NSRP Sustainment Panel | September 6, 2023

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Outline

- ARM Institute Background
- How might the ARM Institute support Sustainment & Modernization of the Shipbuilding Community?

The ARM Institute

Leads the way to a future where people and robots work together to respond to our nation’s greatest challenges

About The ARM Institute

- Established 2017 by Carnegie Mellon University
- One of 16 national Manufacturing Innovation Institutes (MIIs)
- $80M DoD Technology Investment Agreement (TIA)
- Target of $173M non-Government cost share
- Complete ecosystem ~ 400 members
- Over 100 projects funded to date in both technology and workforce development
- Headquartered at Mill 19, Hazelwood Green, Pittsburgh

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The ARM Institute Mission

The ARM Institute accelerates the development and adoption of innovative robotics technologies that are the foundation of every advanced manufacturing activity today and in the future.

We leverage a unique, robust and diverse ecosystem of partners across industry, academia and government to:

- **Make robotics, autonomy, and artificial intelligence more accessible to U.S manufacturers large and small**
- **Strengthen our economy and global competitiveness**
- **Train and empower the manufacturing workforce**
- **Elevate our national security and resilience**

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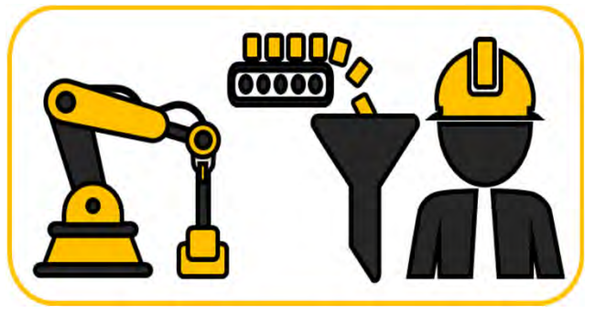
Pursuing our Mission on Three Fronts.

Ecosystem Development

Convening and leveraging a nationwide consortium of innovators



Technology Development

Lowering barriers to adoption of robotics by advancing technology

Education & Workforce Development (EWD)

Expanding the robotics workforce with new and better career pathways

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More than 400 Members - Building the Right Ecosystem via Ecosystem Engagement.

- **Small & Start-up** businesses across a variety of industries with over 75 small robotics companies
- **Large DoD OEMs** and businesses and dominant share of robot suppliers to the US with broad industry representation (AI, Space, Textiles, Logistics, Materials Automotive)
- **Top Research Universities** with leading robotics programs
- **Community Colleges and Trade Schools**
- **Government Partners** including the Army, Air Force, Navy, DoC/NIST, NIOSH, DoL
- **Economic Development Partners** – MEPs, workforce training, STEM programs

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Education & Workforce Development

Focus Areas

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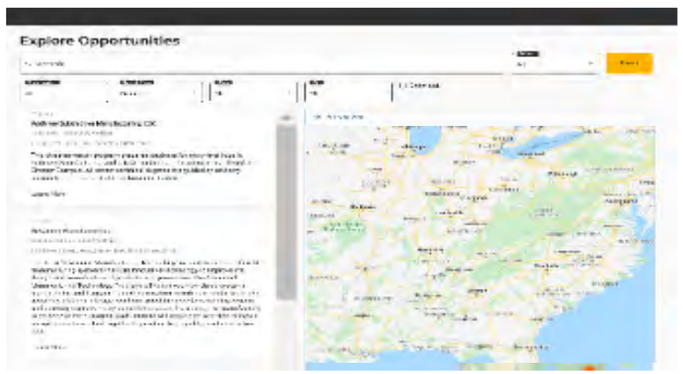
RoboticsCareer.org

POWERED BY ARM INSTITUTE

Connecting Students & Workers With Leading Robotics Education Programs for Manufacturing Careers

Online Platform

- Designed for employers, employees, job seekers, and students
- Unique mapping of advanced manufacturing robotic competencies to career pathways



Content

- Provides information about robotic training programs from micro-credentials and apprenticeships to PhDs
- Search over 13,000 training programs from 2,500 training organizations nationwide

ENDORSED ARM INSTITUTE

Program Endorsement

- ISO-like audit to provide validation & endorsement
- ARM “Seal of Approval”
- Identifies best practices

