



JOINING  
INNOVATION  
AND EXPERTISE

# Robotic Inspection

Increasing Benefits  
To The Energy Industry

WEBINAR 17 APRIL 2024



JOINING  
INNOVATION  
AND EXPERTISE

## TWI Industrial Membership

**Ameni Lounissi**

Sector Manager, Construction and Engineering

# TWI – The welding Institute



**01** **Research and Technology Organisation**  
Membership based Research and Technology Organisation  
Provide our Industrial Members with reliable and impartial expert advice, knowhow and safety assurance through engineering, materials and joining technologies

**02** **Training and Examination Business**  
World's largest provider of welding technology and Inspection related training for individuals and companies alike  
20,000 people per year benefit from our individual training  
Internationally recognized by certification award body including CSWIP, etc...

**03** **The Welding Institute – Professional Engineering Institute**  
Professional Membership arm of TWI Ltd and was formed in 1923, supporting the development of welding and joining professionals.  
Licensed Member of the Engineering Council



# TWI – Serving Industry for Over 75 Years

- Research & Technology Organisation
  - Established in 1946
- Industrial Membership based
  - Effectively owned by its Members and run by representatives from Member Companies
- Non-profit distributing
  - No share holders
  - All income re-invested in the business for the benefit of Members



# TWI- Overview

Over **600** Experts & Engineers



Over **1800** Projects per year



Over **600** Member Companies



**4** Technology Centres

**10** Global Offices  
Training Centres



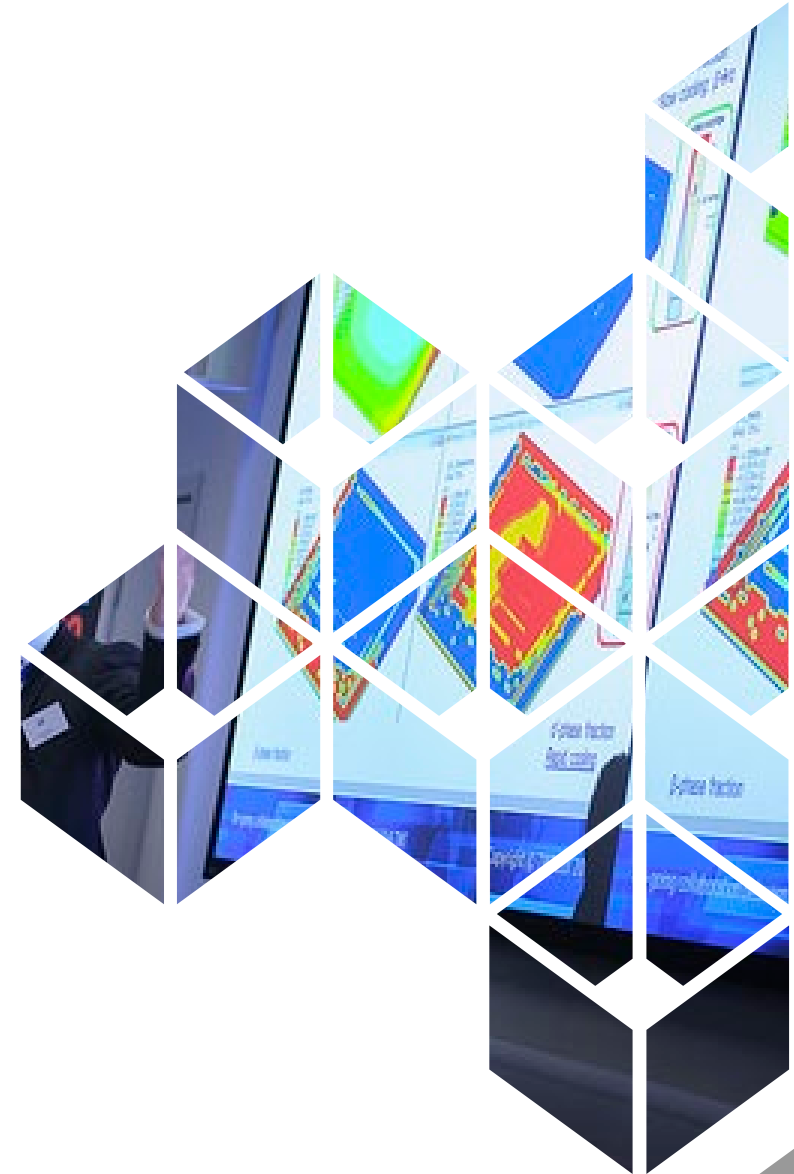
# The industry sectors we serve



Transport, Energy, Supporting Industries  
and Supply Chain

# TWI – Serving Industry for Over 75 Years

- Accelerate the uptake of new technologies
- Improve existing processes and production
- Design and engineer for optimum performance
- Establish FFS of structures and assets
- Understand cause of failures and mitigation
- Understand and apply codes and standards
- Train and develop



# TWI Technologies and Expertise



## Advanced Manufacturing

- Arc welding
- Electron Beam
- Friction & Forge
- Furnace Technologies
- Laser & Sheet
  - Additive Manufacture
  - Resistance Welding
  - Mechanical Fastening
- Joining Systems Integration
- Micro-technology



## Materials and Integrity

- Materials Performance & Ferrous Alloys
- Corrosion Testing
- Stainless Steels & Non-Ferrous Alloys
- Non-metallics (composites, polymers, adhesives, functional coatings...)
- Asset Integrity Management
- Fracture Integrity Management
- Fatigue Integrity Management
- Thermal Spray & Surfacing



## NDT

- Long Range Ultrasonic Testing
- Non-Destructive Testing
- NDT Validation
- Condition & Structural Health Monitoring



# Member Services - Inclusive

- Unlimited user access to information resource through our **website**
  - Over 6,500 content items
  - more than 1,000 frequently asked questions
  - TWI Digital Library
- Support Members **technical enquiries** (via e-mail, web-site or telephone)
  - Response within **24 working hours**
- **Pre-Paid consultancy Allowance or PCA (20%)**
- **Meet Members at TWI** for in-depth technical discussion on specific issues
- Provide access to the **Core Research Programme Reports**
- E-newsletter - Events update
- Dedicated **Technical Webinars**
- Industry **Panel Meetings**
- **Professional Membership**
- **Member Showcase**

For Industrial Members only

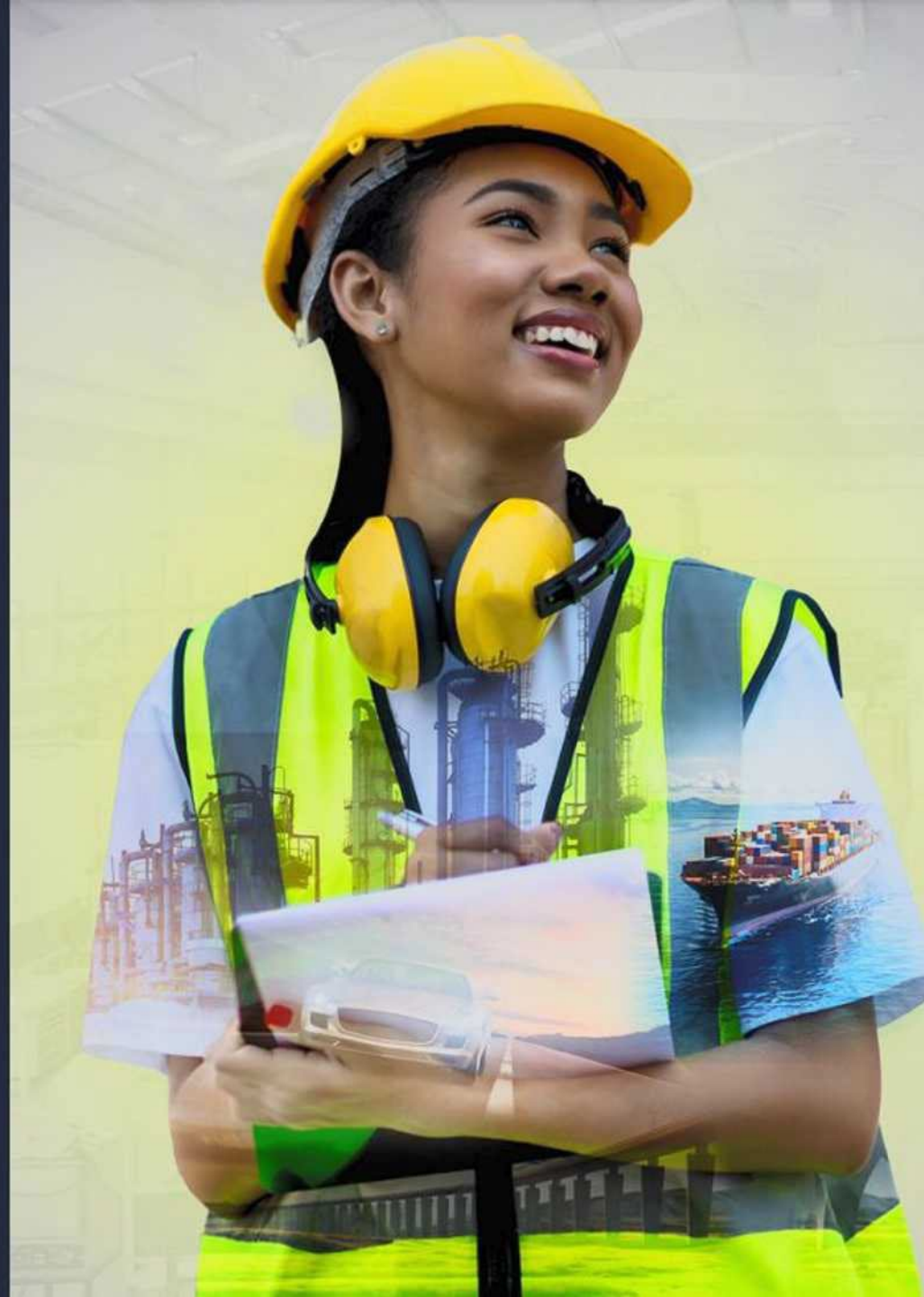
# Member Services by Proposal

- Conduct R&D/testing & analysis/consultancy projects
- On-going Joint Industry Programmes (JIP) for Industry
- Buy back of past JIP reports
- Attend project meetings with or on behalf of Members
- Third Party projects – e.g. Supply chain, inspection, expert witness, litigation
- Training & Examinations (10% discount applied on advertised courses)
- TWI Software (Discounts on selected products)



# GLOBAL TECHNICAL SOLUTIONS

Ali Elkordi  
Regional Engineering Manager-MENA



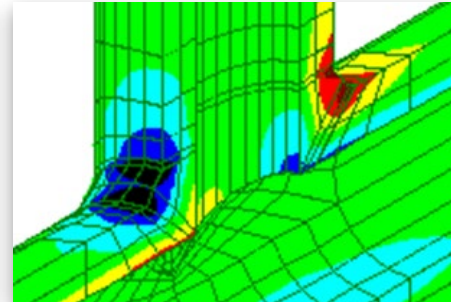
# Our Services



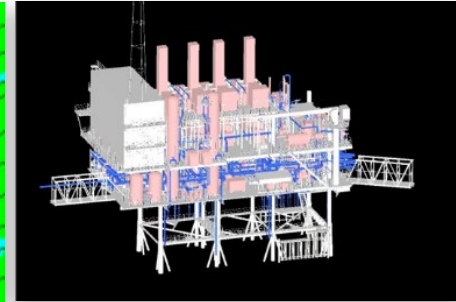
**Bespoke Inspection  
Rope Access  
Underwater**



**Inspection  
(NDT & ANDT)**



**Engineering**



**3D Modelling**



**Manpower Supply**



**Aged, Existing assets  
condition assessment and  
monitoring**

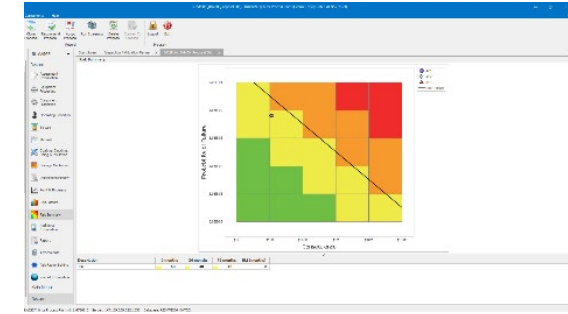
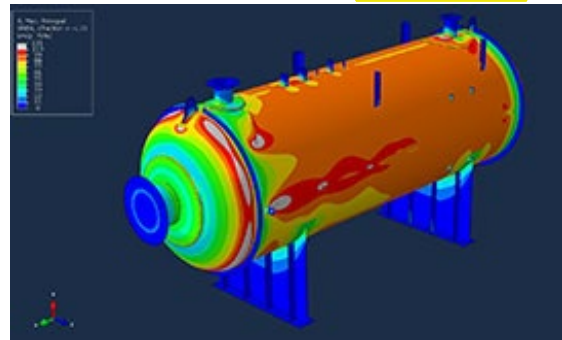


**Preparation; WQT,  
WPS&PQR, NDT  
Procedures**



**Technical  
Consulting**

# Engineering services



### Power-RBI An Integrity Solution for Power Plants

A TWI & Antea Collaboration

Advanced risk and life management software developed for boilers integrity management based on formal risk-based inspection practices.

