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BASF Robotic Inspection Plan

EPSC Digitalization Working Group

Seçmen Akbas, May 4th, 2021

BASF in Antwerp

Second largest "Verbund" site in the world



6

km²



3.529

employees



580

km



50

plants



Antwerp 4.0 digitalization is organized in 6 workstreams



Verbund Digitalization



Innovation in Maintenance



Data Analytics



Digital Operations



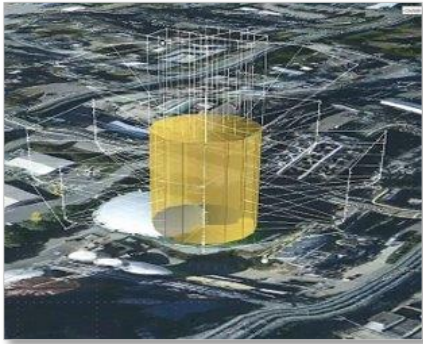
Logistics Execution



Mobile & wireless

Global approach and alignment on robotic initiatives

Automated Inspection Support



- Positioning and navigation
- Repeatability
- Image Processing Technologies
- 3D Modelling

Automated Transport



- (Semi) Automated transport of goods
- Above private and public areas
- Environmental and legal issues to take into account

Confined space inspections



- Inspections & Maintenance
- Trials and deployments of robotics for cleaning purposes
- Define equipment for in-service inspection (e.g. vessels, columns)

Using robotics and other non-destructive technologies, our site can increase safety and efficiency of inspection and maintenance

Long term vision

- › Improved safety
- › Increased inspection quality by increasing frequency & scope
- › Shortening shutdown increases time efficiency
- › Reducing costs

The ultimate goal is to **prevent human entries in confined spaces**



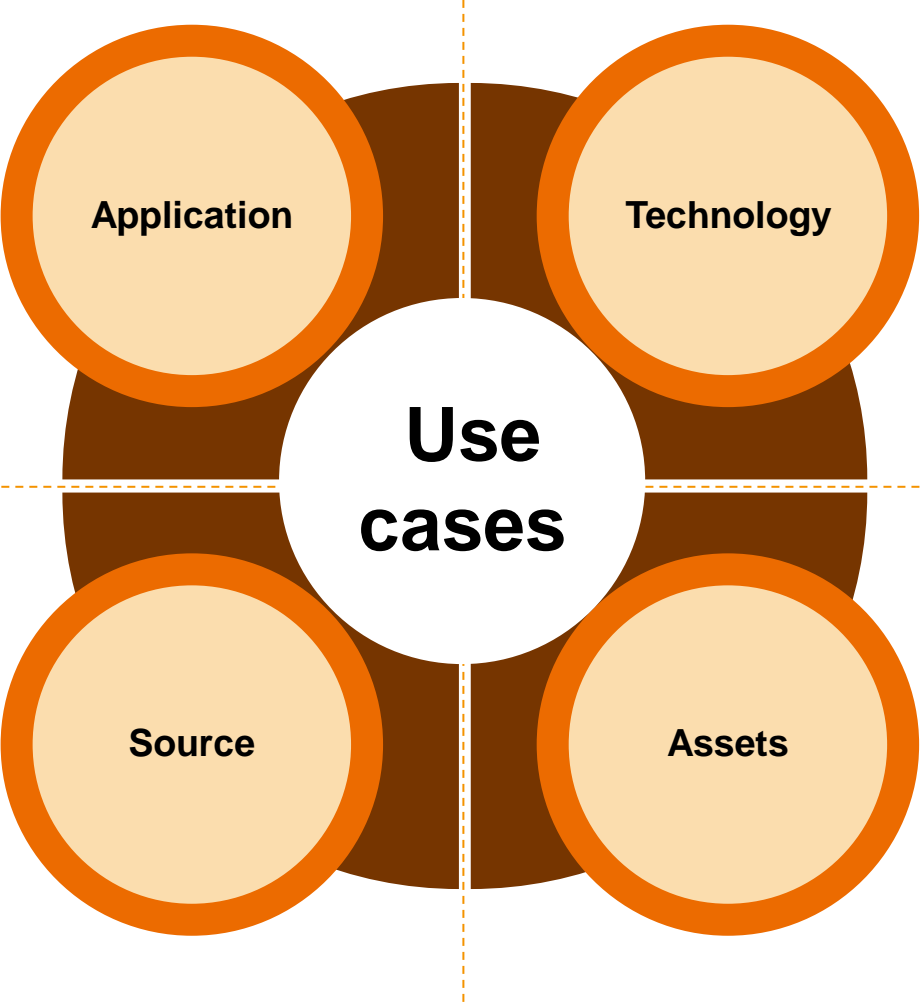
Robots don't get corona

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Customer need variety of robotic usage @ BASF

