mission-focused solutions for aerospace and defense.

- **Main offices in Dayton OH, Arlington VA, & Torrance CA**
- **~175 employees, $50M+ annual revenue**
- **Core competencies:**
  - *Aerospace Systems*
  - *Advanced Materials*
  - *Smart Manufacturing*
  - *Digital Engineering*
  - *Modeling & Simulation*
  - *Sensing & Analytics*

ARCTOS

Technology-Focused Workforce Development

We provide professional services supporting workforce development across critical aerospace technology domains.

We offer technical and project management leadership, **enabling education/training partners** to accelerate & excel!

- **New technology training program development**
- **Workforce development optimization and acceleration for the Defense Industrial Base**
- **Facilitated partnerships for optimum collaboration and synergy**
- **Innovation and leadership for new opportunities**
- **Technology roadmaps for the Future of Work**

ARCTOS

Example Project Success

Air Force Prime Contract No. FA8650-21-F-5579
AFRL Manufacturing and Industrial Technologies (MITS)
Prime Contractor: ARCTOS Technology Solutions, LLC

“Regional Fabrication and Certification Training Labs”

Training and education partners:
Lorain County Community College
Sinclair Community College
Clark State College

ARCTOS

Define, Develop, Validate and Deploy models, training, and pilots to facilitate scale across multiple institutions

- **Support the creation of fully capable training partners in future technologies**
- **Drive consistency of quality in education and training**
- **Facilitate DoD Air Force Base training Replication Projects**

A FANUC robot tends a HAAS CNC machine fitted with data monitoring sensors

ARCTOS

CONOPS – Concept Of Operations

	Stage 1 Define	1A Industry Engagement	1B Pilot Project Assessment	1C Technical Interchange Meeting – As Required	**Stage 2 Develop Training Packages**	**Stage 3 Validate**	**Stage 4 Deploy**
Description	Training Needs Assessment Define Credentials and Certifications: Leverage existing or create new	Define Industry Partners: Industry Engagement to solicit pilot projects directly and via regional and state partners	Define Projects: Project is assessed for readiness. Projects that aren't ready are connected to support partners for further development (MEP's, SME's)	Define Teams: Introductions to team members; technical working session	Develop training package needs, validate credentials, equipment required, schedule.	Fund and Implement Pilot: Purchase equipment, conduct training	Demonstrate Increased enrollment Share Model for replication and scaling Conduct Train the Trainer
Go/ No Go	Industry Validated List Proposed list for new development	List of Engaged partners	Business Case and Value Proposition Drafted/Verified	Pilot Teams formed: Education Partner, Technical Partner, Industry Partner Draft Plan	Draft Proposal Training Package: Required Equipment, Schedule, Cost Estimates Define new credentials if required	Training package developed and implemented Credential/Certifications Issued	Work product available and shared White Paper

ARCTOS

Lorain County Community College

Industry 4.0 Roadmap

Bachelor of Applied Science Smart Industrial Automated Systems Engineering Technology

Level 3: Robotics Integrator

Advanced Product ID	HMI	Advanced Robotics	Advanced PLC	Smart Maintenance	Cyber Security
Vision Technology II Near Field Communications RFID II Potential & Impact	Manufacturing Processes Programming Creating Visual Awareness Recipe Creation Data Acquisition	Collaborative Robots Augmented Reality IRA Safety Standards Integration of PLC's w/Robotics Virtual Commission	Sensors III OPCUA w/MES & PLC I/O Condition Monitoring Advanced Networking & Connectivity	Predictive Maintenance Data Analysis LEAN & Visual Awareness Top Floor- Shop Floor Communication	Data Corruption: Understanding Risks & Consequences Preventing Cyber Attacks

Bachelor of Applied Science Smart Industrial Automated Systems Engineering Technology and Specialist Certificate

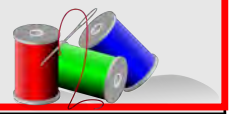
Level 2: Robotics Specialist

Product ID Fundamentals	Applied Fluid Power	Applied Mechanical Systems	Applied PLC	Applied Robotics	Applied Industry 4.0
Vision Technology 1 RFID 1 Bar Coding 1	Maintenance & Troubleshooting Energy Efficiency Vacuum Technology	Gear Drives Bearings & Gaskets, Seals Clutches & Brakes Ball Screws and Linear Bearings	Sensors II PLC Technology II Basic Networking CoDeSys	Programming & Editing Maintenance & PM Welding Material Handling Palletizing	Introduction to MES Introduction to HMI Introduction to Data Safety Introduction to 3D Modeling