Use RiskWISE® for boilers software to better target and schedule inspection and maintenance activities.

- Web-Based Software made in collaboration with Antea
- Compliant with API 580, API 581, ASME PCC-3, API 570, EPRI
- Fully integrated electronic AIM tool, equipped with IDMS
- 2D/3D visualisation of the assets and TMLs

**Contact us today** and discover how TWI Software can enhance your services!

110, 1 Jalan Ulu Bendu, Section 11, 46100 Shah Alam, Selangor Darul Ehsan, Malaysia | +603 2988 1000 | [risewise@twi.co.uk](mailto:risewise@twi.co.uk)

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### Empower Your Assets with CorrosionWISE

TWI's AI powered Corrosion Screening Technology

- Powerful yet user-friendly ML tool
- Seamlessly integrates with other tools
- Continuously learning and improving
- Cost-effective for corrosion monitoring
- Generalisable for wider applications
- Leverages next operational factory

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# Software in Global Technical Solutions

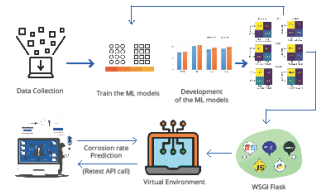
- Powerful yet user-friendly ML tool
- Seamlessly integrates with other tools
- Continuously learning and improving
- Cost-effective for corrosion monitoring
- Generalisable for wider applications
- Leverages asset operational history



## Empower Your Assets with CorrosionWISE

### TWI's AI powered Corrosion Screening Technology

- Corrosion is a major problem for the safety of piping systems in industries like oil and gas.
- Traditional methods for assessing corrosion are time-consuming and subjective.
- Artificial intelligence can increase the efficiency of corrosion assessment by creating predictive models based on data from various sources.
- This project uses machine learning models trained on historical data to estimate the rate of corrosion, providing a powerful screening tool.
- The output of this tool can be used to estimate remaining life and plan repair and replacement tasks proactively, reducing the likelihood of failure and downtime.
- As more data becomes accessible and the models become more complex, machine learning-based tools like CorrosionWISE have the potential to revolutionise how industry assesses corrosion.



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## Power-RBI

### An Integrity Solution for Power Plants

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- 2D/3D visualisation of the assets and TMLs



Contact us today and discover how TWI Software can enhance your services!

No. 1, Jalan Utamad US/13, Section US, 40150 Shah Alam, Selangor Darul Ehsan, Malaysia | +603 7848 1000 | riskwise@twi.co.uk

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## IntegriWISE™



### IntegriWISE™

IntegriWISE™ is a Fitness-For-Service (FFS) assessment software tool designed by TWI to assist engineers in evaluating the integrity of ageing pipework, pipelines, storage tanks, boilers, pressure vessels and high temperature equipment. It is the fastest and easiest software tool to undertake FFS assessments. IntegriWISE™ is designed to help calculate and record FFS assessments for industrial plants and equipment.



FFS assessments are conducted to assess the structural integrity of a component, and its suitability for continued service under the same or changing conditions. Procedures such as API 579/ASME FFS-1 enable the integrity of critical components and welded structures to be assessed against different failure modes, using a validated engineering approach. The methods can be used to support design, fabrication, operation, change-of-service, and life extension programmes, and are employed in a range of industries.

FFS assessment is widely used as part of the plant life management process, to increase availability, reliability, efficiency and safety. The FFS concept has become accepted practice throughout the engineering community for asset integrity management.

IntegriWISE™ is designed to assess pressure equipment against different damage mechanisms such as general and local metal loss, pitting corrosion, blistering, hydrogen



damage, crack-like flaws and laminations. In addition, the system provides evaluation techniques for assessing resistance to brittle fracture.

This software complements TWI's existing suite of integrity management software such as RiskWISE™ and CrackWISE™ and can be integrated with other software packages for additional features relating to asset integrity management.

### Key benefits of IntegriWISE™

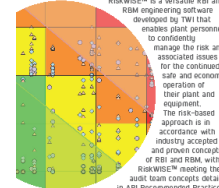
- Automates Level 1 and Level 2 FFS assessments described in API 579/ASME FFS-1.
- All assessments are rigorous applications of a selection of the most widely used and relevant FFS standards or procedures from API and ASME (eg. API 579-1/ ASME FFS-1 2007, ASME B31.G).
- Material databases from the following design codes are included in the software: ASME VIII ASME B31.3, ASME B31.4, ASME B31.5, PD 5500, API 650, and API 650.
- IntegriWISE™ offers the next generation in plant integrity management systems, by allowing engineers and managers to improve safety, and plant availability and reliability through targeted inspection and maintenance costs.
- Decision-support software designed to assist engineers in evaluating the integrity of pipework, pipelines, pressure equipment and high temperature structures.
- Full customer support and after sales service.



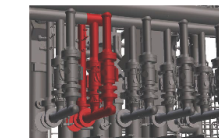
## RiskWISE™

### RiskWISE™ for process plants

The uptake of formal risk-based inspection (RBI) and risk-based management (RBM) approaches is increasing as the benefits to asset integrity management through improved targeting and scheduling of inspection and maintenance effort are being recognised.



RiskWISE™ is a versatile RBI and RBM engineering software developed by TWI that enables plant personnel to confidently manage the risk and associated issues for the continued safe and economic operation of their plant and equipment. The risk-based approach is in accordance with industry accepted and proven concepts of RBI and RBM with RiskWISE™ meeting the audit team concepts defined in API Recommended Practice (RP) 580 – Risk Based Inspection (RBI) and API RP 581 – Risk Based Inspection Technology (RBIT).



### Key features of RiskWISE™

- Fully quantitative RBI assessment as per API RP 581
- Semi-quantitative assessment as per industry best practice
- Inspection frequency determined for all types of assessment
- Thickness measurement data import and corrosion growth prediction
- Sensitivity analysis capabilities, ideal for situations where data is unavailable
- Customisable reporting capability
- Unlimited number of items at one site
- Hierarchical asset register information
- Possibility of remote hosting
- Comprehensive inspection / Mitigation Planner
- Automatic change mechanisms screening
- Single and documentation storage
- Web programming language and SQL database

### Additional benefits of RiskWISE™

- Integration with TWI's IntegriWISE™ software for fitness-for-service assessments
- 2D/3D laser scanning interactive viewer
- Technical support on an on-going basis
- Material Library
- Software upgrades if required for specific industry and plant covered by bespoke software modules



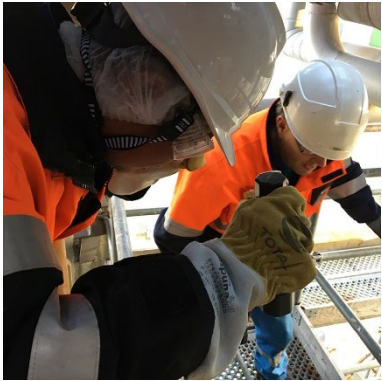


# The SPRINT Robotics Collaborative

[www.sprintrobotics.org](http://www.sprintrobotics.org)

**Niels Westendorp**  
Program Manager European Chapter

# WHY ROBOTICS FOR INSPECTION AND MAINTENANCE?



**Safety improvement**



**Environmental performance improvement**



**Cost avoidance and reduction**



**Performance improvement**





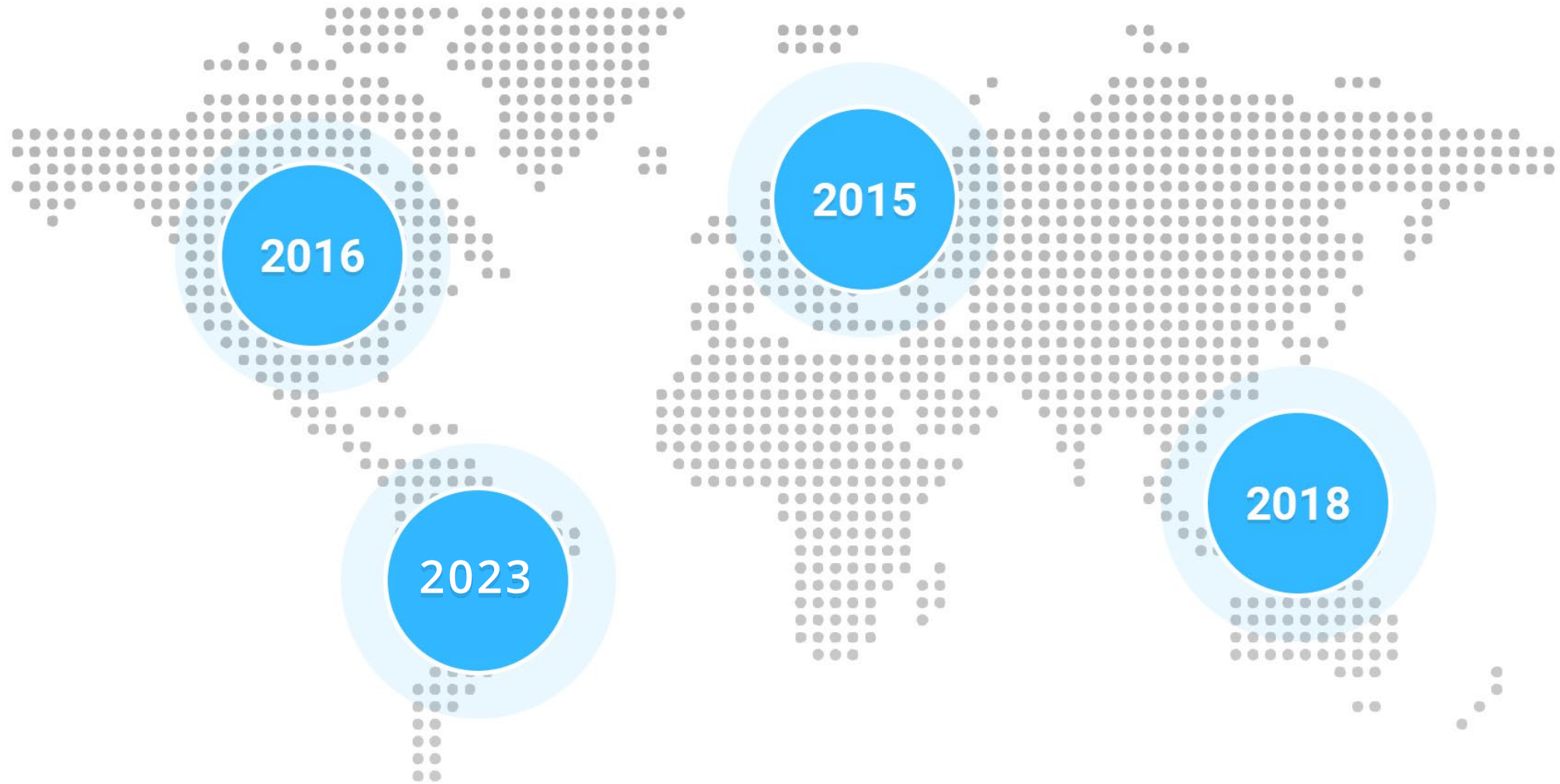
Industry-driven, not-for-profit organization  
Support base of more than 130 organizations globally



To achieve field use of Robotics for I&M of capital-intensive infrastructure assets on a large scale to address immediate needs and long-term industry priorities



SPRINT Robotics strongly focuses on the **value** that robotics for I&M can deliver to **end-user organizations**

