Robotic Inspection Solutions

29 November 2018

Why we launch robotic solutions

From equipment sales to solution provider

What we do in UT/RVI

HAND-held NDT sensors and devices

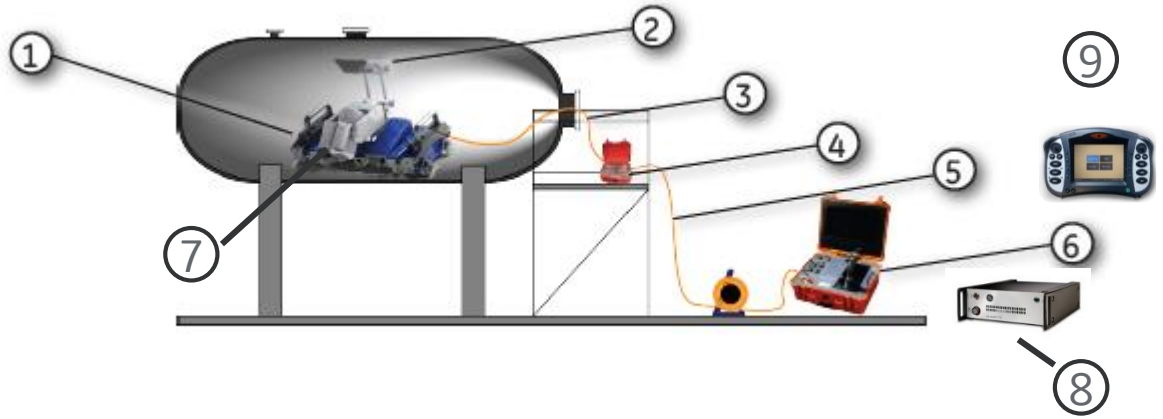
Strategic pain points of our customers

Delivery of the NDT sensors and devices is risky, slow, expensive, and the results are unreliable with too little data

What customers need

- **No human entry in confined spaces by 2020 / 2025 – Chrevon, DOW, all others**
- **No working at height – all asset owners**
- reliable and repeatable inspection results
- Reduced outage time & costs
- Less people and manual work on site with process improvement by automation

