

Aker BP – Field of the future

Automation

Terje Hammer Meling



FIELD OF THE FUTURE

A focused portfolio on the NCS



Skarv / Ærfugl

Solid base performance and area upside potential



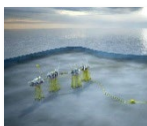
Alvheim area

High production efficiency and low operating cost



Ivar Aasen

Production ramp-up and IOR opportunities



Johan Sverdrup

World class development with break even price below 20 USD/bbl*



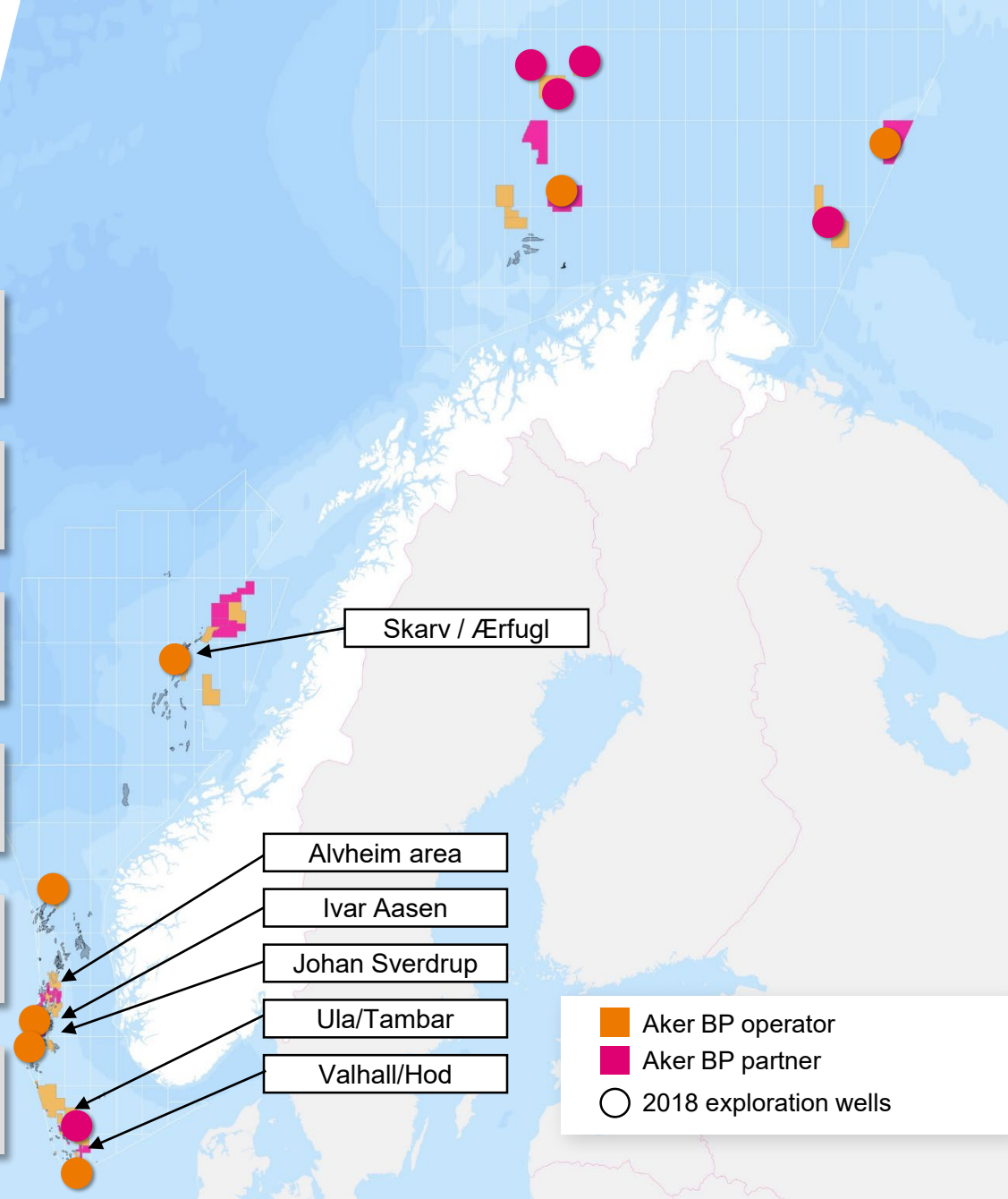
Ula/Tambar

Late life production with significant upside potential



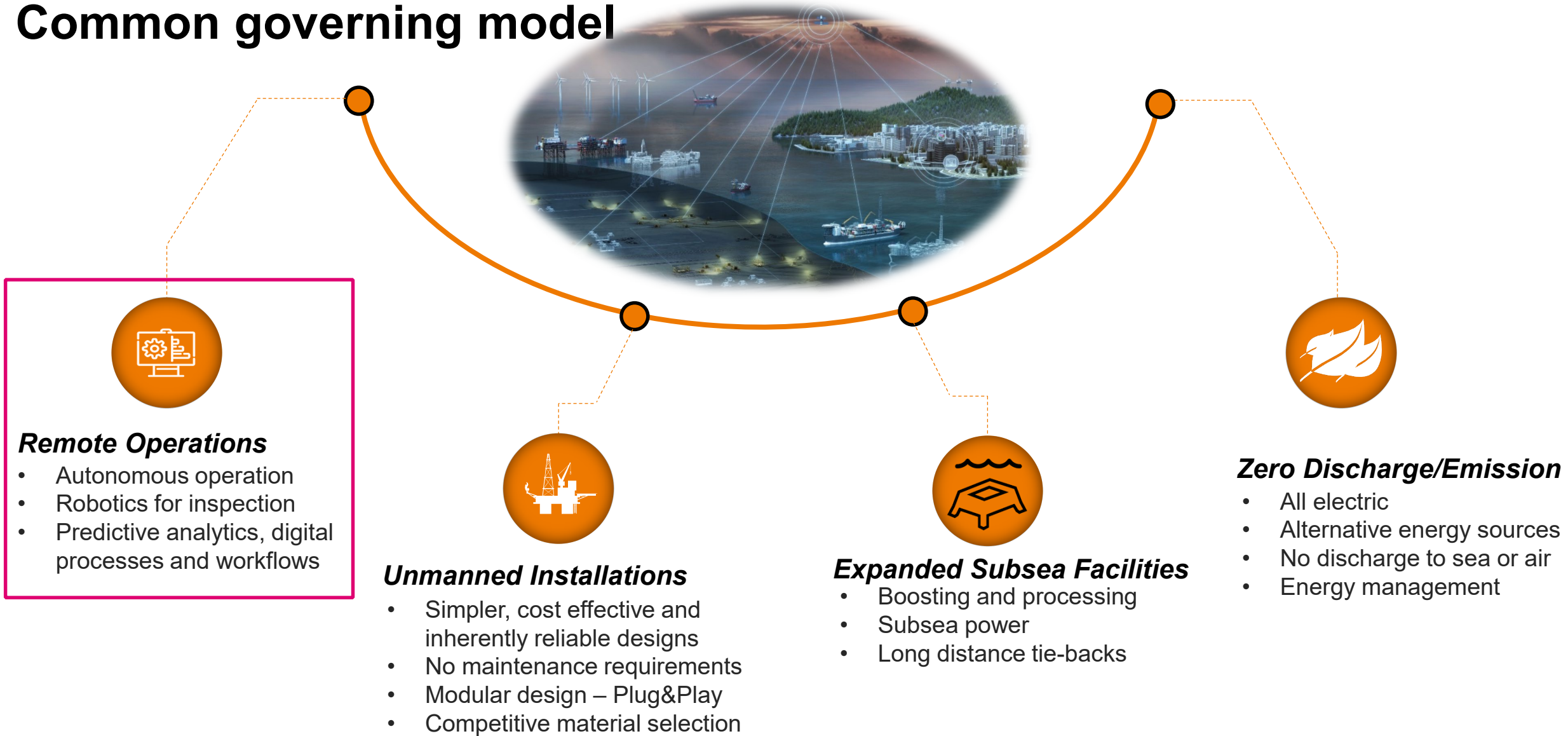
Valhall/Hod

1 billion barrels produced, ambition to produce additional 1 billion barrels





Common governing model



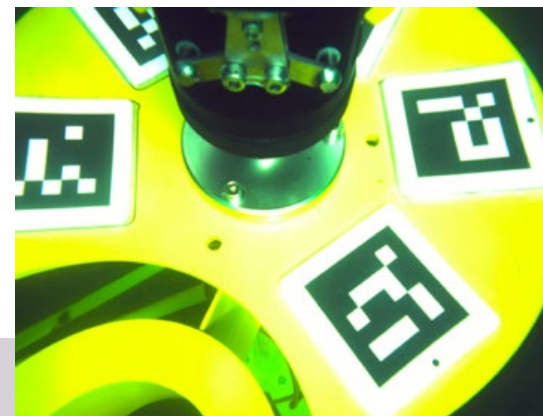
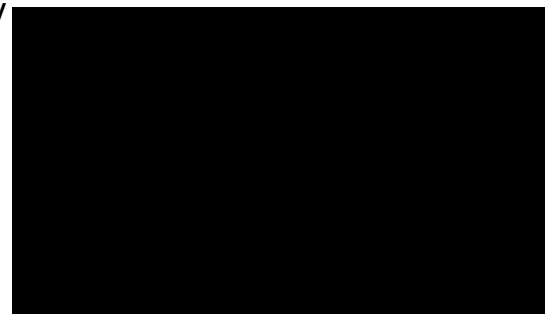
