ROS-Industrial North America Updates and Application Highlights

Paul Evans

Southwest Research Institute & ROS-Industrial

ROS-Industrial Conference 2019 | Stuttgart | Fraunhofer IPA

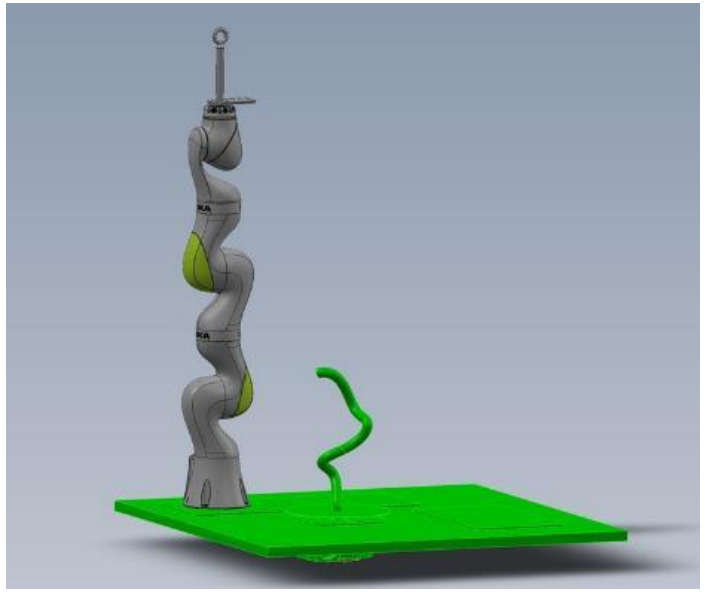
Highlights

- Membership Growth
- Automate 2019
- ROS-I Americas Annual Meeting
- Consortium Member Feedback
- ROS-I Training
- ROS 2.0
- Community Engagement
- Application Highlights

New 2019 Members

Automate 2019

- ROS 2.0 Demo
- Many ROS-I enabled exhibitors



Automate 2019 Star Attraction

2019 ROS-I Consortium Americas Annual Meeting

ROS industrial

Engaging Line Up of Speakers, and working sessions, featuring a Panel on ROS2 – *Is ROS2 Ready for the Factory Floor?*.

Dr. Dave Coleman - CEO of PickNik Consulting

Chris Lalancette - software developer at Open Robotics

Matt Hansen - Sr. Robotics Software Architect at Intel Corporation

Jerry Towler - Software Lead/ROS-M Lead at Southwest Research Institute

2019 ROS-I Consortium Feedback

Direction-Setting Feedback from ROS-I Americas Consortium Membership

- **Soft/Communication Needs/Resources**
  - Perception of Open-Source, ROS, performance, security
  - **Practical Case Studies, ROI Use Cases/Examples, simple explainers (ROS v ROS-I, 1 v 2)**
  - How to for things like: dockers, Windows, application to custom robot
  - **Reduce learning curve**
- **Technical Needs**
  - **Non-programmer user capabilities/tools**
  - Improve simulation capabilities
  - OEM Supported Drivers
  - Industrial Grade Localization
  - **Planners – multi-query, smooth motion in Cartesian space, time consistency**
  - Real-time
  - Use of ROS in leverage of built in controller features (Sensors, grippers, external I/O)
  - **Auto-recovery – all level faults**

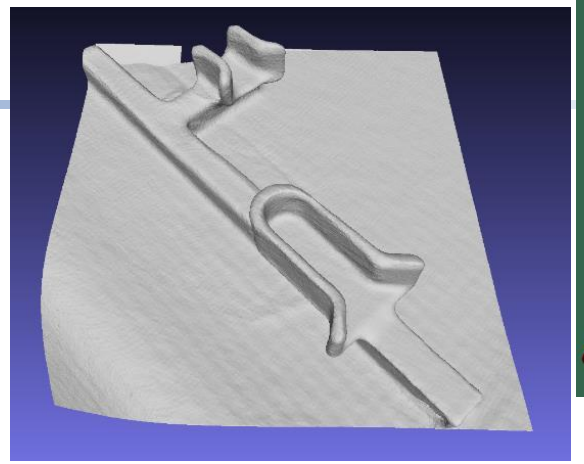
Vision Development for ROS-I High Level/Global

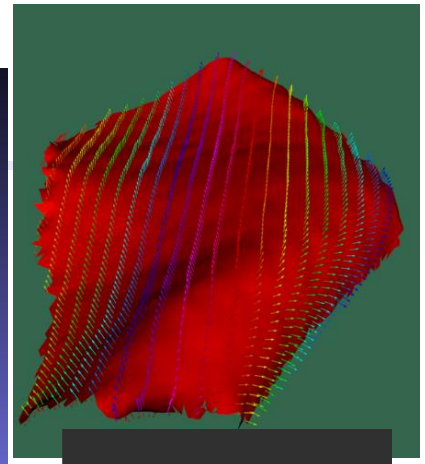
High Level Strategic Goals (examples)

