

# Inspections from a different perspective – about Drones, Data and Disruption ...

## CORAL 2.0

Cost Reduction Alliance

Reimagining Cost Competitiveness

SKY  
-FUTURES™



Robotic, Drone  
&  $\mu$ -ROV

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# Challenging conventional wisdom



## Improved safety

- ✓ No people working at height or in confined space
- ✓ Better advice on safety of continued operations
- ✓ More frequent dropped object inspections possible

## Lower cost

- ✓ More than 5 times faster vs. rope access or scaffolding
- ✓ Smaller team, simpler logistics
- ✓ More focussed work scope for maintenance

## Less disruption

- ✓ Inspections do not require halting of operations
- ✓ Early detection of potential problems
- ✓ Timely advice on continuation of operations and mitigation

## Better information

- ✓ Live equipment = better information
- ✓ More flexibility in inspection locations
- ✓ Operate in high winds (up to 29 knots)



# Inspect 'hard to access' areas



Live offshore and onshore flare inspections.



Topside, jacket and dropped object inspections.



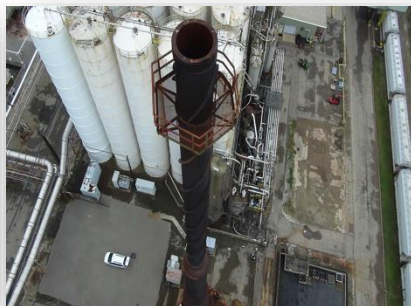
Under deck and splash zone.



FPSO inspections.



Pipe racks (visual and thermal imaging for CUI)



Smoke stacks and chimneys.



Confined space (e.g. in-tank, boilers).



Storage tanks and silos (internal / external)



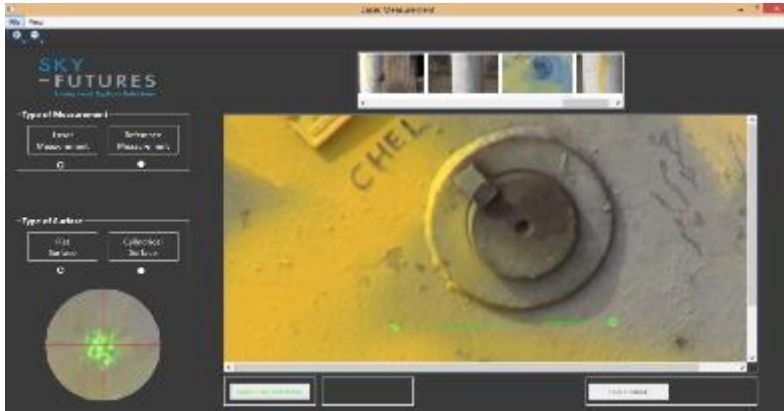
# Risers





## Defect Size Measurement – laser referencing

- Perform flat and cylindrical measurements
- Accurate reference from two laser dots at fixed distance in image
- The key idea relies on the comparison between the size of a know segment (i.e. the laser segment) and the size of the object to be measured



