

Service Support Activities in Offshore Fields Development Using AUVs

International Business Congress
Working Committee «Industry, Innovations and Prospective Development»

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Subsea Technologies

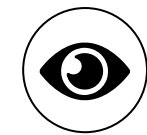
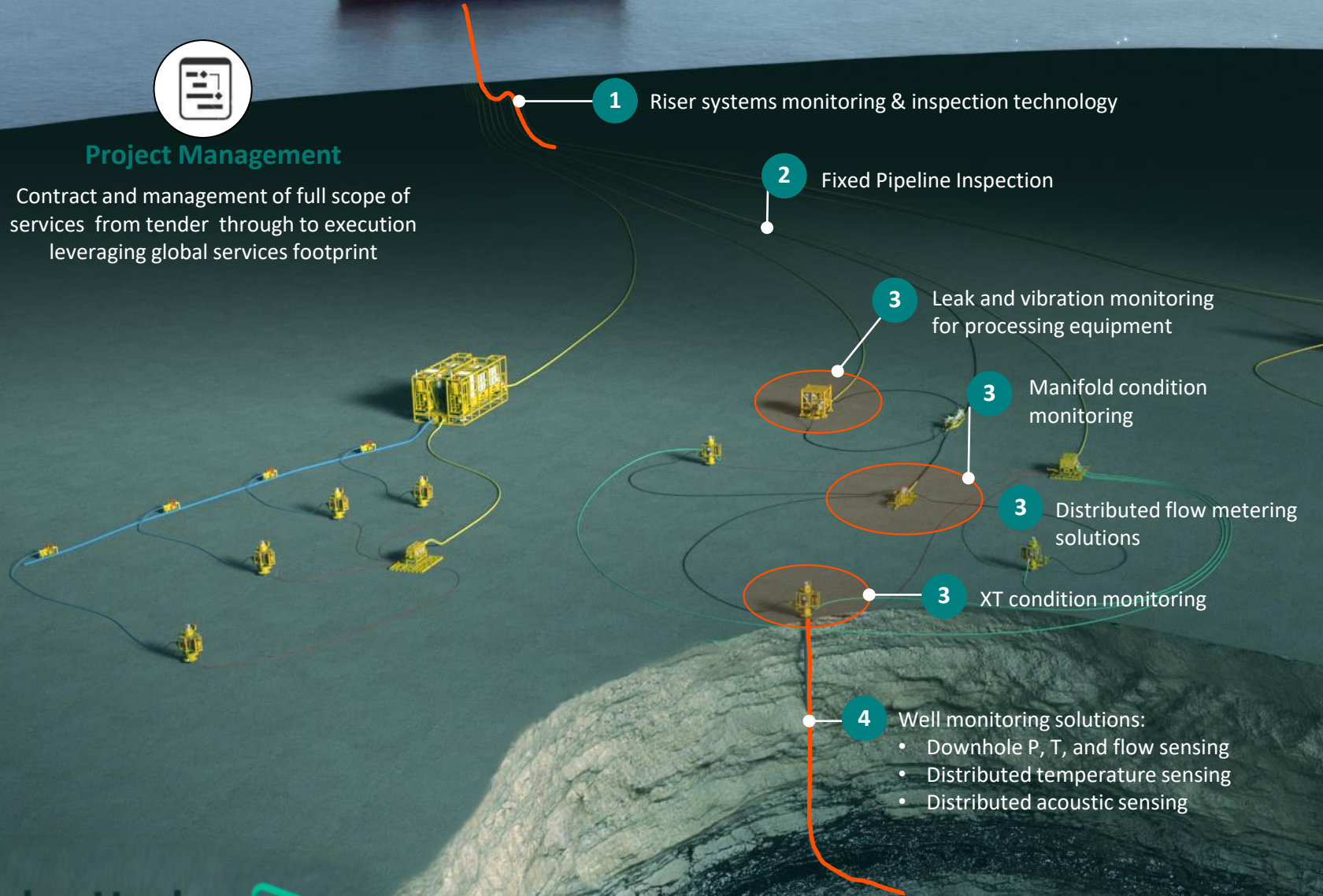
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Baker Hughes smartIMR