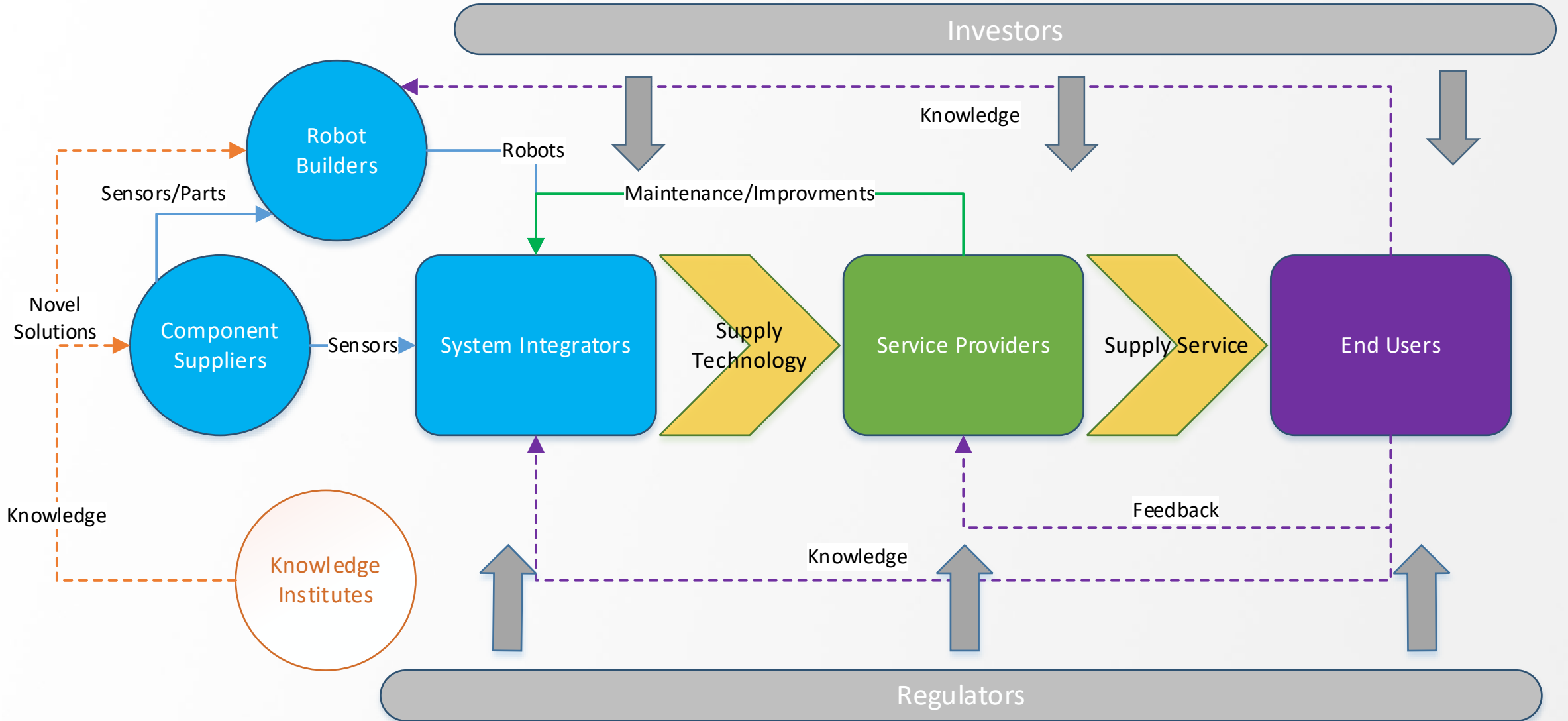


# Participants



# Associate Participants





## Action Groups



**AGST**

Action Group Storage Tanks



**AGPV**

Action Group Pressure Vessels



**AGPP**

Action Group Process Piping



**AGRO**

Action Group Remote Operators

# Comparison of Robotic and Human-Entry Inspection of Pressure Vessels

- Internal Publication in SR Community
- Find the report here:
  - <https://community.sprintrobotics.org/14402/SPRINT-Robotics-Comparison-of-Robotic-and-Human-Inspection-of-Pressure-Vessels-Report>



## Robotic vs Human Inspection at TOTAL OLEUM



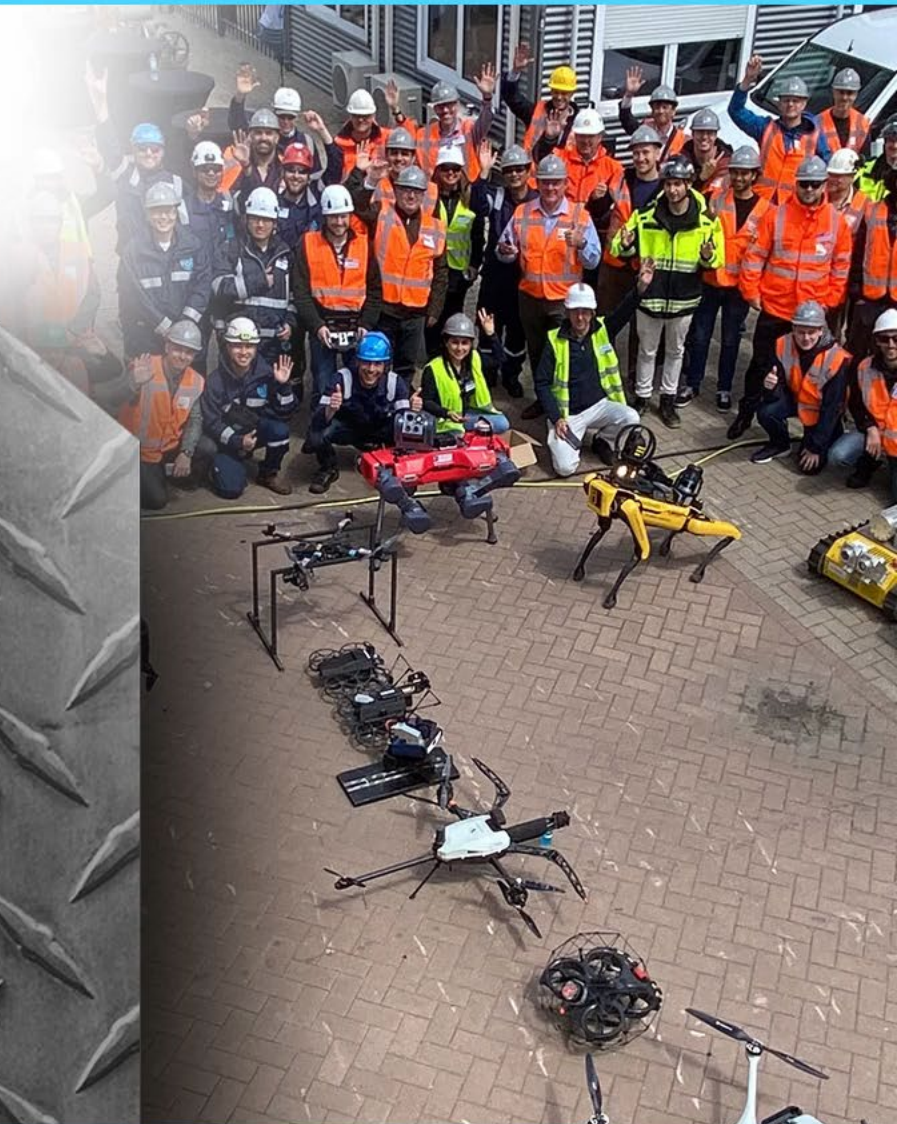




# ROBOTICS FITNESS CHALLENGE

 BRAZOSPORT COLLEGE,  
LAKE JACKSON, TEXAS, USA

MAY 31 – JUNE 1, 2023

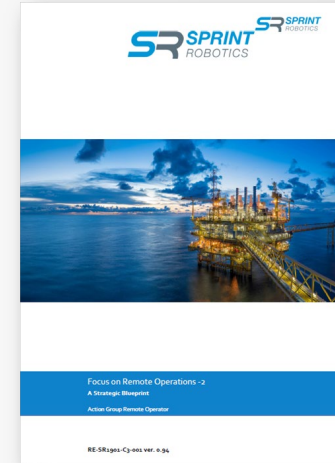
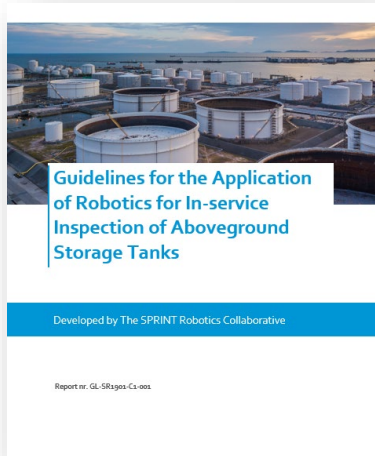


VENUE SPONSOR



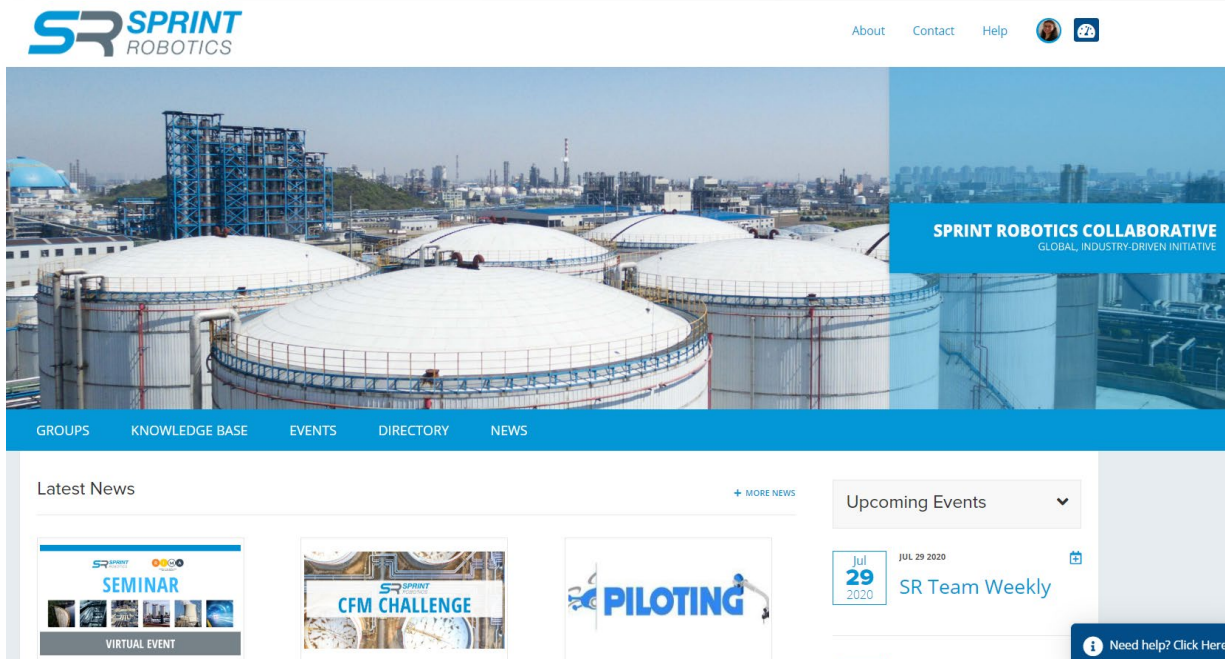
- Webinars & Seminars
- SR Community
- Publications
- Robotics Fitness Challenges
- Roadshows
- World Conferences





- Guidelines for the Application of Robotics for In-service Inspection of Aboveground Storage Tanks
- Guidelines for the application of Robotics for the Offline Inspection of Pressure Vessels
- Focus on Remote Operations
- Inspection and Maintenance Robotics Standardized Trials and Validation
- Standard Test Methods for Remote Operations; Operator Rounds & Incident Response
- Artificial Intelligence for I&M of Steel Constructions

# SR COMMUNITY



- Online community platform exclusively for SPRINT Robotics Participants and Associate Participants
- A place to collaborate, share knowledge, & keep up-to-date with SPRINT Robotics events and activities

[community.sprintrobotics.org](https://community.sprintrobotics.org)





# WORLD CONFERENCE FOR INSPECTION & MAINTENANCE ROBOTICS 2024

29 - 30 OCTOBER 2024

A Room With A ZOO | Antwerp, Belgium

LEADING GLOBAL CONFERENCE DEDICATED TO  
INSPECTION & MAINTENANCE ROBOTICS



[www.sprintrobotics.org](http://www.sprintrobotics.org)



[linkedin.com/company/sprint-robotics](https://linkedin.com/company/sprint-robotics)

