Strategies for Making Advanced Robotic Manufacturing Technology Accessible to System Integrators and End Users

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Director Engineering

ROS-Industrial Annual Meeting

San Antonio TX

March 27, 2024

Agenda

- ARM Institute update: ROS-Industrial contributions
  - 2023 highlights
- Technology transition to system integrators & end users
  - 2024 initiatives
- ROS-Industrial / ARM collaboration opportunities

ORGANIC INDUSTRIAL BASE
MODERNIZATION CHALLENGE
WINNERS

ARM Institute, Aris Technology
Robotic Non-Contact 3D Inspection Replacing Tank Ammunition Hard Gaging
ARM Institute, Grid Raster Inc.
Extended Reality and AI-Assisted Paint Masking
ARM, Figure Engineering, Siemens, Lockheed Martin
Maskless Robotic Painting with Realtime Control
MxD, Anark
A Closed-loop Technical Data Exchange that Meets the OIB Where They Work
NextFlex, Aptima Inc
Cybersecure Data Compliance for Integrated Sensors and Shop Floor Digitization

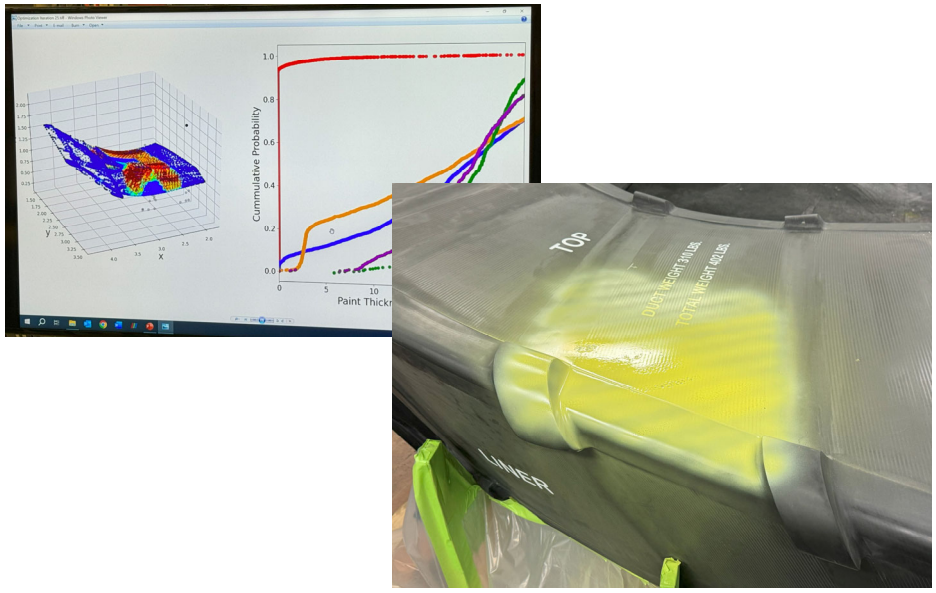
ARM INSTITUTE M D NEXTFLEX

DEPARTMENT OF DEFENSE MANUFACTURING TECHNOLOGY PROGRAM INNOVATING MANUFACTURING

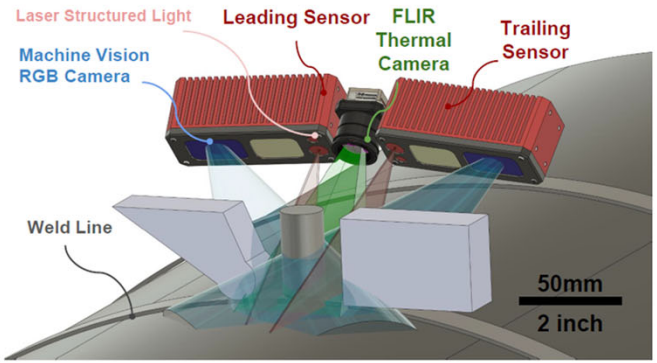
We are thrilled to announce the winners of the Organic Industrial Base Modernization Challenge. Each of these innovative projects will be awarded $500,000 in government funding sponsored by OSD.