Project Management

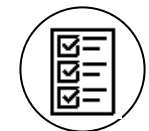
Contract and management of full scope of services from tender through to execution leveraging global services footprint



Equipment integrity services

Increased equipment availability & predictability while reducing cost and risk in operations through inspection, maintenance & repair

- 1 • Flexible Pipeline: Inspection & monitoring solutions (MAPS, PEBL, DAS, Annulus Testing)
- 2 • Fixed Pipeline: Offshore heavy walled pipelines wall-thickness (Ultrascan™ WMP), Baseline & routine corrosion inspection, geometry & pipeline mapping (MagneScan HR & SHR) low pressure, dual diameters, complex geometrics (CPIG)
- 3 • SPS monitoring, repair solutions & rental tooling (Inspection/ IWOCS/ Remove & Replace) - Acoustic & electromagnetic sensing, distributed flow metering solutions - Leak detection & hydrates remediation
- 3 • Well integrity monitoring (electrical & optical)
- 4



Maintenance, Inspection & Engineering

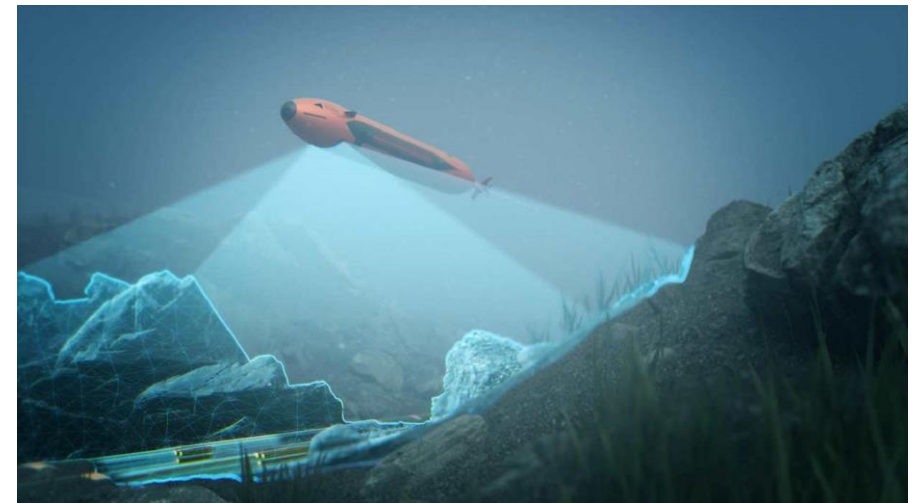
Optimize plant reliability and efficiency; machinery uptime; and gas production, transportation & processing, & to reduce maintenance & inspection costs

- Strategy & Documentation
- Inspection tooling selection & test design
- Repair design, procedures & tooling
- Life Extension analysis

AUV Technology On the Rise

AUV (Autonomous Underwater Vehicle)

