Enabling Autonomous Inspection Technology Solutions to Transform IMR Operations

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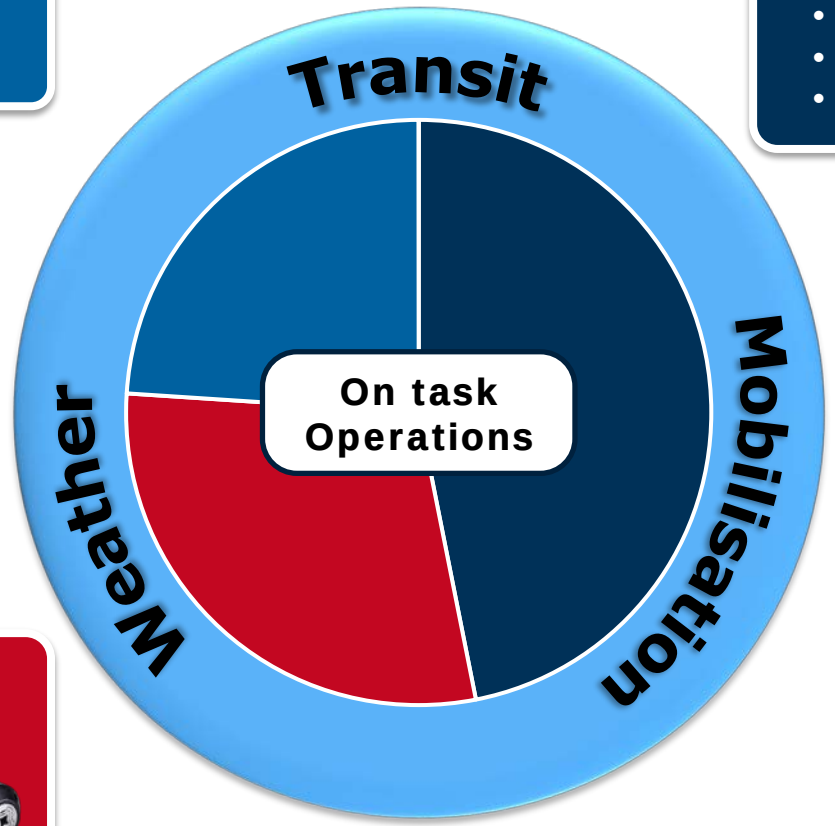
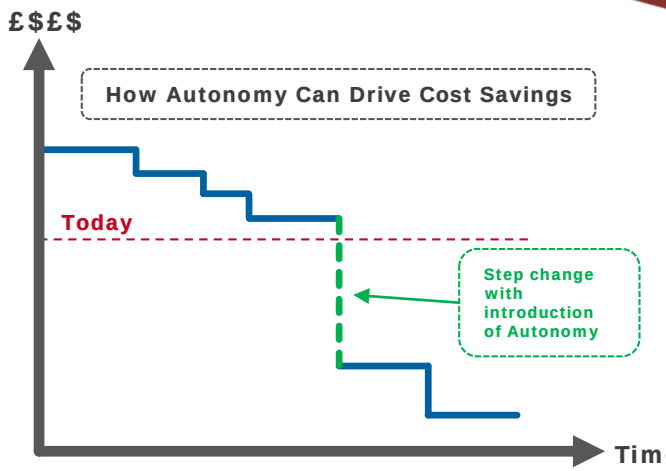
Inspection, Maintenance & Repair Today: Vessel Reliance

Inspection
- ROV
- General Visual Inspection

Maintenance
- Light Intervention
- Torque tool
- Manipulator operations



REPAIR
- Heavy Intervention
- Crane / Module handling
- High power tasks



Todays Trends and Enabling Technologies

Technologies & Trends

- Access to high bandwidth “4G” communications offshore
- Secure Wide Area Network connectivity
- Electrification of underwater systems
- Autonomy

What do we mean by Autonomy Underwater?

- The application of **intelligent behaviours** that enable underwater systems to operate independently or be remotely supervised
- Reduce the dependency on surface vessel support & required resources
- Increasing efficiency

Autonomous Technology Solutions

A	Onshore Control Centres	G	Surface Power Communication Buoy
B	Autonomous Vehicle (SIMOPS)	H	UWILD/Moorings
C	Pipeline Inspection	I	Riser Inspection, Condition Monitoring, Analysis & Integrity Management
D	FPSO Hosted AIV		
E	Seabed Hosted AIV	J	RWOCS/Hydrates/Sampling
F	Subsea Enabled Vehicle	K	Autonomous Surface Vessel

AIV

i-Tech Services' AIV is the most advanced, fully autonomous, hovering vehicle in the market capable of unmanned autonomous inspection of pipelines, umbilicals & risers and subsea structures.