#OIB MODERNIZATION

2023 Highlights: Painting

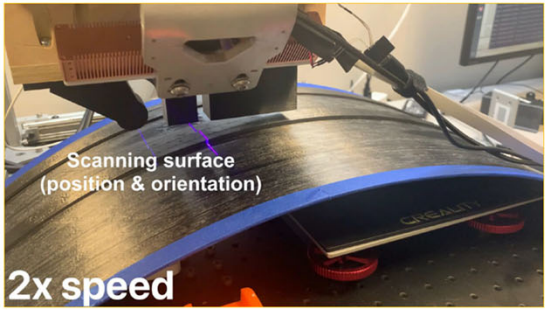


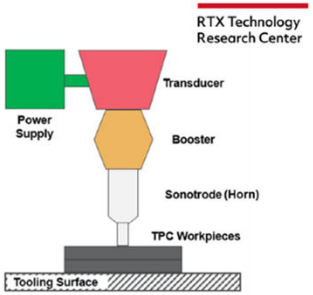
2023 Highlights: Welding



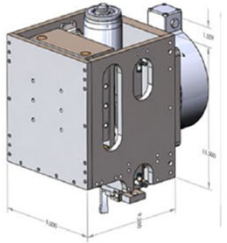
RGB-D-T sensor package schematic

- Compact multimodal sensor design
- Dual RGB-D Sensor mode
  - Leading: pre-weld detection and tracking
  - Trailing: post weld monitoring
- FLIR Thermal camera (Center)
  - Temperature monitoring
  - Welder feedback to control
- Rugged protective packaging
- Design for in-situ closed-loop control