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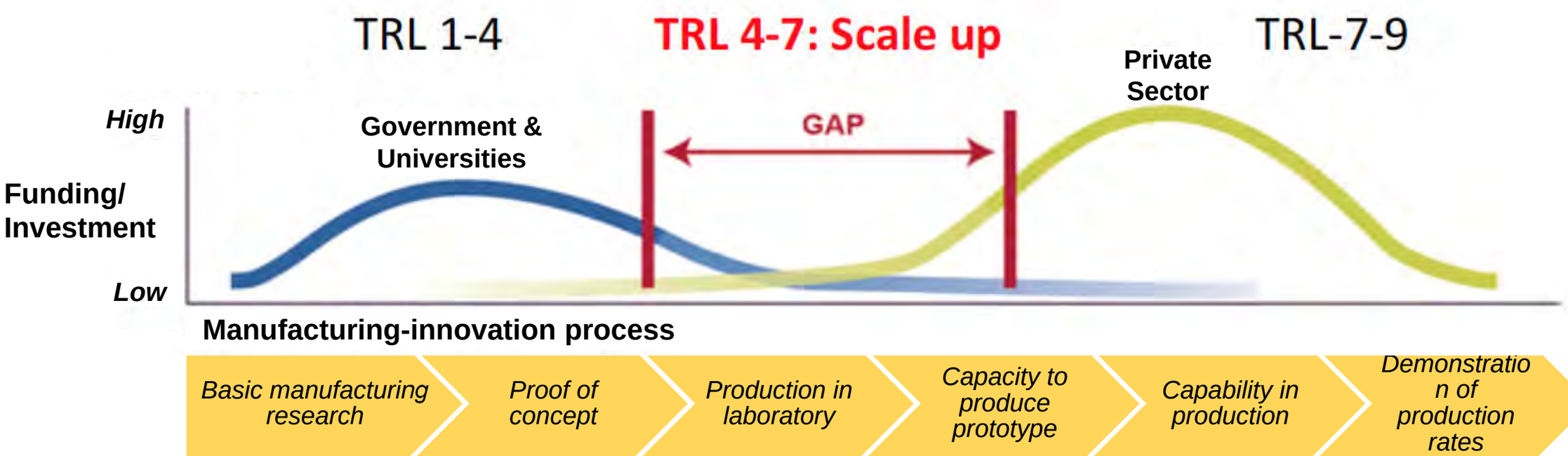
The Robotics for Manufacturing Innovation Gap



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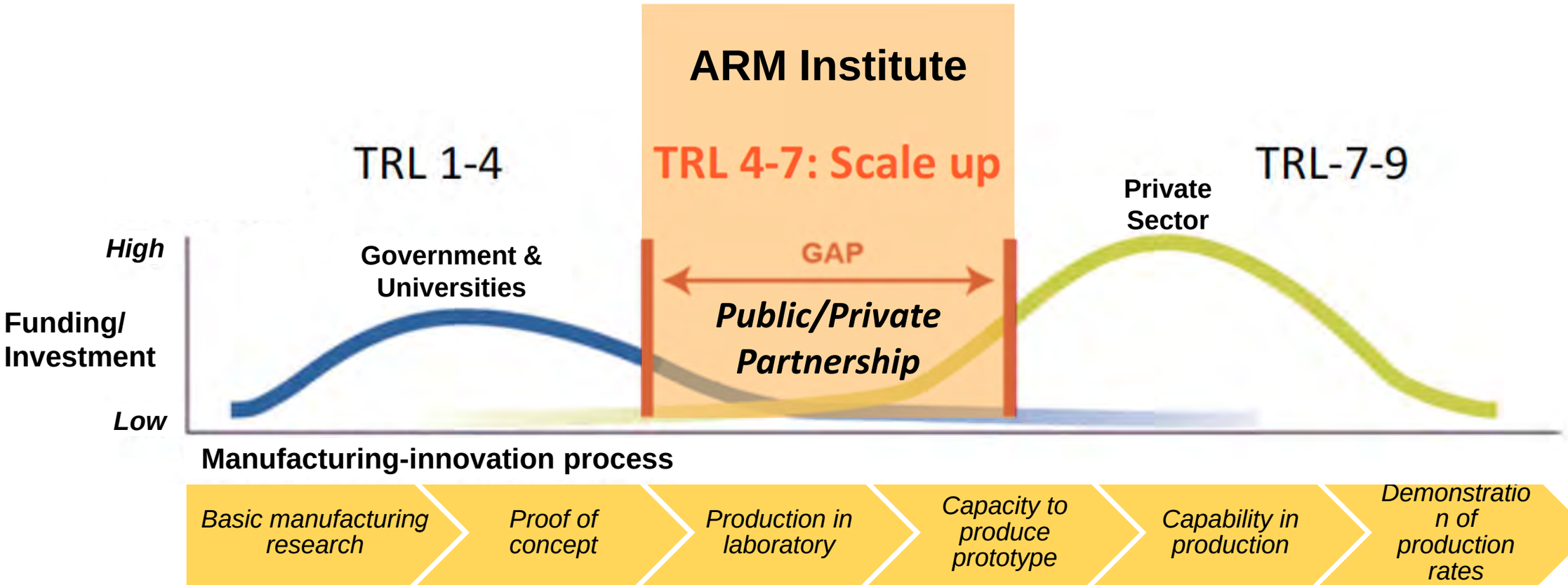
The Robotics for Manufacturing Innovation Gap