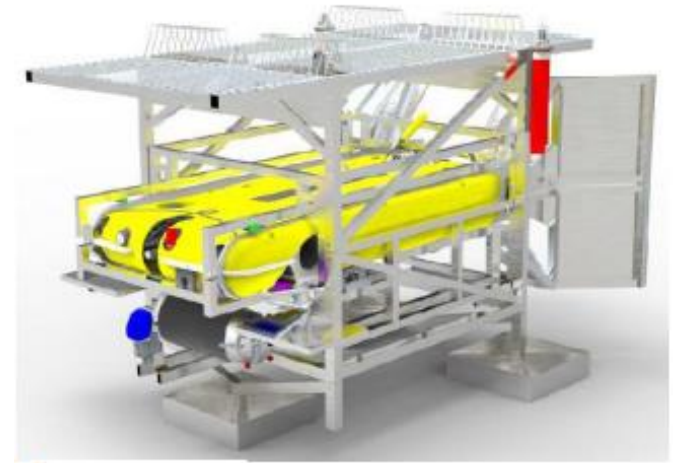
- Taking ROV technology to the next level, removing need of tether umbilical for power supply and communication
- Already well established in military/ naval applications, now emerging into non-military applications (including Oil & Gas)
- «Drone» system that can be programmed and tasked remotely, both with pre-programmed survey missions and ad-hoc follow-up missions based on survey findings
- Can be configured as Resident AUV, staying submerged for long periods of time, performing inspection and maintenance of subsea assets (e.g. Pipelines, Umbilicals, Subsea XTs, Subsea Manifolds etc.)
- Can carry large range of sensors, survey instruments and tooling
- Can provide valuable input to condition monitoring and predictive maintenance
- Can be of particular value in Arctic applications where vessel access is limited for parts of the year due to sea ice conditions, and therefore makes traditional vessel based IMR (Inspection, Maintenance & Repair) operations difficult or even impossible