Associate of Applied Science in Automation Engineering Technologies – Systems Specialist

Level 1: Robotics Technician

Electricity Fundamentals	Fluid Power Fundamentals	Mechanical Systems	PLC Fundamentals	Robotics Fundamentals	Industry 4.0 Fundamentals
Electricity AC Electricity DC	Basic Hydraulics Basic Pneumatics	Mechanical Drive Systems Components & Calculations Belts, Chains, & Lubrication Maintenance & Installation of components	Sensors I PLC Technology 1	Introduction to Robotics	Introduction to Industry 4.0



I4.0 Thread + Occupation-Based Learning Outcomes + Competency Led

+ Embedded Stackable Credentials and Certificates

Lorain County Community College

Automation and Robotics

Introduction to Systems Integration Training

0-25% Robotics Experience

FANUC and Allen Bradley Industry Recognized Credentials

Capstone Course

Work Based Outcomes

NOCTI Exams

Robotics and PLC Credentials

- Introduction to Advanced Manufacturing Systems Approach and Integrating Industry 4.0
- Experience and Implement Industry Relevant Capstone projects for Students
- Learn how to Incorporate I4.0 Skills, Competencies, Technologies
- Customized Topics to the Industry

The Ohio Manufacturers' Association | OhioTechNet | OhioHigherEd | ARCTOS All In.™ | Rockwell Automation | IST | FANUC

Digital Thread Workforce Development Progress

- Led by ARCTOS, Sinclair College is advancing a project to create new training models and materials enabling small to medium-sized companies to rapidly and successfully transition to a digital manufacturing paradigm.

- UAS and AAM aircraft are leveraged throughout the curriculum as a linkage to the advanced aerospace defense and dual-use manufacturing needs of the Air Force Research Laboratory and private industry.

Develop an active, expert-level Digital Thread Manufacturing Advisory Group.

Seek employer input during the entire project period, including pilot projects with defense suppliers ready to accelerate use of digital thread in their manufacturing processes.

Employ a Train-the-Trainer approach for disseminating knowledge and information across the college and the state.

Develop credit-based and non-credit-based training and education programs that are industry-informed.

Explore an industry-recognized credentialing system.

Collaborate with high schools and four-year institutions to create an academic digital thread pathway from high school through a bachelor's degree.

CENTER FOR ADVANCED MANUFACTURING AND LASER MATERIAL PROCESSING

CLARK STATE COLLEGE

INDUSTRY OUTREACH

- Developing a Curriculum (DACUM)
- Tours
- Training Needs Assessment
- Skilled LMP Pipeline

TRAIN THE TRAINER

- High School Teachers
- Manufacturing Foundations Certification
- Dual Enrollment
- Lending Lab

TRAINING PATHWAYS

- Customized Industry Training
- Stackable Certifications

INDUSTRY RECOGNIZED CREDENTIALS

- OSHA 10-General Safety
- Laser Safety
- TruLaser 3000 Operator
- SME Certified Additive Manufacturing Fundamentals

K-16 COLLABORATION

- Interactive Onsite Demonstrations
- Career Fairs
- Manufacturing Days
- Dayton Regional STEM School
- University of Dayton
- Wright State

Collaboration Opportunities for Industry and Education

- Develop training, course materials, and programs
- Audit training
- Teach
- Act as advisors
- Guest lecture on key topics
- Host tours for faculty
- Connect to Defense Industrial Base Partners
- Provide Technical Use Cases
- Earn & Learn, Internships

ARCTOS

Thank you!

Mission-focused innovation.

Customer-focused delivery.