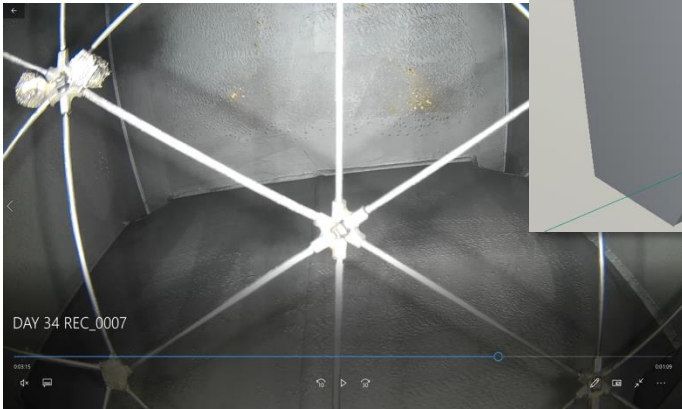
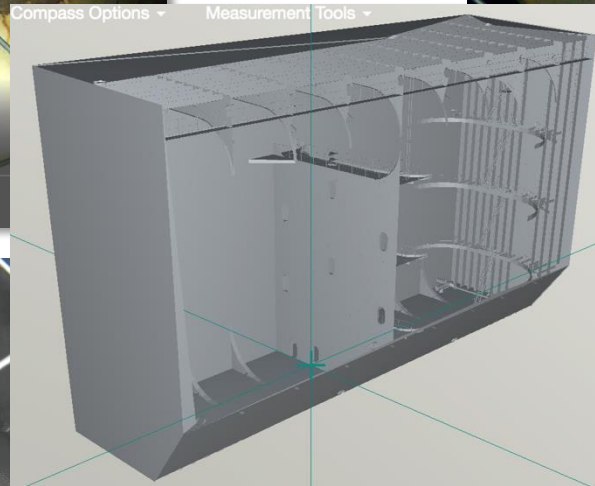
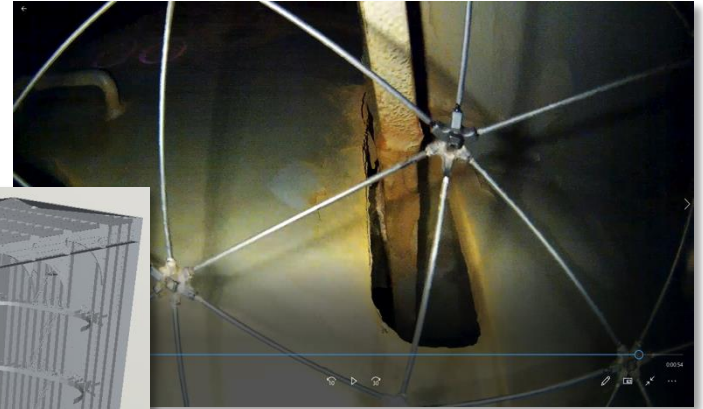
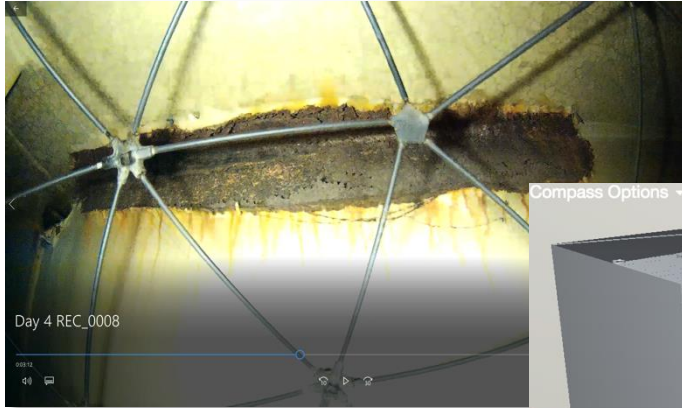
~~Coming soon~~

Available Now:

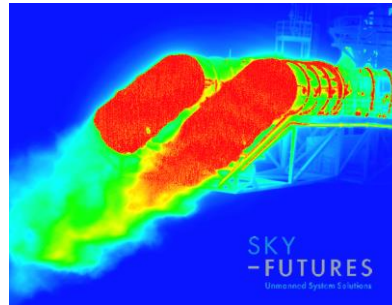
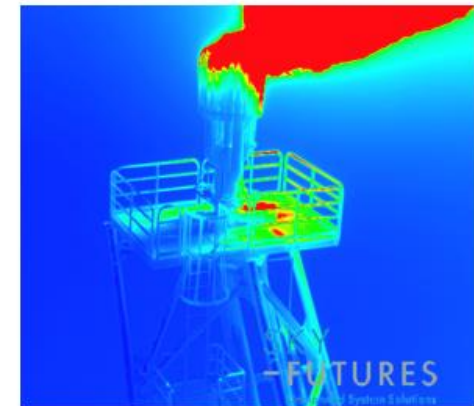
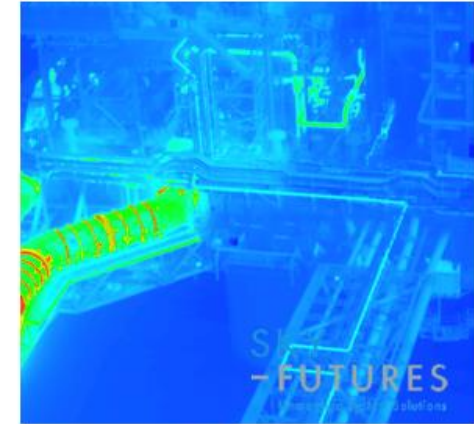
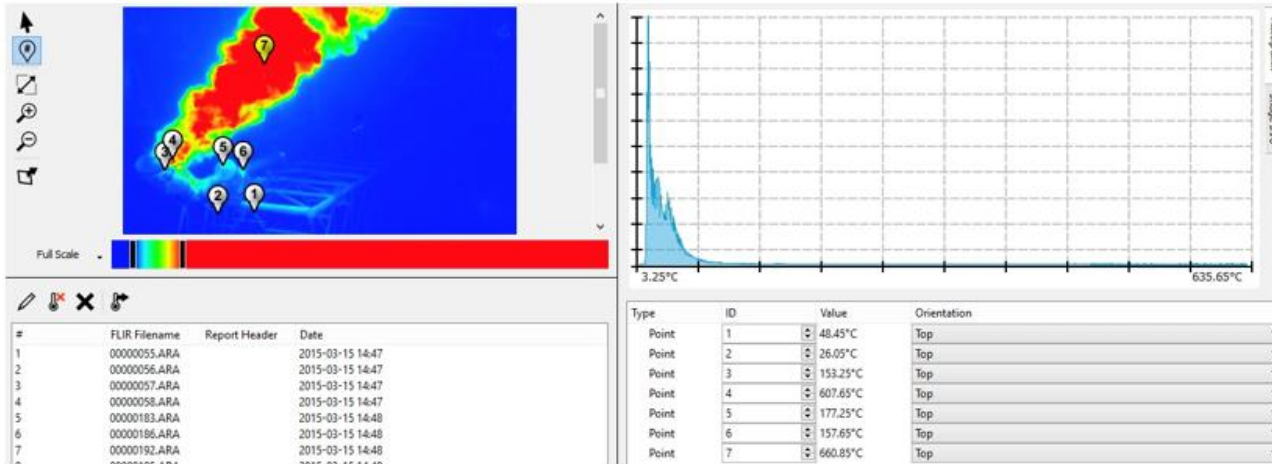
✓ Confined Space / In-tank inspections