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Strategic Technology Focus Areas

1. Risk Reduction for Transition to the Factory Floor
2. Human-Robot Interaction
3. Interoperability
4. Reconfigurable, Agile, and Flexible Robotic Workcells
5. Intelligent Robotic Systems

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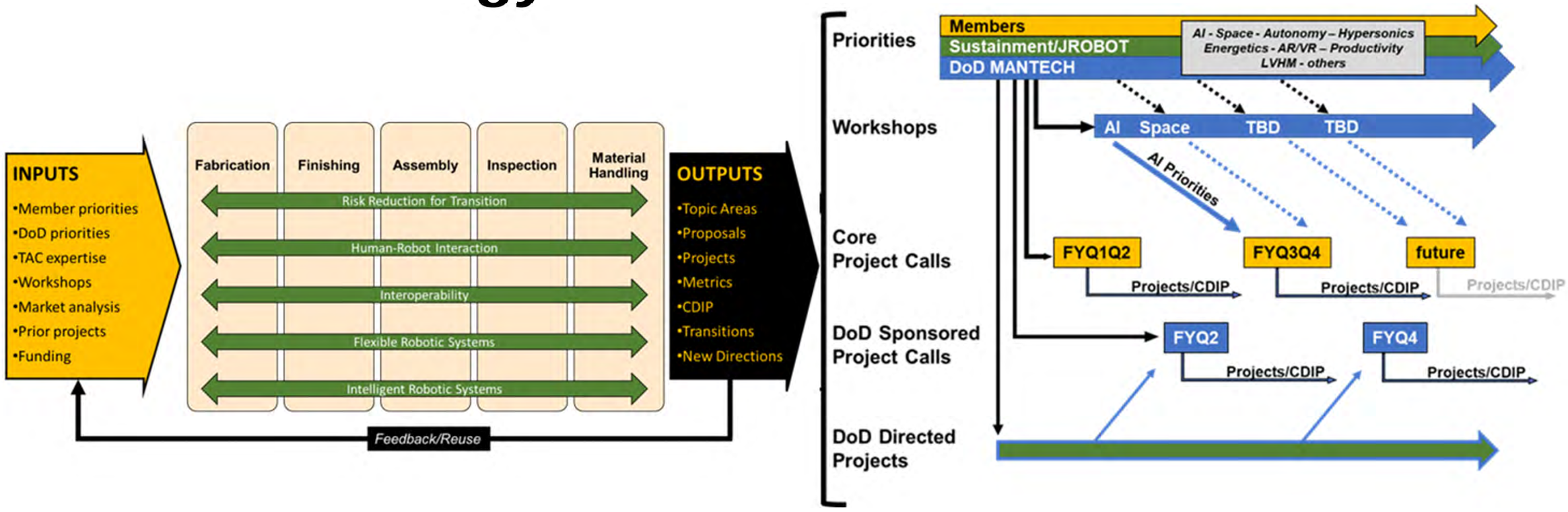
ARM's Strategy in Motion



ARM develops pervasive technology to address DoD's manufacturing priorities

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How might the ARM Institute support Sustainment & Modernization of the Shipbuilding Community?

- Contracting
- Ecosystem
- De-Risking
- Transition

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Contracting

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Contracting

Contract Management: Under contract ~ 120 days

Leveraging ARM Institute “Technology Investment Agreement”

- Sole Source Projects
- Competitive Project and leverage the ecosystem
- Success Story: DAF / AFRL / ManTech $20M in various programs
  - Active relationship between ManTech, Sustainment / Depots, Prime
  - Depot Requirements

SeaPort NxG IDIQ - Platform for acquiring support services in 23 functional areas including Engineering, Financial Management, and Program Management.