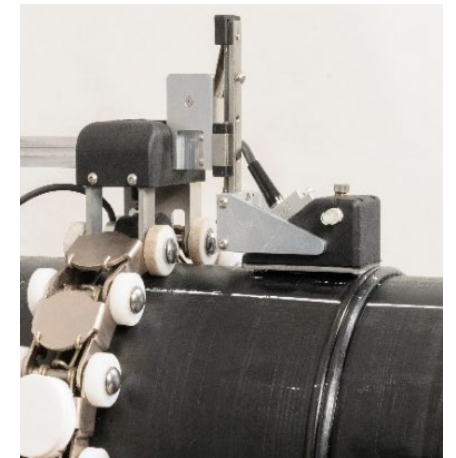
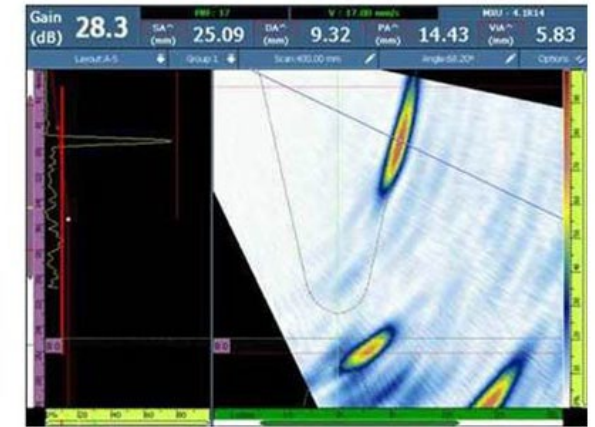


[sprintrobotics@sprintrobotics.org](mailto:sprintrobotics@sprintrobotics.org)

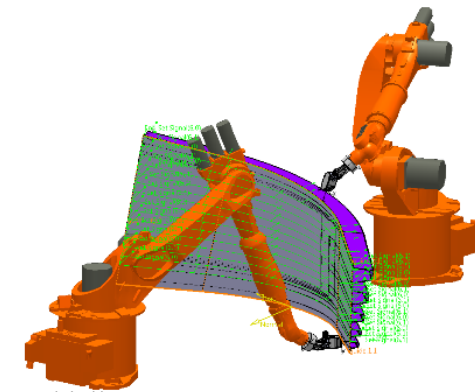


[twitter.com/SPINTRobotics](https://twitter.com/SPINTRobotics)

# Non-Destructive Testing



**Dr. Richard Lewis MIET, MBIInstNDT**  
Business Development Lead- Advanced NDT



# TWI's Non-Destructive Testing Group

TWI's Non-Destructive Evaluation (NDE) Group brings together expertise from TWI's Cambridge Headquarters with two regional, specialist Technology Centres.



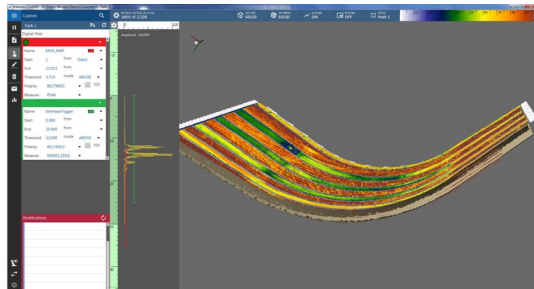
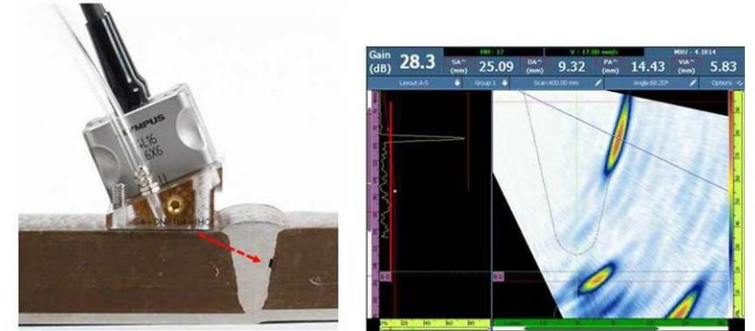
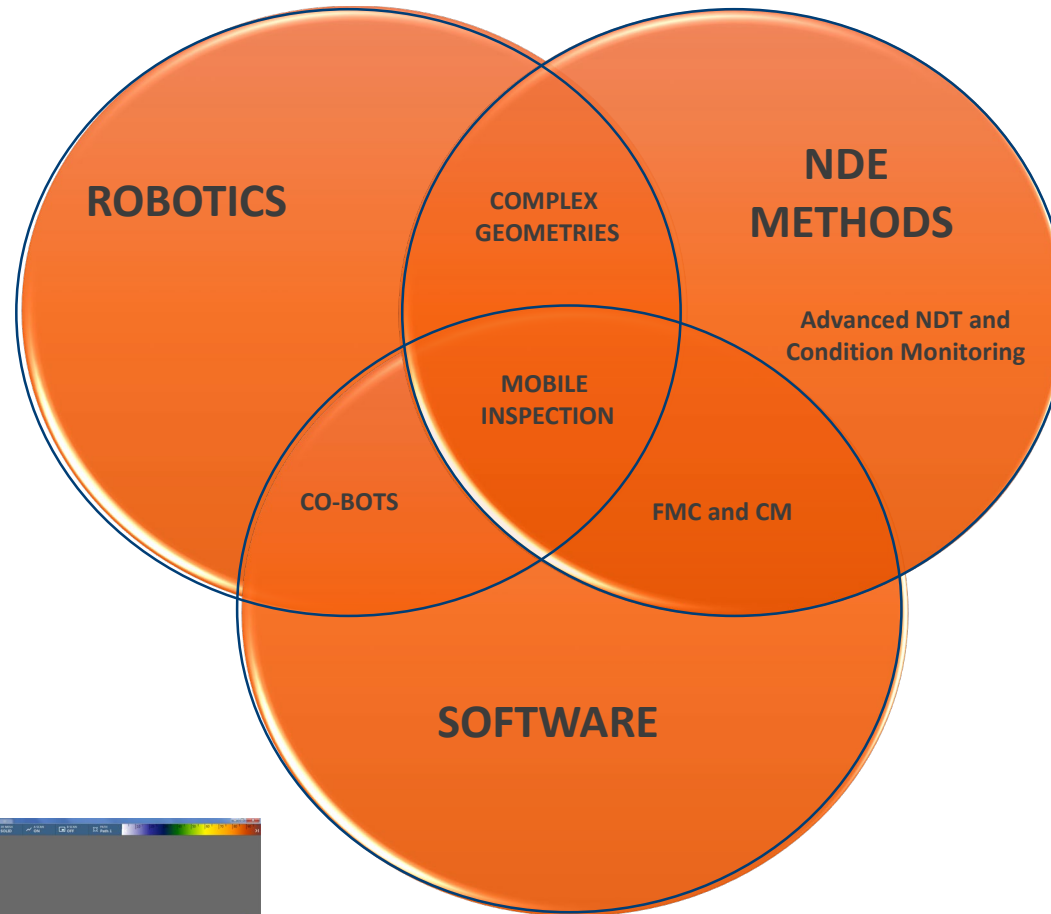
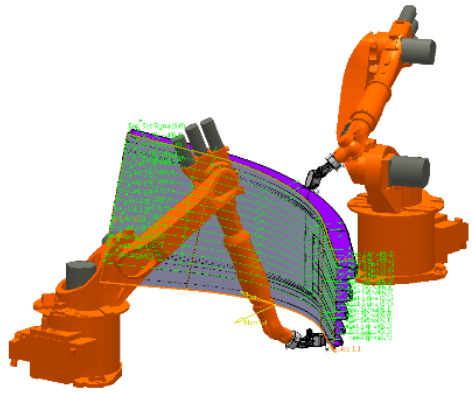


## TWI Technology Centre (Wales)



The Port Talbot site in South Wales, UK is a purpose built facility for NDT, housing the state of the art in NDT technology after receiving £20m investment from TWI and Welsh Government. This site is also home to the NDT software team that supports the integration of NDT instruments, robotics and automated vehicles with user interfaces that support bespoke applications.