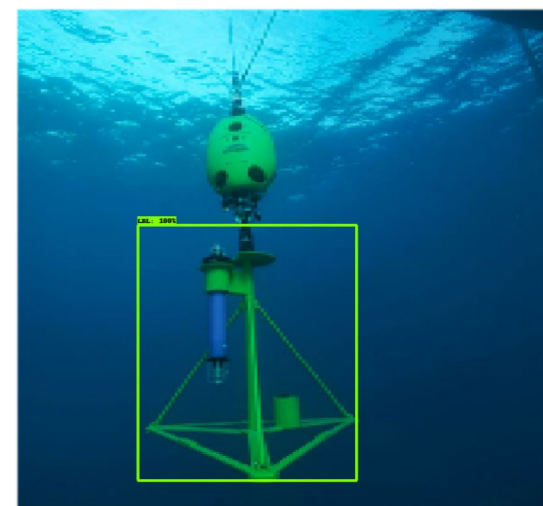
Underwater Intervention Drones

- **Today:** Remotely operated vehicle (ROV)
- **Future:** Autonomous drones and ROVs
 - General visual inspection/Close visual inspection
 - Light intervention – cleaning, operate valves, CP-probe
 - 3D-scanning – laser (point cloud), pictures and photogrammetry



Autonomous Inspection Drone

- 800 x 800 x 1200 mm
- 4 hour excursions
- Autonomous Behavior
 - Pipeline tracking
 - Subsea Target Detection
 - Docking and undocking
 - Pathfinding by QR code highway
- **Equipment skids**
 - Class 4 Torque tool
 - Grabber
 - CP probe / Brush
- **Operation modes**
 - Vessel
 - Subsea Residency



Common standards and guidelines

Subsea Wireless Group (SWiG)

Standardised communication protocols for :

