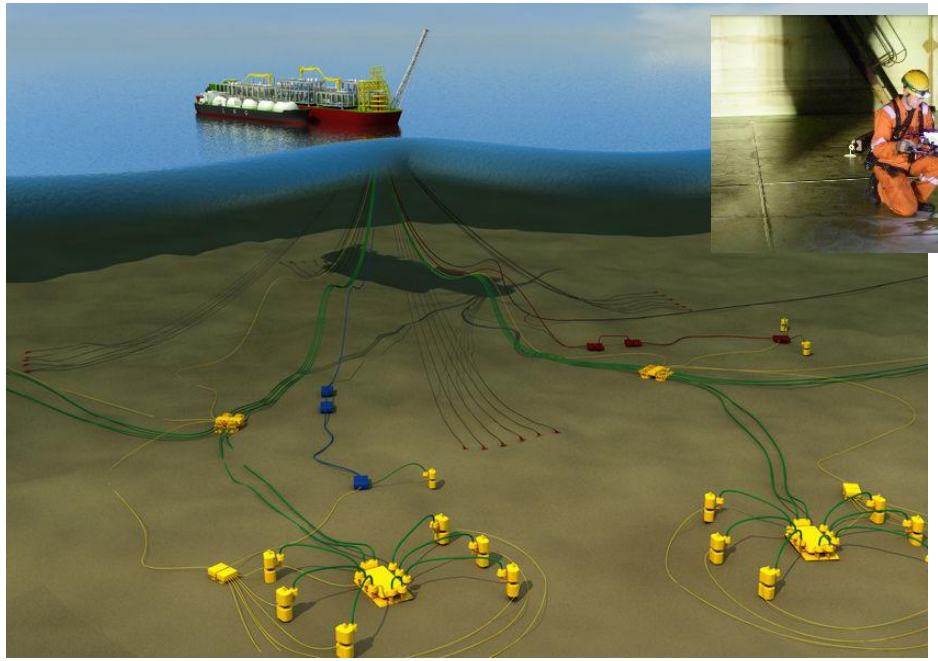

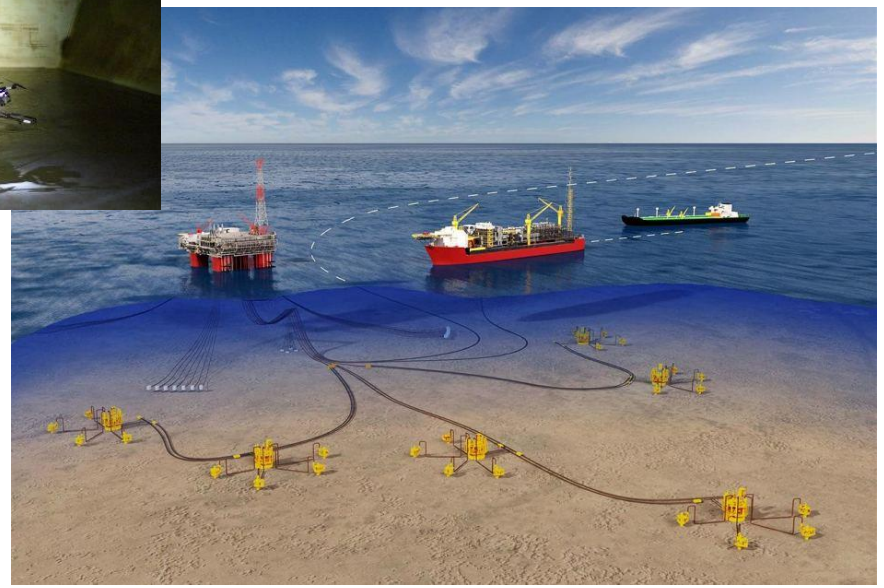

RHUM Forum

RISERS | HULL | UMBILICALS | MOORINGS

Optimising Hull, Mooring and Riser ROV/UAV Inspections – An Industry Position

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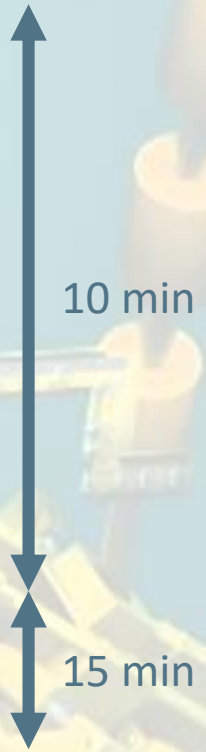


1. What is the RHUM collaboration forum?

1. What is the RHUM collaboration forum

Background

1. Evolution of individual 'coffee catchups' – providing group focus and networking
2. Founded March 2016
3. Self funded (the time we provide)

Purpose

1. Regular structured forum to enable informal Operator sharing of best practices for technical, safety & operation for hull, marine and related subsea disciplines
2. Share knowledge of new (public domain) technologies and practices which will benefit the industry
3. By sharing best practice, avoid repeated inefficiencies and mistakes which could have an impact on safety, environment and economics
4. Identify and escalate key topics that require formal collaboration
5. Share learnings associated with Regulatory matters (e.g. NOPSEMA, AMSA, Class)
6. Interface with other collaboration forums