# Digitisation in NDT



Advanced ultrasound  
Radiography  
Electromagnetics

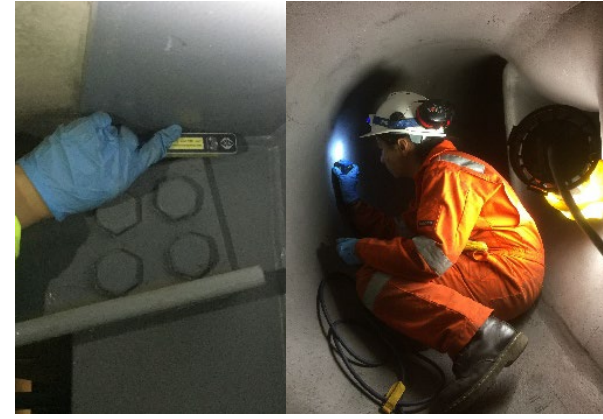
# NDE Inspection Capability Highlights



Offshore inspection



Polyethylene pipe weld inspection



Steel Inspection



WTG Blade Root inspection



Long Range UT



Acoustic Emission and Vibration Monitoring

Advanced Ultrasonic Testing

Eddy Current Array

Tap Testing

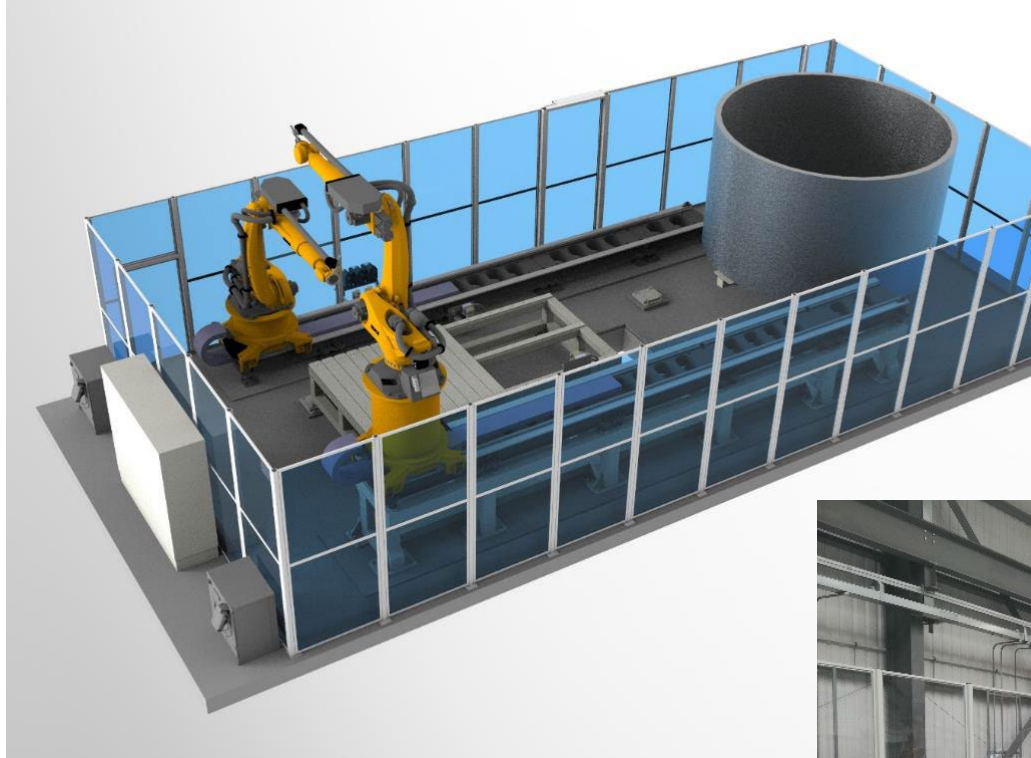
Microwave/terrahertz inspection

# Non-Destructive Testing

**Ross Hanna**  
Project Leader Robotics



# Automated & Robotic Inspection

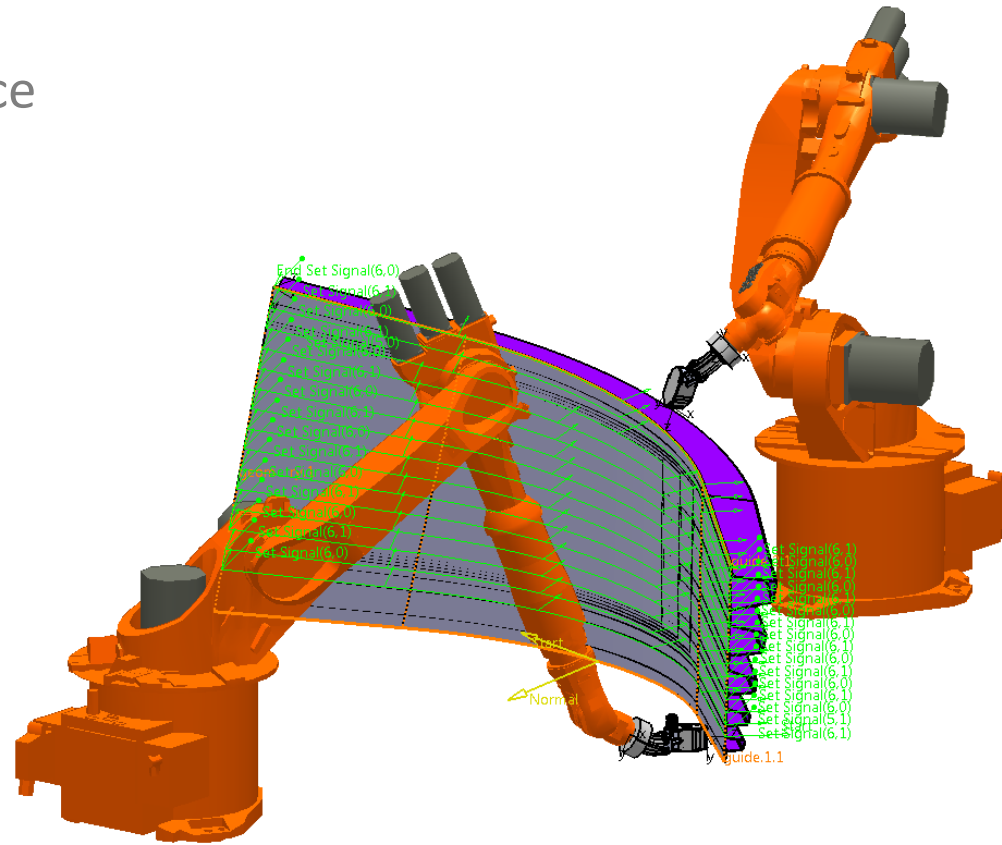


2 x 10m tracks  
4m dia Turntable  
Can accept parts 14m Long x 5m High

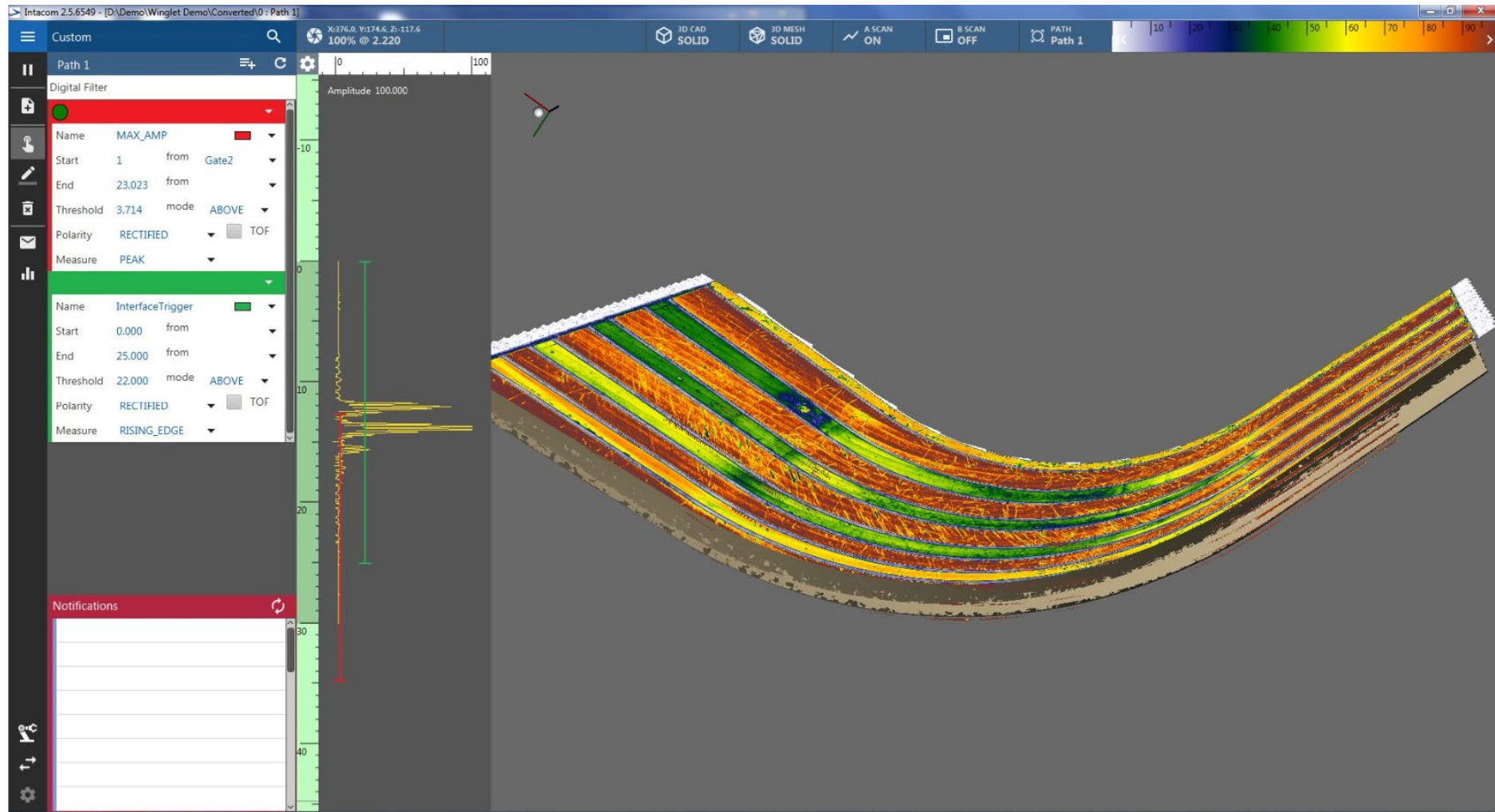


# Complex Geometry Inspections

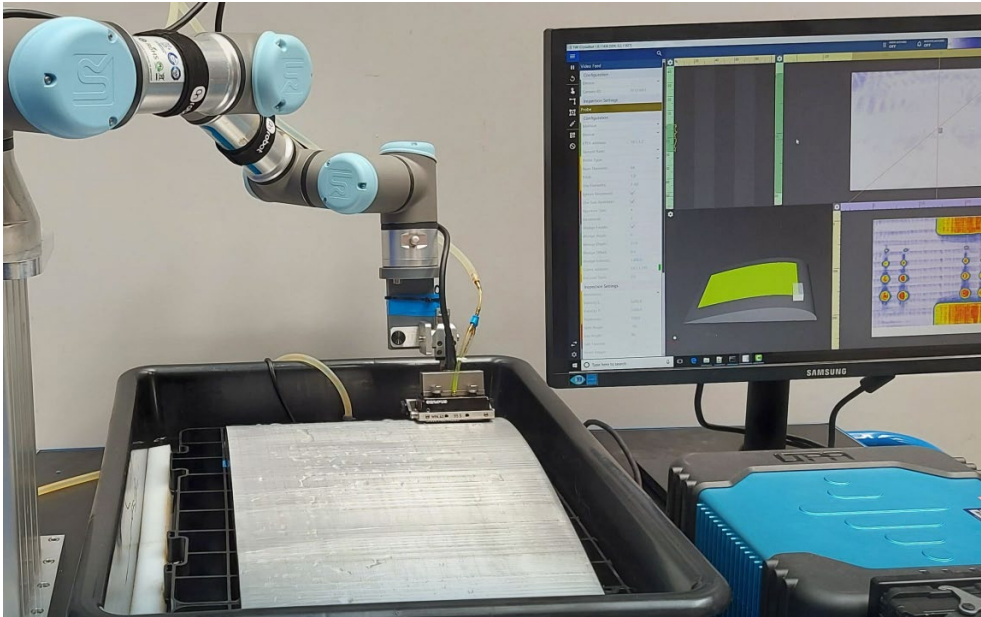
- Off-line path planning used to generate paths from CAD data
- Paths are optimised for each surface