- Acoustics,
- radio,
- free space optics,
- Wireless power transfer



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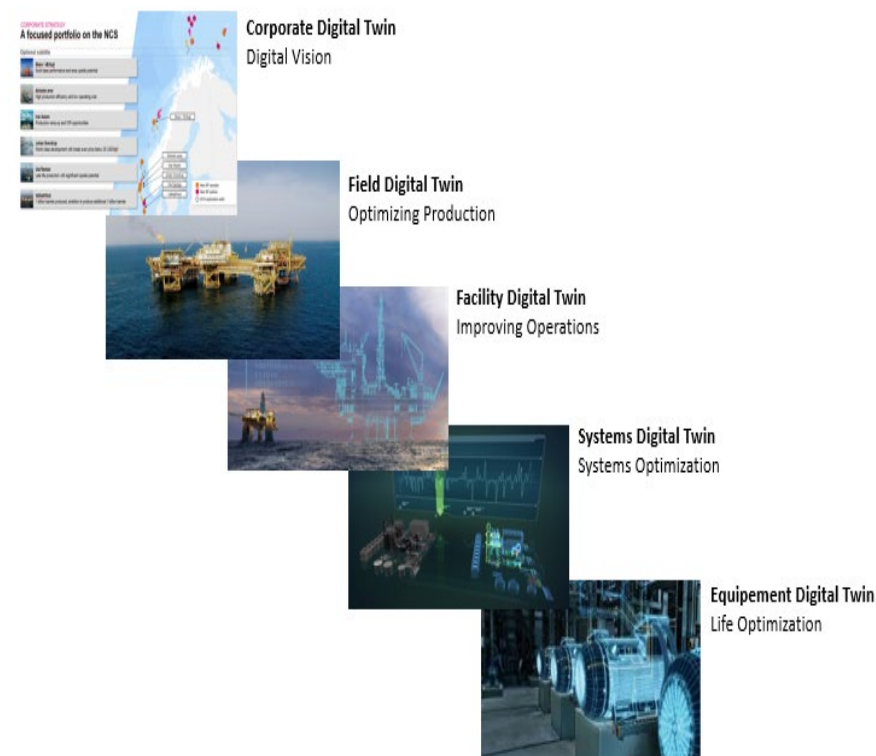
Digital twin

Concept Extension from Product Life Cycle Management to Asset Life Cycle Management

A digital / virtual replica of physical assets, systems, facilities that can operate in a digital / virtual equivalent of the real environment: process / field / business etc., using a collection of information mirroring models, where data and information tie the real and virtual world together. The digital representation reflects an “up to date” condition of physical elements, instances and dynamics of how the real system operates and lives throughout its life cycle.