- RVI inspections
- IR monitoring
- UT and other NDT functional measurements
- Surface treatment
- Cleaning
- Prevention and surveillance

- Legal imposed
- Process/Production request
- Maintenance



- Drones – Indoor/outdoor
- Crawlers
- Ground robotics for remote operations
- Snake arms
- ROV

- Storage tanks
- Pressure vessels
- Boilers
- Process piping
- Waste water basins
- Flares
- Sewer pipes and canals

3 important levers need to be balanced to achieve a successful site-wide collaboration



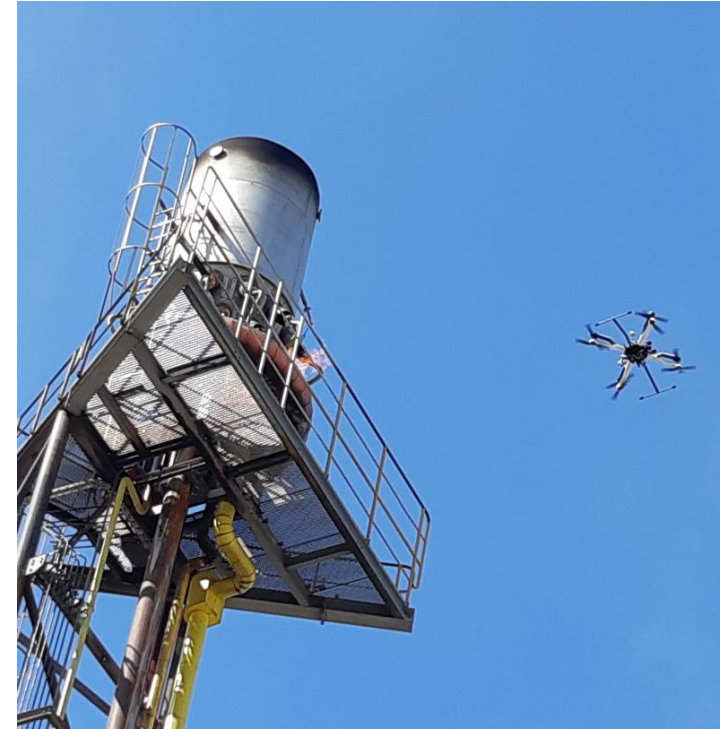
Future challenges



- Inspections are **legally imposed**, so new inspection techniques need to be accepted and validated
 - **Internal and external collaboration** very important
- Doing inspections beyond RVI, meaning NDT functional measuring
- Maintenance and machining
- Data storage, management and processing

Flare inspections

- Condition monitoring of burner head
- Integrity inspection of the support construction
- Presence of corrosion, cracks, missing parts,..
- Searching for (gas) leakages, heat points

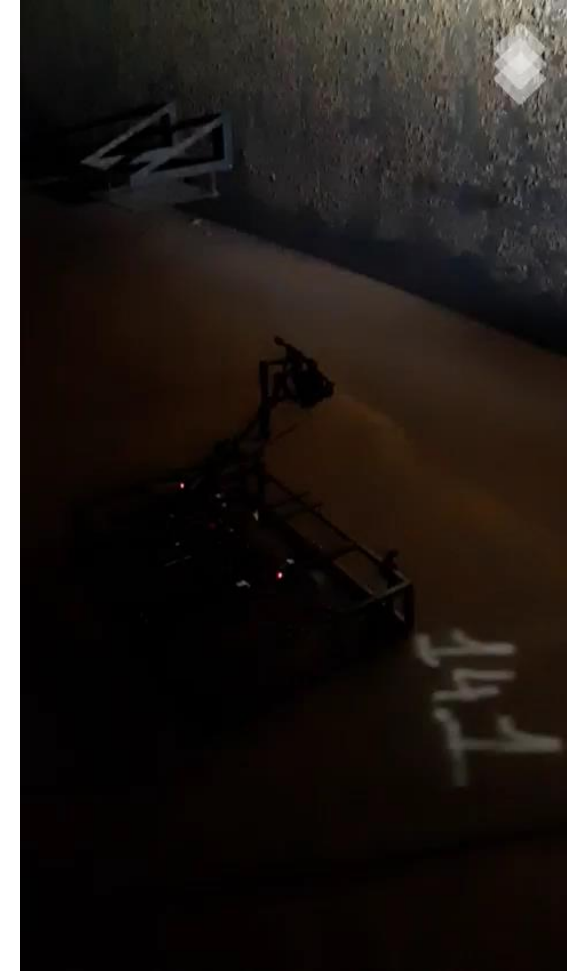


Benefits

- Examin unreachable places
- Saving crane or scaffolding
- Online condition monitoring
- Increased safety and quality