# Complex Geometry Inspections



# Remote Inspection

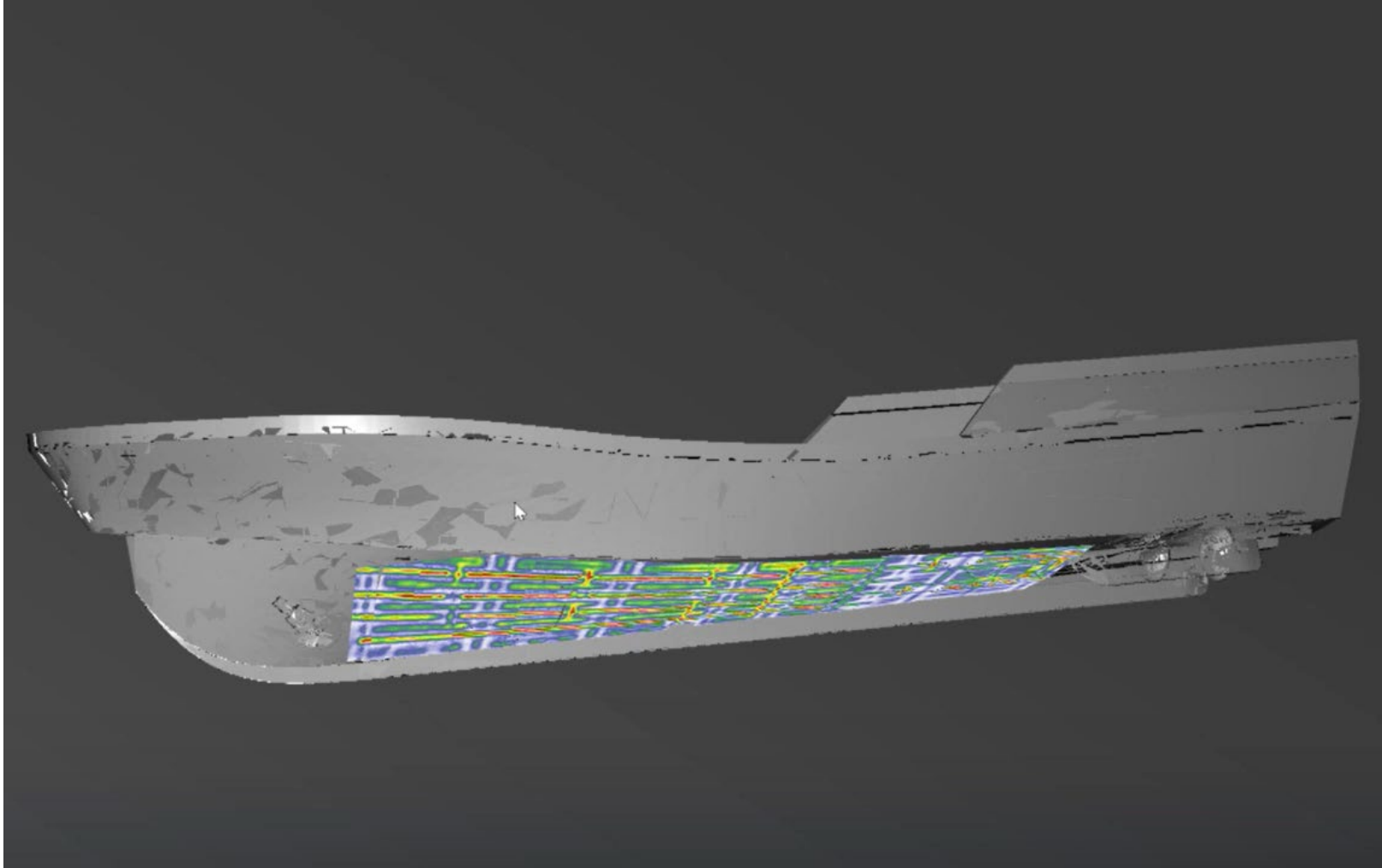




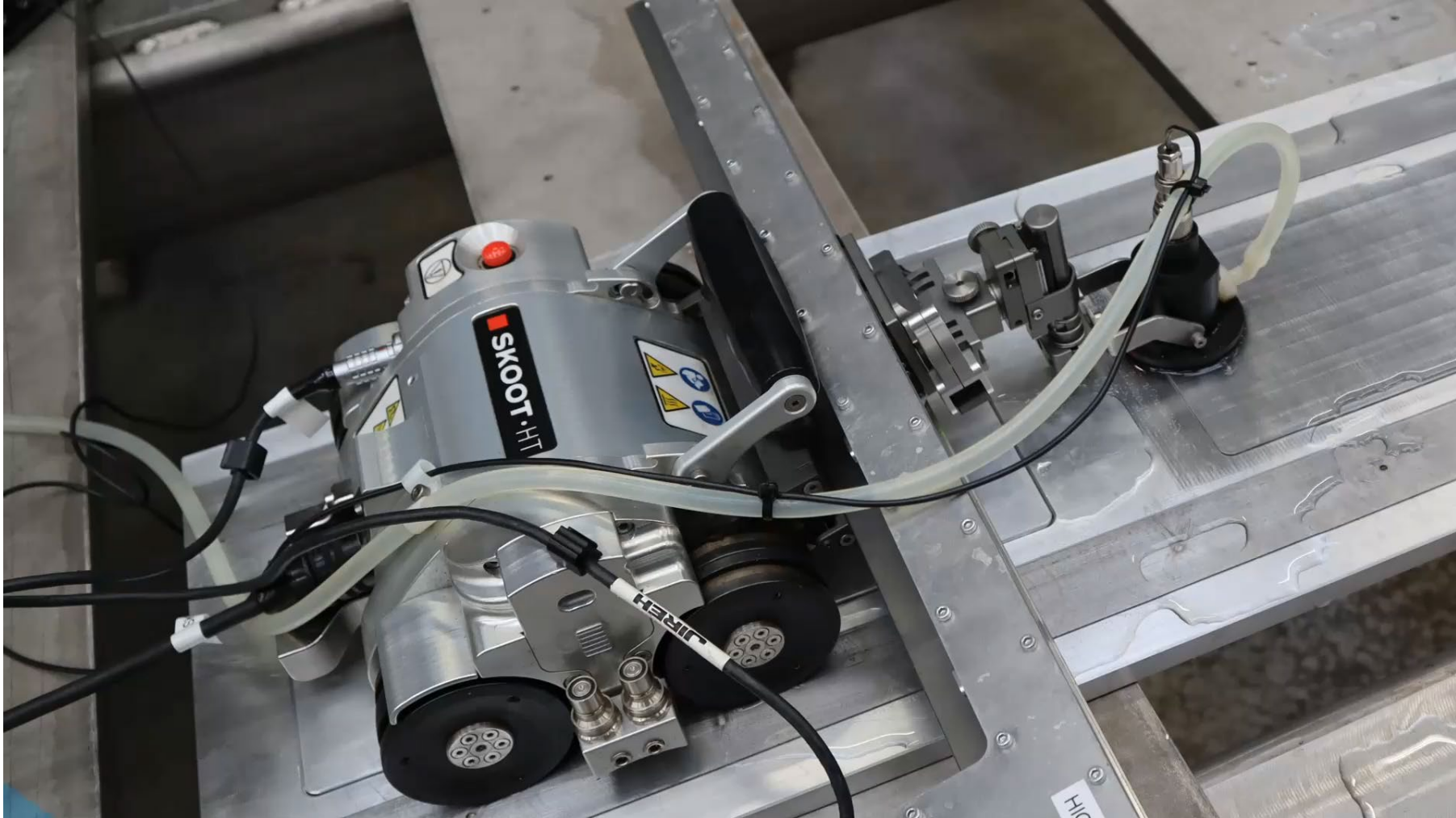
# Robotic Inspection - COBOTS



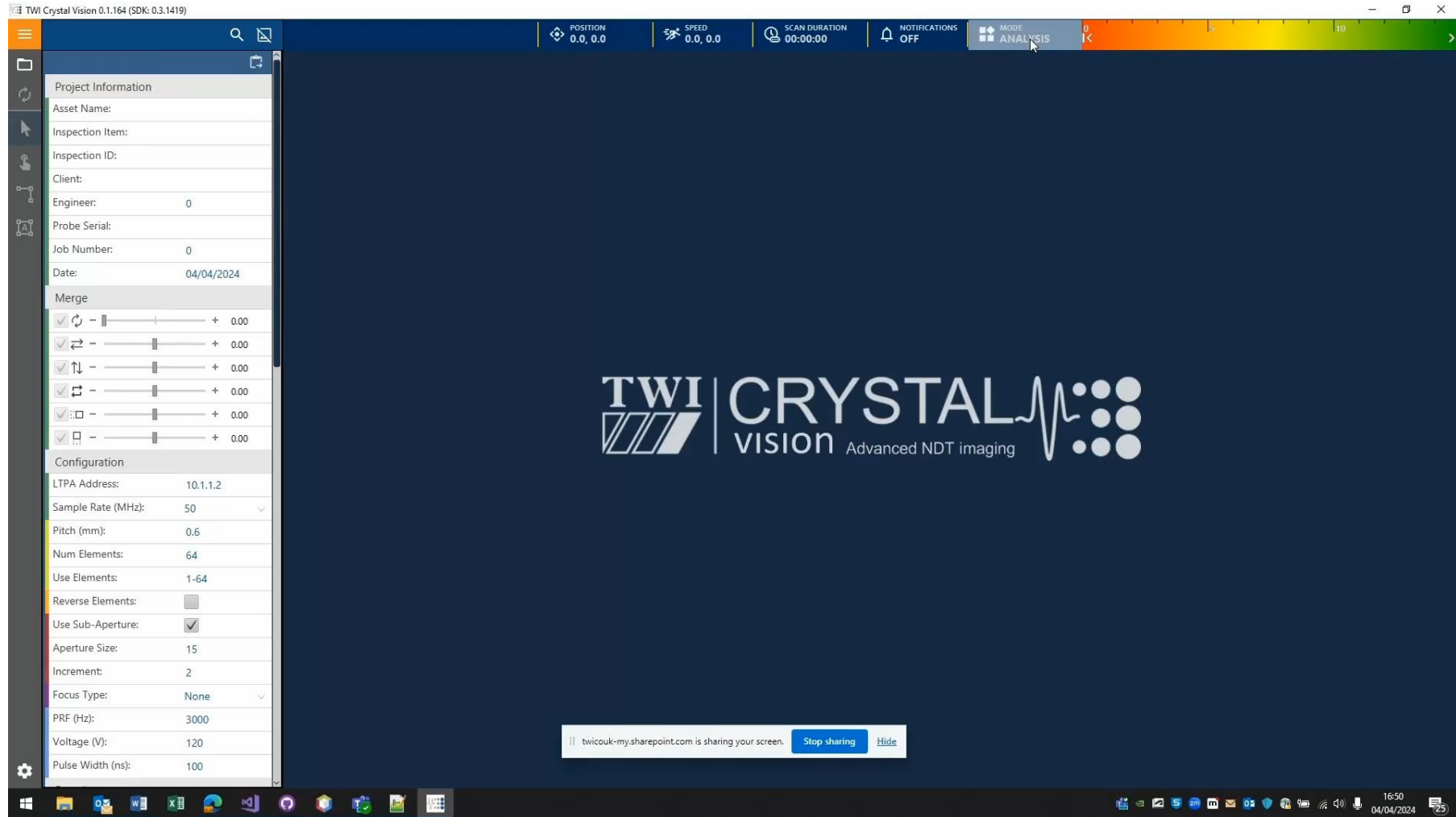
# Robotic Inspection - COBOTS



# Robotic Inspection – Powered Scanners



# Robotic Inspection – Software Integration

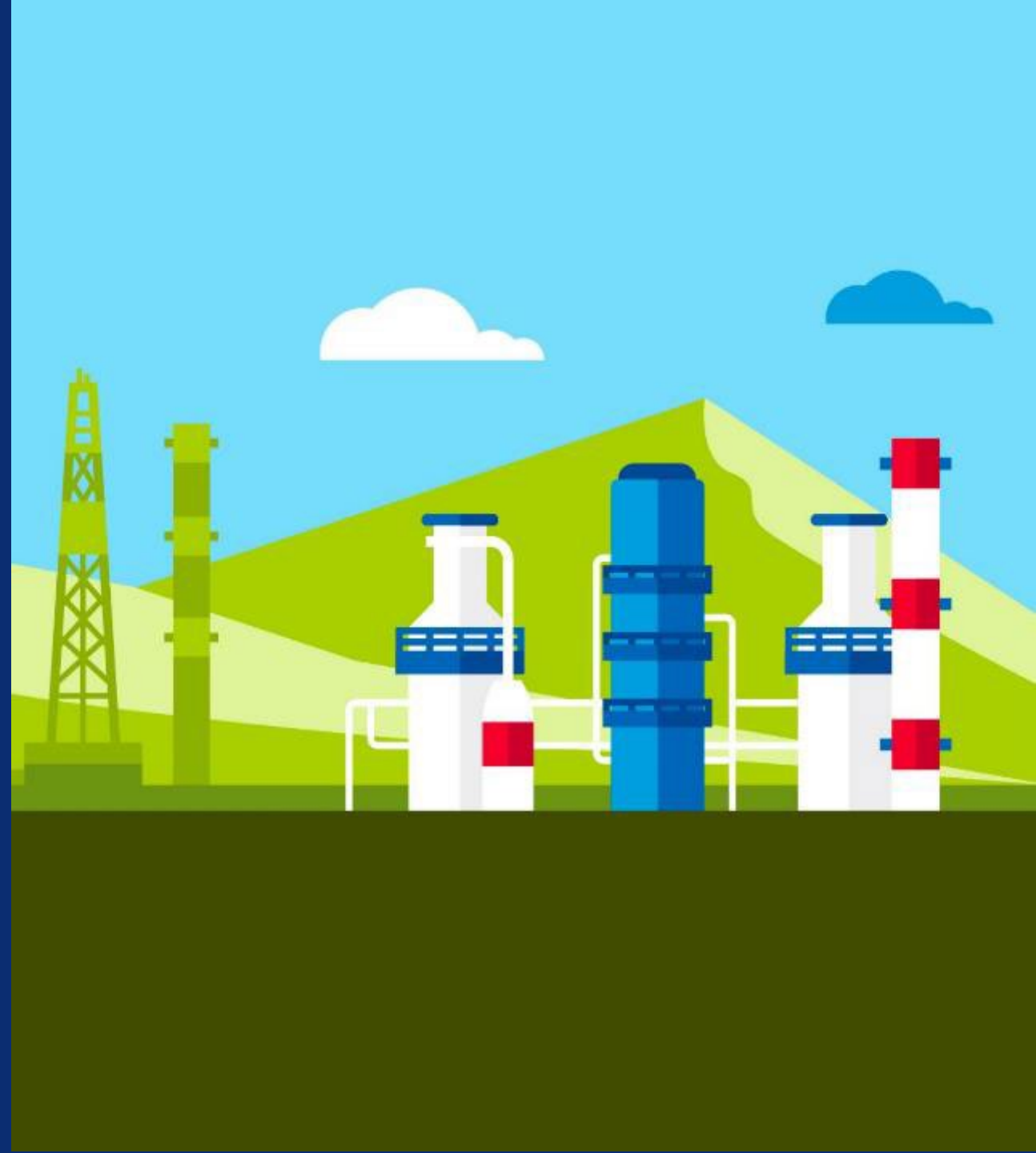


# Process Facilities of the Future

## Robotic Solutions Integration and Adoption

Mauricio Calva  
Chevron Technical Center  
Inspection Robotics Engineer

SPRINT ROBOTICS  
Chairman of the Board of Directors



# future facilities



# optimized resources

**needs will not  
change**

**... operations, maintenance  
and inspection**





sensors, actuators,  
fixed cameras...

... and robots...