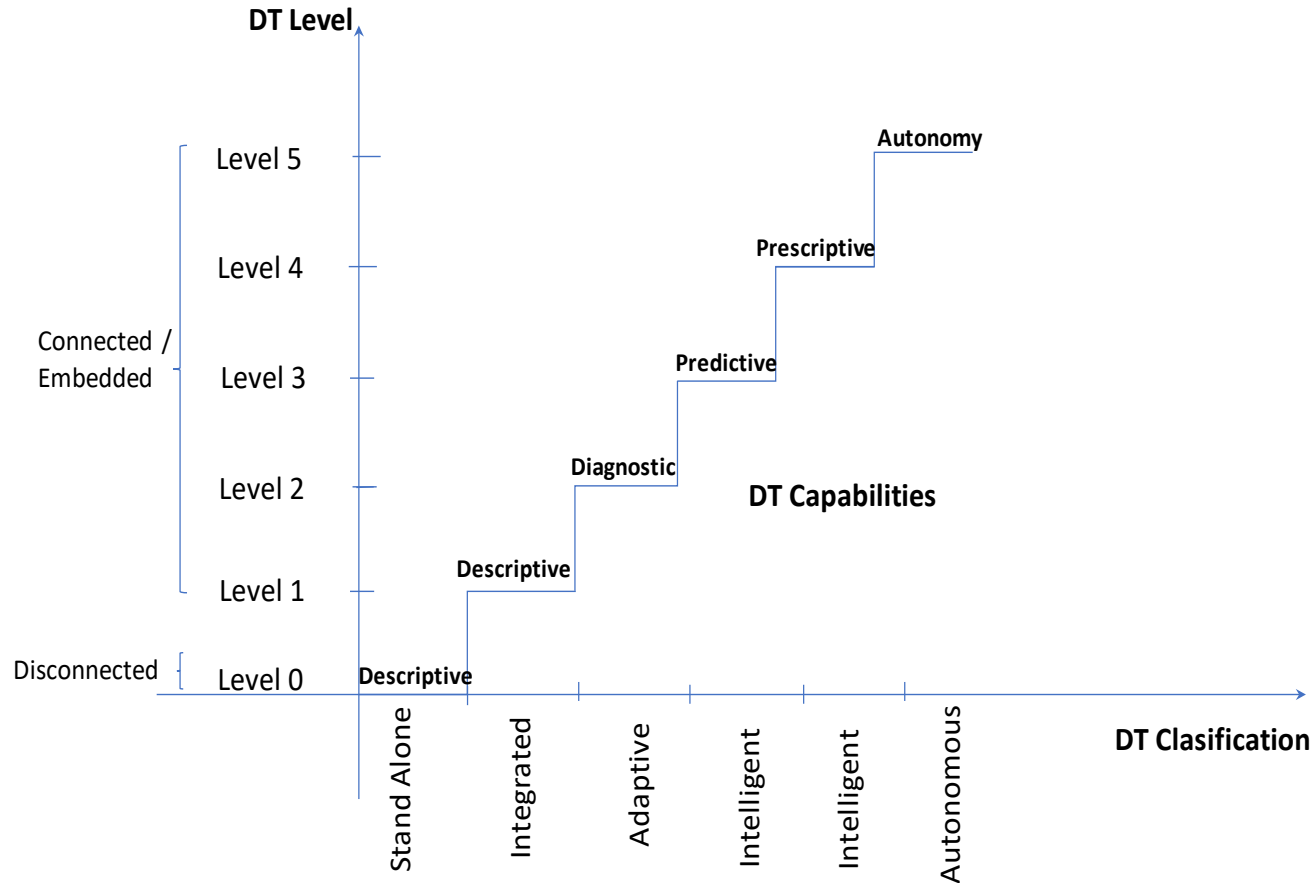


Digital Twin High Level Hierarchy

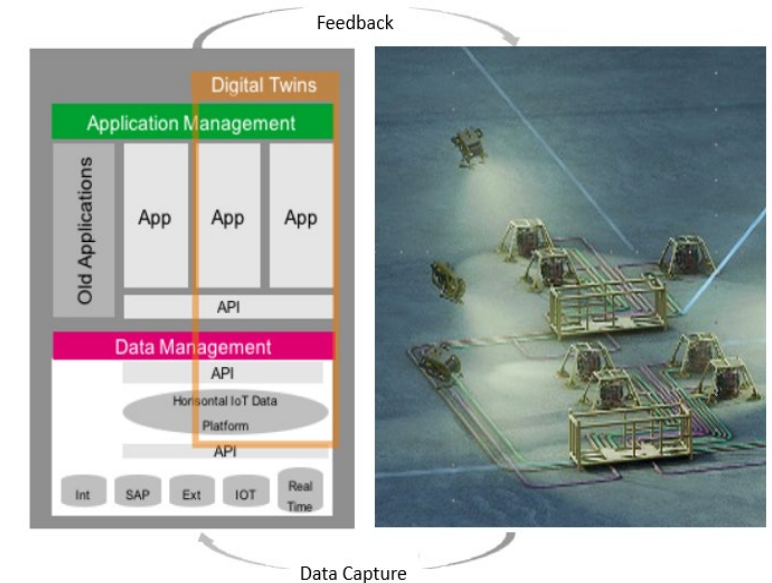


- Ref. «A Systems of Systems Digital Twin to Support Life Time Management and Life Extension for Subsea Production Systems» MTS/IEEE Oceans Conference Marseille 17-20 June, 2019

Digital twin cont.d.



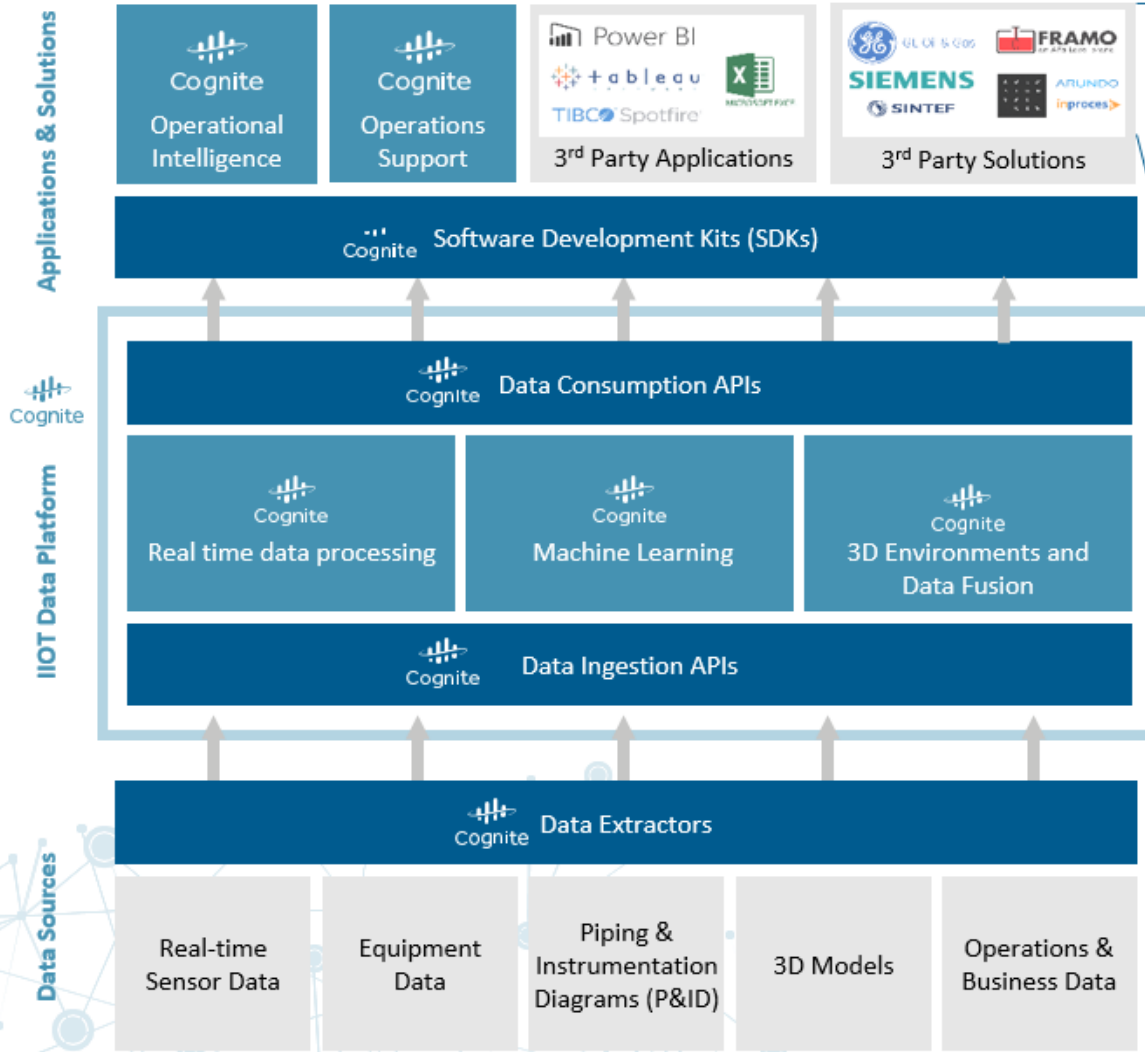
- Stand alone – Disconnected asset data, Prototype
- Integrated – Asset data connected to DT
- Adaptive – Reflect actual state from live data
- Intelligent – Predictive and Prescriptive
- Autonomous – Intelligent control system, drones, robots



- Ref. «A Systems of Systems Digital Twin to Support Life Time Management and Life Extension for Subsea Production Systems»
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FIELD OF THE FUTURE

Cognite Data Fusion



Partners active on platform today

- Predictive Maintenance
- Production Optimization
- Remote monitoring
- Simulations and visualization



ARUNDO

Honeywell

SIEMENS

inprocess



Eureka

AkerBP digitalisation

- Smart subsea crew, use case 1: Smart riser health
- Smart subsea crew, use case 2: Smart subsea health