3000m
Rated hover capable infield inspection vehicle

24
Hour endurance, 40km round trip

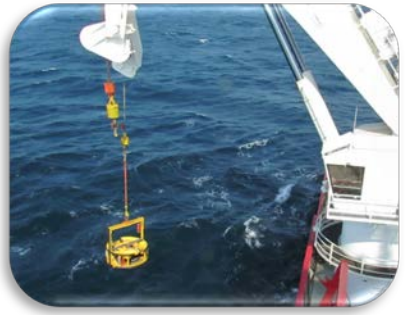
36
Inspections carried out within a single 18 hour period

4
offshore trials completed (TRL 5)

Autonomous Inspection Vehicles (AIV)

Capabilities:

- Hover / Stop / Close maneuvering
- Advanced mission planning
- Feature based navigation
- Subsea docking to Basket
- Flexible launch & recovery
- UHD imaging
- Field wide coverage



i-Tech AIV Footage

Specifications:

• Depth rating:	3,000msw
• Dimensions:	1.7m (L) 1.3m (w) 0.8m (h)
• Weight:	~750kg (in air)
• Current Endurance:	24 hour, 40Km
• Inspection sensors:	Sonar & UHD Imaging systems
• Power system:	Bespoke Lithium-Ion Power Modules
• Communications:	Acoustic, Radio, Satellite

Qualification Case Study: Docking

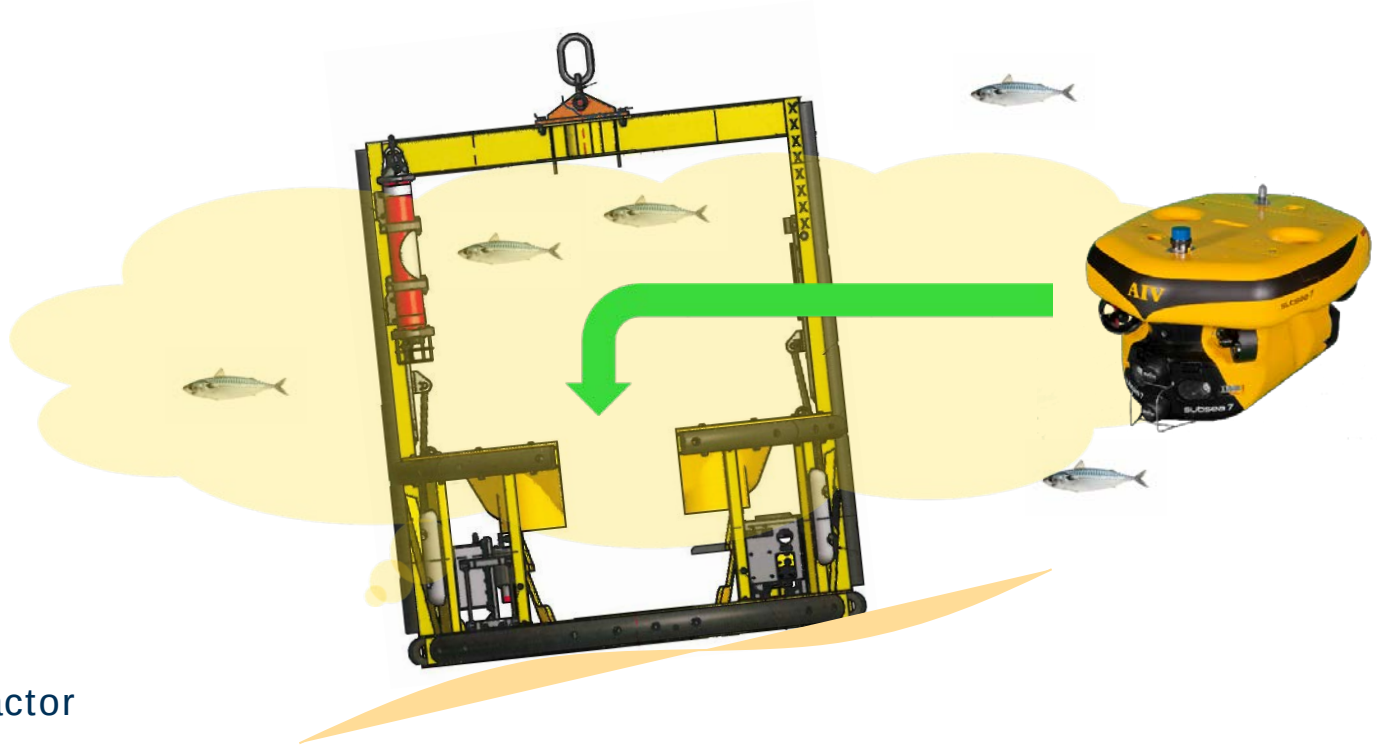
Qualification Example – Docking

Goal: 100% docking rate with the ability to autonomously deal with expected and unexpected events.