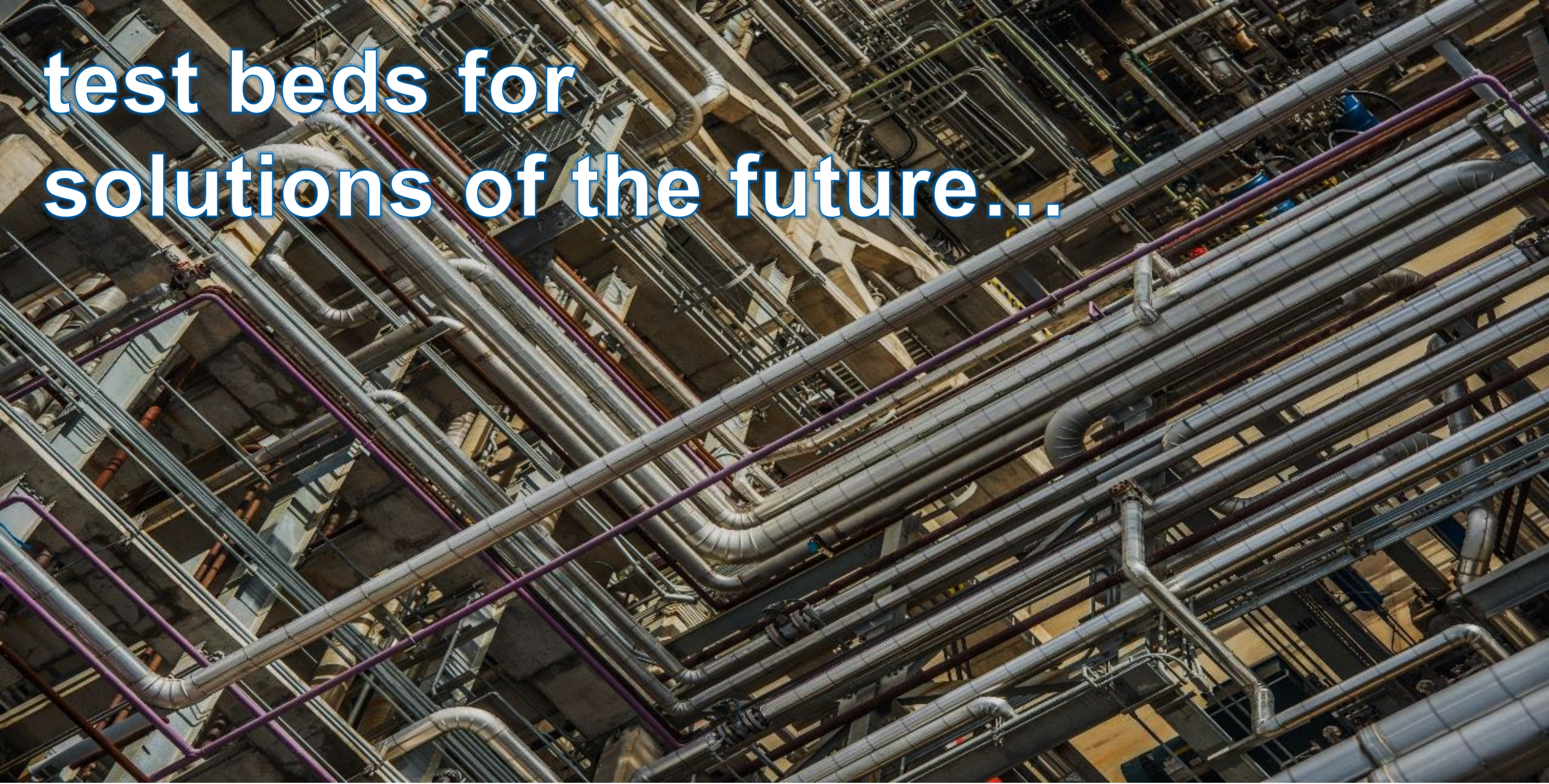







... dexterous human hands

test beds for  
solutions of the future...



A photograph of an industrial facility, likely a refinery or chemical plant, featuring a complex network of large, dark-colored pipes and valves. The scene is brightly lit, possibly by natural light, creating strong shadows and highlights on the metallic surfaces. The pipes are arranged in a grid-like pattern, with several large valves featuring handwheels. The background shows more industrial structures and a clear sky.

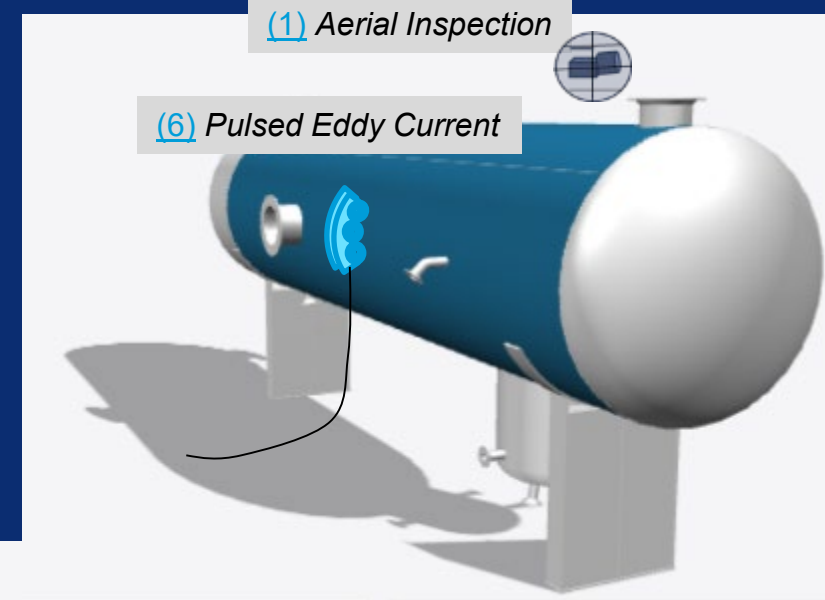
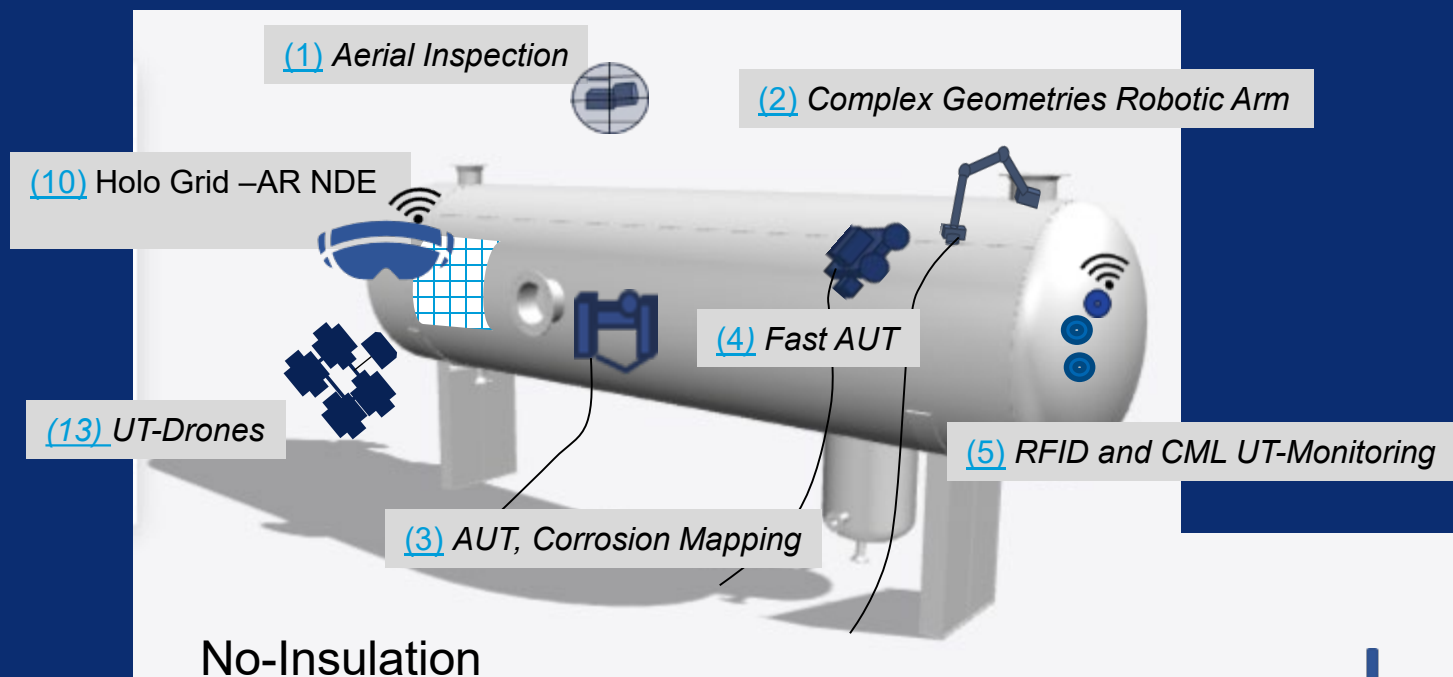
**What's available? Does it work?  
What's the benefit? How it  
compares...**