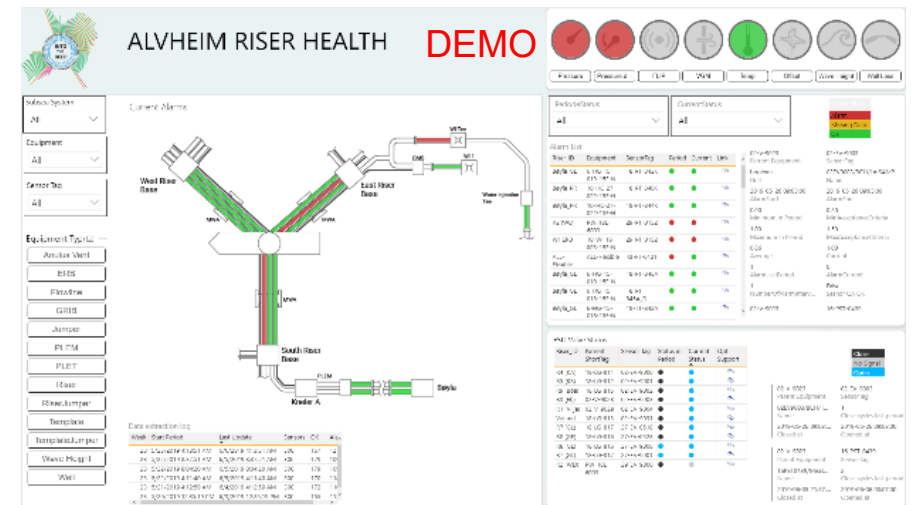
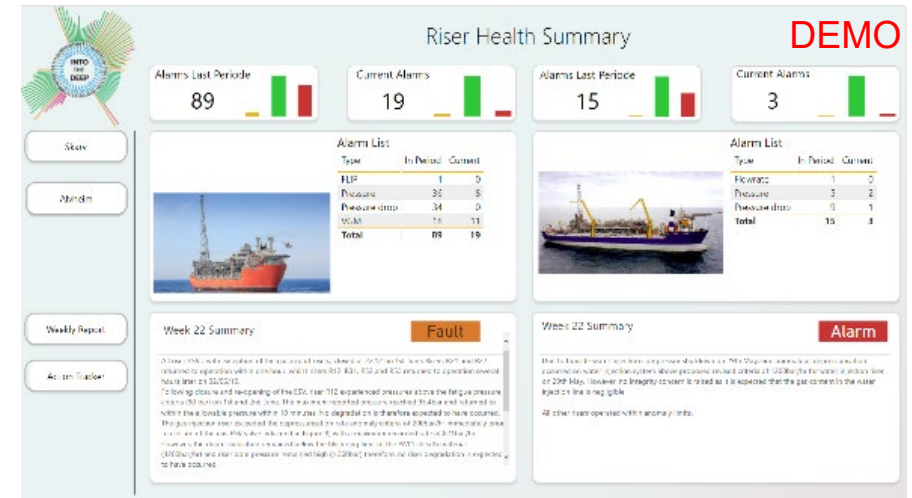
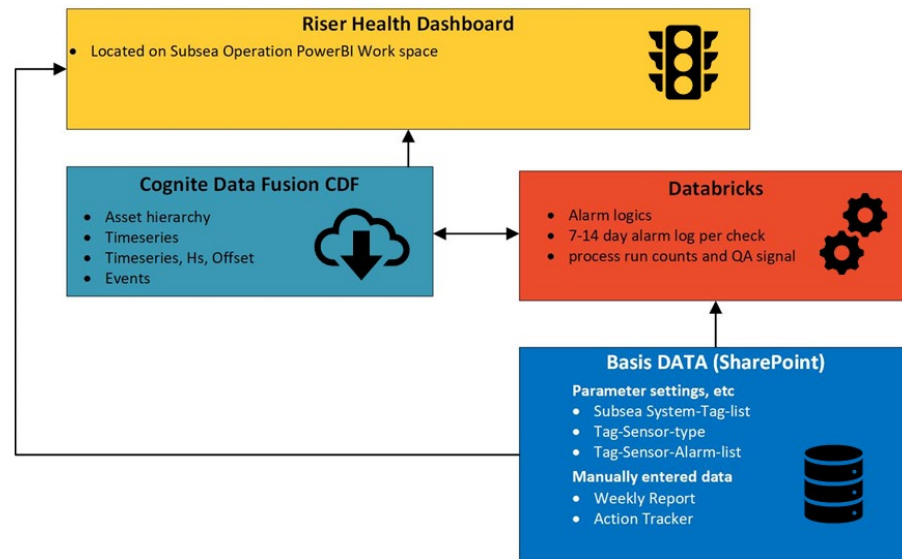


FIELD OF THE FUTURE Smart riser health

Eureka

Objectives:

- Remove weekly status reports
- Automate identification of alarm events
- Simplify sensor status evaluation directly in application
- Reduce review time by Integrity Engineer
- Enable performance comparison between weeks