# FPSO COT Inspection

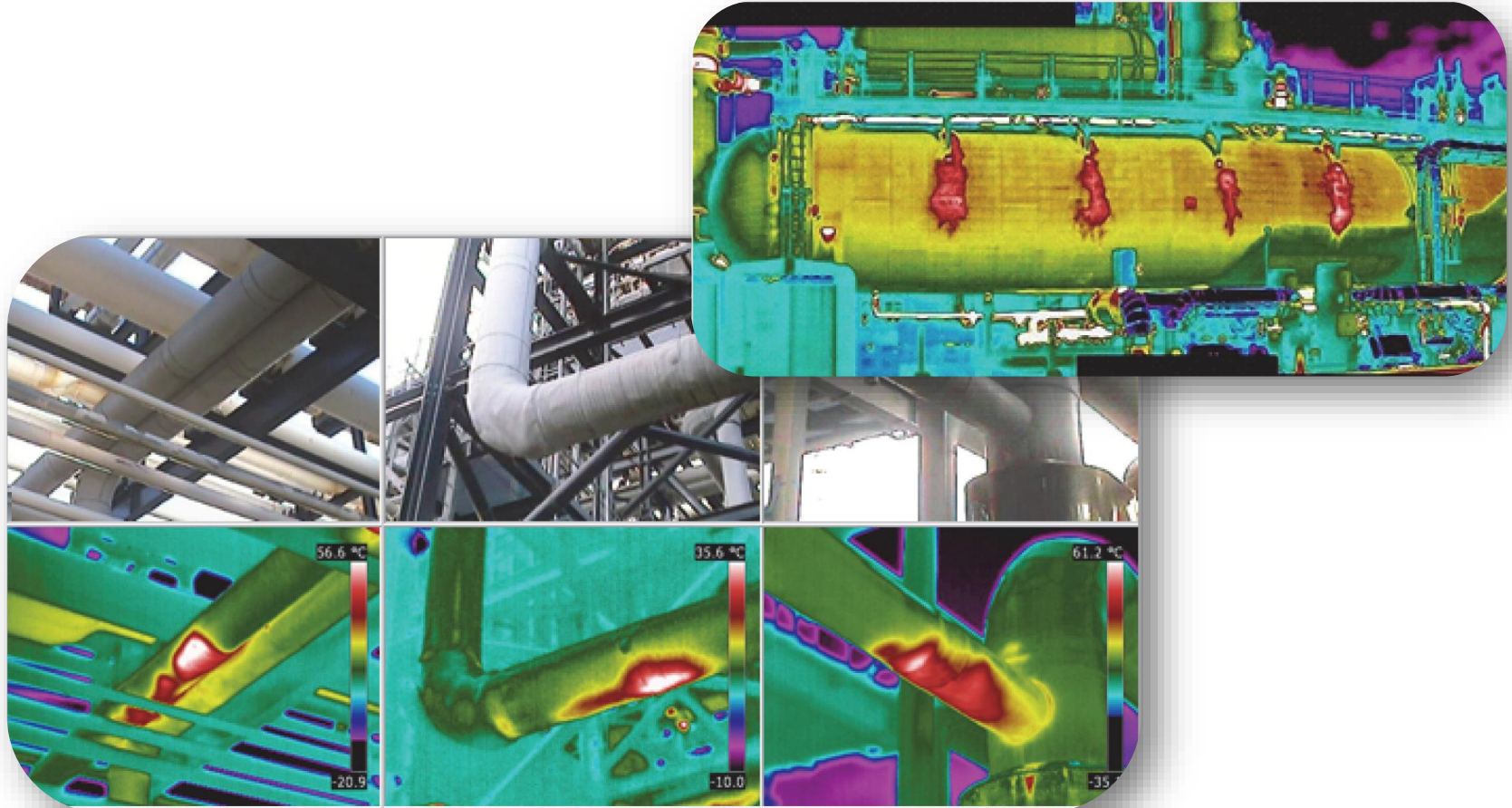


Hotspots and temperature gradient





# Thermal imaging of water in insulation



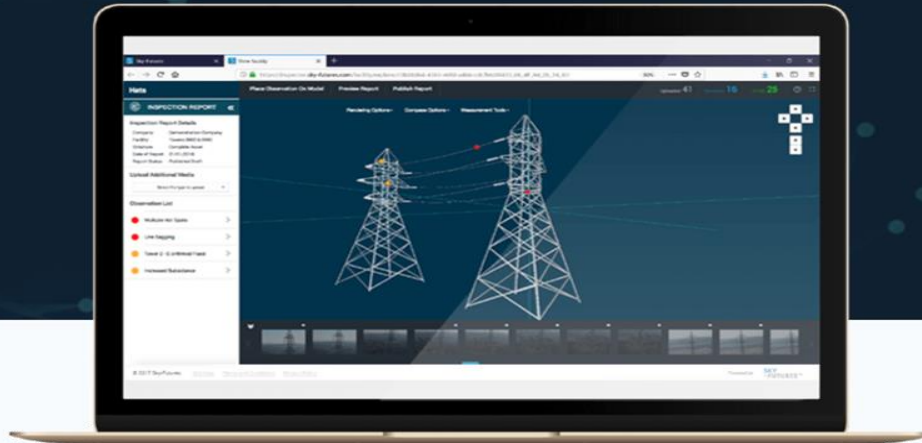


# Creating an integrated eco-system



# E X P A N S E

Asset Management & Data Analytics Drone Inspection Software for Industrial Inspections



# Access to inspection data via 3D models



SKY -FUTURES | Map | Facilities | Inspections | Reports | Management | System

Chris Blackford - System Admin

**TIME**

- 2018
- 2018
- FLARE BOOM

**TYPES**

**STRUCTURE**

**ANOMALY**

**CORROSION**

**COATING CONDITION**

Apply

Clear all filters

**Remedial Band Strap Repairs**

**INSPECTION** SP-0028

**REPORT** Report: Flare Boom

**SEVERITY** Low

**LOCATION** Flare boom  
Members and Chords along

**DESCRIPTION**

Band strap and shear inserts to chords and members, areas where lower shear has been secured to steelwork with strap appears loose. Potential corrosion issue.