Lori Baukus

Director, Training, Education and Outreach

ARCTOS Technology Solutions, LLC

Dayton OH • Arlington VA • Torrance CA

Phone: (937) 306-6743 • www.arctos-us.com

Digital Thread Initiative

Sinclair Community College

Elizabeth Generas, Program Manager

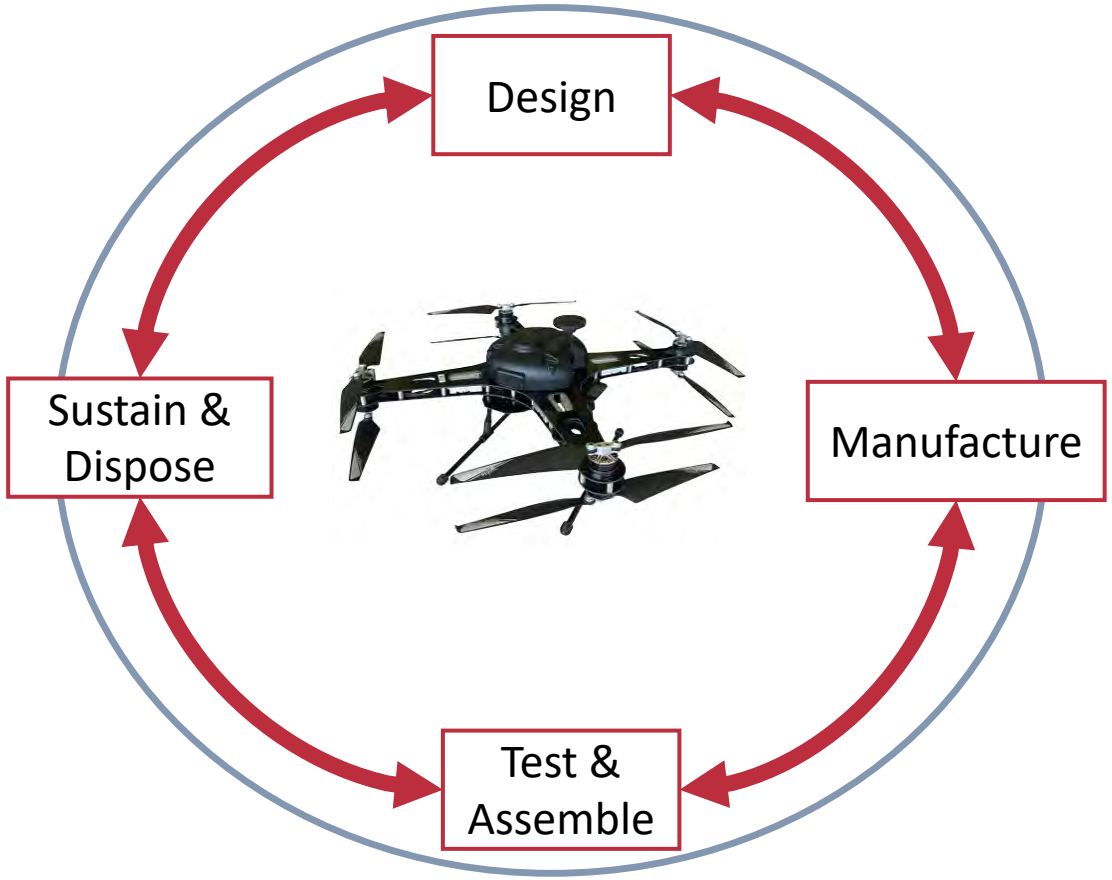
Dayton, Ohio

Digital Thread Initiative Mission

Develop and deliver smart manufacturing training programs for current and future workforce centered on technologies and processes related to digital transformation in advanced manufacturing.

- K-12 STEM Programs
- Academic Programs
- Workforce Programs

Grade 6-12 STEM Learning Experiences



National UAS Training and Certification Center

SelectTech GeoSpatial

DECA Dayton Early College Academy

Wright Brothers Institute

AIR Camp Scholarship Leadership Citizenship

Academic Programs

- Short-Term Technical Certificate “Digital Thread Engineering Technology”

5 new courses from 4 departments; Industrial Systems Engineering, Computer & Information Science, Management, Business Information Systems

