Disruptive Innovation to Enhance Asset Integrity

Deep Offshore Southeast Asia Congress 2019
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Peter Davies, Director Regional Development Asia Pacific

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ISO 9001:2015 ANAB

2019 ROSPA President's Award

Recognized ABS Specialist

Achilles FPAL Registered

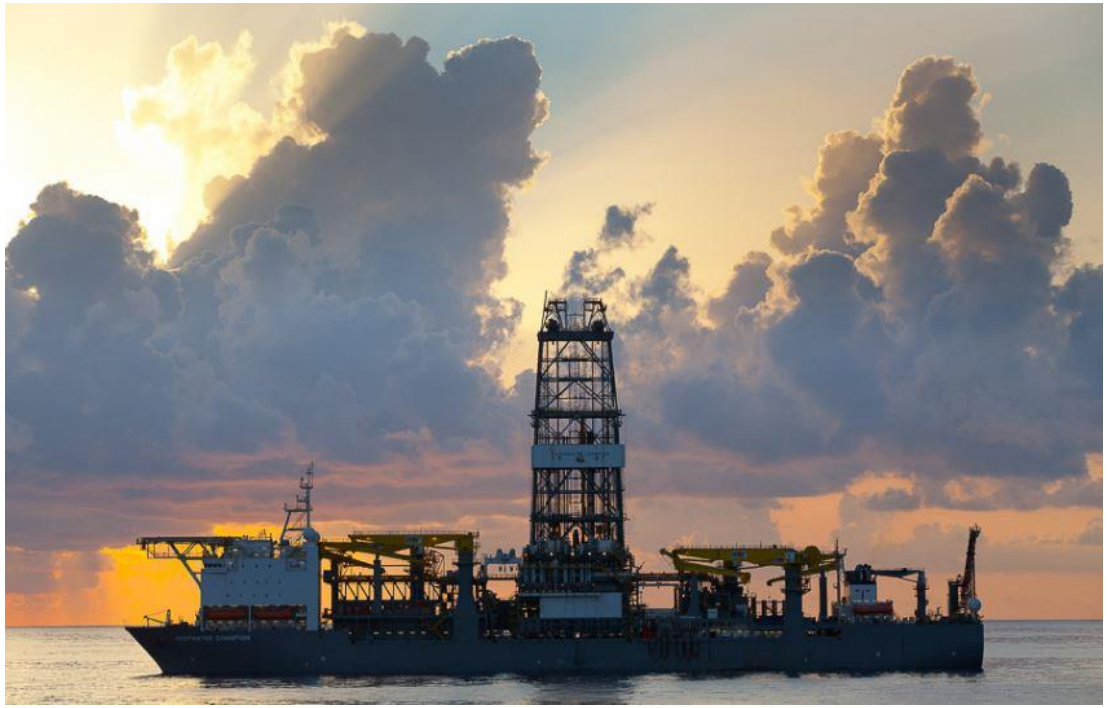
NATA Accredited for Technical Competence

2018 Safe Way Achiever Award Winner Gold

Management System Certification DNV·GL ISO 9001 = OHSAS 18001 AS/NZS 4801

Disruptive Technologies

- Diverless solutions for UWILDs.
- Non-intrusive inspection of Ex equipment.
- Digital methods for reducing Pressure System inspection scope.
- Remote inspection of tanks in confined spaces.



Why have we 'landed' on these topics and capabilities?

The HITS JIP, its Members, and Participants led by EM&I

The ***Hull Inspection Techniques and Strategy*** (HITS), ***Joint Industry Programme*** (JIP) includes members of all major Class Societies and Operators, whose objectives are to improve hull inspection methods.

Desire to change
- New ideas supported, encouraged and added to by all parties

Clear Direction
- No divers
- No people in confined spaces
- Minimum tank cleaning
- Hull Inspector Competency

Today, leading to improved safety and large reductions in cost and POB aligned to the $50 barrel world...

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UWILD Requirements

Currently Class Societies Rules for Floating Offshore Installations mirror their Ship Rules

However:

1. FPSOs do not suffer bottom damage;
2. Hull hydrodynamic efficiency is not critical;
3. Damage to Antifouling cannot be repaired *in-situ*;
4. Many do not have propellers or rudders; and
5. FPSOs do not drydock for extended periods of time, if at all.