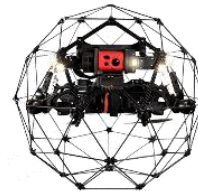
Above ground storage tank inspections

- VI and UT with drones as a supplement of the general tank inspection
- WM on wall, roof, beams and floor plates
- Unreachable places
- Surface treatment rust removal



Benefits

- Non entry inspection
- Saving scaffolding up to 100%
- Increased safety and quality
- Reduction of downtime



VI and UT measurement pipe bundle in boilers



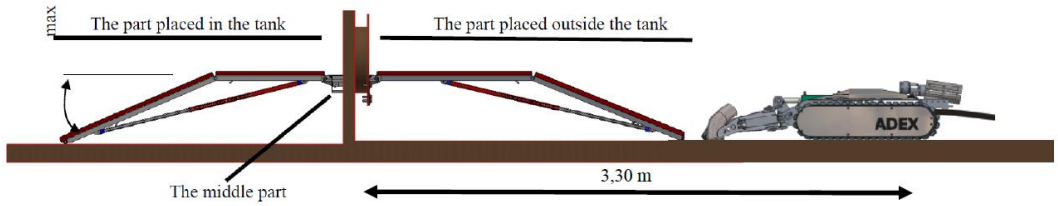
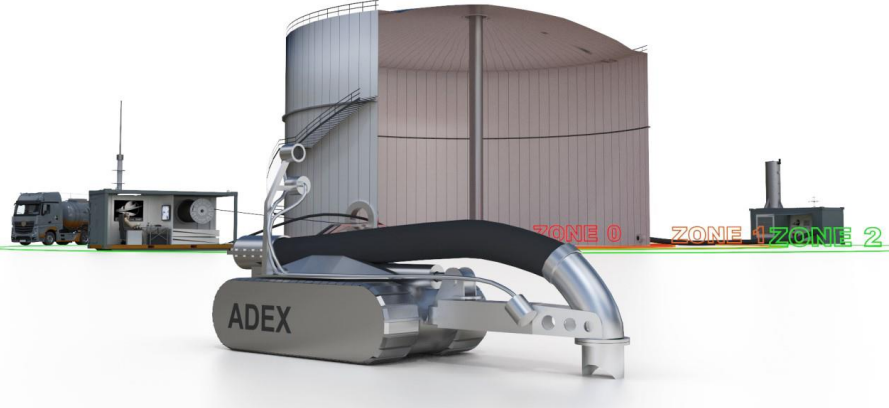
- RVI & thickness inspection of boiler tubes
- Integrated mechanical module for UT thickness readings of pipe bundle on drone
- Consecutive brushing and UT
- **Curved UT probe** adapts to curvature
- Narrow manhole required launch platform to insert and pole to retrieve the drone