**CORROSION SEVERITY** Class 2

**COATING CONDITION** Class 2

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# Data analytics: automated detection of objects or defects



Hitachi - Inspections

REVIEW DATA SET

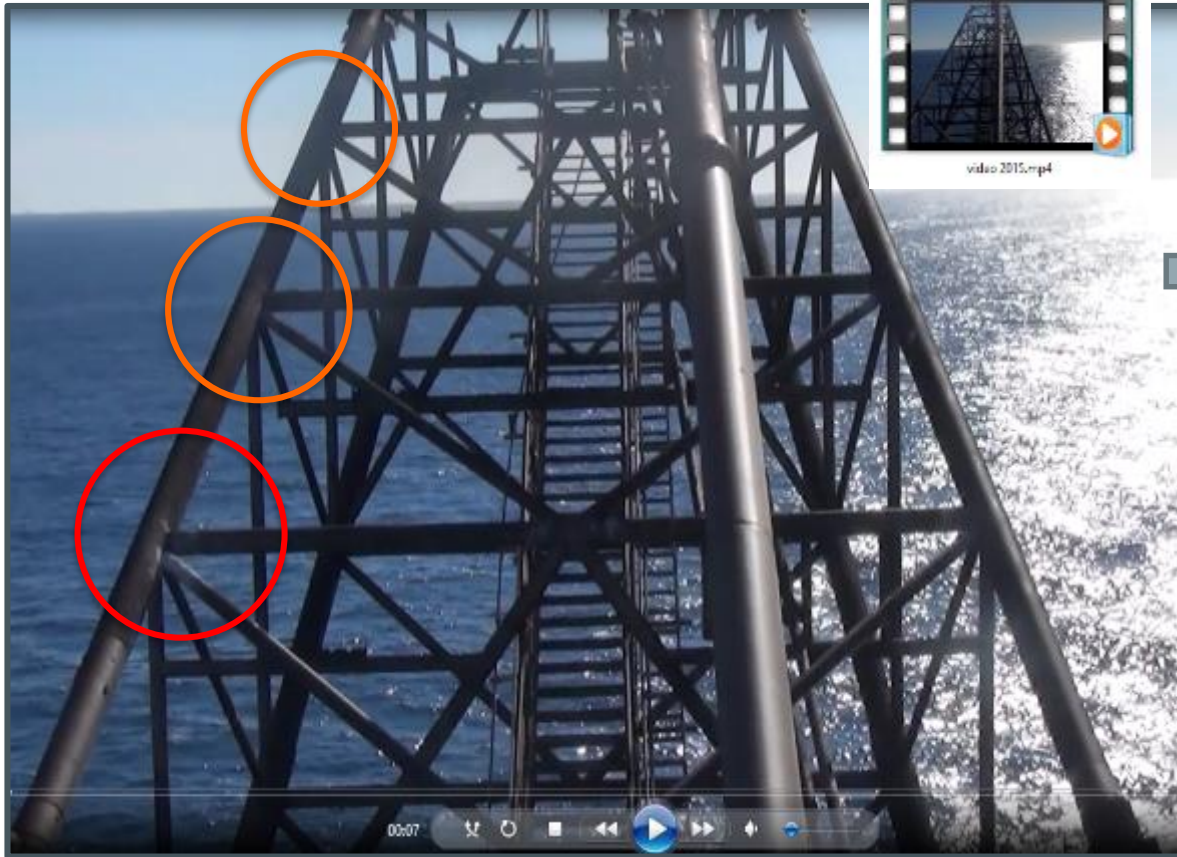
Customer: Eku Power Line Inspection  
Asset: EP - Object 0001  
No. Of Files: 64  
Uploaded On: 14-Feb-2018

Asset Mapper View Generate 3D Model  
Send Data Set Create Formal Report

Expand automatically searches through your data

This also applies to faults or broken structures

# Automated identification of inspection points



From a flare boom with many similar joints...