In lieu of the above:

- *IS HULL CLEANING REALLY NECESSARY?*
- *HOW DO WE MANAGE SHIPSIDE VALVE INTEGRITY?*

EM&I Approach - ODIN®

Reducing and now eliminating requirement for divers and work class ROVs; Class-approved UWILDs; therefore reducing or eliminating OFF-HIRE time to the vessel owner

Asset	2018 – Actual Cost Using ROV	Cost Using Divers (estimated)	Total Saving to Client / day
FPSO in Angola	US$ 55,000	US$ 370,000	**US$ 315,000**

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Internal Valve Isolation and Sea Chest inspection:

- Inspection port welded onto critical piping or sea chest; and
- Specialised cameras inserted into the port, inspect the valve functionality during normal operations.

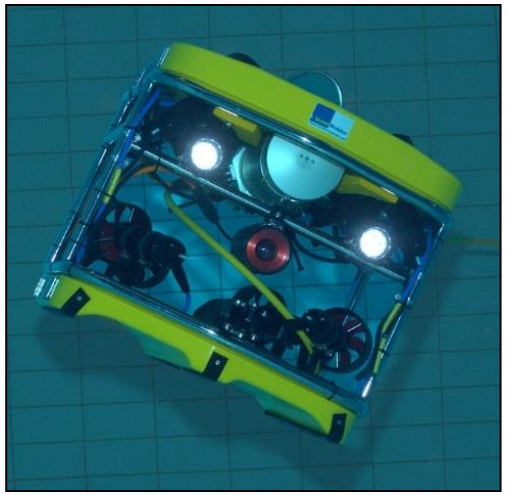
….and External Bottom Hull Survey

ODIN® External Bottom Hull Survey

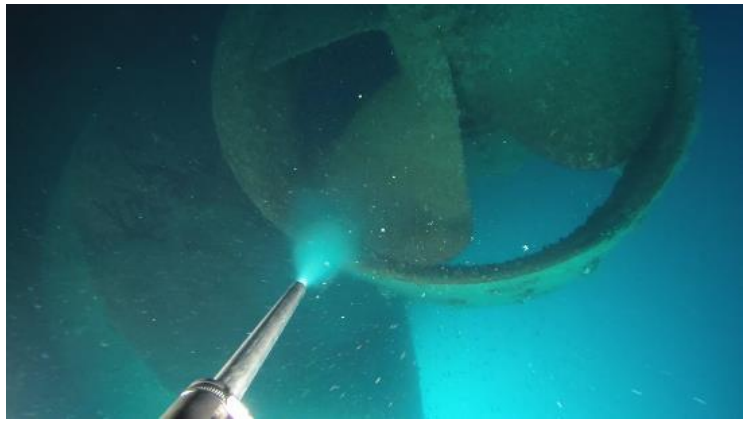
Mini-ROV Survey & Hull Cleaning

Use of deck-launched ROV for external bottom hull survey:

- Hull Cleaning [including sea chest inlet grids]; cavitation blaster;
- Thickness Gauging; and
- CP Readings