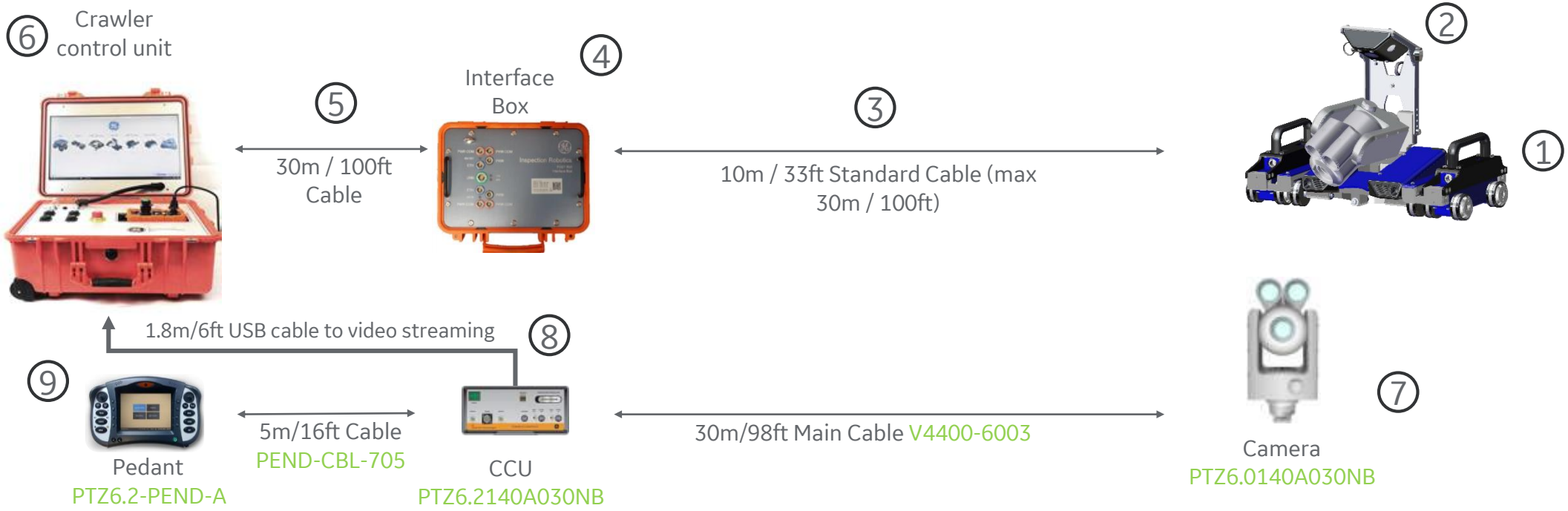
FAST RVI System Architecture



GEIT Order number in SAP

0680017 (1,2,3,4,5,6)

PTZ6.2140A030NB (7,8,9)



Value Proposition

Safer

Confined space entry is DANGEROUS

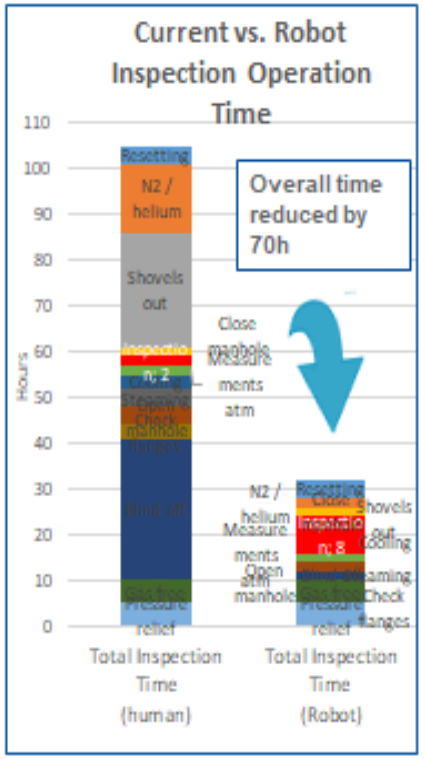
during the 5-year period (2005-2009), there were a total of 481 fatalities. This averages to about **96.2 fatalities per year** (or 1.85 fatalities per week). Source

Work on height is DANGEROUS

The Census of Fatal Occupational Injuries (CFOI) of the Bureau of Labor Statistics (BLS) reported that falls to a lower level comprised 9.9% of fatalities. The CFOI data identified roofs, ladders, and scaffolds as the most common fall locations Source

Faster

On average 70% faster considering the full cycle



dringer. https://www.tekna.no/

Cheaper

- Scaffolding cost:
  - ➢ ~30k$ per construction/ 2 days
- Worth of 1 day downtime:
  - ➢ up to 1M USD
- Insurance rate reduction by not entering with human:
  - ➢ 50%

Case Study 1: Statoil Offshore in North Sea

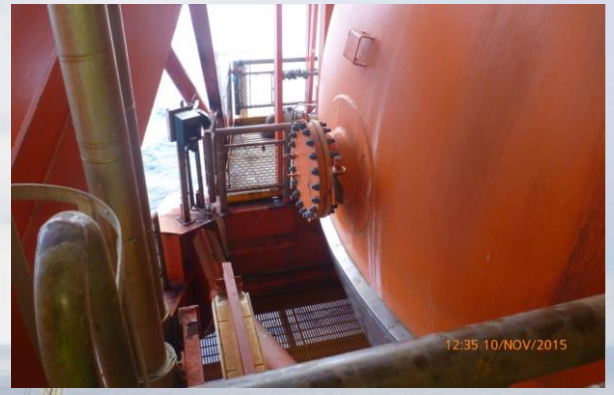
2011: Conventional Flare Knockout Drum Inspection