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Depot Factory Artificial Intelligence Robotics

- Autonomous Mobile Robot
- Autonomous Path Planning
- Fastener classifiers
- Optimized fastener removal
- Prototype delivery & testing
- 24 months (RFP to Delivery)

Ecosystem

Ecosystem

- Convening and share best practices
- Leverage pervasive technology
- Product / Technology Roadmapping
- Robotic technology generalizable, scalable and accessible?

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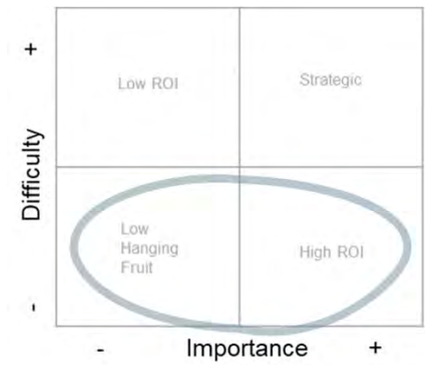
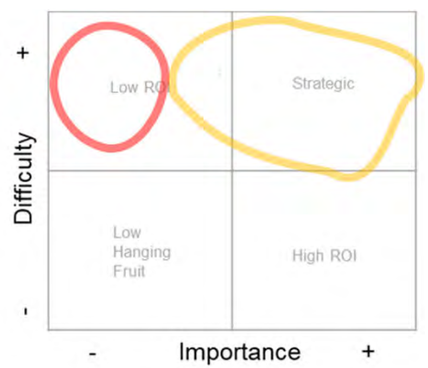
Ecosystem & Roadmapping

- Acquisition / Prototyping
  - Higher TRL
  - Available technologies
  - How might we acquire automation quickly?
  - How might we begin to modernize our manufacturing processes?



Advanced manufacturing supply chain

- R&D
  - Higher risk or strategic development
  - Lower Technology Readiness Level (TRL)
  - “How might we” identify and map robotic capabilities for _____?
  - How can we de-risk capabilities for development of new products?



Providing de-risking services & new robotic capabilities

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Ecosystem

Robotics & Automation Supply Chain?

TITAN ROBOTICS

READY ROBOTICS

GRAY MATTER ROBOTICS

rpGatta inc
custom engineered machinery and automation

PREMIER AUTOMATION
POWERING INDUSTRIAL AUTOMATION

CapSen ROBOTICS

FANUC ROBOTICS

VEO ROBOTICS

YASKAWA
MOTOMAN ROBOTICS

PLUS ONE ROBOTICS

ABB ROBOTICS

RAPID ROBOTICS

WAYPOINT ROBOTICS

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PUSHCORP

FORI AUTOMATION INC.

De-risking

- “Build Back Better Regional Challenge”
  - U.S. Economic Development Administration (EDA)’s American Rescue Plan
- Robotics Manufacturing Hub:
  - collaborative de-risking space where small and medium manufactures (regional) and technology providers work together to find ways to make manufacturers more competitive
- Develop, Test and Validate (advanced robotic manufacturing prototypes)

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Technology Transition

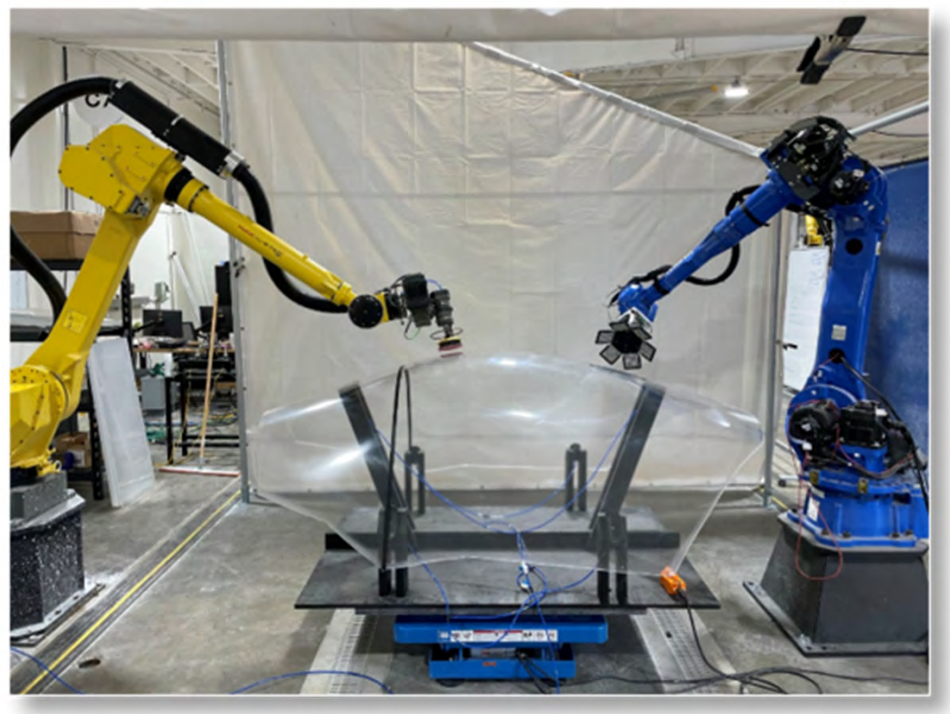
ARM-TEC-21-02-P-31: Uniform Work Robotic Sanding with Intrastage Inspection