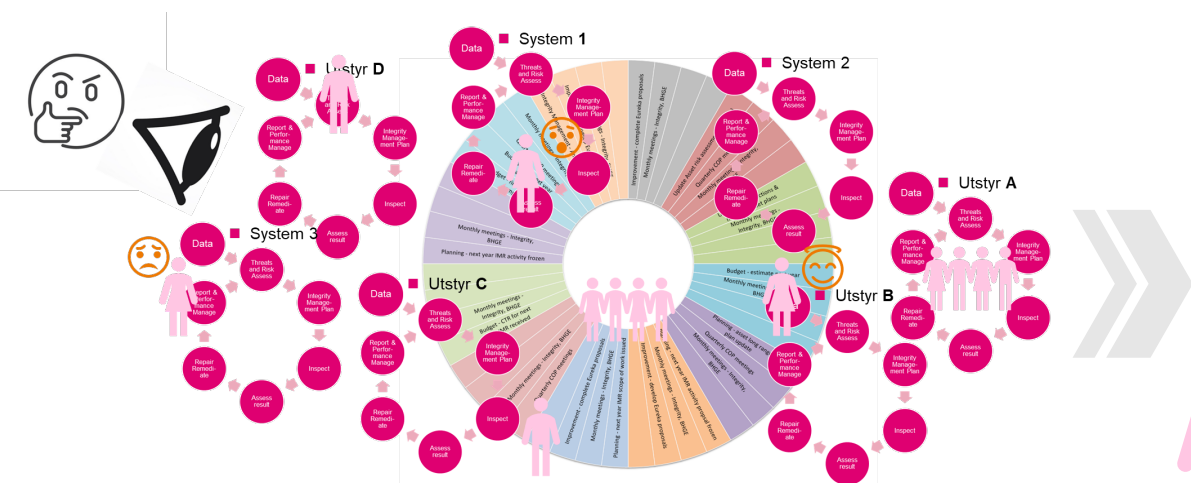


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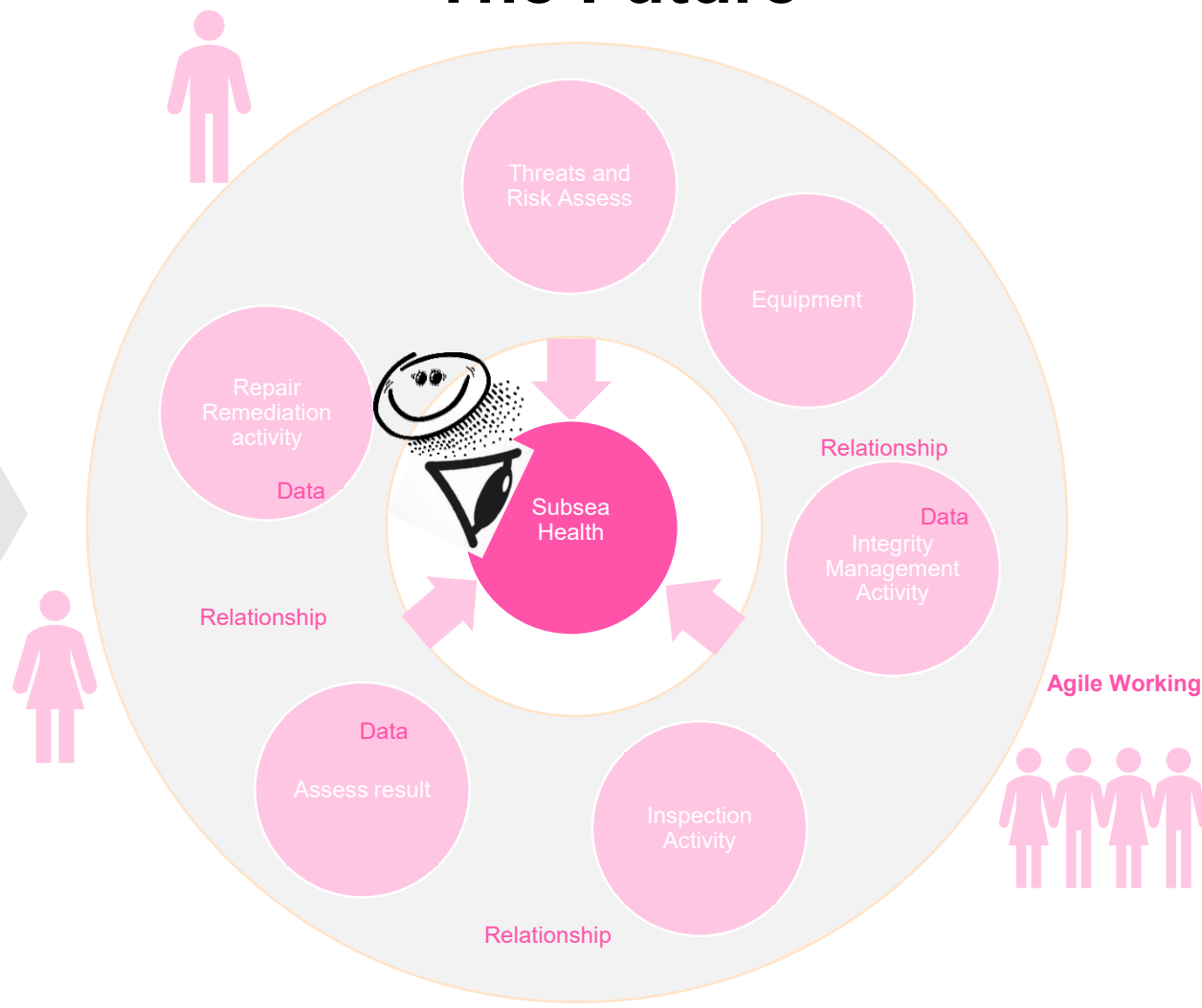
Smart subsea health