Challenges & Cost Drivers Visual Inspection

Offshore:
- Food
- Lodging
- Transport
- Certification

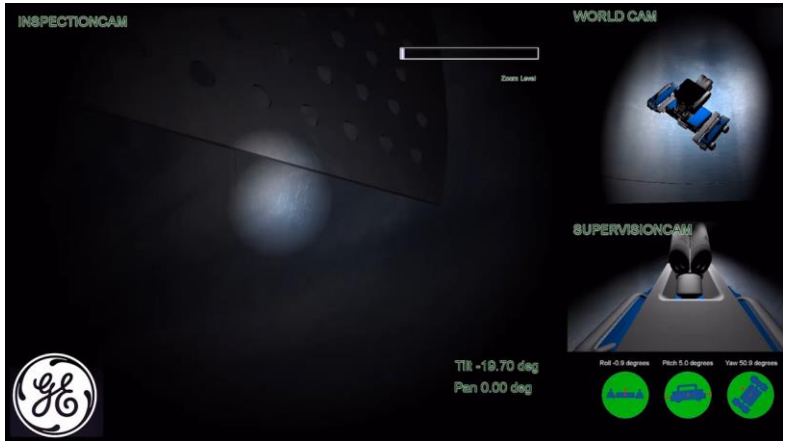
Logistics:
- Cleaning
- Scaffolding

EHS
- Rescue Team
- Work Permit
- Risk Assessment



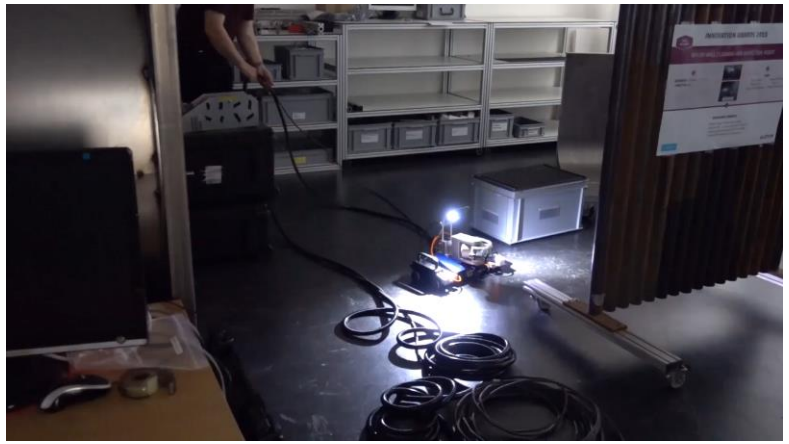
2016: Robotic Flare Knockout Drum Inspektion

1. Simulation



- Generate 3D model of the drum
- Check Accessability
- Virtual Inspection in Simulation Software

2. Training



- Remote Control and Navigation
- Deployment and retrieval
- Inspection path planning in 3D

3. Offshore Support

- Logistics
- Risk Assessment
- Data Handling & Reporting

Summary

Statoil

" By avoiding blinding, cleaning and scaffolding inside the knock out drum, we saved about 1,500 hours. Additionally HSE was improved by not exposing personnel when entering into the knock out drum. "

Microsoft Word Document

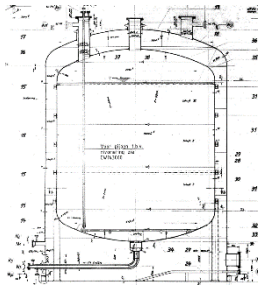
Double click on icon for full report. (internal use only, do not distribute externally)

More Use Cases (Tecson Inspection, The Netherlands)

Internal Inspection of Gas Spheres

"We could perform a very detailed close-up assessment of the interior. No need for rope-access, scaffolding or flooding. Image quality was much higher compared to drop-in cameras, the total savings where close to USD 20.000,00"

Double walled tanks



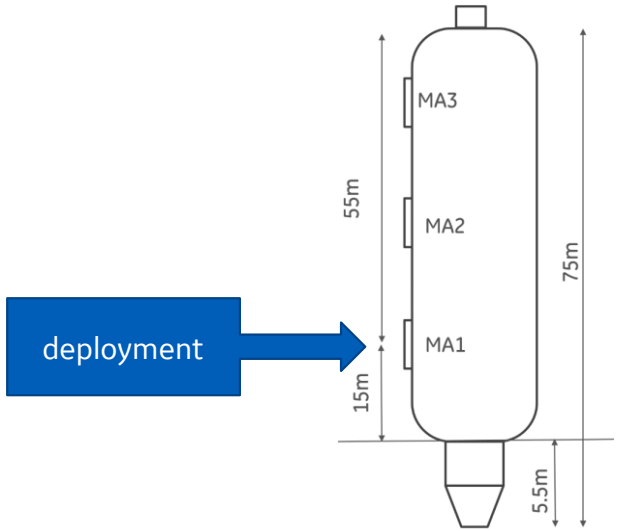
"Chlorine is stored at -35°C in a double walled tanks. Between the walls the atmosphere is kept on a slight vacuum. Only two ways for inspection today is rope access and unpacking. By using the FAST RVI we saved USD 30.000, and the down time was reduced by 35%."