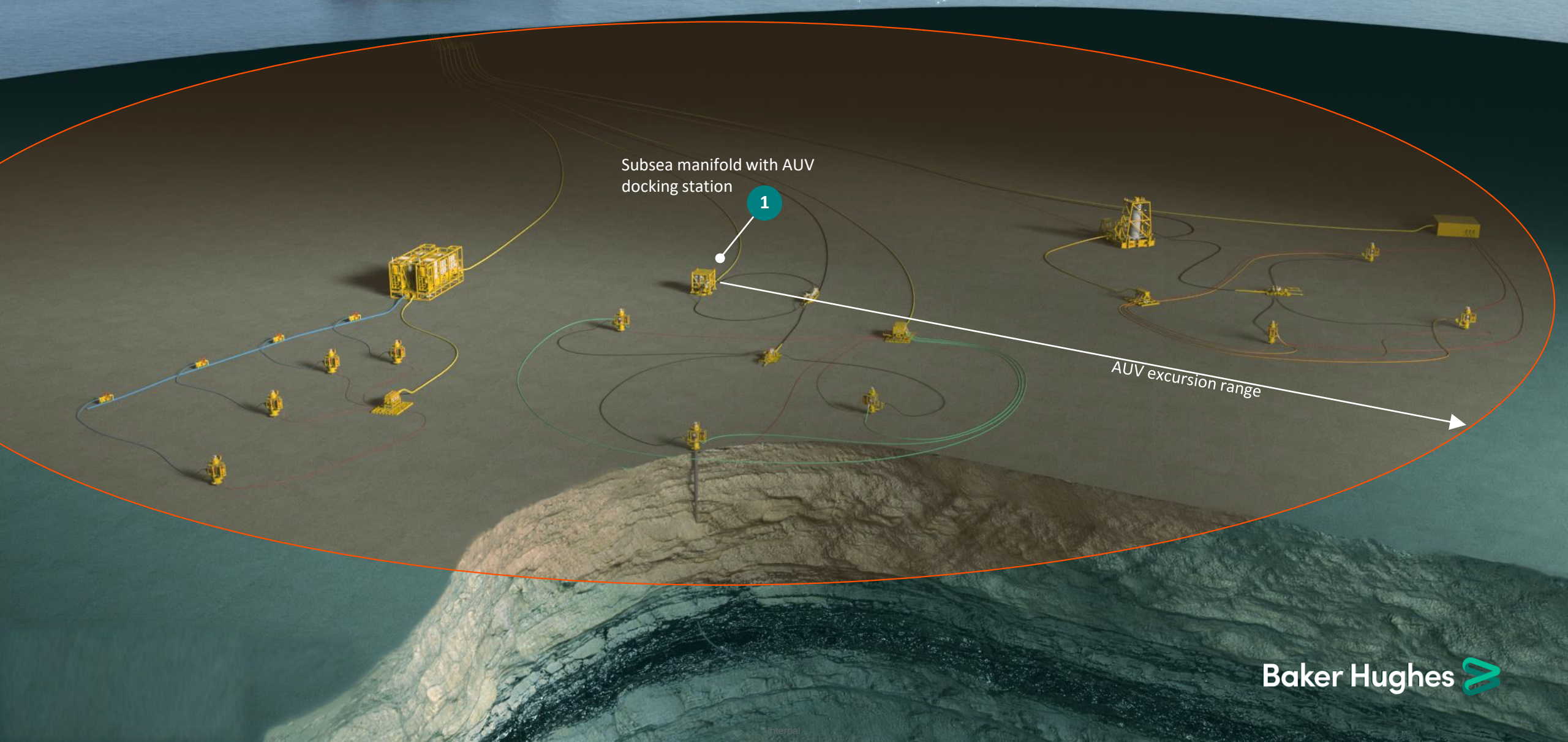
AUV Based IMR Operations

Use of Resident AUV

- Will provide all-year access for inspection and light intervention tasks, underneath the sea ice
- Typical AUV tasks:
 - Visual inspection
 - CP measurements & anode inspection
 - Debris removal
 - Environmental monitoring
 - Subsidence & settlement measurements (e.g. sinking of subsea manifold foundations)
 - Early detection of potential issues, allows for early planning and preparation of full vessel campaigns in next ice free window
- Carries manipulator arm, supports light ROV tooling
- Carries electrical torque tool, e.g. for valve override operations
- Domiciled in docking station subsea, e.g. on a subsea manifold
- Power charge & communication provided in docking station, communicating with operator in Onshore plant
- Long excursion range from docking station, can cover all infield locations and drill centers
- Recovered to land for overhaul during summer season, and redeployed subsea each autumn for next operation window during winter season