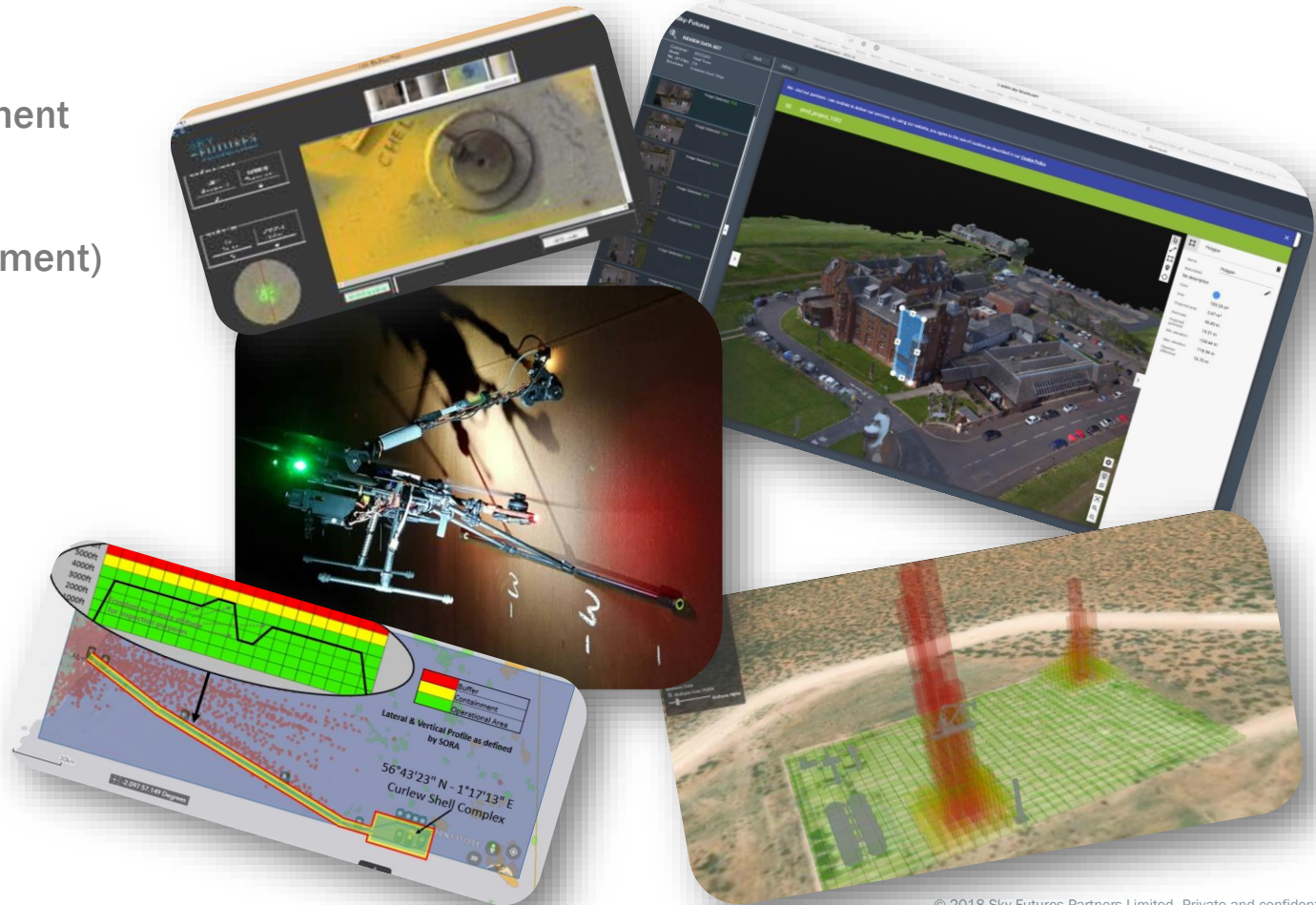
...and correctly identified on an  
inspection video one year later