1. What is the RHUM collaboration forum

Participants

2. RHUM focus topic: Optimisation of ROV/UAV inspections

2. RHUM focus topic: Optimisation of ROV/UAV inspections

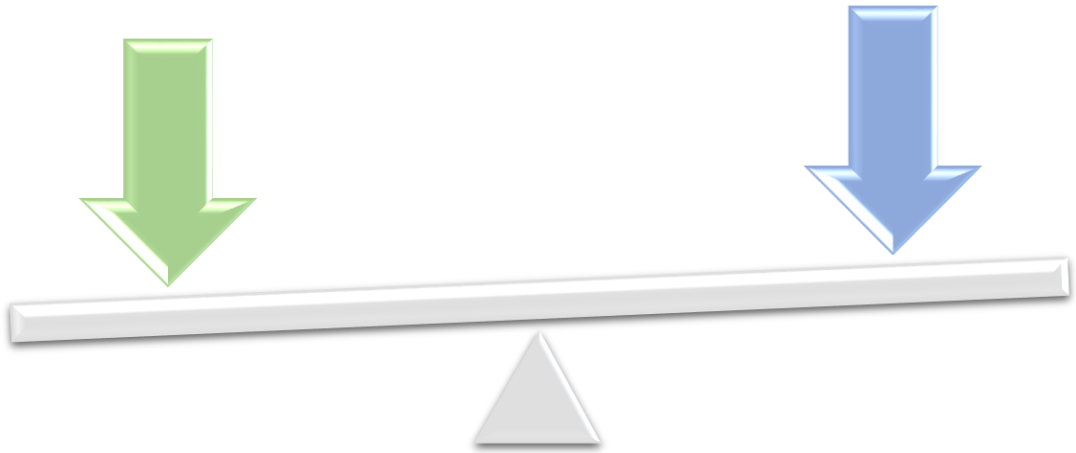
Challenge: Balancing & bridging gap between supplier offering & operator requirements