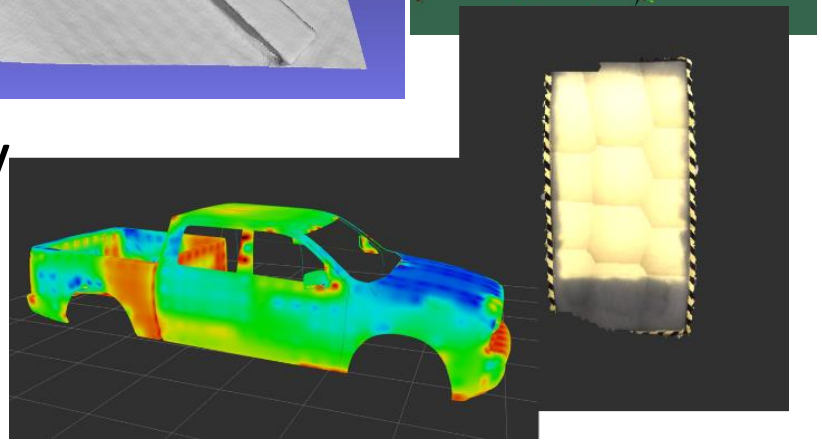
Quality, Improved User Experience, Novel Intelligent Capability

Lower Level Focus Areas/Thrusts

Initiatives







- Building a complete ROS2 system
- Supporting ROS and ROS2
- Launching FTPs relevant to the community
- Providing new capabilities at a greater frequency
  - Tesseract
  - TrajOpt
  - YAK
  - Reach
- More knowledge sharing – perception sensor benchmarking; DDS implementation benchmarking

Goal for Future Development

Environment Layer (MoveIt, Tesseract, Dart, etc.)

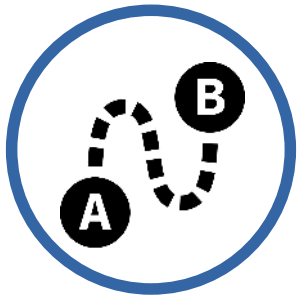
Messages, Topics

ROS 1 / ROS 2 / Middleware Layer

Build ROS1 or ROS2, these are independent

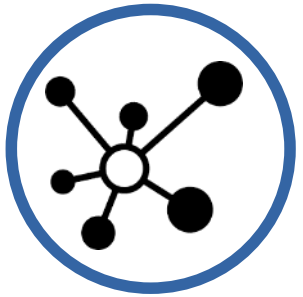
Independent of ROS

Collision Detection



Motion Planners

Kinematic Solvers

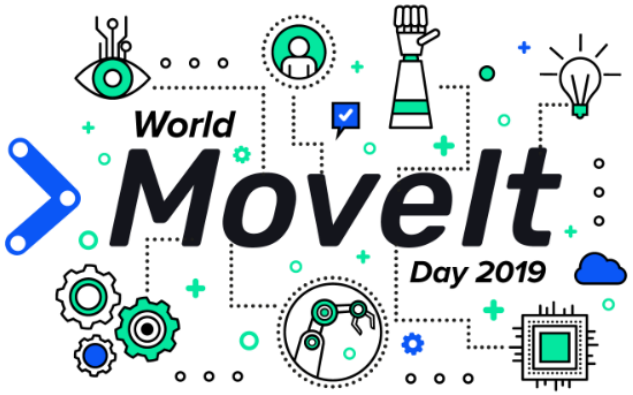


Connectivity Structure

Continue to support deployed end-user ROS1 systems with new capabilities as they are developed even if for a ROS2 solution