Backgrounds and Motivation

- Optical requirements for modern combat aircraft canopies challenge conventional manual sanding resulting in rework.
- Path planning on existing robotic sanding systems has irregular material removal, deep scratches, and material burning resulting in optical distortion

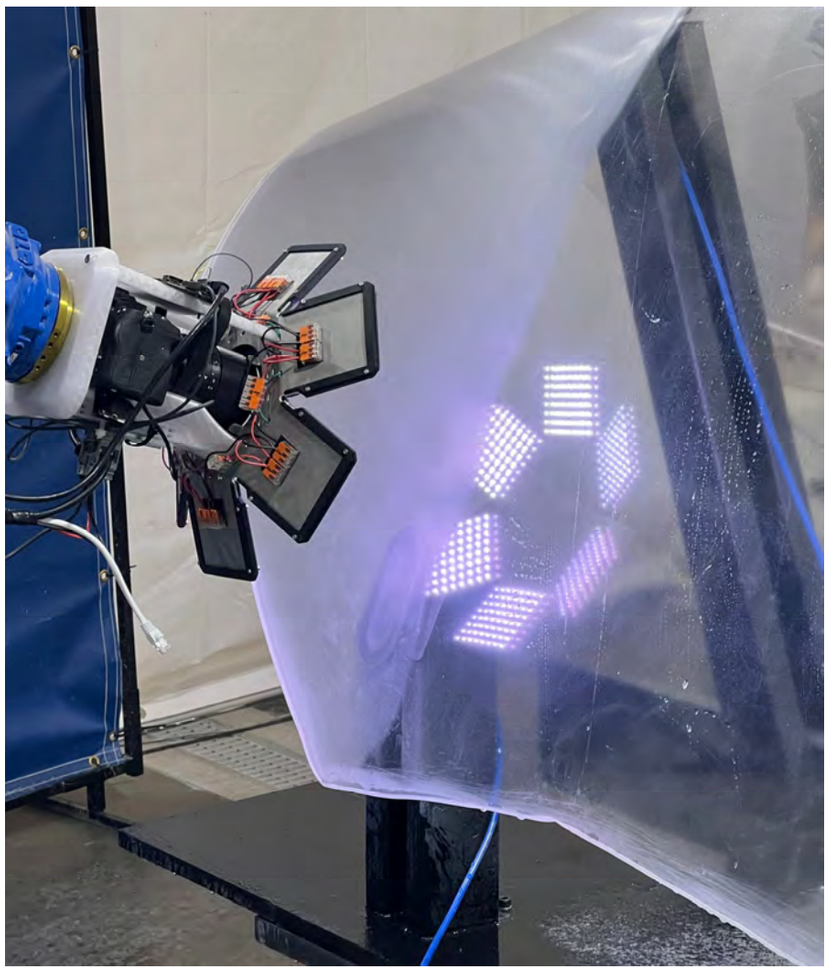
Results:

- “Uniform Work” tool path planning and optimization with intra-step digital inspection to reduce rework, worker fatigue, and injury
- Demonstrated sanding and inspection capability on F-35 canopy
- Sanding hardware design (pad design, paper selection, compliance mechanism, direct drive spindle, water delivery, scanner, system)
- Inspection hardware design (camera, LED array, system)
- Scan and Plan software iteration and modification to support