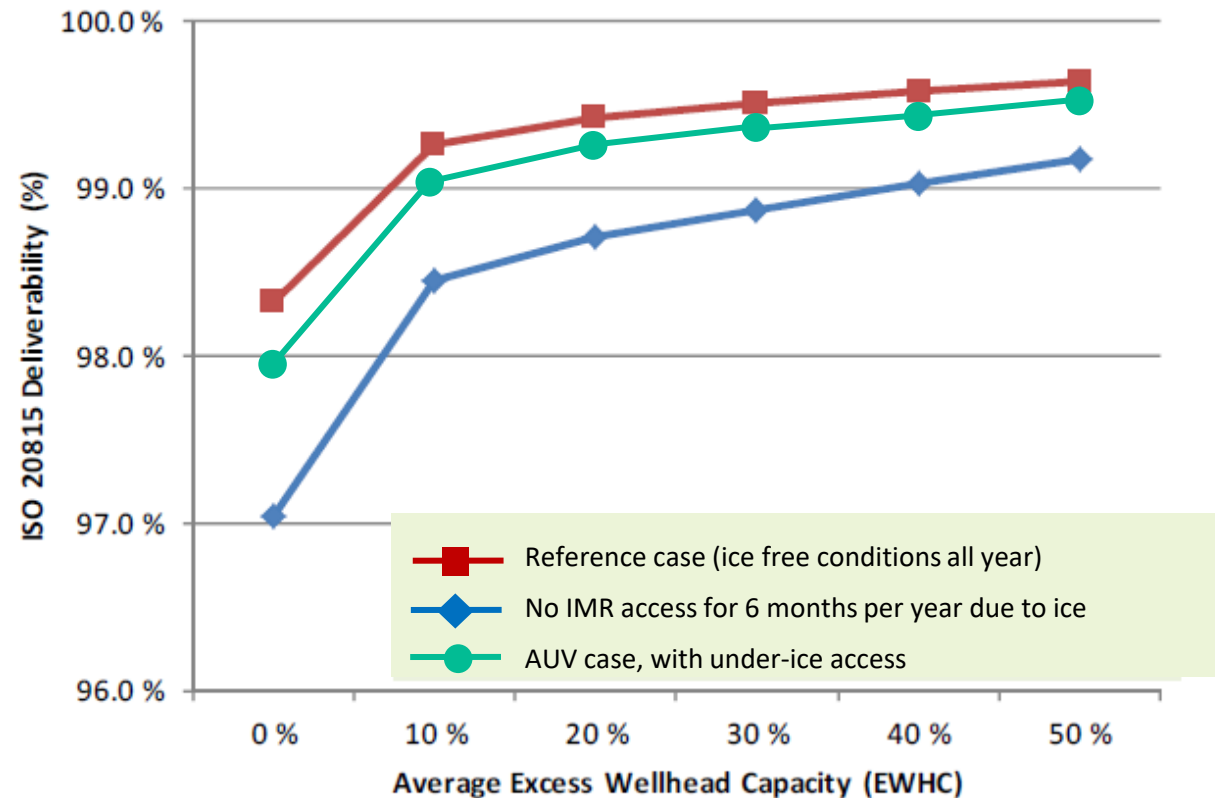
AUV Based IMR Operations