Community Engagement

- Meetups
- World MoveIt Day
- World ROS-I Day

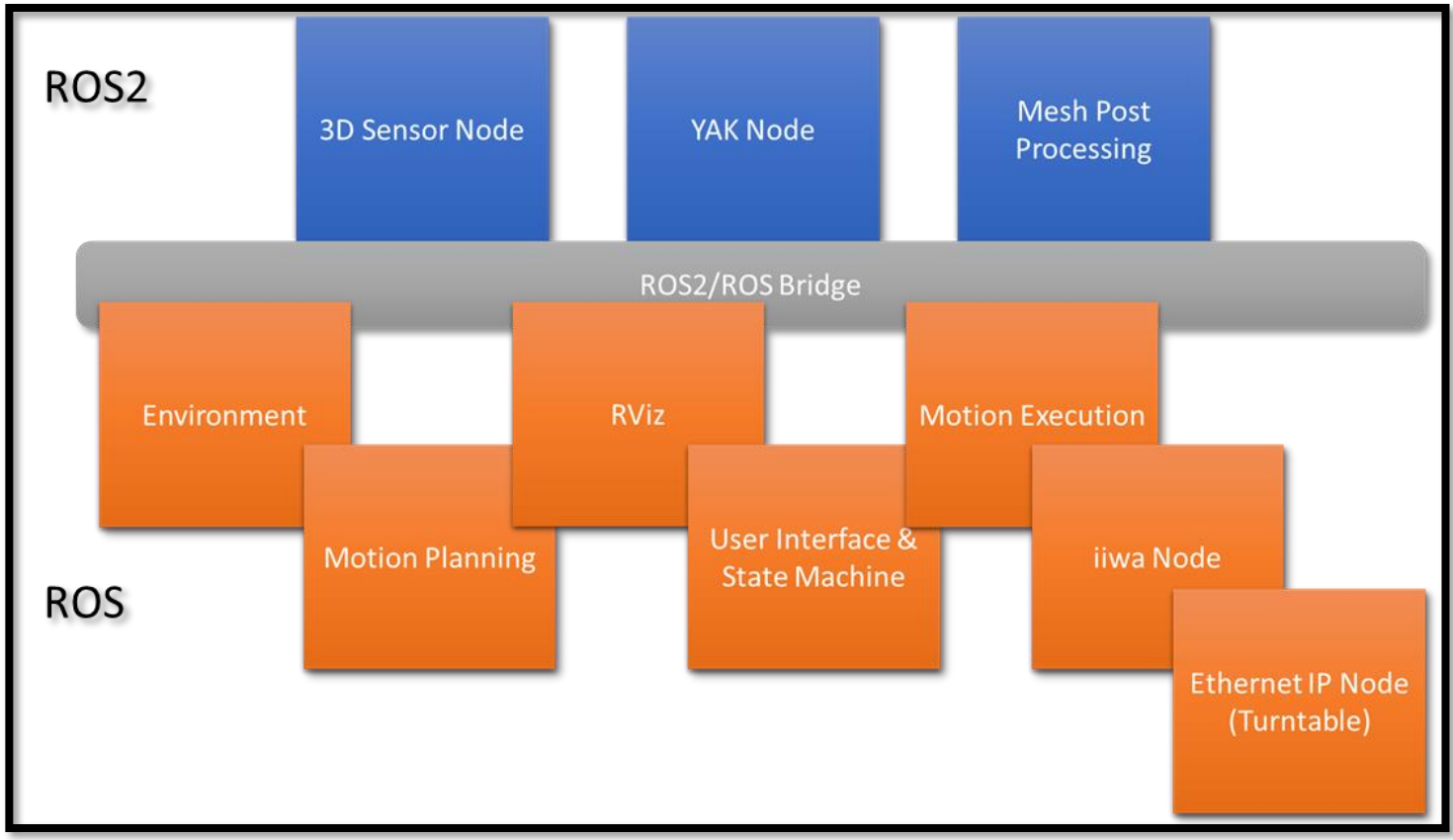


Robotics Meetup at PlusOne Robotics

World ROS-I Day 2019

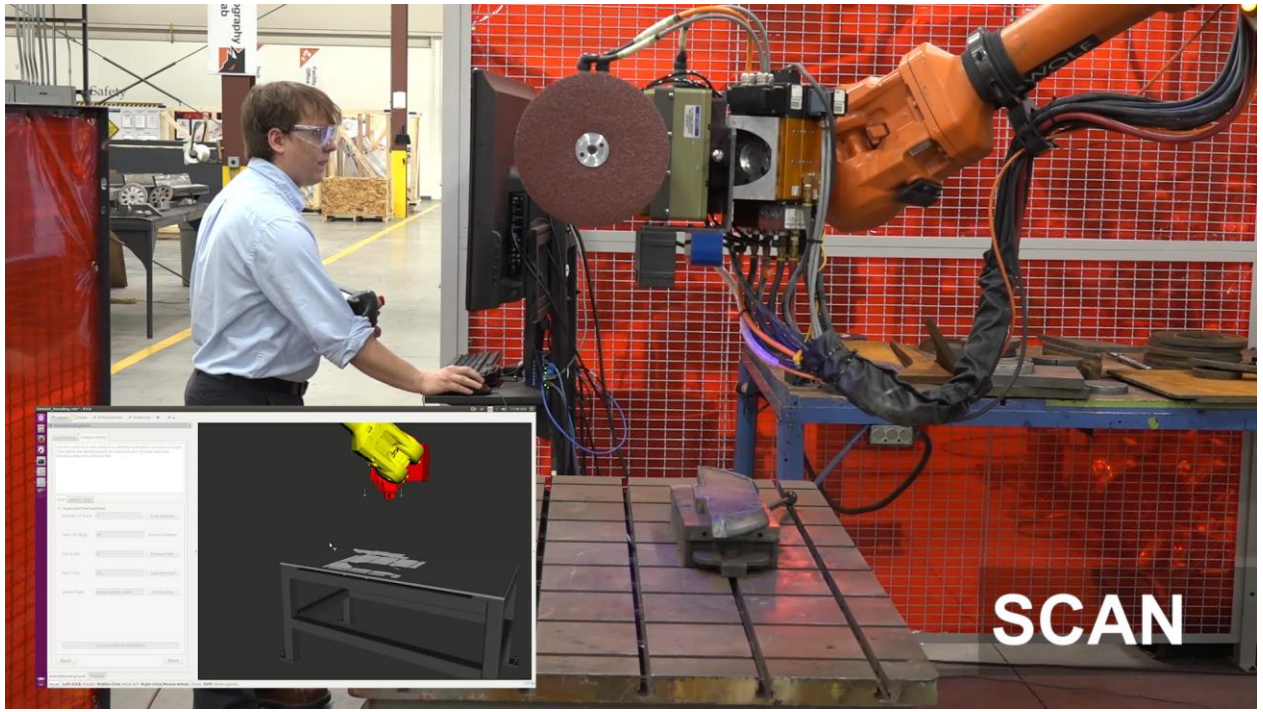
Training

- Introduction to ROS2 (Dashing)
  - Intended for those familiar with ROS
  - Highlight what is different from ROS
  - Exercises include
    - Getting set up
    - Services
    - Actions
    - Porting
    - Utilizing the Bridge
- First course was 8 October in San Antonio, TX