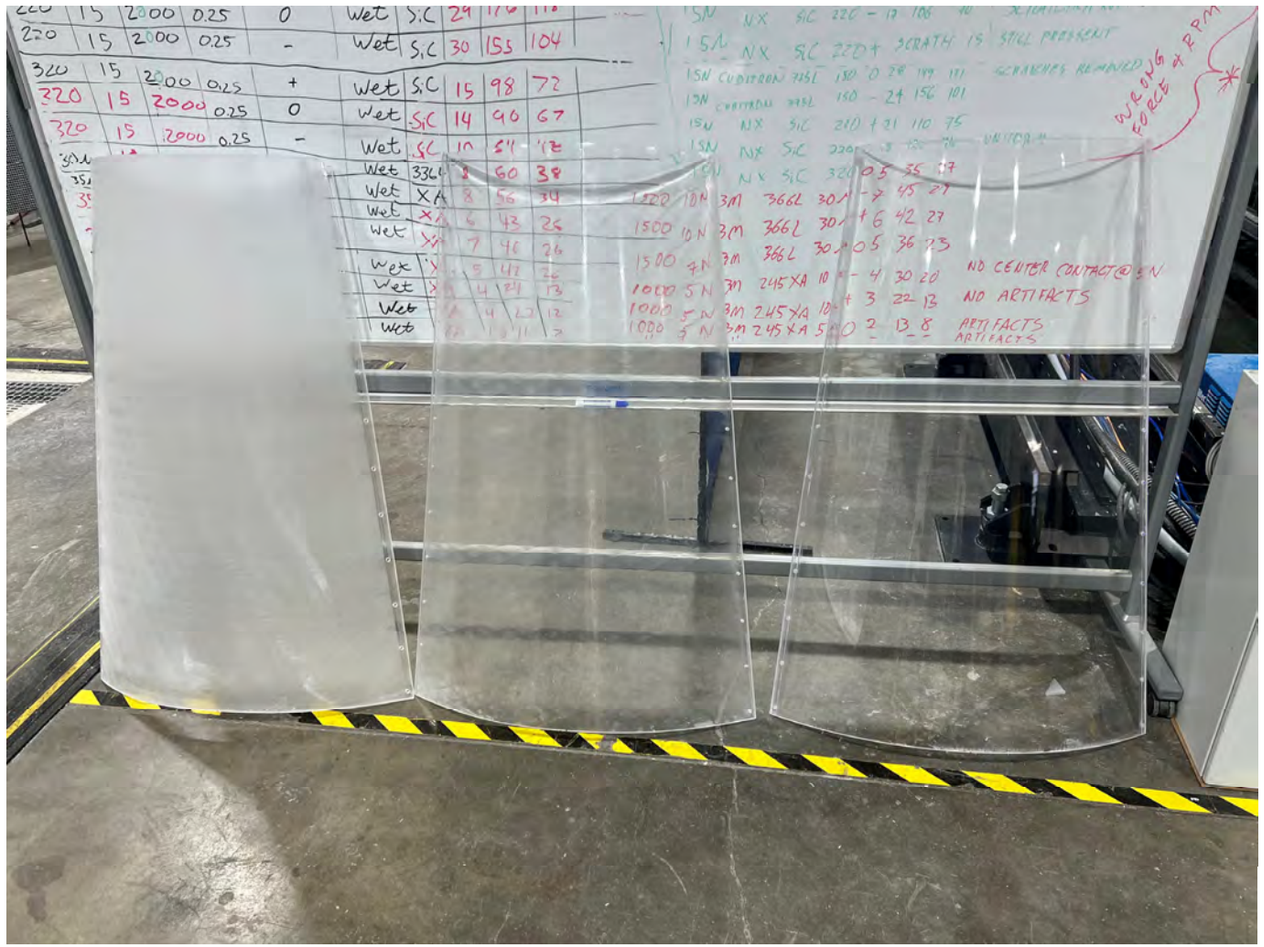


Uniform Work Robotic Sanding

Intrastage Inspection



Intrastage Inspection



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Sanding / Finishing

ARM-TEC-18-01-F-16:
Large Metallic Sanding and Finishing

ARM-TEC-19-01-F-27:
Robotic Sanding and Finishing Phase 2