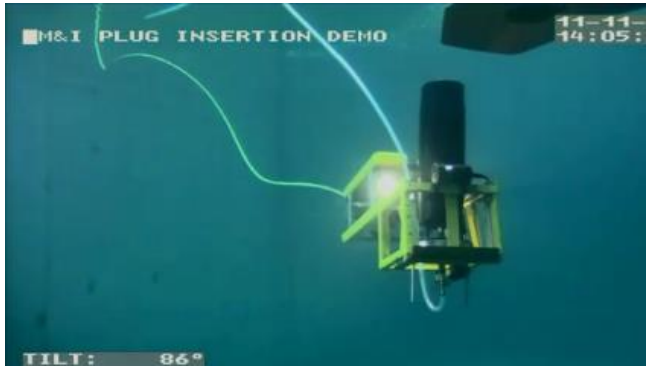
Cavitation Blaster

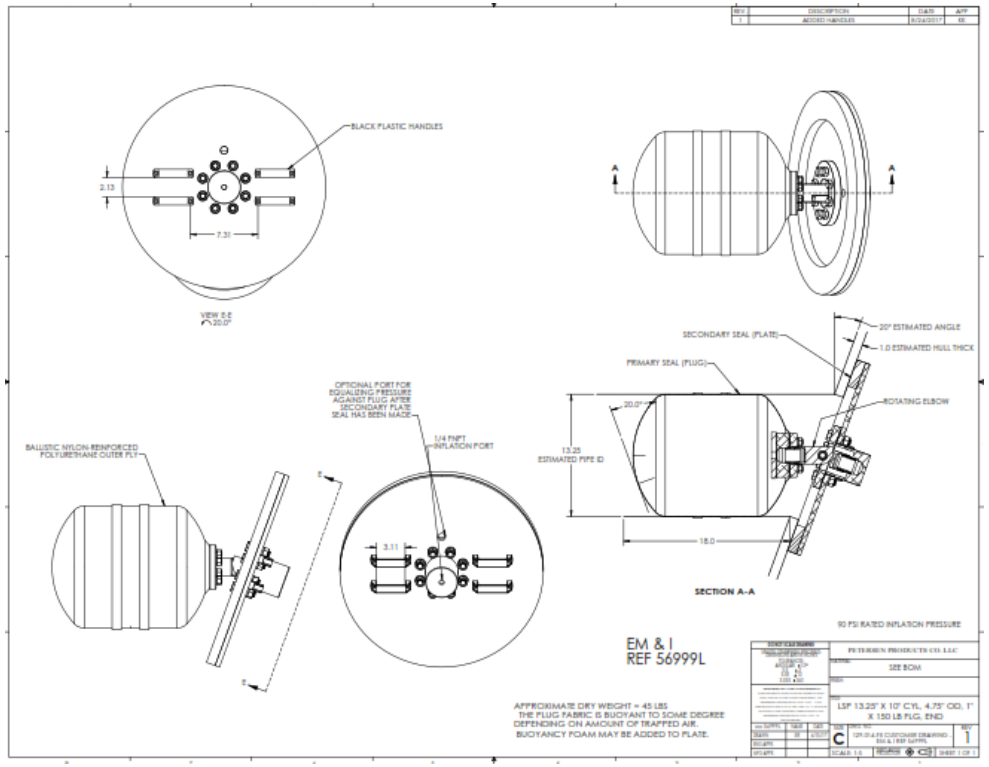


UT Probe

CP Probe

ODIN® Valve Repairs – ROV or Internal Installed Plugs





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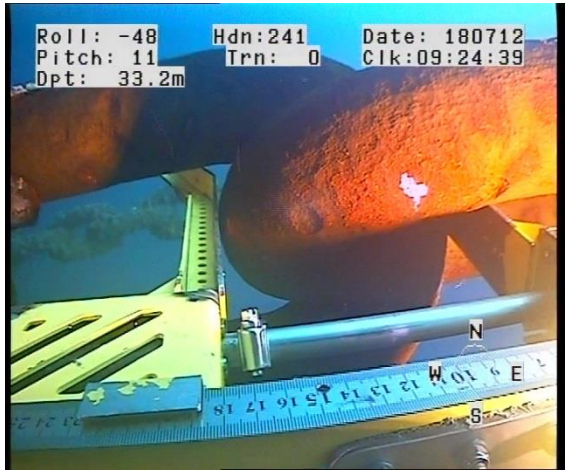
Mooring Integrity

Deck-launched, stabilised ROV and calipers:

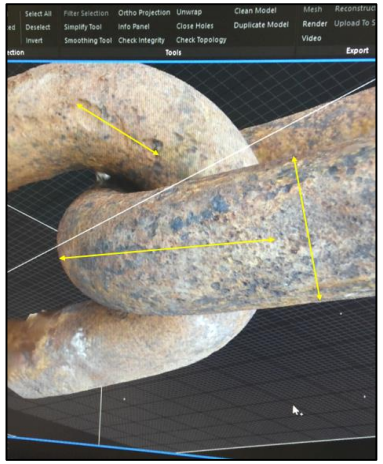
- Inspection of 30-40 metres with focus on cleaning to detect **pitting and cracking;**
- Development of advanced optical systems underway and to be introduced later this year; and
- Angle Measurement.



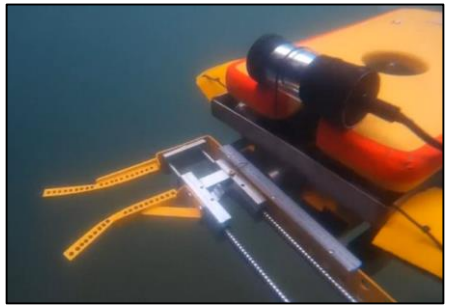
New Development for Mooring Chain Inspection

LORIS – under development for 2019 capability

Hydraulically-operated, swimmable chain measuring, does not require ROVs for Inspection



- Descends chain down to sea bed;
- Cleaning using cavitation blasting;
- Measures chain with Laser Scans;
- Advanced Photogrammetry; and
- Measures chain angle through inclinometer.