Two Key Mechanisms for Advancing ROS-I

ROS-I Focused Technical Projects



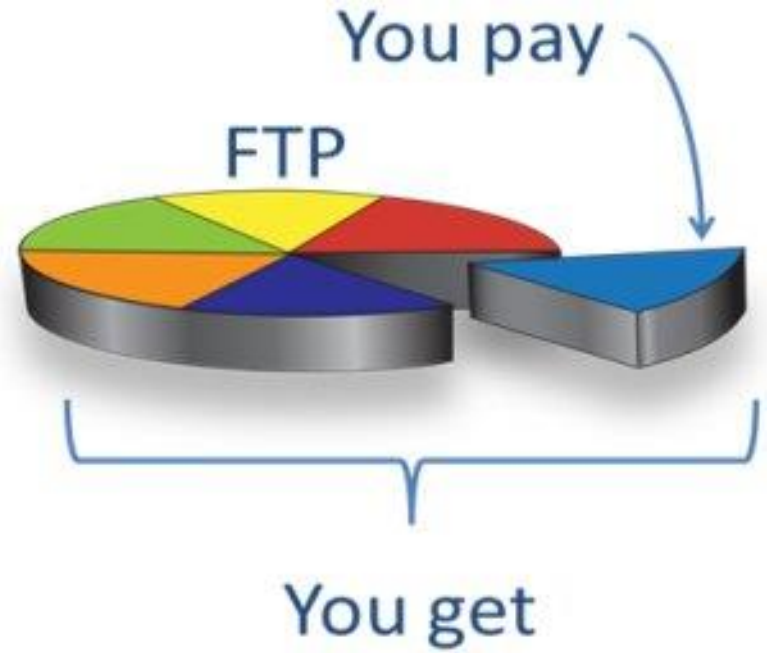
Tech Demonstration of Robotic Blending Milestone 4
Caterpillar, 3M, GKN Aerospace, Wolf Robotics
https://youtu.be/PWCpehyKnTY

Member Contributions & Projects

Visual Programming – Teaching Robots through Demonstration of Tasks
SwRI Internal Research & Development Program

FTP Goals, Process, Topics

- Collaborative Multi-member Projects to Solve Challenges or Develop foundational capabilities th benefit the membership/industrial community
- Championed by a member, usually involves demonstration via application/use case, and costs split equally across team
- Current Topics:



Robotic Blending Milestone 5
Dynamic Reprogramming
ROS-I Workbench
MoveIt2

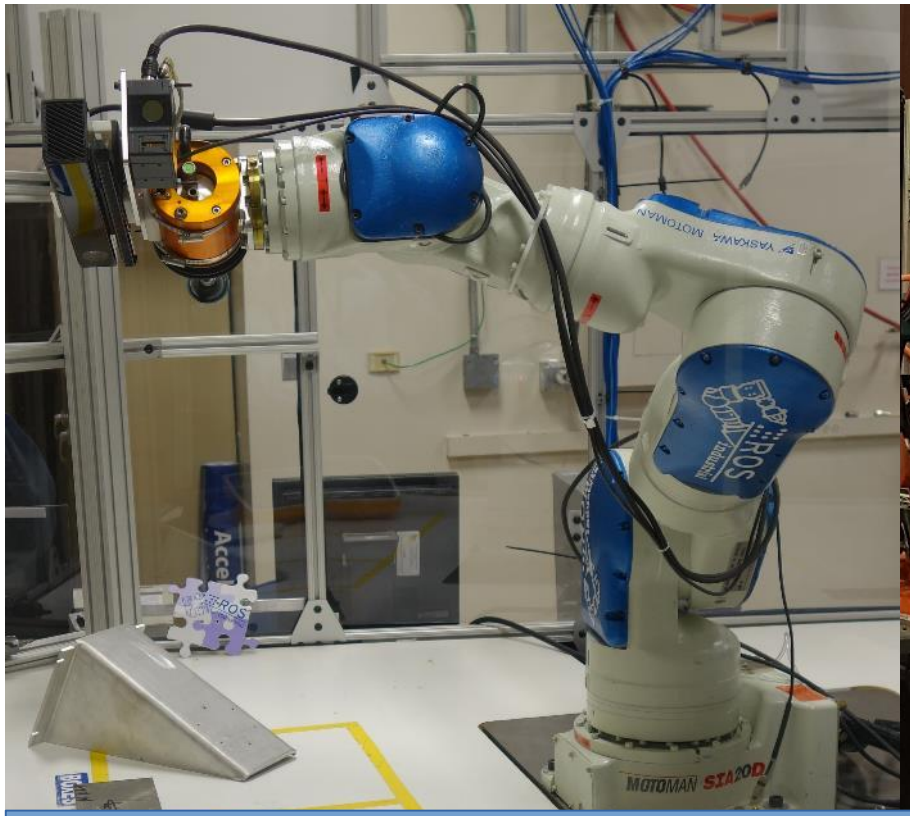
Unified Calibration Framework
Simulation for Verification and Validation
Teaching through Motion Capture
Coordinated Mobility and Synchronized I/O