**Transformation and adoption**

# SOLUTIONS ARE AVAILABLE

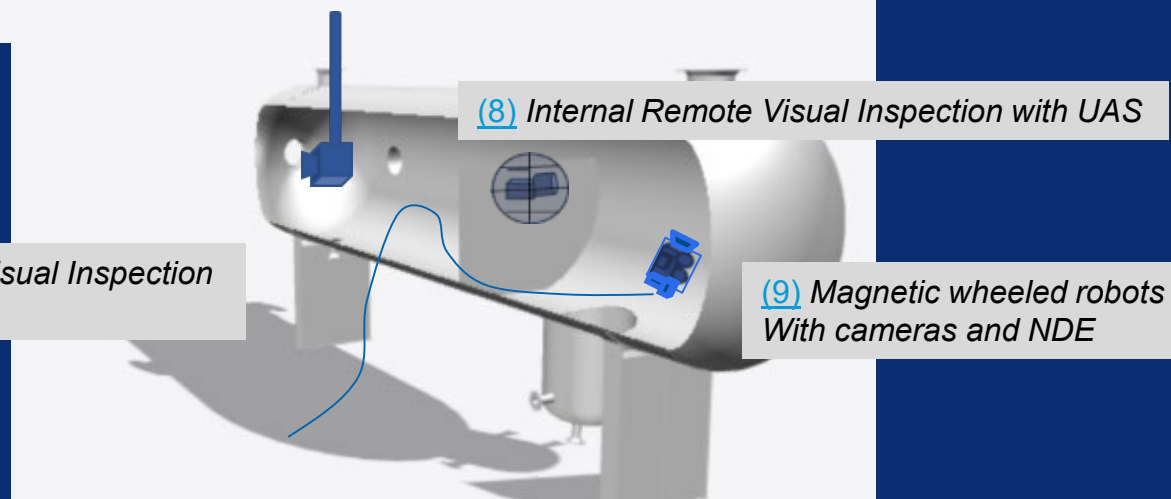
## Vessel Inspection

External – On-Stream ; Non-Intrusive; In Service

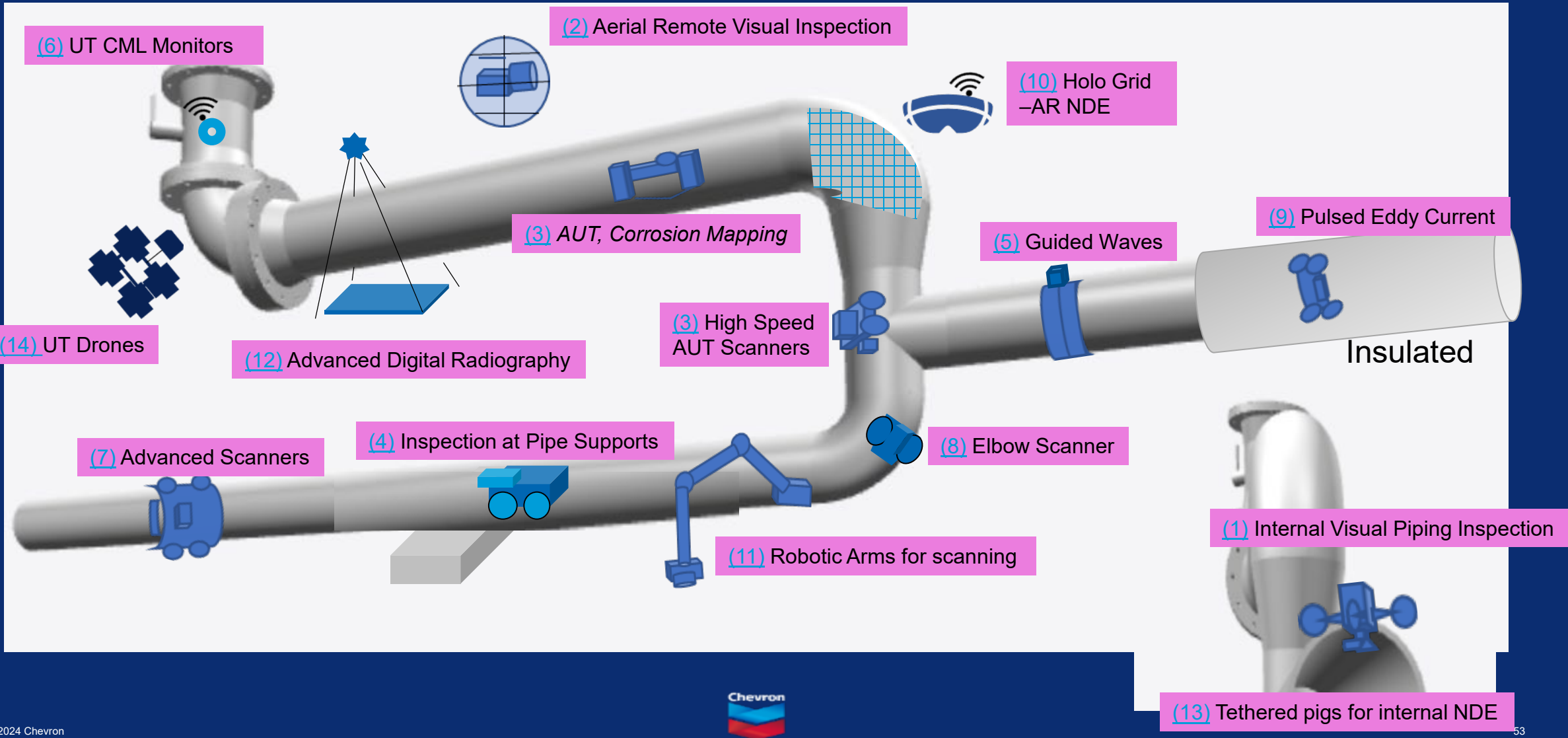


Internal – Turnaround; Internal Inspection

(7) Internal Remote Visual Inspection with Cameras

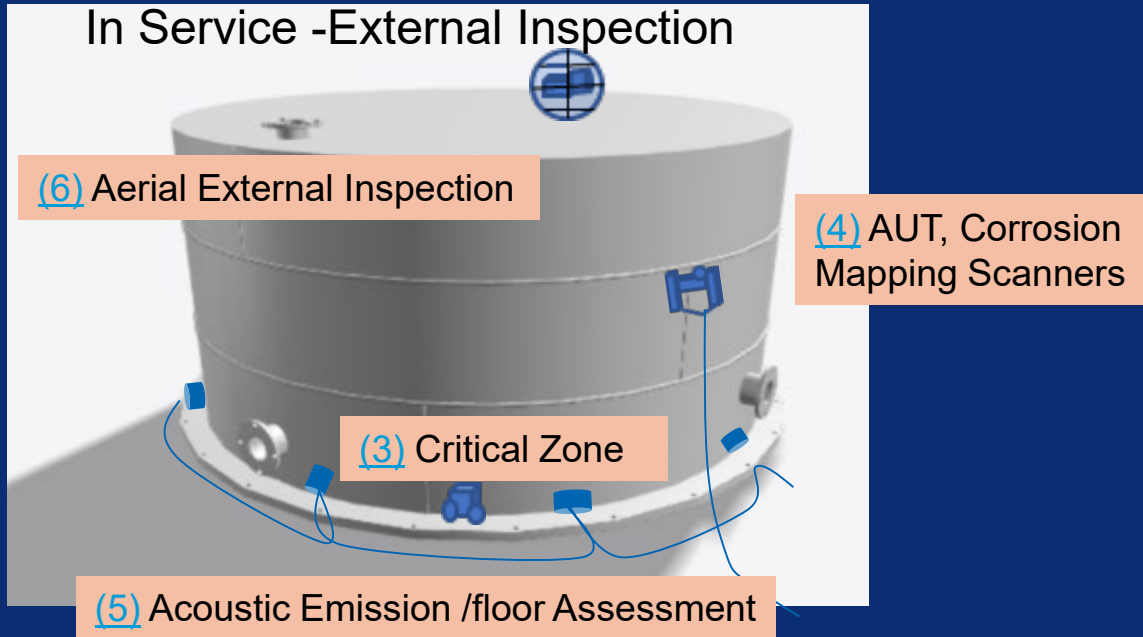


# Process Piping Inspection Technologies

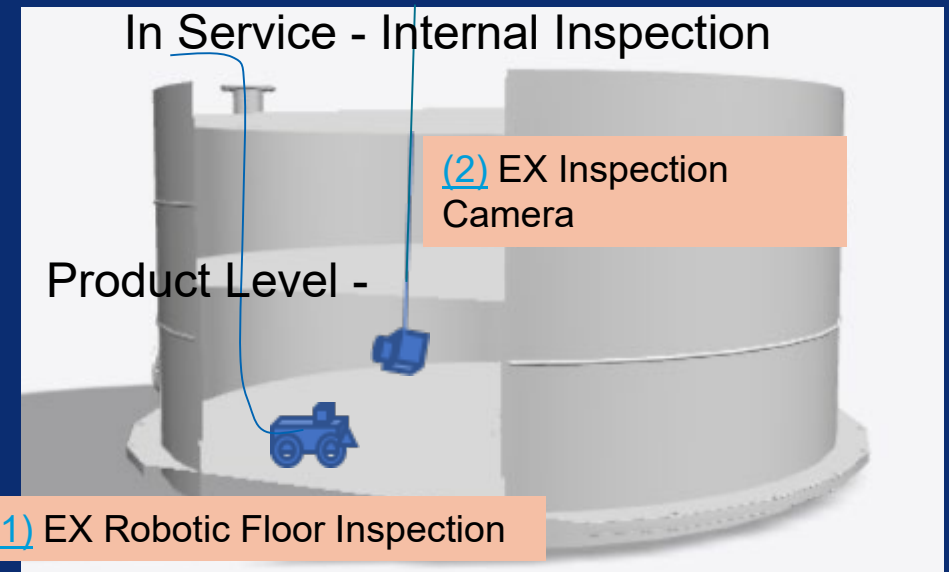


# Tank Inspection

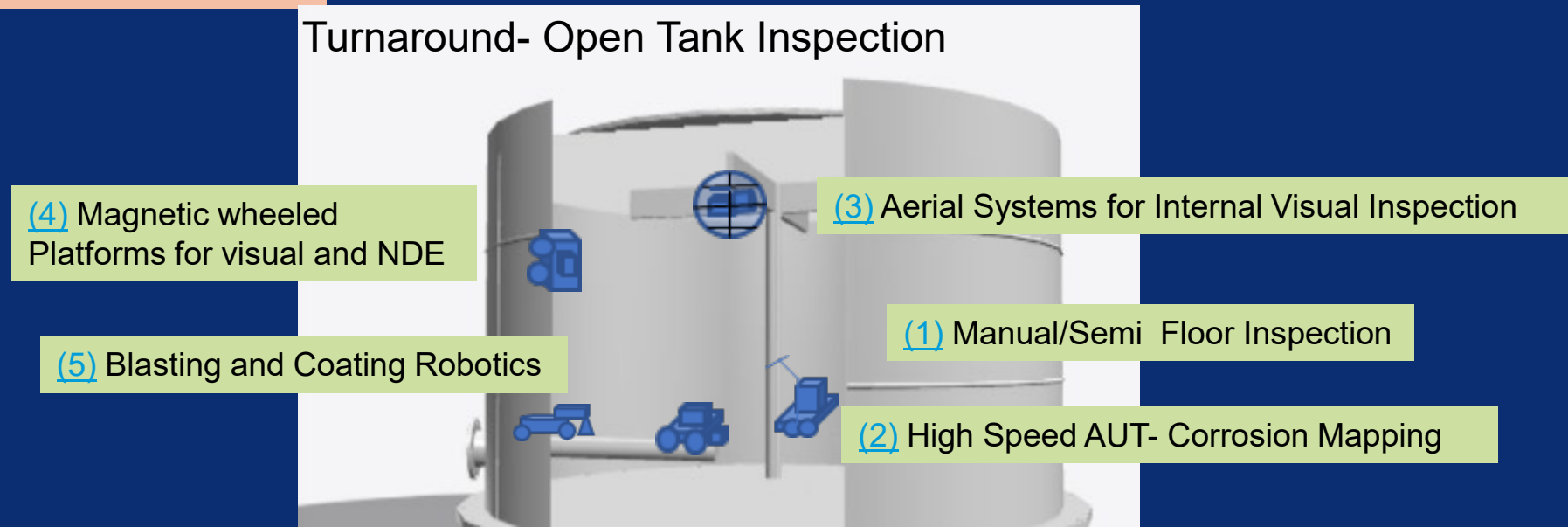
## In Service -External Inspection



## In Service - Internal Inspection

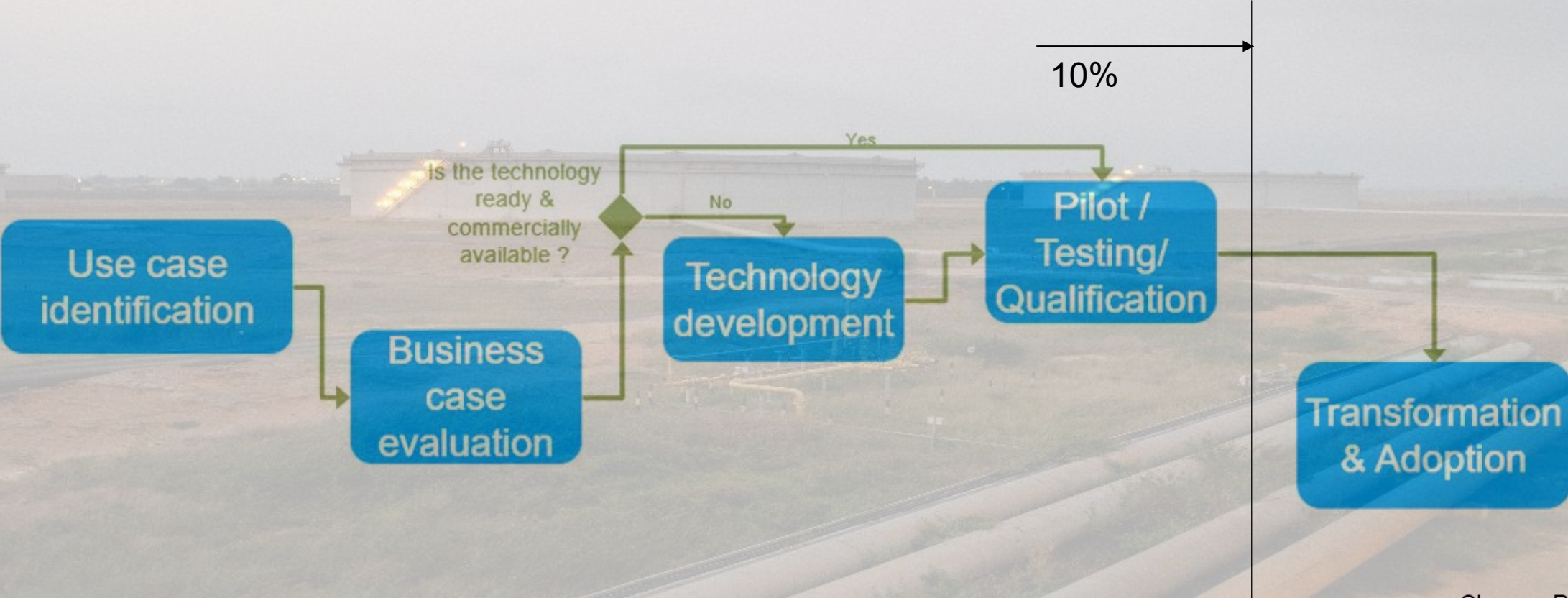


## Turnaround- Open Tank Inspection



# a model for robotics and technology integration

*Process and steps followed to identify, develop, and deploy robotics technology*



Chevron Pictures



# Transformation and adoption



Chevron Pictures





# the Chevron Robotics Program





... much to do



**Now what?**  
**What are the roles of Sprint and TWI?**



Thank you

[enquiries@twime.com](mailto:enquiries@twime.com)

**Upcoming 1 day workshop - Robotic Inspection in the Energy Sector**

**Date: May 2024, Qatar**

# Questions