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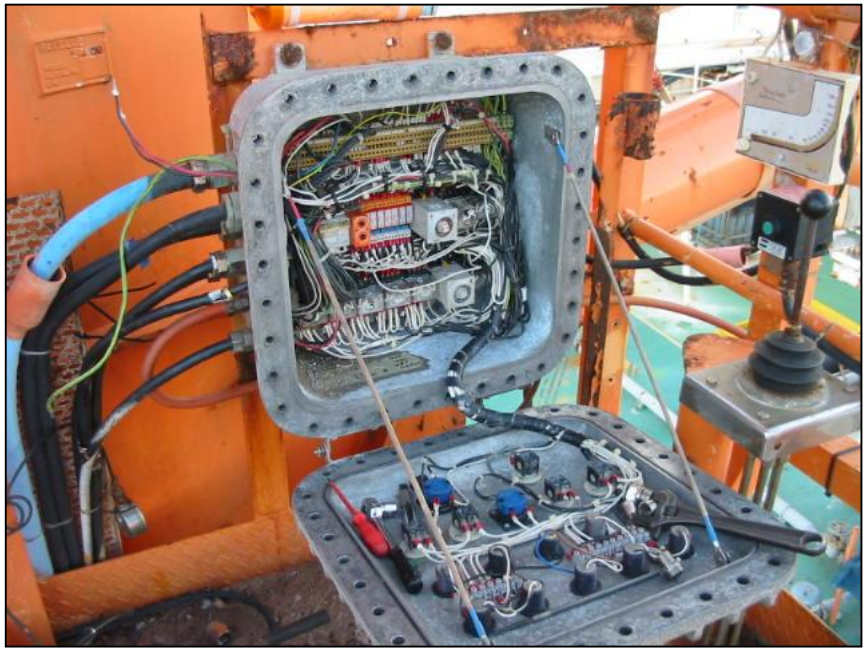


ExPert Inspections

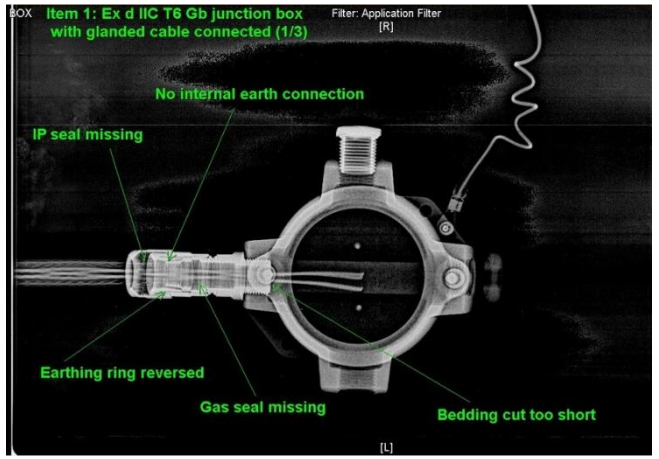
- Large number of electrical components.
- Criticality-based inspection prioritises but doesn't reduce scope
- Risk-based inspection will reduce scope and cost – target >25%

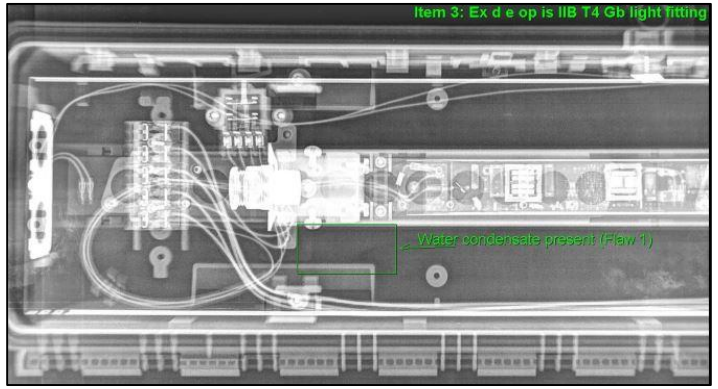
What's the challenge?