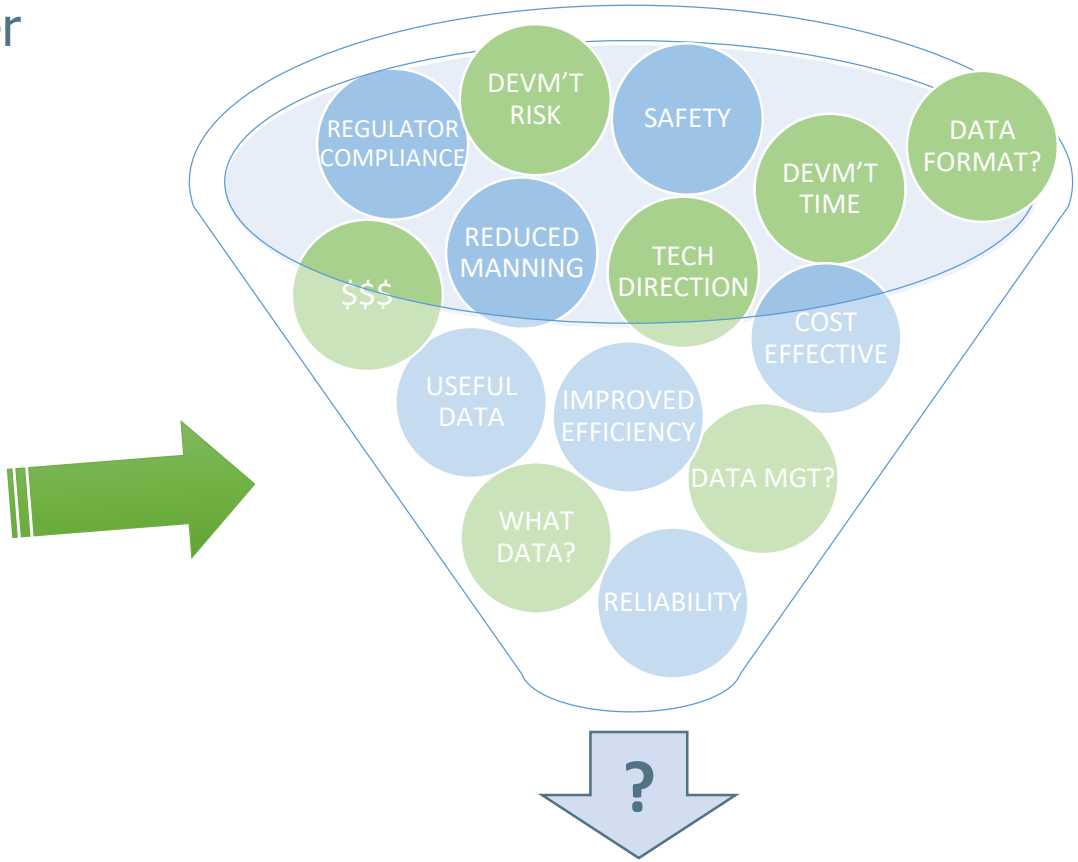
Suppliers

Develop new technology

Operator

Improve integrity management



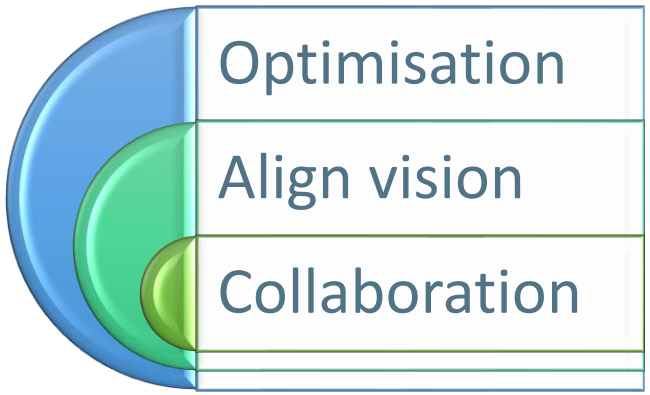


Optimised inspection

2. RHUM focus topic: Optimisation of ROV/UAV inspections

How could the RHUM collaboration forum assist with this process?

- Facilitate dialogue between Supplier and Operators
- Agree common goals & directions



What we did and are doing (developing an industry position)

- December 2017: Supplier lead discussion
- Aim of session: *'With a focus on new technologies, discussion around optimisation of inspection methods and their integration into the wider integrity management process. Agree the two most important topics which could benefit from collective action.'*
- Numerous subsequent operator meetings to discuss requirements and vision
- Present the findings to you today

3. Industry position

3a. Industry position – Suppliers

- Forum discussion areas:

ID	Topic	Votes
1	Launch & recovery	
2	Ability, necessity of tracking ROV outside of hull	2
3	UAV photogrammetry	5
4	Technical qualification / risk - Collaborative trials	6
5	Collaborative use of high value technology	1
6	**Understanding Operator data requirements including longer term vision**	**7**
7	R&D Funding	7
8	**Agreeing short & long-term goals (included in 6)**	
9	Remote Inspection Technology (RIT) technical acceptance by Regulatory Framework	4

➢ Agreed that each Operator could provide:

i. High-level 5-year ambition for ROV/UAV inspection progress
ii. Short list of key drivers to act as a framework in achieving this ambition

3b. Industry position – Operator key drivers

Key drivers

- Safety: Reduce manhour exposure offshore
- Economics: Demonstrably cost effective compared to manned inspection
- Data: Capture only useful data & enable better use of data
- Technology risk: Palatable to Operators and Suppliers

3c. Industry position – Operator vision: 5-year horizon

Now	1-3 years	4-5 years

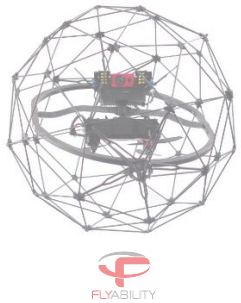
Vehicles & tooling:

- ROV GVI, CVI & TMs for WBTs, external hull, mooring & risers
- UAV GVI, CVI cargo & WBT in dock, & external hull on station
- Remote camera GVI & CVI of cargo tanks

Navigation / location: Manually piloted, line of sight (tanks &hull), USBL (moorings & risers)

Data: Mostly still 'traditional' pdf reports, starting to use digital systems

Manning: Team of 2-4 for remote inspection, Class Surveyor presence & significant levels of complementary manned inspection required (e.g. CSE, diving…)



3c. Industry position – Operator vision: 5-year horizon

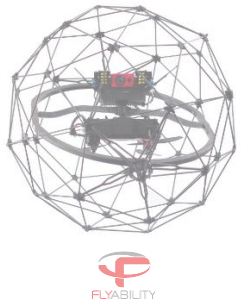
Now | **1-3 years** | 4-5 years

Vehicles & tooling: Range of vehicles with NDT tooling to accurately & repeatably report tank condition (corrosion, cracks buckling…)

Navigation / location: Pilot aids to reduce level of training required & make technology more accessible, navigation in tanks

Data: Send data directly to a digital twin

Manning: Smaller team (dual roles), reduction in Class Surveyor offshore attendance, significant reduction in CSE /diving requirements



3c. Industry position – Operator vision: 5-year horizon

Now	1-3 years	4-5 years

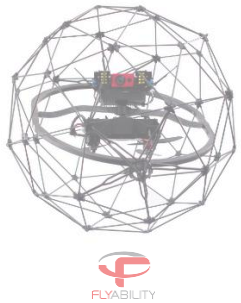
Vehicles & tooling: NDT capabilities comparable or superior to manned inspection, intrinsically safe devices for live hydrocarbon tanks

Navigation / location: Autonomous navigation / location & flight in all situations

Data: Fed directly into live analysis models for real time integrity status

Manning: CSE mostly eliminated for tank inspection, Class Surveyor and Inspector shore based with live link

NB: Technologies shown for example only - other brands are available!



4. Panel discussion