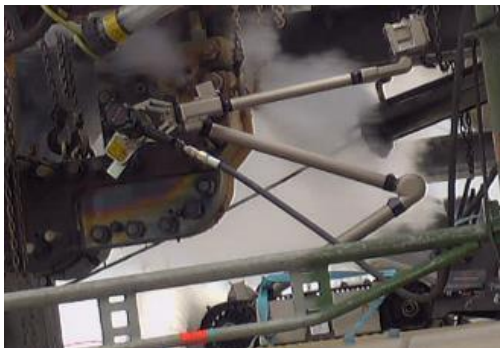




ROBOTICS @ DOW

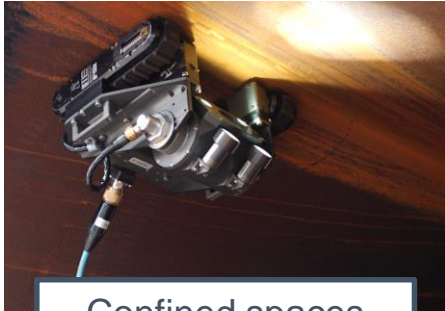
A Paradigm Shift in Safety



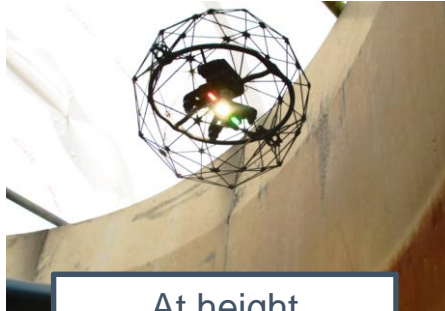
BACKGROUND

Main drivers for robotics

- **Improve safety:** preventing people to enter hazardous and hard to reach areas



Confined spaces



At height



Under water

- **Improve efficiency:**
 - Reduce preparation time/effort (no scaffolding, reduced ventilation time for air quality)
 - Data gathered via robotics is key in digital roadmap for asset management
 - Inspections/maintenance while installations are in operation

AMBITIOUS GOALS @ Dow

Transition driven by top management

- **2025: Target to Eliminate all Confined space entries (incl. repair, NDT, visual)**
 - October 2018: Remote Visual is the standard, confined space entry requires special permission
- **Results for EMEAI Region:**
 - 2018: Over 1,500 CSEs eliminated
 - 2019: Over 3,750 CSEs eliminated
 - EMEAI 50% of total

A new era for inspection and maintenance

- Industry and technology providers in learning curve
- Important role for robotics teams to develop, pilot and deploy technology



IMPLEMENTATION AT SCALE

Example of current status

- TA TNZ
 - +100 items for robotic inspection (RVI)
 - 5 teams in 15 days
 - Need to team-up with contractors
 - Get procedures, work-processes and training in place



Challenges towards 2025



Challenge I

Do-work and complex manipulation



Transitions from visual inspection towards NDT and Do-work



- **NDT and Do-Work often involves complex manipulation**
 - Remote operator controlled
 - Opportunity to improve consistency by semi-autonomous operation