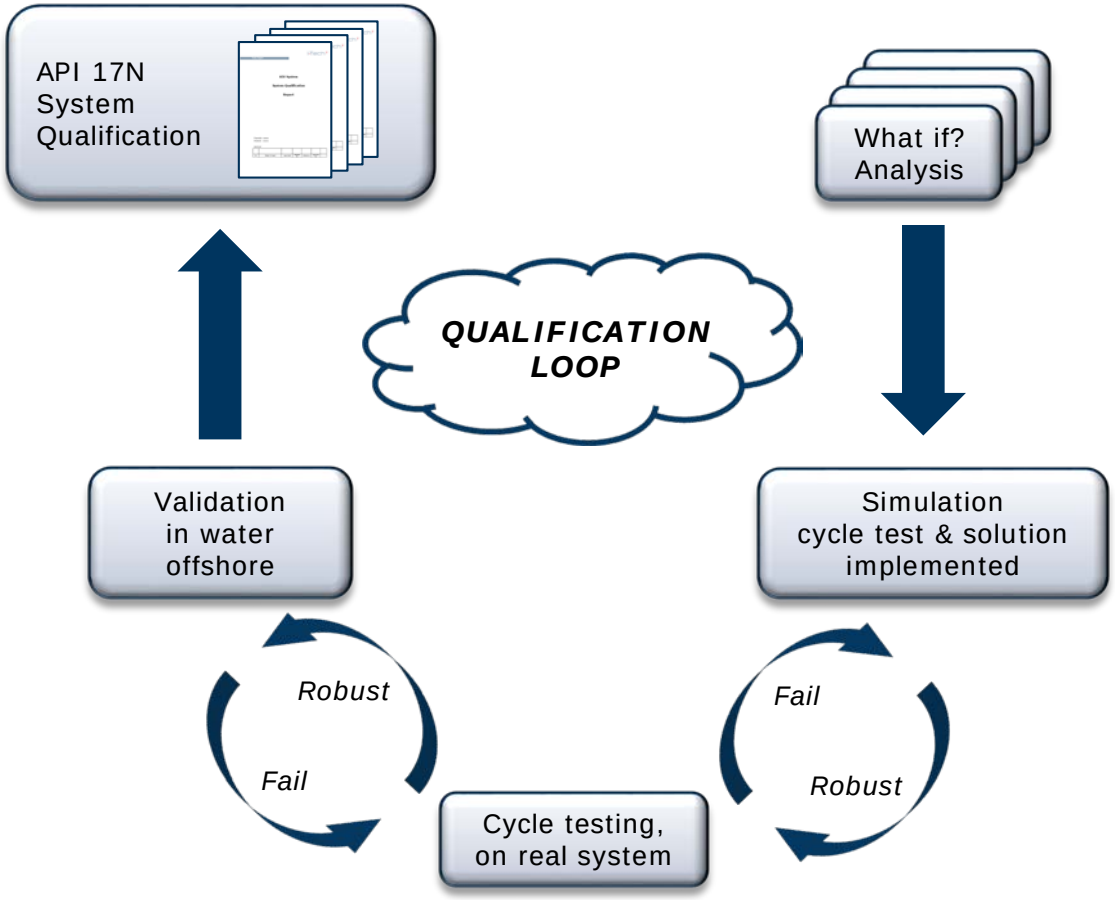
What does the AIV have to do:
- Navigate
- Identify
- Position itself

Environmental Challenges:
- Sea Current
- Bad visibility
- Fish!
- Basket poorly landed, i.e. angled
- “the unknown”

Tolerances:
- Hardware limits
- Sensor resolution, repeatability
- Exception handling – the “what if” factor



Qualification Case Study: Docking



Every single element is assessed, tested and validated.