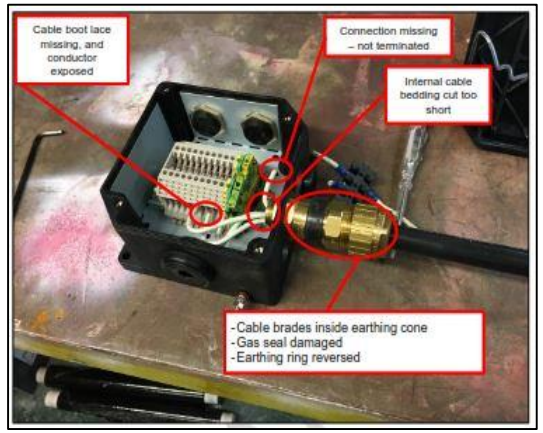
- RBI needs data on degradation mechanisms.
- This is being gathered from industry sources

Solution:

- Industry-led approach will accelerate success







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Pressure System Integrity (PSI)

ANALYSE™

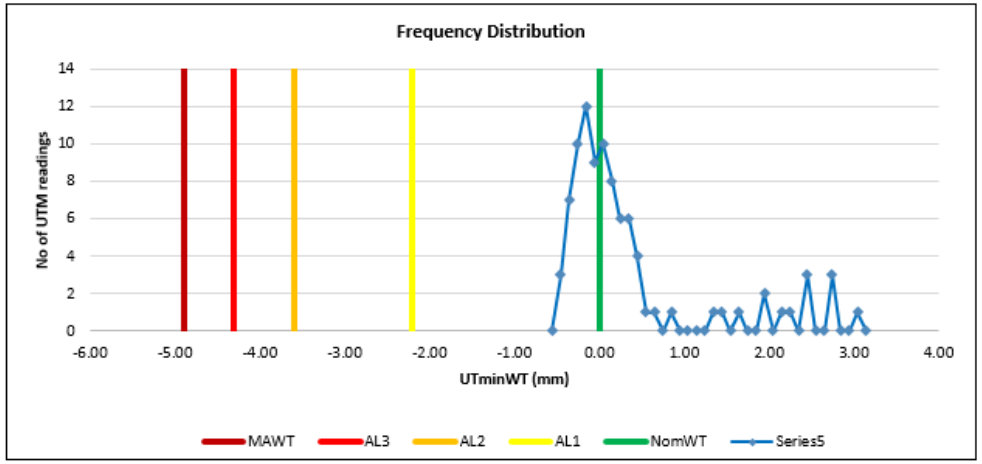
Traditional Way

- Objective – eliminate LOPC (Loss of Pressure Containment)
- RBI of high and medium-high risk components with ~10% 'Hit Rate' for internal anomalies

Are we wasting money inspecting the other 90%?

New Way

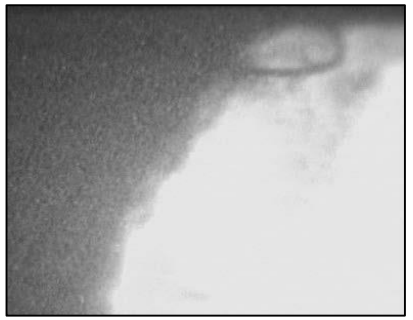
- ANALYSE – provides integrity information about:
  - remaining wall thickness; and
  - internal condition of piping
- More efficient way than current industry practice:
  - Statistical RBI using 'big data' analysis; in order to
  - reduce inspection by ~ 50% without loss of assurance
- This allows spend on real issues such as CUI



Pressure System Integrity (PSI)

Corrosion Under Insultation [CUI]

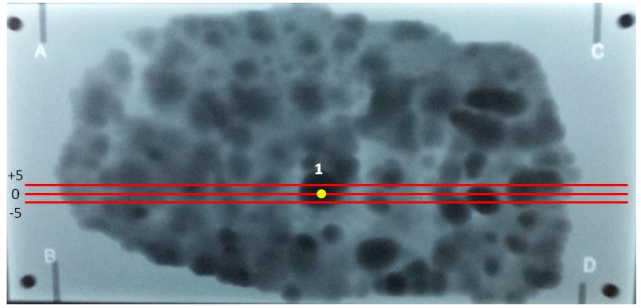
- RBI – identify righ risk failure areas and reduce scope;
- Thermography – water ingress;
- RTR – Real Time Radiography – Screening;
- Digital Radiography;
- Anomaly Management; and
- Reduced requirement for insulation removal as a matter of course

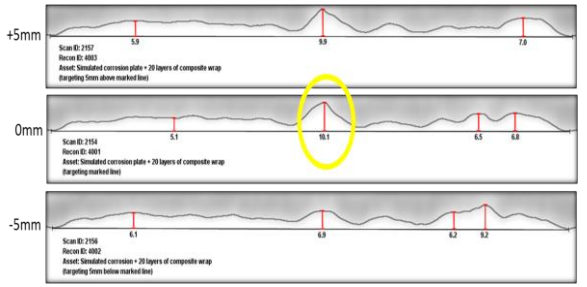


Pressure System Integrity (PSI)

BCT – Backscatter Computed Tomography

- Conventional systems place the object inside the scanner.
- This is not practical for many industrial applications.
- EM&I has developed a new approach which complements radiography for O&G applications….