Benefits

- No human confined space entry
- No scaffolding
- Reduction of boiler downtime



Cleaning chemical sludge and sediment out storage tanks



Remote-controlled sludge cleaning in preparation for inner tank inspection

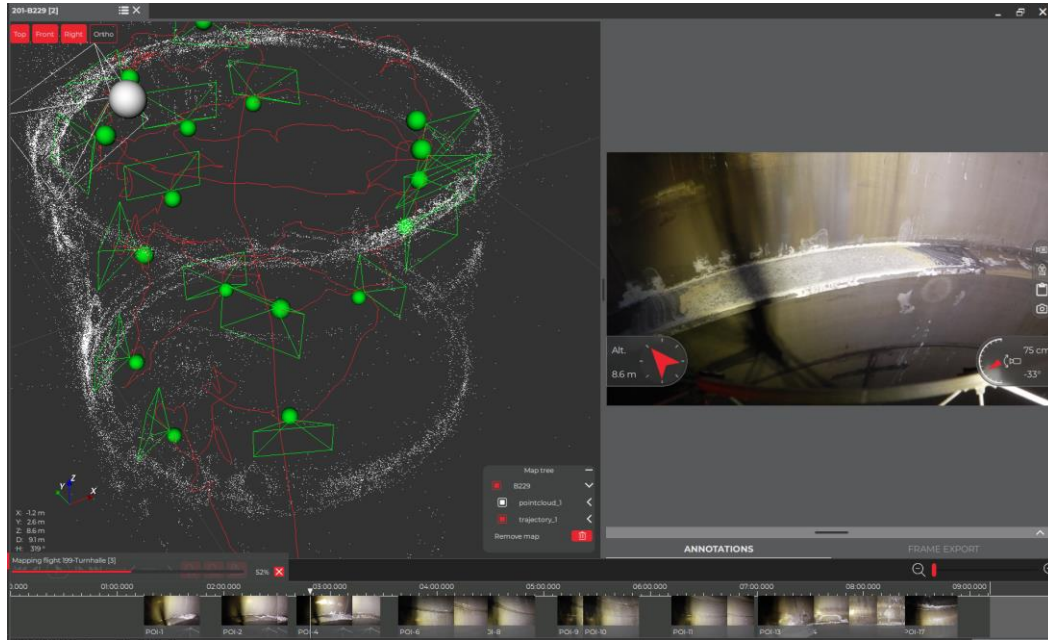
- Investigate a safe manhole habitat system



Benefits

- No confined space entry** by human
- Ex zone 0** - proof and certified, safe manhole habitat system
- Experienced service provider**

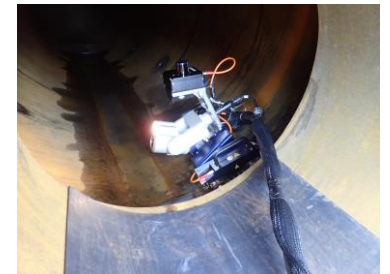
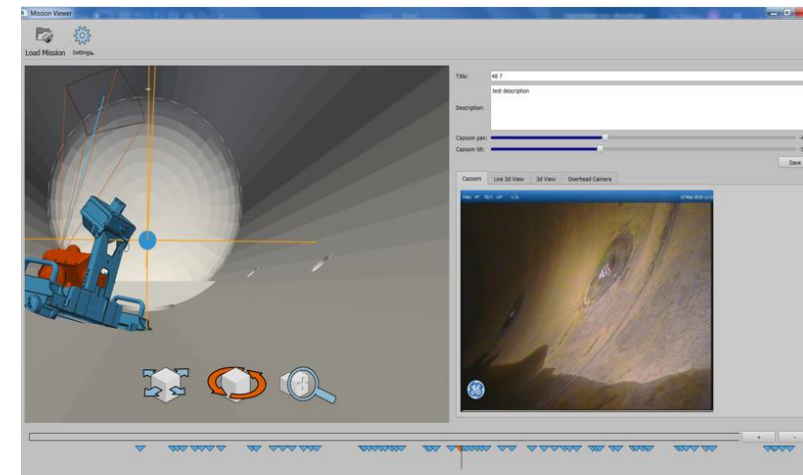
Legal drone & crawler inspections on steam pressurized equipment



- **First RVI and WM regarding legal acceptance**
- **3D model** as help for navigation
- Qualitative and stable images
- NOBO to present findings to local government for validation