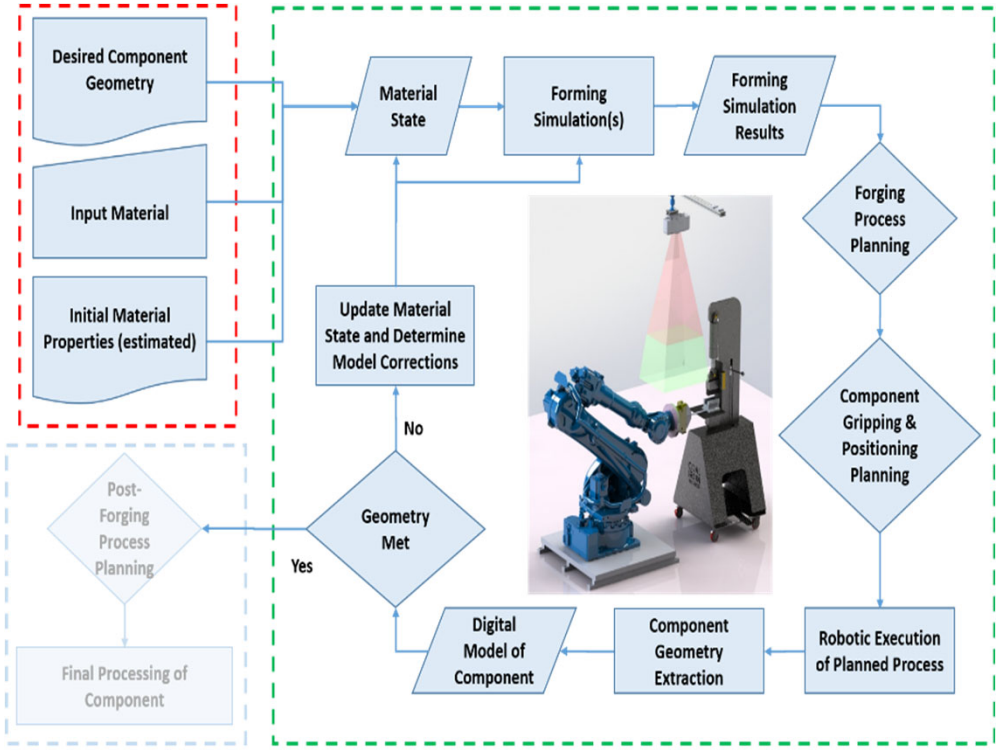
A schematic of ultrasonic welding



CAD of end effector design

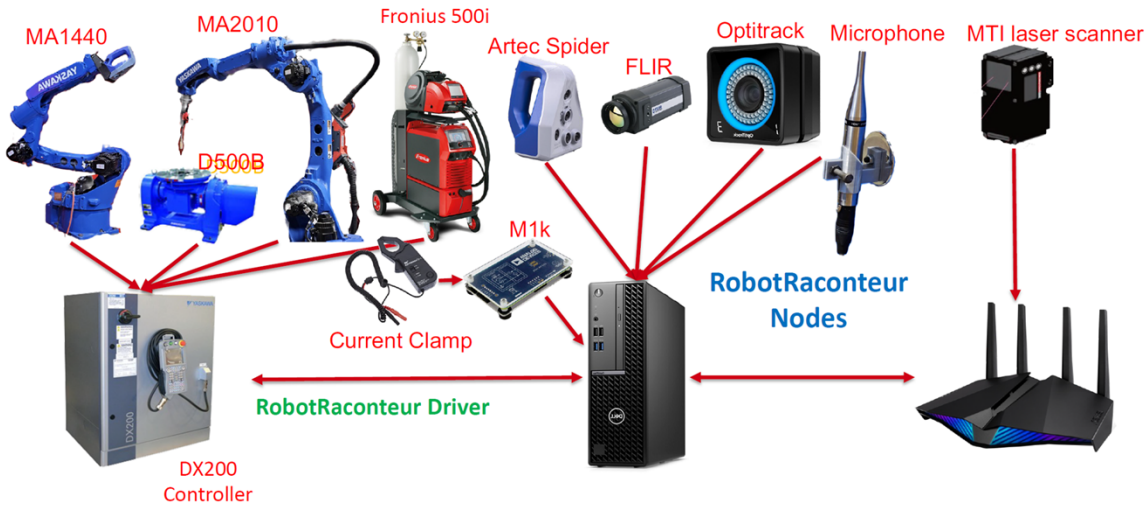
Rapid Welding of Thermoplastic Composite Structures (RTX, CMU)

2023 Highlights: DoD Sustainment



Incremental Forging (OSU, Capsen)

Example: ROS-based project



RPI GE Research SwRI YASKAWA WASON TECHNOLOGY

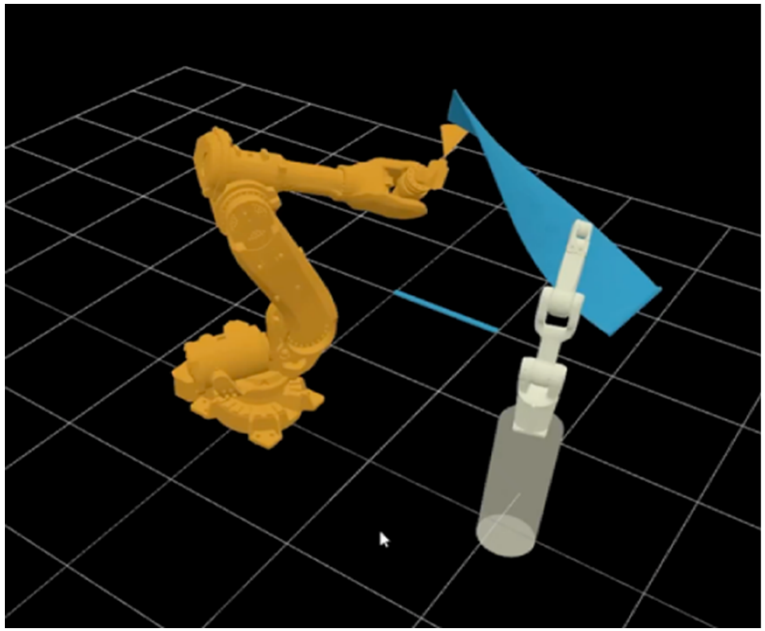
Strengthening Robot System Integrator Engagement

Current situation

- Integrators are the missing **critical link** between ARM Consortium Developed IP (CDIP) and delivering Advanced Robotic Manufacturing capabilities to US manufacturers.

- Need to **reduce risks** for integrators in transitioning lab prototypes and breadboard systems to readiness for pilot production.