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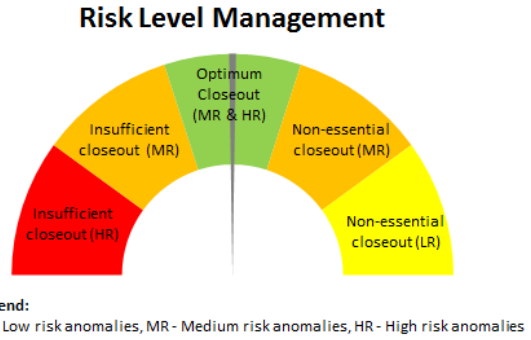
RBI – Risk Based Inspection

- Reduce and focus inspection scope;
- Inspection plan based on failure mechanisms, identify areas of high risk;
- Engineering recommendation;
- Integrity Reports;
- Asset management information; and
- Management program – HIMPS (hull inspection management program system)

Fleet Anomaly Matrix

	Totals	*2*	*5*	*77*	*984*	***1068***
Anomaly Severity	**5**	0	0	1	8	*9*
	4	1	0	4	31	*36*
	3	0	0	4	65	*69*
	2	0	0	13	256	*269*
	1	1	5	55	624	*685*
		L	**ML**	**MH**	**H**	**Totals**
		Consequence				

Figure 1 – Fleet Anomaly Matrix



Legend:
LR - Low risk anomalies, MR - Medium risk anomalies, HR - High risk anomalies

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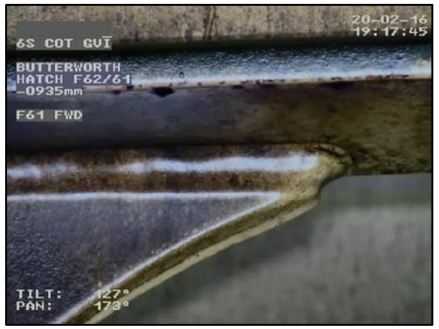
NoMan® Inspection of Cargo Oil Tanks

Objective

- Reduce personnel entry into confined spaces
- Class and Flag require an 'equivalent' inspection
- GVI / CVI
- Distortion / deformation survey

If corrosion evident will require Gauging

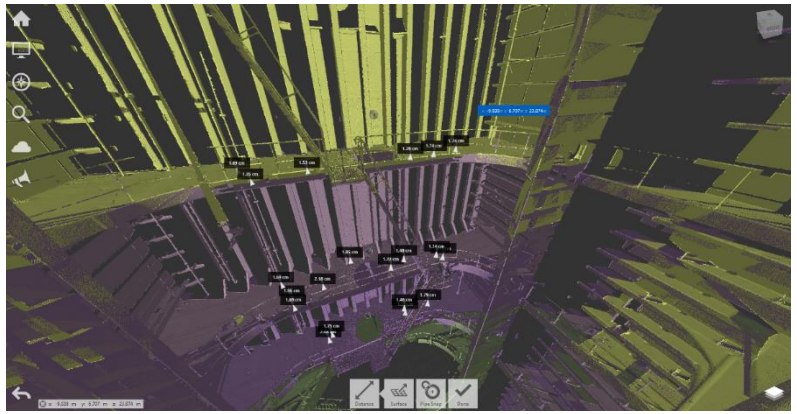


NoMan has met this challenge – EM&I carried out ABS and LR approved inspections of COT/WBT without personnel entry

4 x Cargo Oil Tank Survey	
NoMan Method • 3 days out of operation • 2-man team working outside the tank • 90% mantime + US$ 448,000 saving	**Conventional Manned Entry Method** • 22 days out of operation • 6 man team working in the tank