More Use Cases (IRIS NDT, USA & UK)

IRISNDT

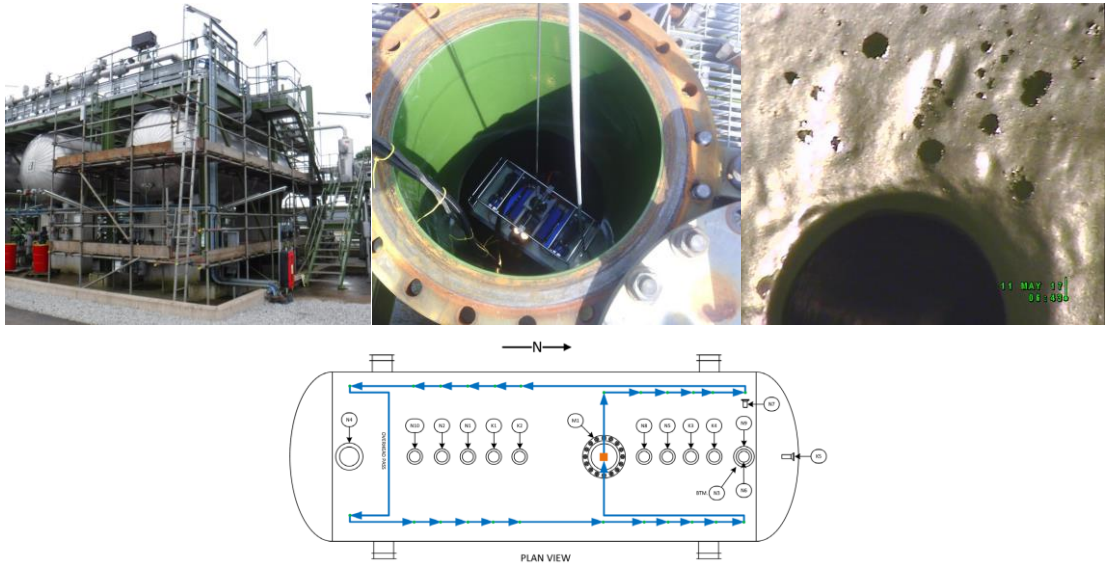
SPRINT ROBOTICS AWARD WINNER 2017

75m/246ft High Distillation Column



"The pressure vessel was a large vertical 75m high reactor with deployment through a side nozzle. It required GE to specially design a side deployment mechanism and provide long cables for all robotic components. This work was completed successfully by IRISNDT inspectors."

TEG Tank



"IRISNDT performed a remote visual inspection, using the FAST RVI Robotic System, on a wet TEG tank. It eliminated the need for the inspector to enter the vessel, removing the traditional safety risks normally associated with working in confined spaces."

Sprint Robotics Award & API 510 Compliance

FAST RVI received the Sprint Robotics Award (click the link for complete story) from Sprint Robotics community, who officially recognized the API 510 compliance of inspection with FAST RVI.

" This collaboration began during planning for the Sprint Robotics demonstrations at Disaster City, Texas in August 2016. Our goal for this demonstration was for IRISNDT to operate a GE Fast RVI robotic system to demonstrate a fully compliant API 510 internal pressure vessel visual inspection without a confined space entry. An IRISNDT API 510 inspector did the interpretation; one GE employee and one IRISNDT employee moved the robot inside the vessel. This work was successful and it resulted in a API 510 report being issued for this visual inspection. "

- GE Inspection Robotics & IRIS NDT