- Bachelor of Applied Science Integrated Systems Technician

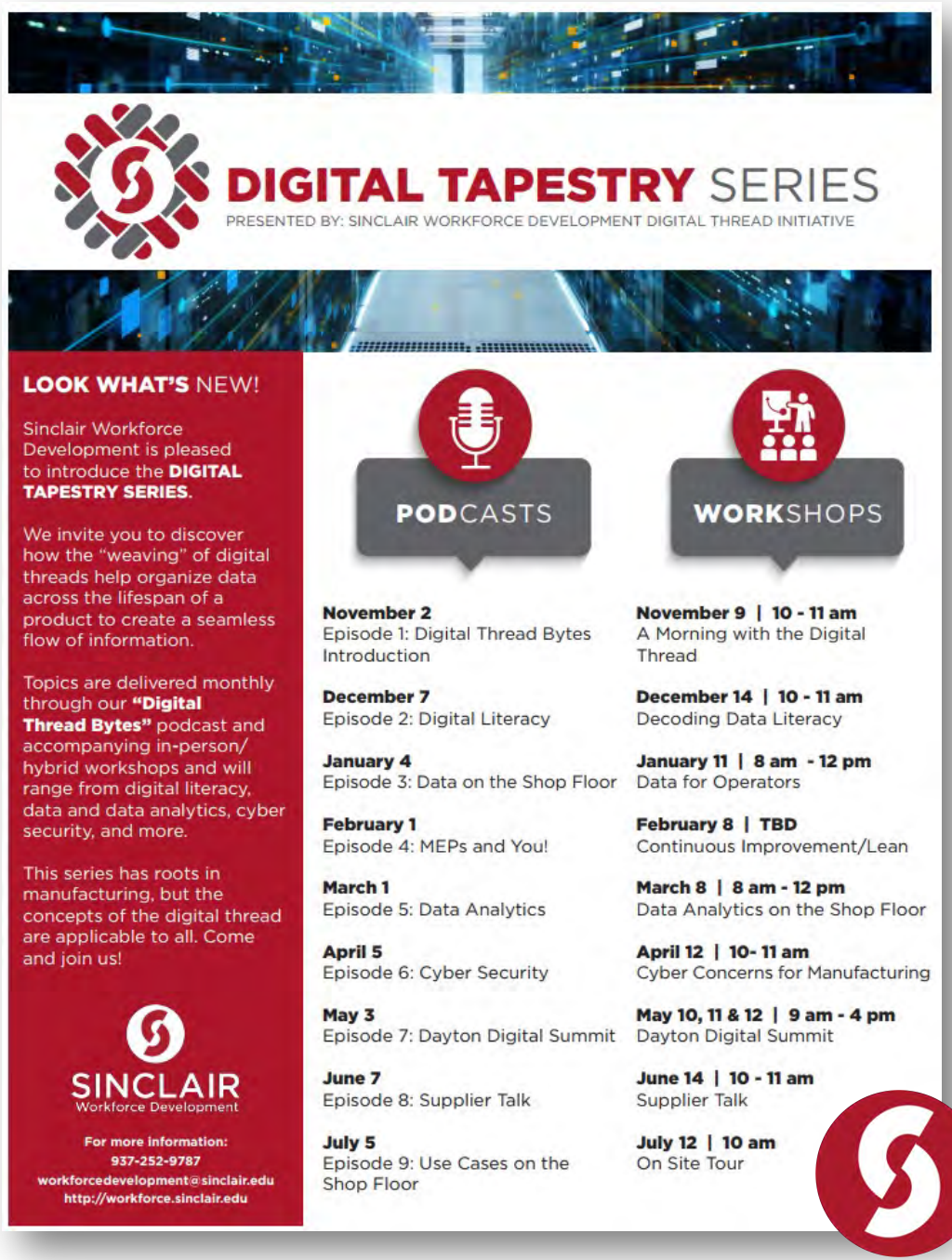
Business Processes	-Operations -Accounting	Cloud Computing	-Data Analytics & Viz -Database Mgt -Cyber Security
Factory Operations	-Logistics -Devices	Automation & Data Acquisition	-Industry 4.0 -Cyber Security

Short-Term Technical Certificate:
Digital Thread Engineering Technology (16 hours)

- ISE 1401 Intro to Digital Thread Technology
- ISE 1402 Digital Thread Enabled Manufacturing
- MAN 1010 Digital Thread Enhanced Logistics
- CIS 1010 Digital Thread Cyber Security
- BIS 1010 Digital Thread Data Management
- MET 1131 Personal Computer Applications for Engineering Technology

Workforce Programs

- Digital Tapestry Series
  - Podcast – ‘Digital Thread Bytes’
  - Workshops
- Topics:
  - Data for Shop Operators
  - Data Analytics for Supervisors
  - Cyber Security



Opportunities

- National Advanced Air Mobility Center of Excellence (NAACE)
- Augmented Reality
  - Training
  - Maintenance
  - Operations
- Next Generation Training

Contact
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