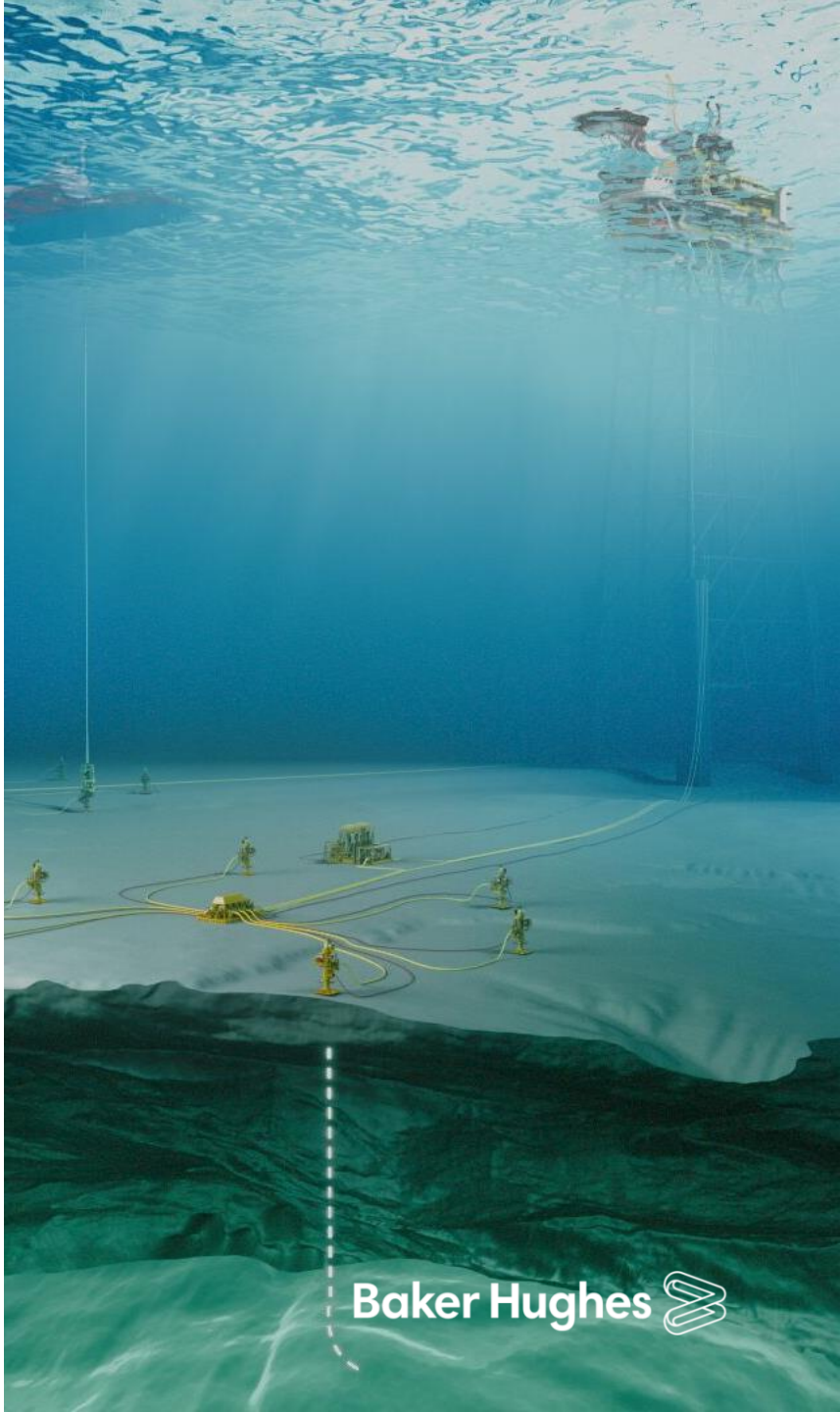
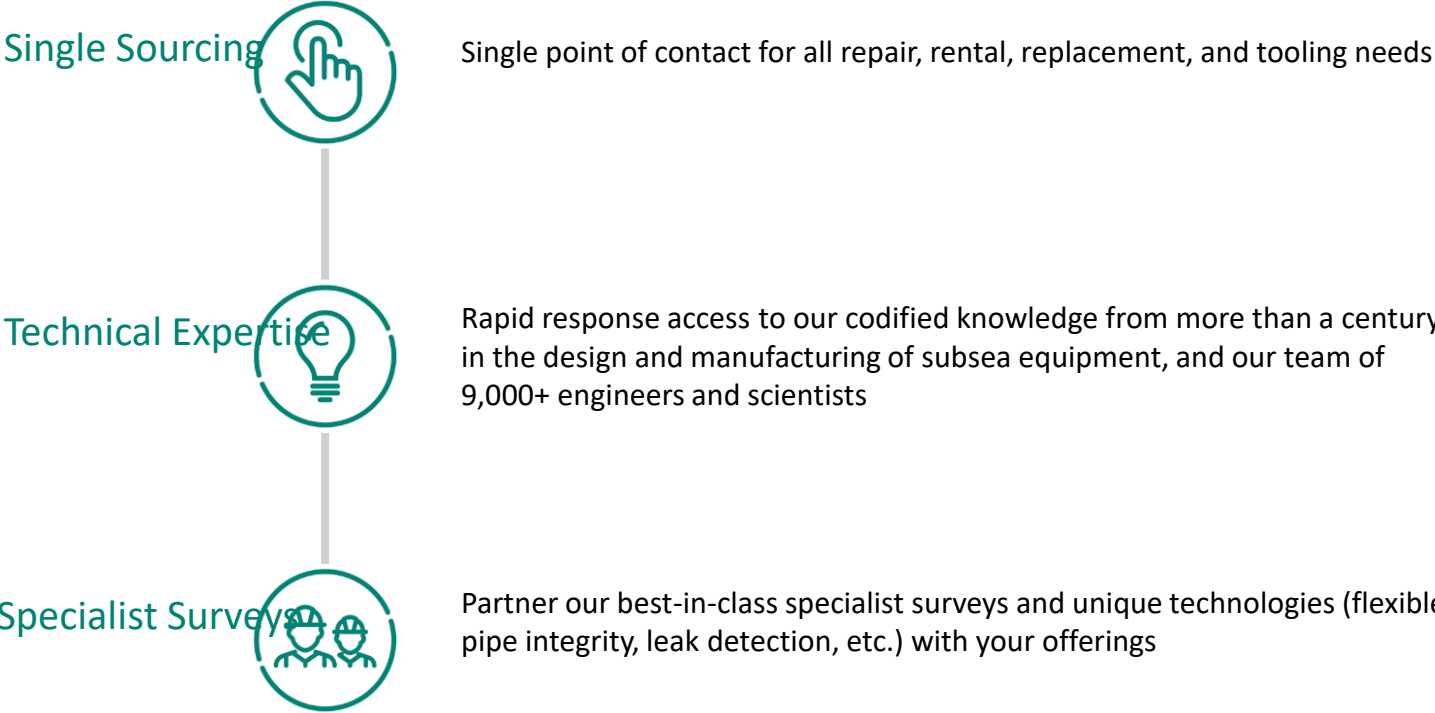
AUV Based IMR Operations