Recent Projects Launched - Americas

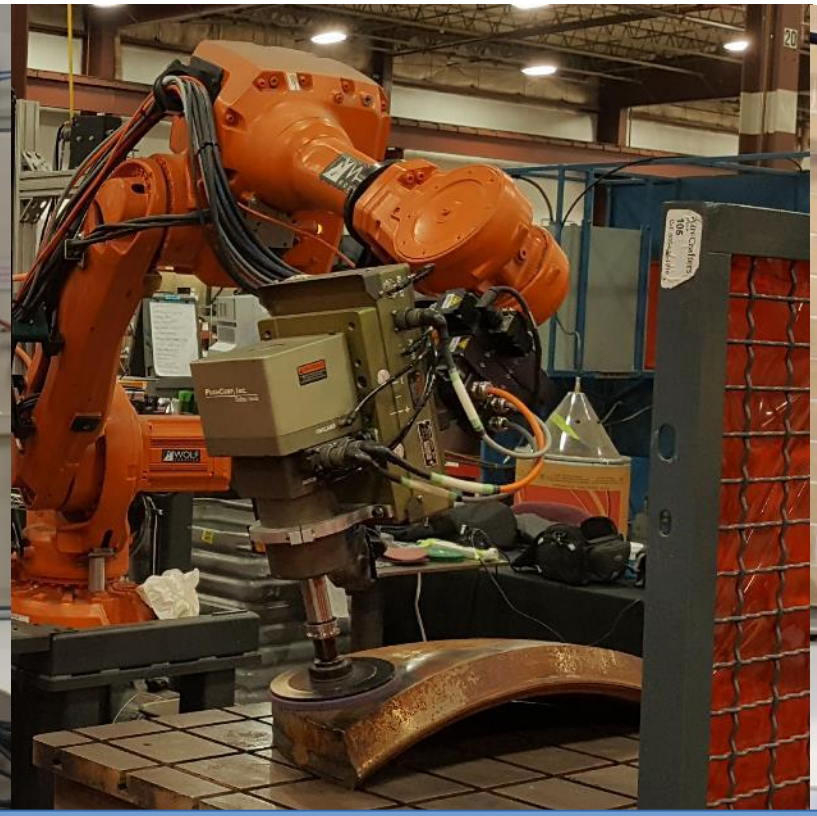
- **ARM Institute Projects Launched Leveraging ROS and ROS-I**
  - ROBOT ASSISTANT FOR COMPOSITES MANUFACTURING
  - SMART COMPANION ROBOT (SCR) FOR AUTOMOTIVE ASSEMBLY
  - COLLABORATIVE ROBOTIC SANDING OF AIRCRAFT PANELS
  - ROBOT RACONTEUR (RR): AN INTEROPERABLE MIDDLEWARE FOR ROBOTICS
  - SEAMLESS MULTI-ROBOT, MULTI-MAC INTEROPERABILITY
  - OPEN SOURCE TEACH PENDANT PROGRAMMING ENVIRONMENT
- **ARM Institute Tech Projects often leverage open-source content and submit back**

Reference: arminstitute.org/projects

Evolution of “Scan-n-Plan”