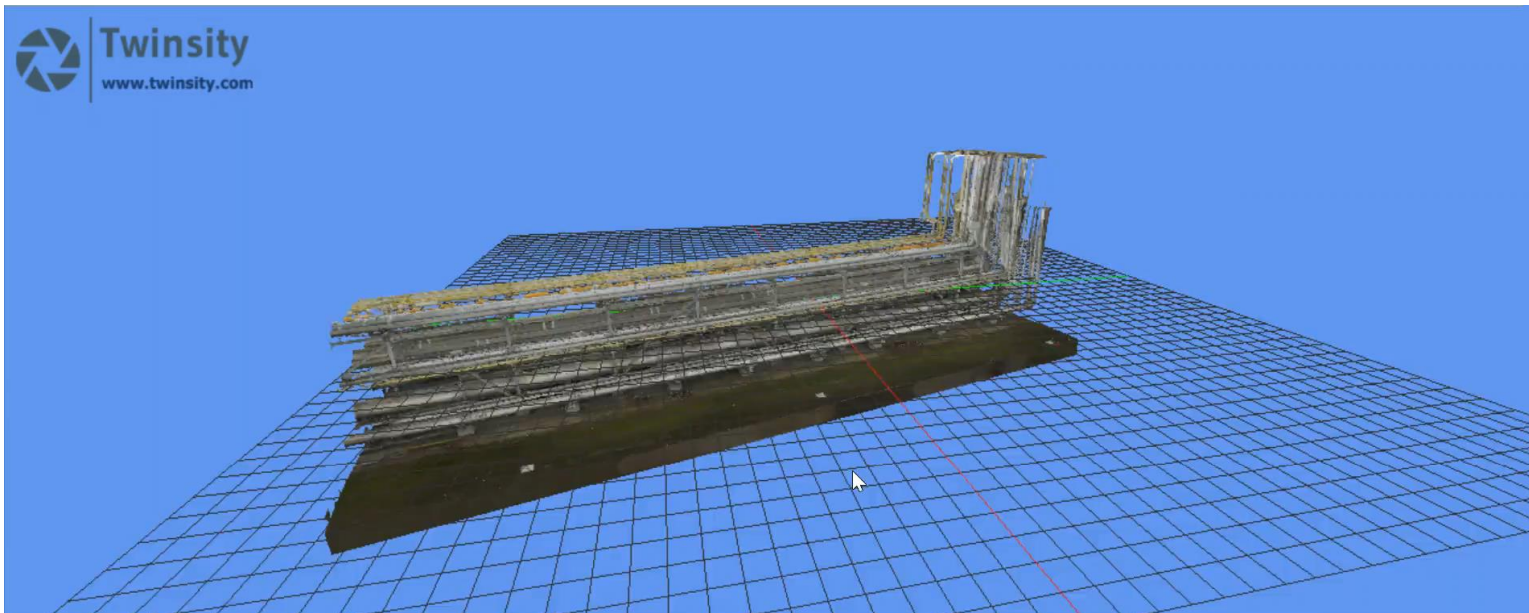
Benefits

- No confined space entry human for visual inspection
- Avoiding working at height (upper manhole)
- No Safety Guard necessary



Pipe bridge inspection using 3D technology

- Remote visual inspection with drone of pipes and pipe rack support construction to clarify damages and/or deterioration
- Compare results with human found damage mechanisms, like corrosion, coating issues, deformation isolation shield



Benefits

- No scaffolding or rope access activities
- Photo's taken of the anomalies and pinpointed in 3D model
- Comprehensive and integrated report available

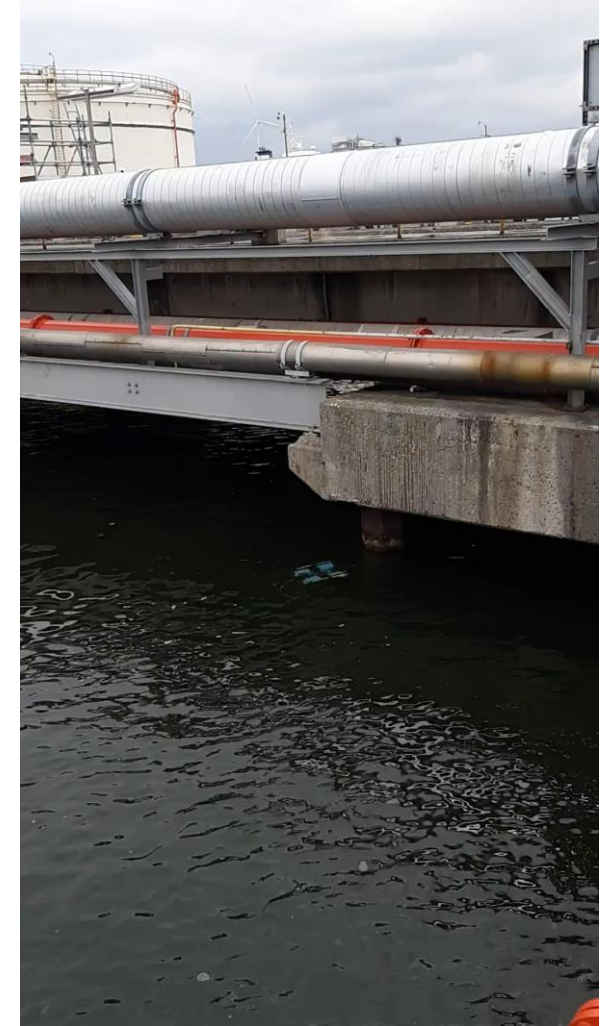
ROV inspection of quay pillars

- RVI inspection on 22 quay posts
- UT at different heights and 4 quadrants
- Compare with human diver results



Benefits

- Inspections fully performed offshore, from a “workboat”
- No need of expensive divers in dangerous circumstances
- Execution period 2 weeks, with 2 à 3 piles a day



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