# More new technologies are being added rapidly



- Defect size measurement
- Photogrammetry (3D models, measurement)
- Ultrasonic Thickness Measurement (UTM)
- Gas detection
- Long range surveys: Beyond Visual Line of Sight / Mixed Traffic

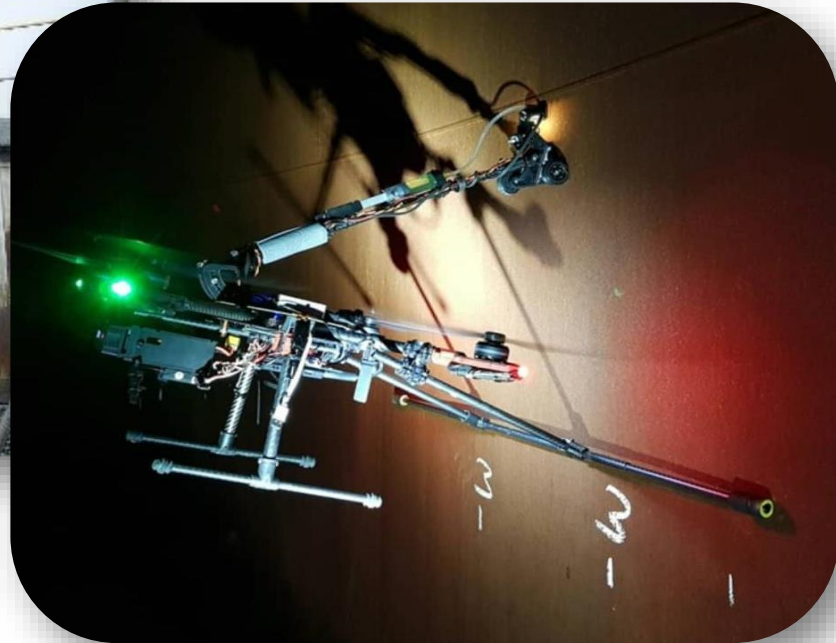


# UAS based NDT – thickness gauging



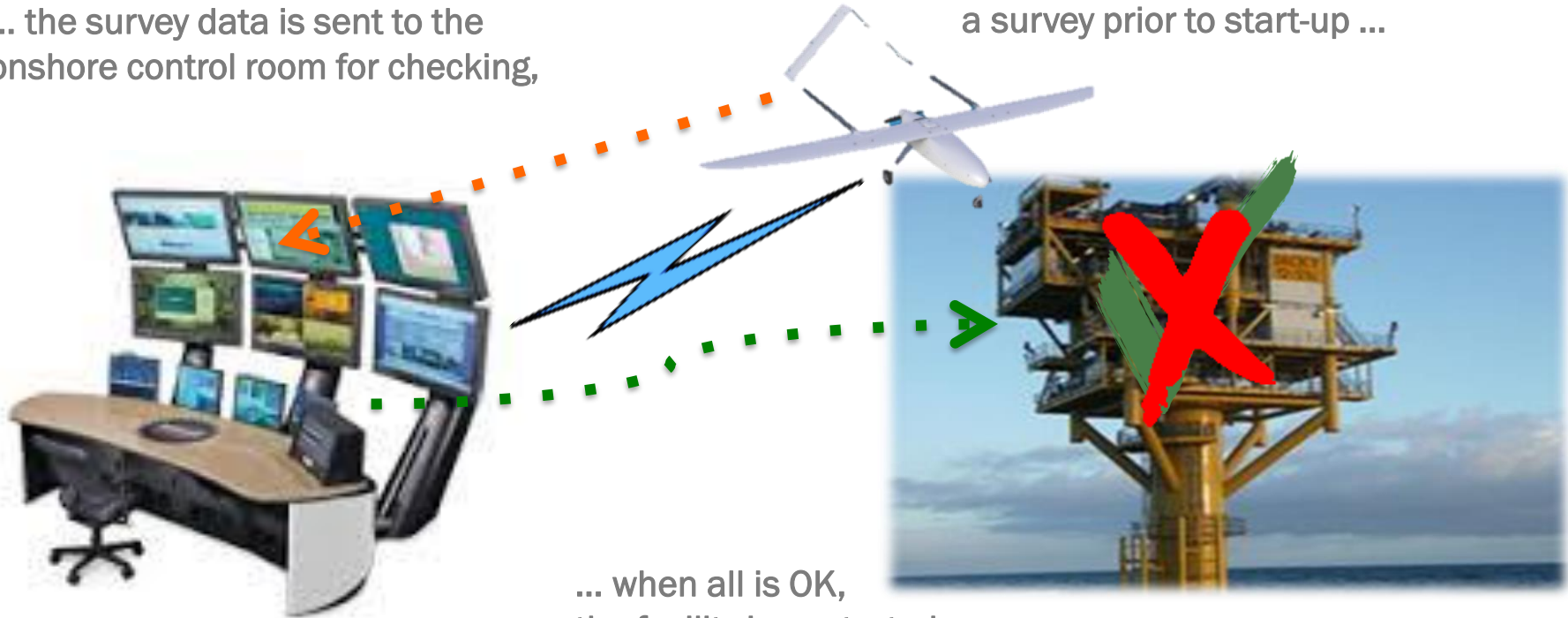
## Two different approaches

- Fixed UTM ‘patches’ – UAS read-out
- UAS born UTM probe with contact fluid injection





... the survey data is sent to the onshore control room for checking,

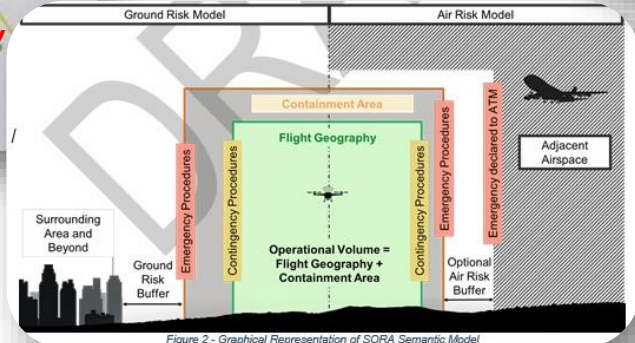
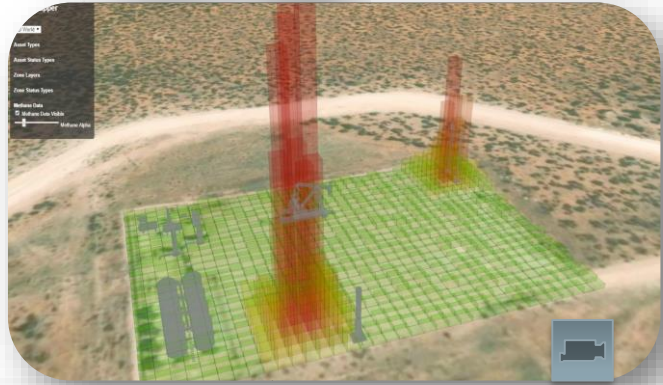


When the facility is shut-down after an upset, the UAS is launched to conduct a survey prior to start-up ...

... when all is OK, the facility is re-started.



# Mixed traffic long range surveys (BVLOS) combined with methane detection



Remote inspection data collection

Figure 2 - Graphical Representation of SORA Semantic Model

# UAS-based fire fighting



## FIRE DETECTION. AND RESPONSE.





*Two distinct use cases, each requiring a different technical solution*



## 1. Rapid Response

Dealing with an immediate fire hazard or beginning fire, before it escalates



**Requires** the UAS to rapidly fly to any location on site and high manoeuvrability, i.e. a free flying solution. Fire suppressing agent is carried by the UAS in a tank; *limited capacity*.



## 2. Fire Suppression

Dispersion of (large) quantities of fire extinguishing agent (foam) on a full fledged fire in areas that are difficult to access by conventional fire fighting equipment



**Requires** the UAS to deliver a high volume of foam over a long period of time (hours), i.e. a tethered solution. Foam is supplied through a hose to the UAS, electrical power and control signals through the tether cable; *Set-up time will be comparable to conventional fire fighting equipment*.



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**Thank you!**