2014

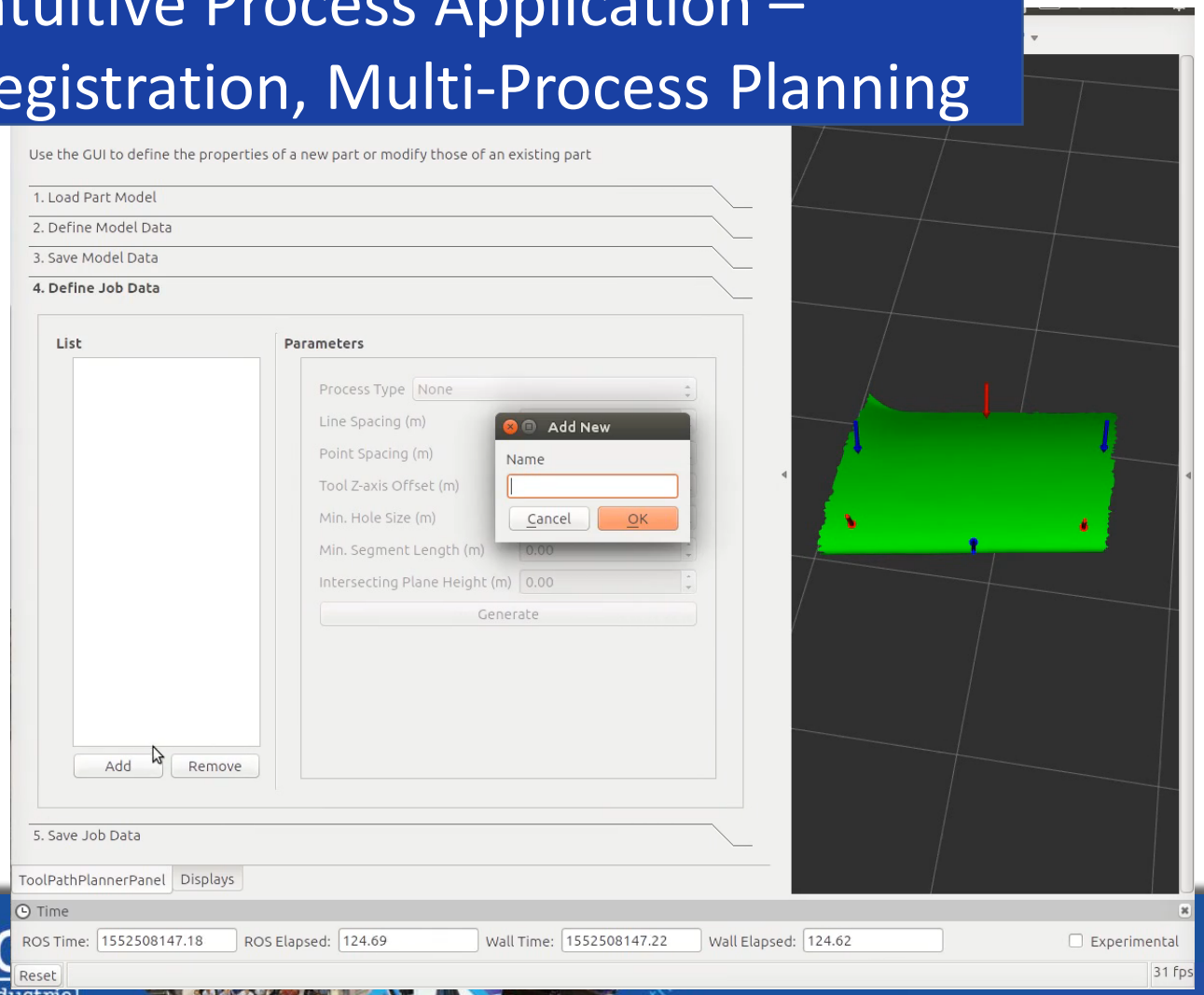


2016

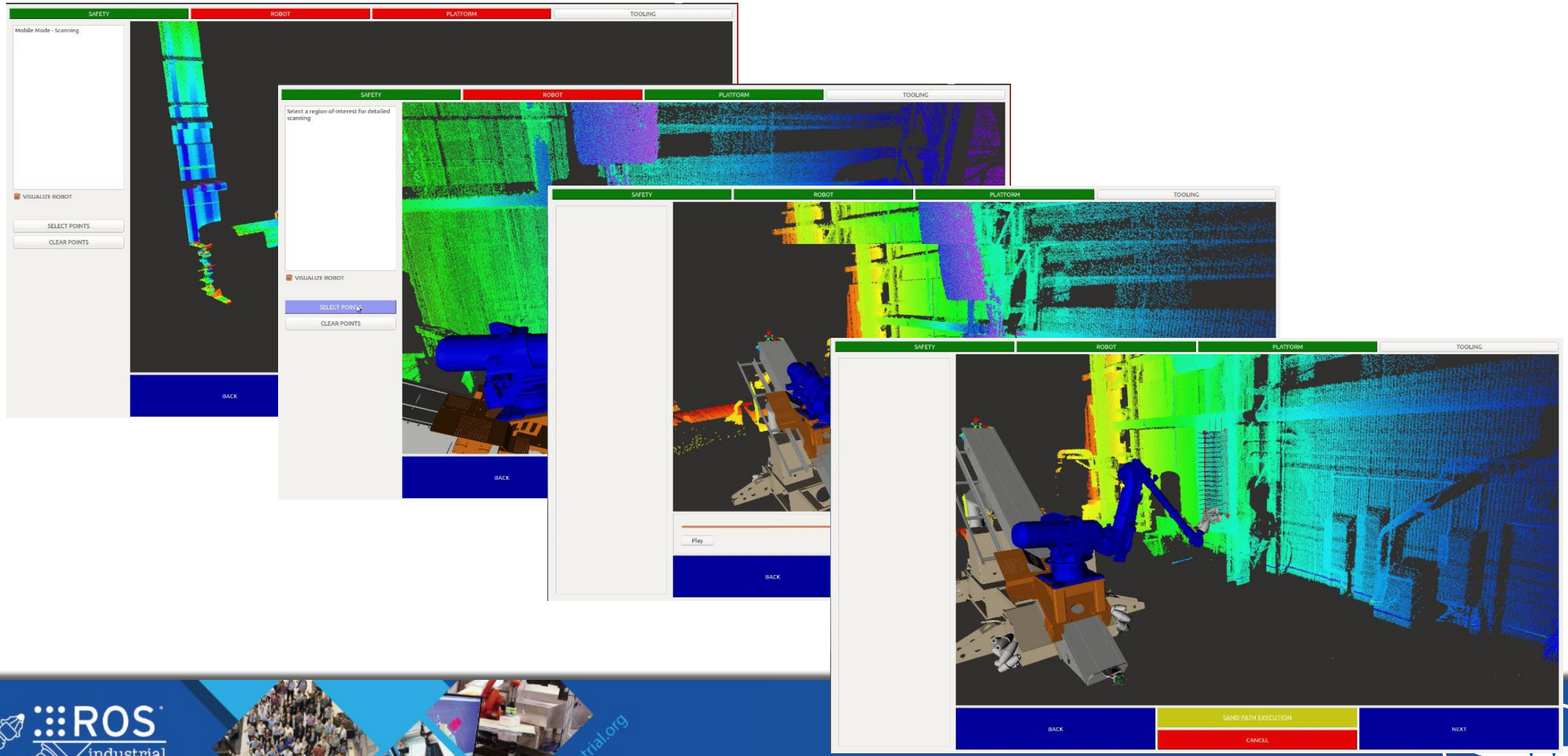
2019

Noether, Tesseract & Trajopt in Action…

Intuitive Process Application – Registration, Multi-Process Planning