Tech Transition to Integrators: Lessons Learned



RPI & GE

Titan Robotics & GrayMatter Robotics

Creating the Process

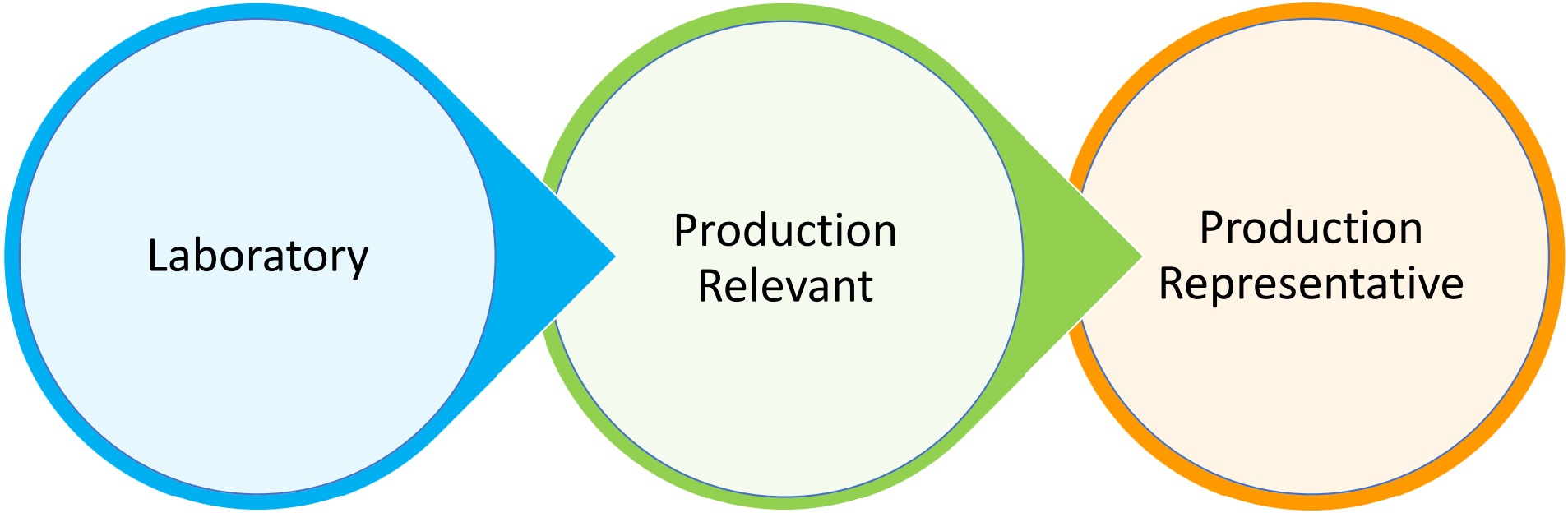
Input Sources:

- Robotics and Automation Technology Suppliers
- Robot System Integrators
- End Users
- ARM Project Principal Investigators
- ARM Funding Sponsors
- ROS-Industrial

Readiness Level Definitions:

- TRL and MRL
- Government Agencies
- Industry Sectors

Transition from Lab to Near-Pilot Production Ready



Accelerating Transition to Near-Pilot Ready

Final project demonstrations

- Production-Relevant or Production-Representative Environments, beyond Laboratory stage
- Operated by production personnel, beyond lab engineers & technicians

• Components, subsystem maturity

- System prototype comprised of components & sub-systems for planned pilot line build

• System architecture and software

- System architecture, networking, operating system, and controls for pilot line build

• System integrators and end users

- Earlier engagement to validate end user production conditions, constraints, targets for productivity, quality, cost

2024 ARM / ROS-Industrial Opportunities

Communication at upcoming events

- ROS-Industrial Annual Meeting, March 27
- Robotic Summit 2024 in Boston, May 1-2
- Automate 2024 in Chicago, May 6

2024 ARM Project Call

• Draft released (members only)	March 11
• Tech Day event at Mill 19 (members only)	April 4
• Final call released to public	April 5
• Concept papers submitted	May 1
• Team presentations	June 11
• Target project start date	On or before July 14

2024 Opportunities

ARM eco-system support for transition to pilot-ready status

- FANUC and Yaskawa interface support
- Integrator-friendly toolkits (Manufacturing Automation Systems, Plus One Robotics, Capsen, others)
- ROS-Industrial tools?
- Coaching project teams as needed (proposal & project execution phases)
- Integrator recruiting visits