Eureka

Today



The Future



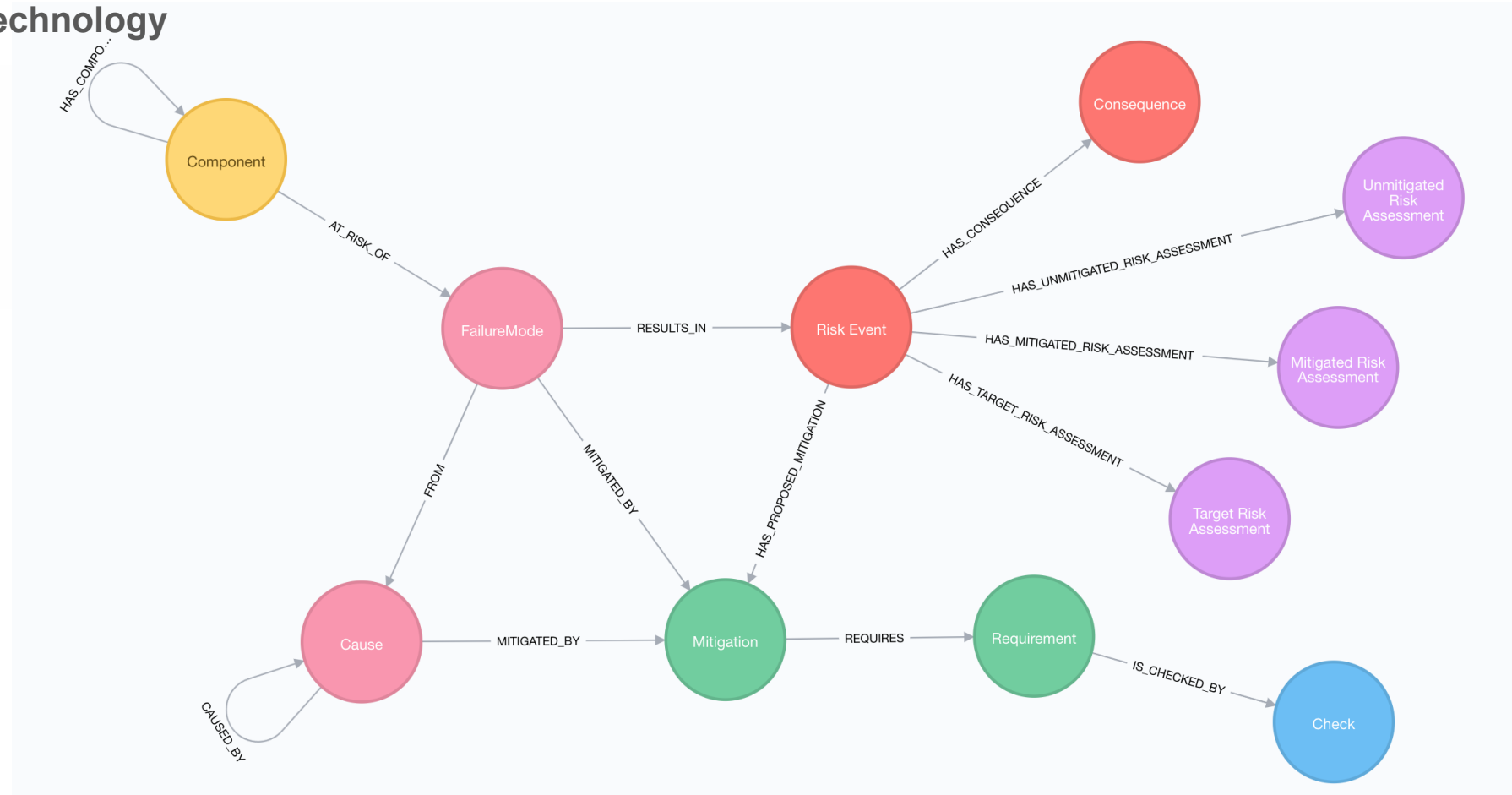
FIELD OF THE FUTURE

Smart subsea health cont.d.

Powered by Graph database technology

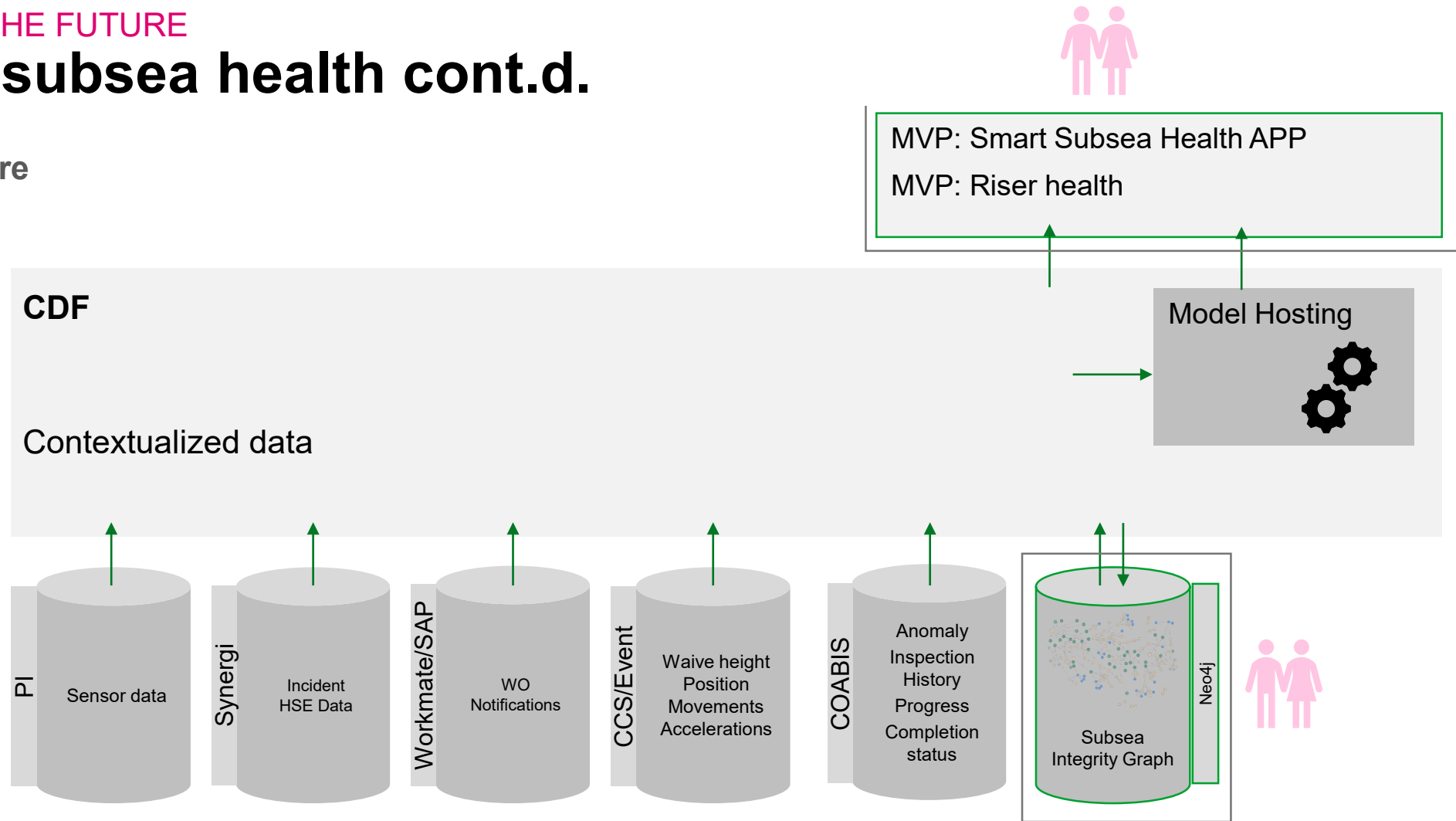


- Impact Analysis
- **Risk Assessment**
- **Asset Management**
- Knowledge Graph
- **Compliance Monitoring**
- Augmented Intelligence



Smart subsea health cont.d.