A5 – Agility in Aerospace Applications



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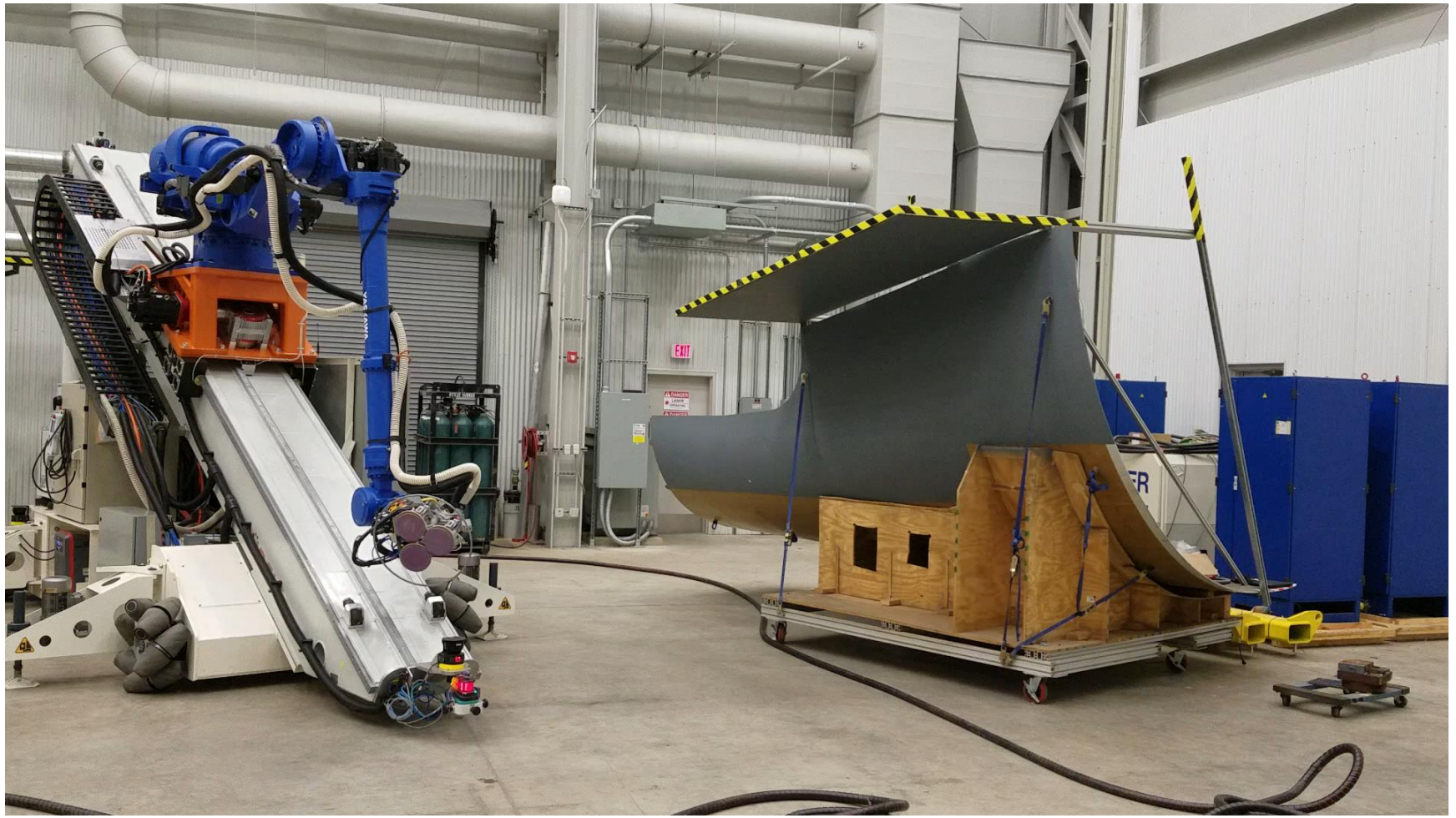
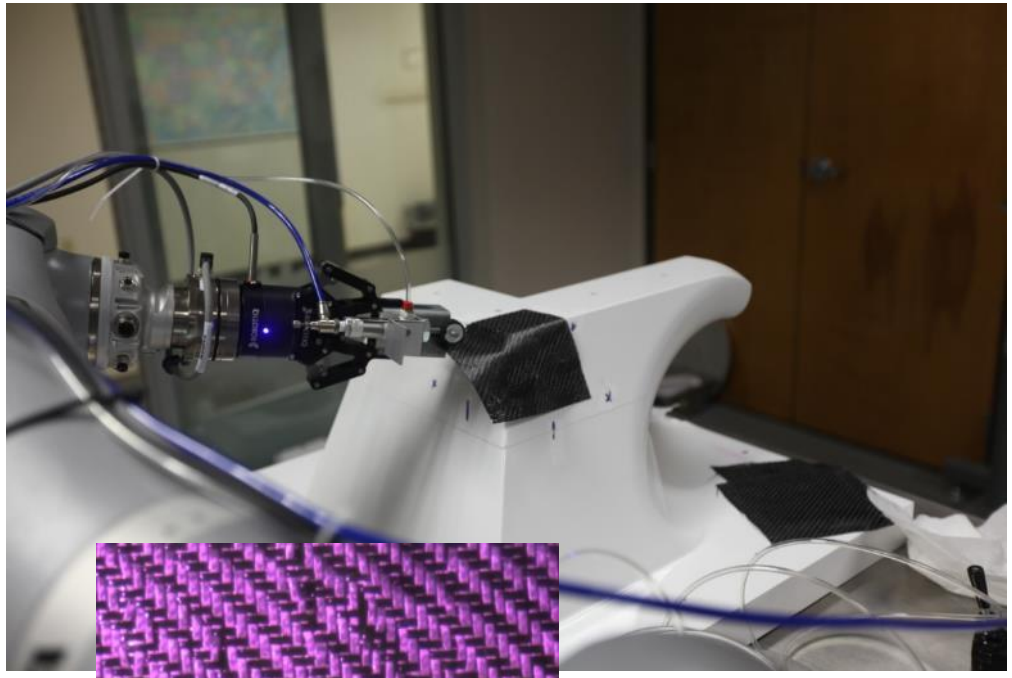