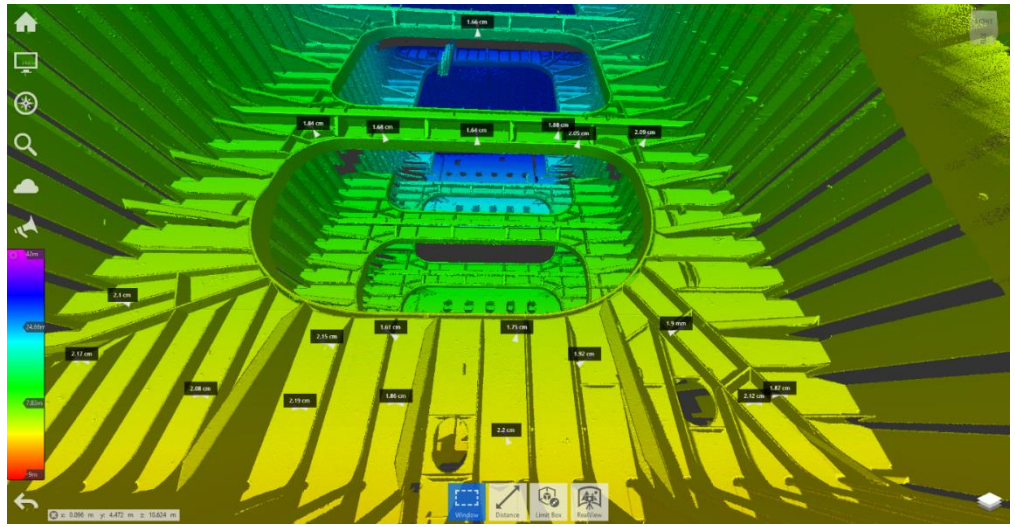
Disruptive Technology – Laser Scan NoMan®

- Structural Survey
- Dimensional Data
- Deformation (Buckling)
- Surface conditioning



- COT
- FPSO offshore Angola
- February 2019
- No man-entry in to the tank
- Point Cloud Model – Baseline for future inspection

- GVI / CVI
- Remote Thickness Measurement
- Deformation / Buckling
- Surface Features – Corrosion + Coating Breakdown



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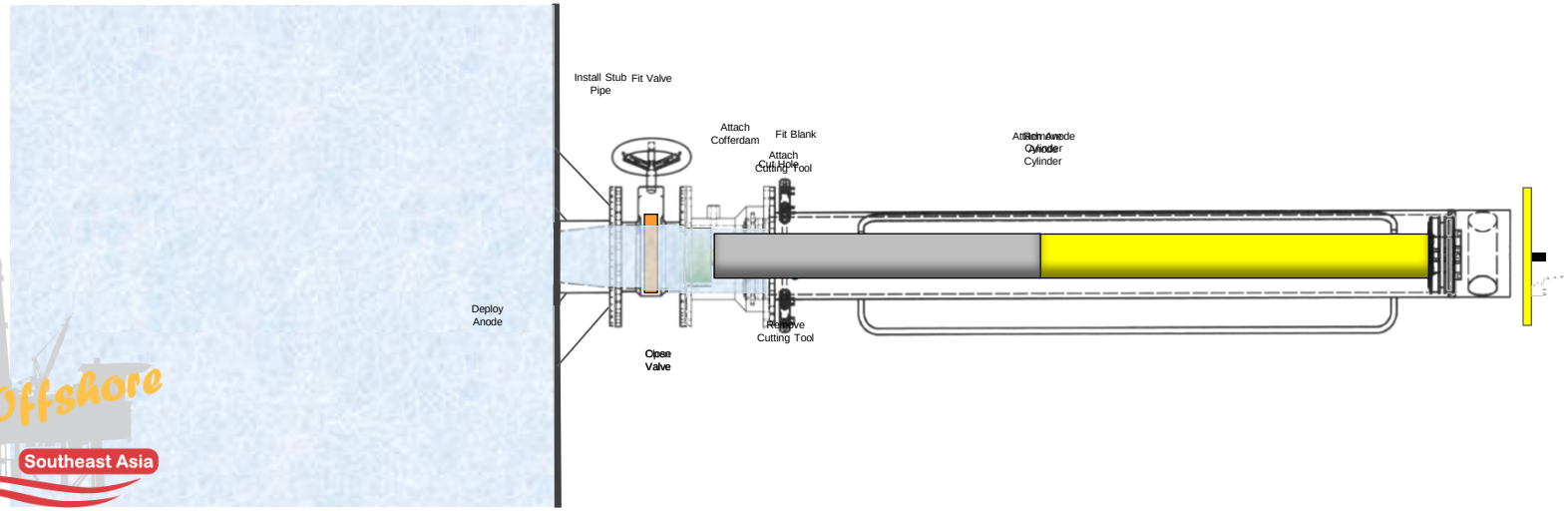
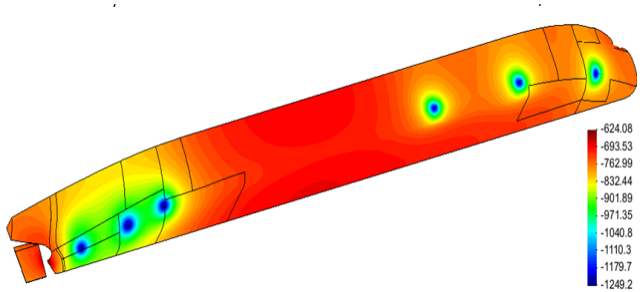
….and finally….