Value proposition for using AUV:

- Use of AUV based IMR operation will help move field availability (=deliverability or uptime) from Basecase level (6 months sea ice conditions) closer to Reference case level (equal to ice free conditions) by allowing for a level of IMR operations to take place without need for surface vessel access during the winter season
- In the diagram to the right;
 - The **Reference case** represents a typical subsea field with full all-year access for vessel based IMR operation
 - The **Basecase** represents a subsea field with no IMR access for 6 months of the year due to sea ice
 - The **AUV case** shows the improved field availability resulting from maintaining IMR access all year round, also over the sea ice, using AUV



Operational Value Proposition



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What We Provide

Planning

Strategy & Procedures

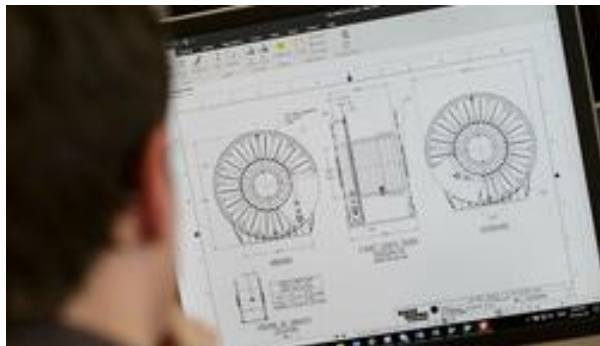
Collaborate on technical comprehension of the system and scope interfaces with IMR activities

Scoping out what activity is required and turning schemes of examination into activities

Provide written schemes of examination and thorough understanding of country's regulations and standards

Training

Immersive 3D environments can be created to aid in ROV training and access studies



Inspection

Piping

First in class inspection and monitoring for both flexible and rigid piping

Remote Support

24/7 access to SME's using augmented reality audio/video sharing

Engineering Solutions

Design and deliver solutions and engineering studies leveraging our 124 experienced global service engineers

Fit for purpose leak detection and hydrate procedures



Post Inspection

Rental Tools & Equipment

Access to 8,000+ subsea tools to support global operations inc. subsea wellheads, control systems, completion tree tooling, well access and manifolds