Robotically Integrated Prepreg Layup

- Collaborative Robot Solution – Human and Robot Work Together
- Adaptive solution with ROS-I enable parts of the workflow



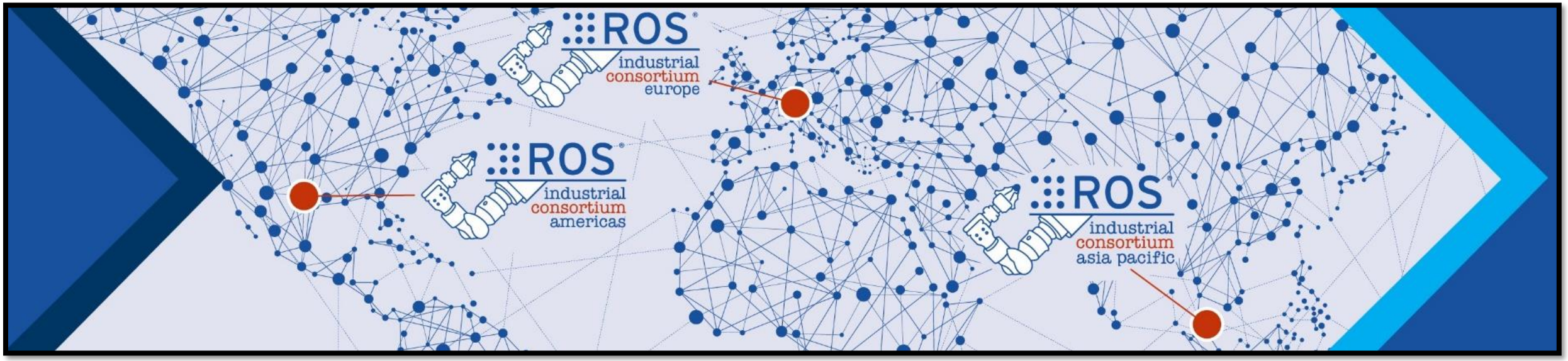
Advanced Systems Development

- Sharing information between multiple traditional industrial systems and tools
- Managing dynamic manufacturing environments
- Reduce reliance on hard to find skill sets and accelerate operations where high mix/low lot is required
- Custom Mobile Robots
  - Bring the process to the part
  - Share information between systems
  - Improved agility
  - Multi-Process
  - Efficiently manage high mix of product

Upcoming Events

- February Training 2020 – hosted by new member Glidewell Laboratories in Irvine, CA
- ROS-I Americas Annual Meeting 2020 – hosted by Southwest Research Institute, San Antonio, TX March 4-5, 2020
  - Day 1 – open to public – presentations and demonstrations
  - Day 2 – members only – use cases, experiences, insights/updates on capability – FTP teaming/project topic workshop

We Advance ROS-I Together



Contact Information

Paul Evans

Director of R&D

Southwest Research Institute (SwRI)
& ROS-Industrial
6220 Culebra Road
San Antonio, Texas 78238

Phone: 1.210.522.2994
Email: Paul.Evans@SwRI.org

Manufacturing.SwRI.org
ROS-Industrial.org