HullGuard® ICCP System

- Class-accepted ICCP system designed specifically for Floating Assets.
- ICCP requirements are determined by computer modelling
- The anodes are installed and maintained through an ODIN® access port using a pneumatic installation tool
- It is modular; the number of anodes can be increased as the asset ages and the modelling indicates requirement; and
- First Hullguard ICCP System Project being completed on FPSO Bleo Holm





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Disruptive Technologies: Outcomes

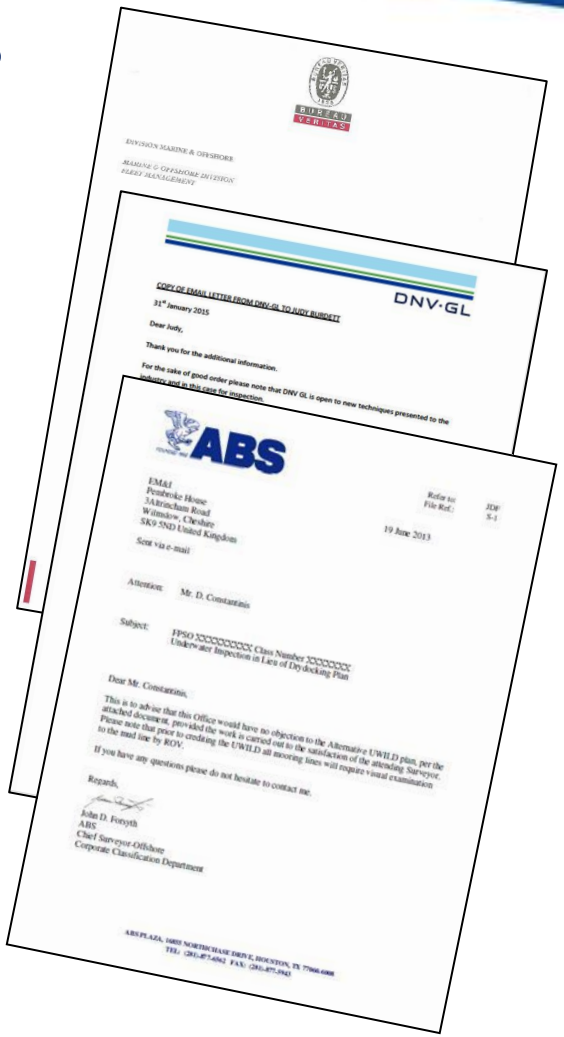
<u>Operator</u> perspective?

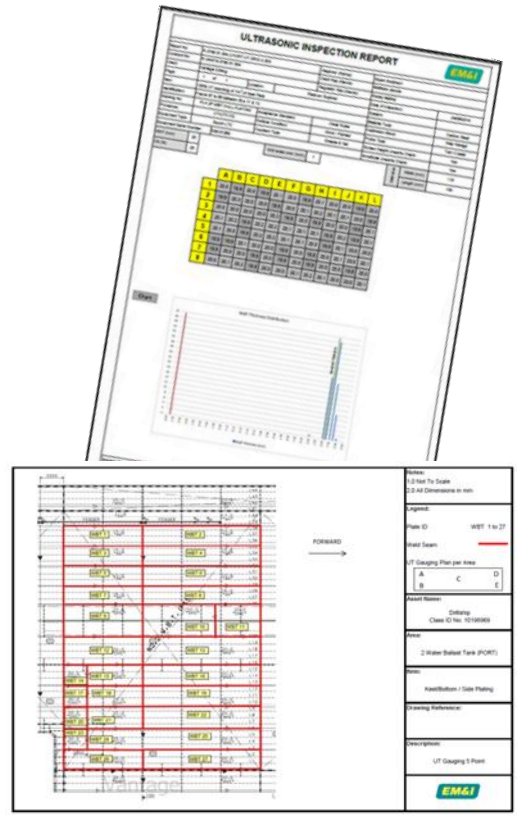
- Improved safety
- Lower cost and budget certainty
- Reduced POB – now available for brownfield projects (life extension and production upgrades)
- Better data to optimise maintenance
- Improved asset integrity and reliability
- Compliance

<u>Regulator / Classification Society</u> perspective?

- Improved safety
- Better hull integrity information
- Compliance

…and hence approvals





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Questions?