i-Tech AIV Docking Footage

Qualification Standard: API 17N

Definition	Technology Readiness Level	Description
Undeveloped	TRL 0	**Unproven Idea/Proposal**
		Paper concept. No analysis or testing has been performed.
	TRL 1	**Concept Demonstrated**
		Basic functionality demonstrated by analysis, reference to features shared with existing technology or through testing on individual subcomponents/subsystems. Shall show that the technology is likely to meet specified objectives with additional testing.
	TRL 2	**Concept Validated**
		Concept design or novel features of design validated through model or small scale testing in laboratory environment. Shall show that the technology can meet specified acceptance criteria with additional testing.
	TRL 3	**New Technology Tested**
		Prototype built and functionality demonstrated through testing over a limited range of operating conditions. These tests can be done on a scaled version if scalable
Maturing	TRL 4	**Technology Qualified for First Use**
		Full-scale prototype built and technology qualified through testing in intended environment, simulated or actual. The new hardware is now ready for first use.
	TRL 5	**Technology Integration Tested**
		Full-scale prototype built and integrated into intended operating system with full interface and functionality tests
Ready	TRL 6	**Technology Installed Full-scale Prototype**
		Built and integrated into intended operating system with full interface and functionality test program in intended environment. The technology has shown acceptable performance and reliability over a period of time.
	TRL 7	**Proven Technology Integrated into Intended Operating System**
		The technology has successfully operated with acceptable performance and reliability within the predefined criteria.

What Does the Next Generation Look Like?

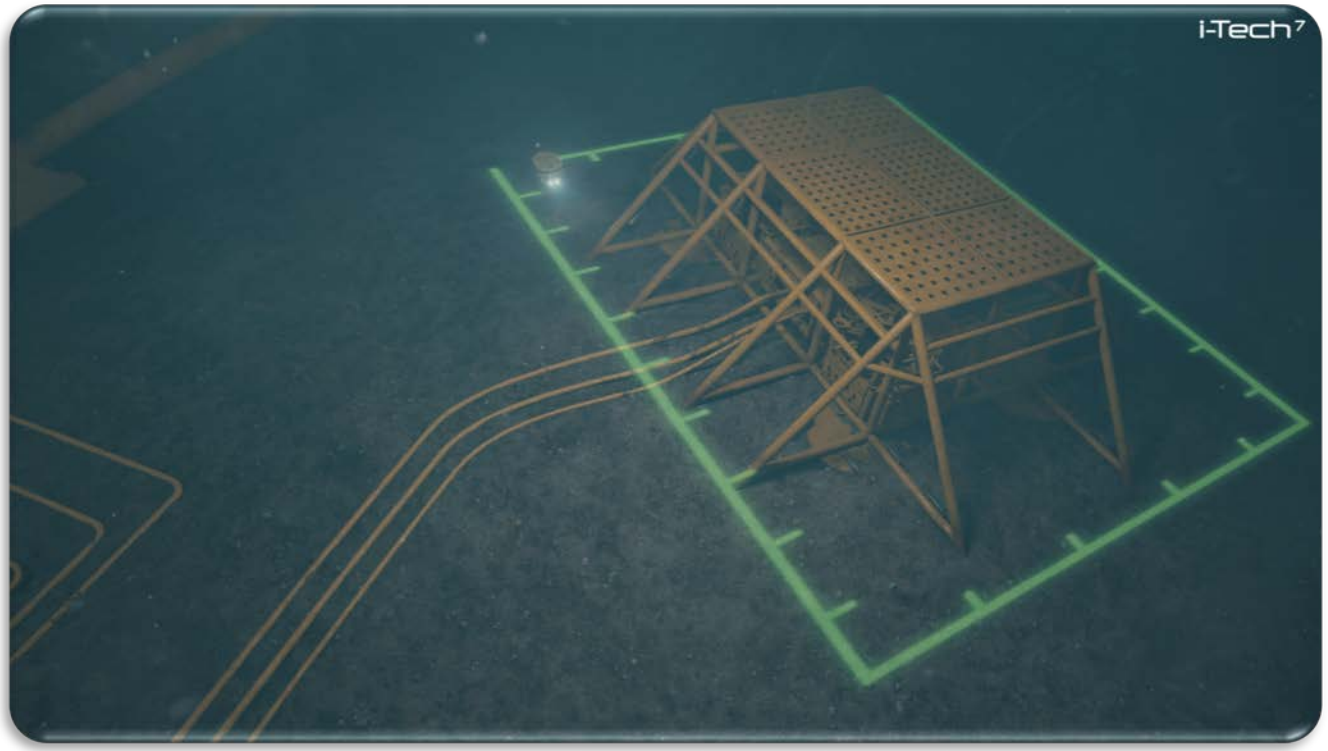
Autonomy can enable a new method and significant change to the way IRM services are delivered today.

Field wide capability.

Seabed hosted vehicles with a 365 day presence.

How can this benefit the industry?

- Reduced Cost and HSE exposure
- More efficient use of skilled personnel
- Operational flexibility
- Improved environmental impact



i-Tech Future Autonomy Vision

ANY QUESTIONS?