ARM-TEC-18-01-F-08:
Collaborative Robotic Sanding of Aircraft Panels

ARM-TEC-19-01-F-07:
Automated Defect Inspection of Complex Metallic Parts

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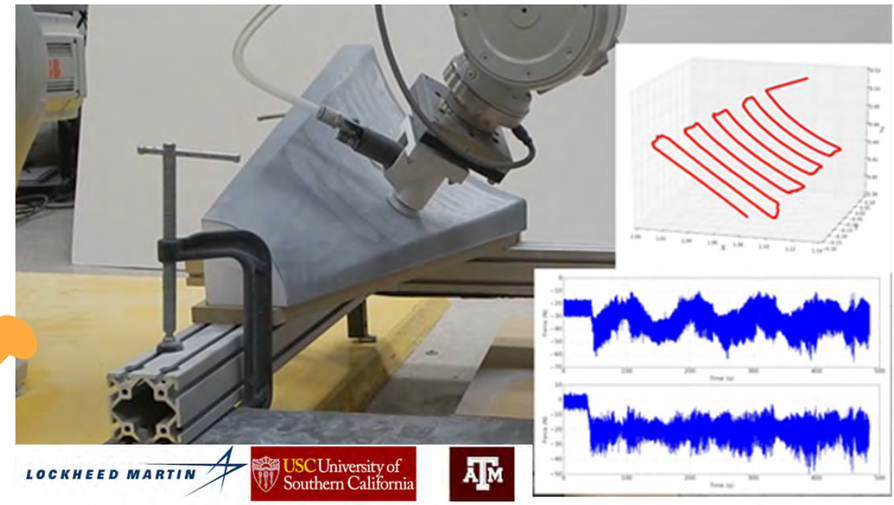
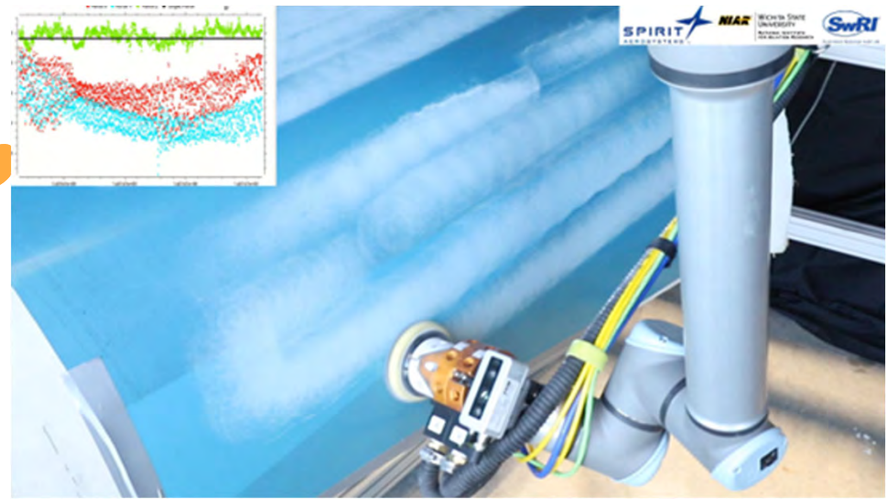
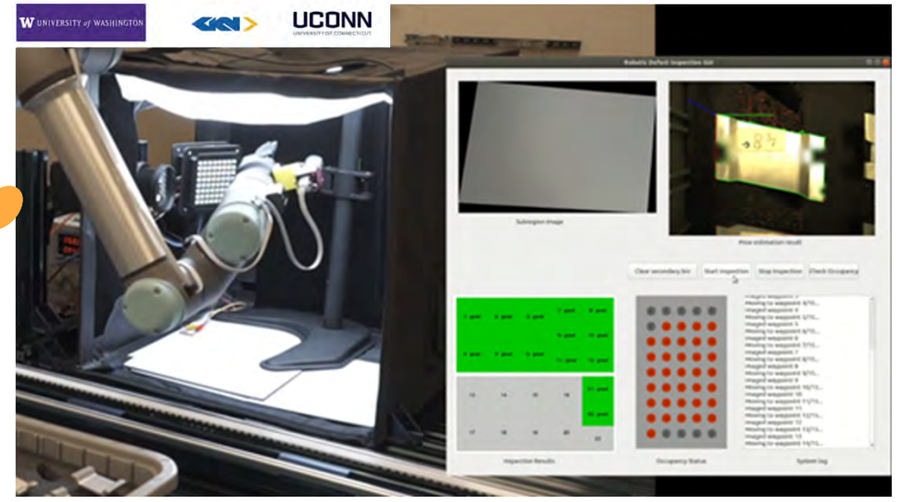