Architecture



Autonomous crane

Remote operations

- Partners: Optilift, Palfinger & IKM Tech Team Solutions.
- All-electric crane.
- Remote / autonomous operation.
- Planned functionality:
 - Auto landing and lift-off.
 - Relative heave-compensation.
 - Anti pendulum compensation.
 - Anti collision for cargo.
 - Anti collision for people.
 - Anti collision for crane boom.



Cargo tank inspection on Skarv

Confined space inspection

Today

- Entering of people to hazardous (gaseous and confined) areas
- Rope climbing
- Entering watch and watch of entering watch
- 14 days of preparing
- Mechanical blinding – approx. 50 hours

Plans

- Perform first test autumn 2019
- Proof of concept

Obstacles

- NDT (non-destructive testing)
- EX/ATEX-certification
- Combined sensory apparatus



Alvheim – Coating robot w/BRI Norhull

Surface treatment

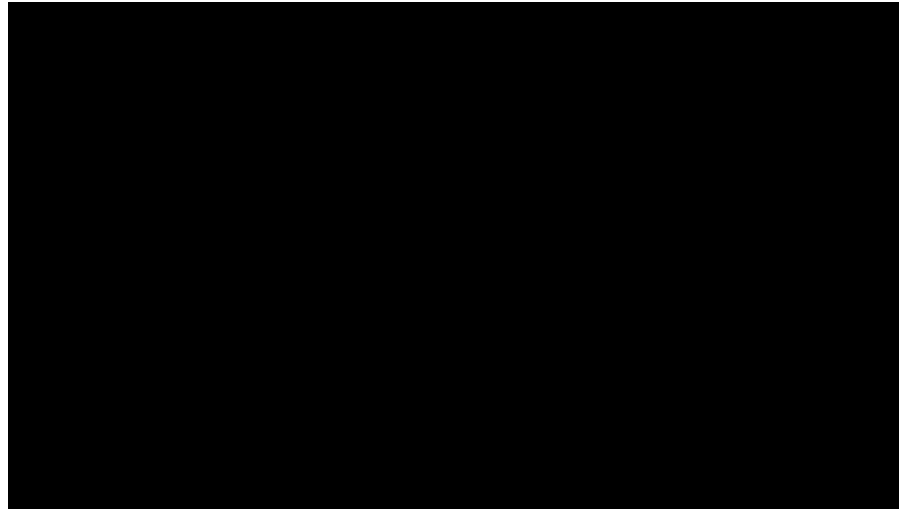
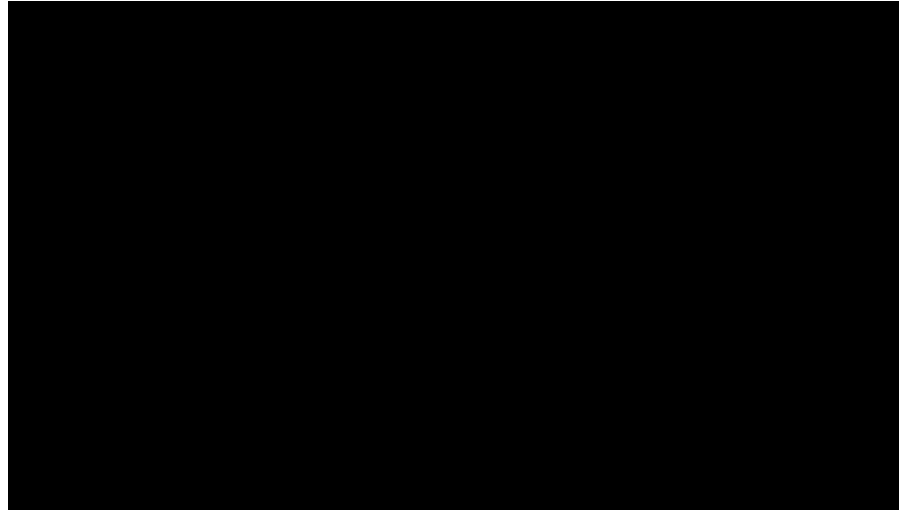
- Complete surface maintenance on flat surfaces
 - High pressure washing
 - Sanding
 - Soap wash
 - Coating
- Operated from deck
- Sensor that checks if surface is ready
- Zero-emissions – “vacuum cleaner”-technology
- Up to 20x faster than traditional surface maintenance
- Alvheim surface area 5500 m²
- Testing
 - Onshore last May
 - Offshore in Q1 2020



FIELD OF THE FUTURE

Robot technology

Offshore testing



Autonomy – Need, opportunity and challenges

Need & opportunities

- Routine inspection
 - Topside
 - Subsea
- Condition monitoring
- System surveillance and reporting

Challenges

- Conservative business
- Low TRL
- Money

References

- <https://www.oceaneering.com/rov-services/rov-systems/> (ROV)
- <https://nfea.no/wp-content/uploads/2018/10/Eelume.jpg> (Elume)
- <https://seekingalpha.com/article/4232371-oceaneering-oi-i-investor-presentation-slideshow> (Oceaneering presentation snip)
- <https://deepoceanogroup.com/assets/rovs/> (AID)
- <https://www.youtube.com/watch?v=RdSE6p-98rE> (Cyber Hawk – tank inspection)
- https://www.youtube.com/watch?time_continue=103&v=qCKKKIViovM (Sky-Futures)
- <https://www.youtube.com/watch?v=cmtVuplkDml> (Sky-Futures, confined space video)



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