Equipment, Component & Tooling Refurbishment, Repair & Replacement Options

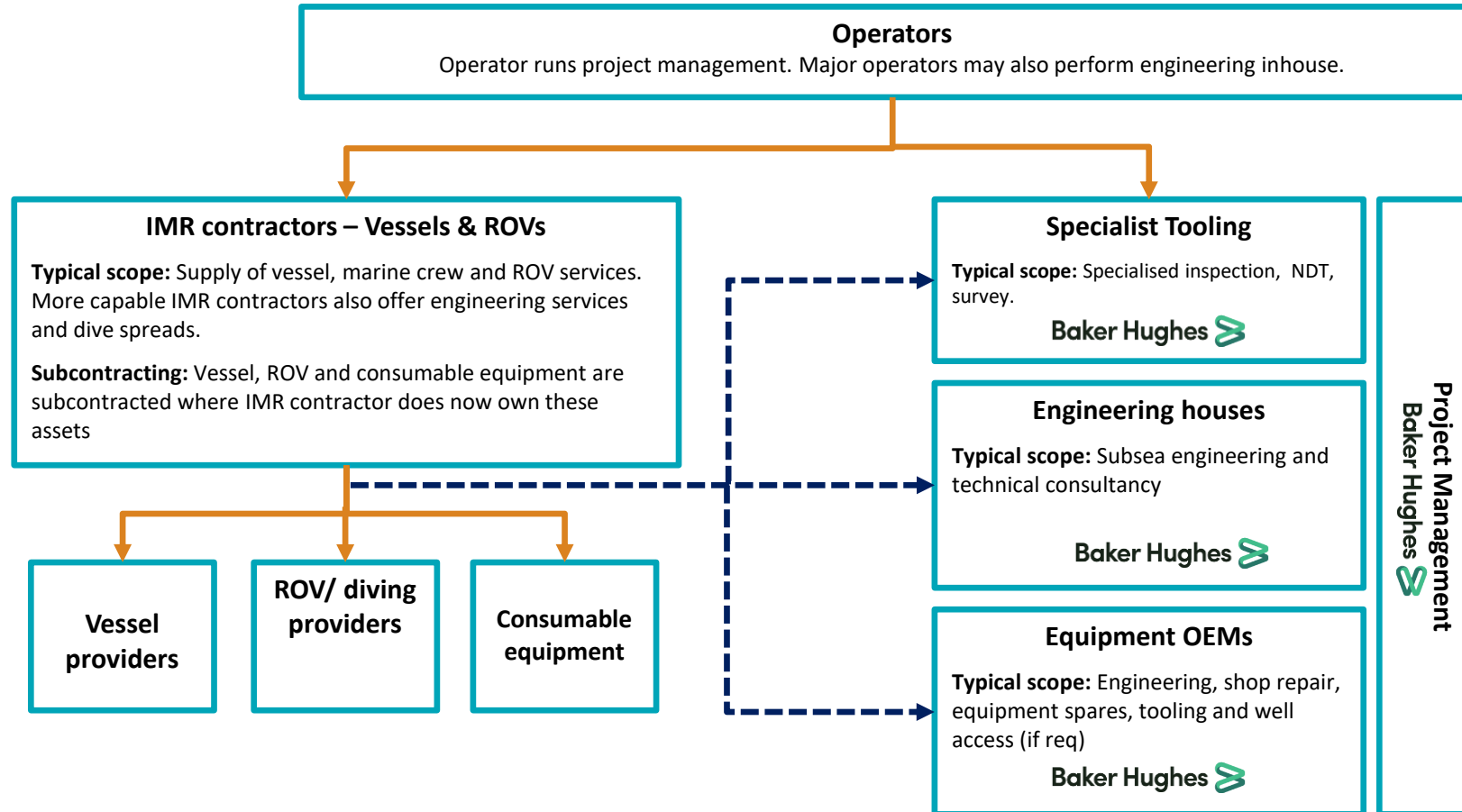
Global manufacturing and service sites

Rapid Tooling Design, Prototyping & Manufacturing

Bespoke tool design, prototyping leveraging AM and manufacture for full solution deployment



Typical IMR Landscape



How is the IMR landscape typically orchestrating opportunities ?

- Operator will reach out to an IMR contractor/vessel provider in support of an IMR campaign.
- Separately going out to engineering houses; specialist tooling; equipment from OEMs; or it might be that IMR contractor may need to engage with outside suppliers.

All of which may increase time and money, reducing efficiency and practicality of all parties involved.

What are we looking to do ?

Offer to provide a service to operators and, or, IMR vessel providers, where we envision to tailor a partnership to deliver an effective IMR solution to the market.

A photograph of an offshore oil rig at sunset. The rig is silhouetted against a bright orange and yellow sky, with the dark blue sea in the foreground. The rig has several cranes and complex structures.

Benefits

- Improved speed of delivery
- Reduced number of interfaces
- Predictable OPEX spending
- Equipment agnostic
- Flexible and streamlined commercial models
- Scalability of solutions

Going Forward – We want a better understanding of your business offerings so we can tailor an envisioned partnership.

Review your current workings to find an opportunity to add value.