Collaborative Robotic Sanding of Aircraft Panels



Automated Defect Inspection of Complex Metallic Parts

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Summary

- ARM Institute:
  - ARM Institute is a DoD MII
  - Accelerates the development and adoption of innovative robotics technologies for advanced manufacturing

- How might the ARM Institute support Sustainment & Modernization of the Shipbuilding Community?:
  - Contracting
  - Leveraging the ARM Ecosystem
  - Technology Development Roadmapping
  - Technology delivery (transition) and providers
  - De-risking
  - Education and Workforce

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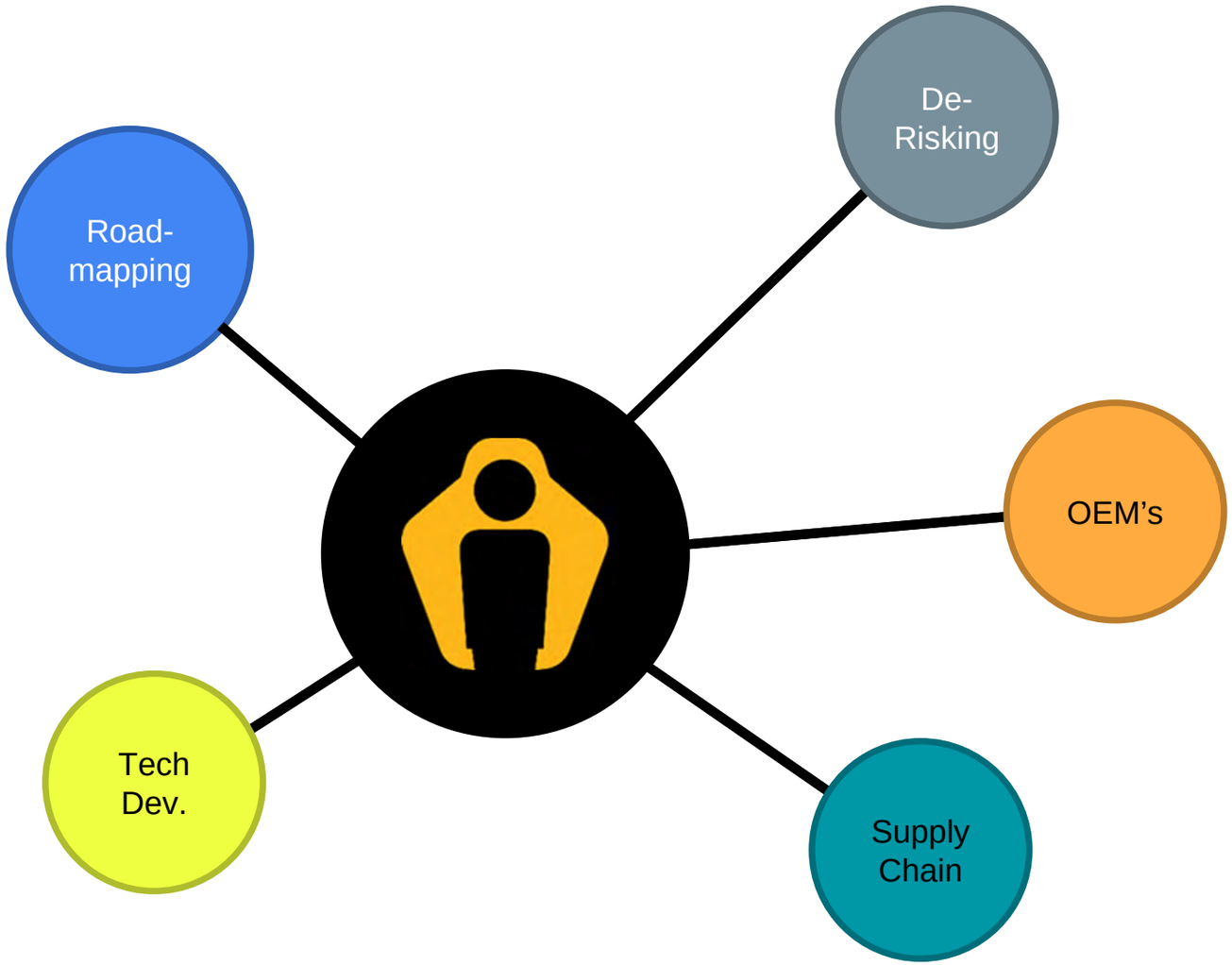
Questions



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