



# INCREASED SUBSEA DRONE SCOPE

Underwater Intervention Drone (UID™) by Equinor

One Shape Fits All... Universal Subsea Docking Station

## VISION

# “One Subsea World”

Realising the full potential of Ocean Space through harmonised requirements and standard interfaces.

Develop, market and sell standard mechanical, hydraulic and electrical products to the subsea interface market, as well as providing related services and special projects to the same market.

## MISSION

# “Industrialising the subsea industry” by

- Standardising interfaces
- Harmonising requirements
- Create innovative high quality products
- Establish smart and efficient high volume production
- Publish and distribute technical and commercial products information



# Product Range

- **Hydraulic Interfaces**

- Fluid and Gas Connectors
- Check valves, relief valves, flow and pressure control
- Multi Purpose Pipeline Penetration System

- **Mechanical Interfaces - Intervention**

- Rotational ISO Class 1-7 (Electrical Torque Tools and gearboxes)
- ROV handles
- Flex Joints

- **Electrical Interfaces - Subsea "USB"**

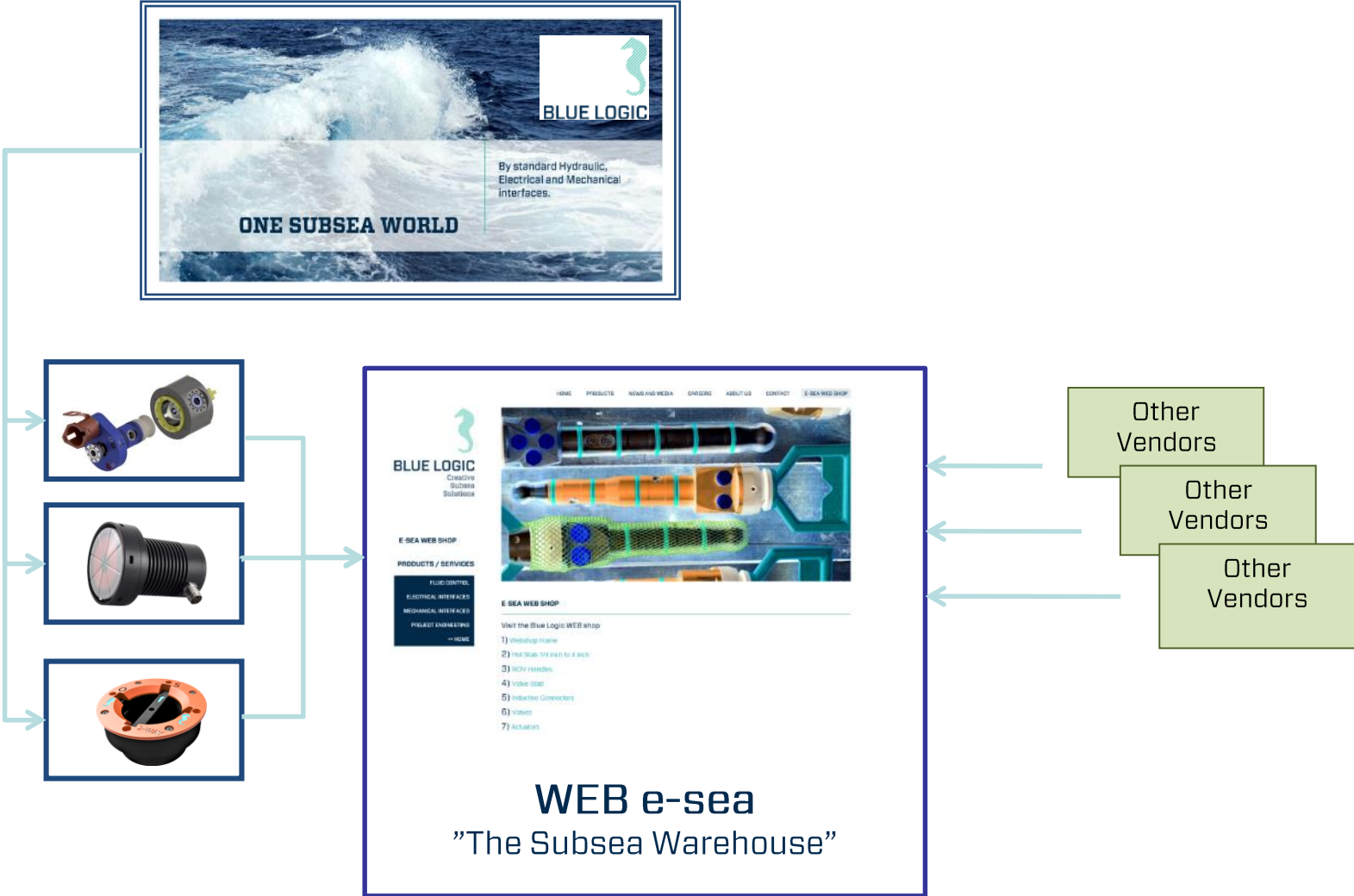
Inductive power and communication connector system

- Type A, B and C (50W, 250W, 2kW)

- **Project Engineering**

- ROV Tooling
- Package engineering with use of Standard Products
- Special systems

# Business Strategy "Blue Logic AS"



# More Data – Artificial Intelligence



Big data er ikke lenger bare for store selskaper, mener big data-sjefen i SAP. Illustrasjonsfoto: Colourbox



# Real-time 3D Scanning - Autonomous systems



6

**GAMLE GATER:** Google Street View har som mål å fotografere alle verdens gater med 360-graders kamera. Her har tech lead Daniel Filip i Google Maps båret med seg systemet med 15 kameraer til Machu Picchu i Peru. Foto: REUTERS/Pilar Olivares



**BLUE LOGIC**

# Why Drones?

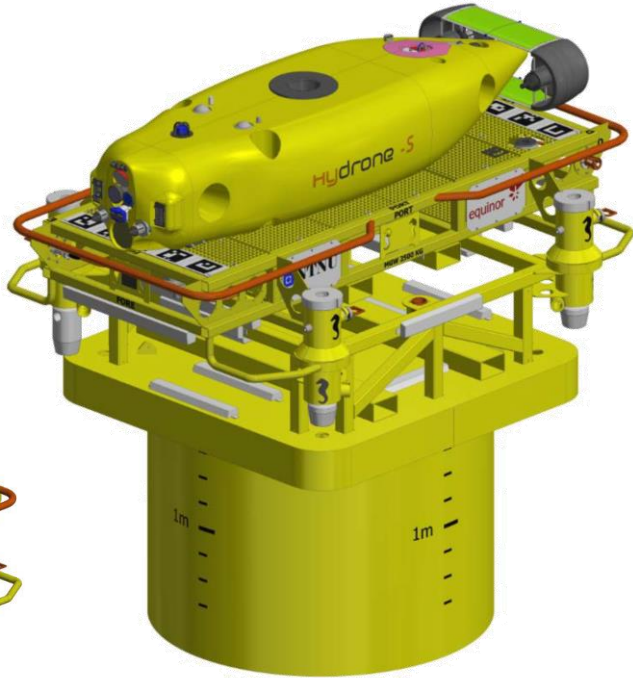
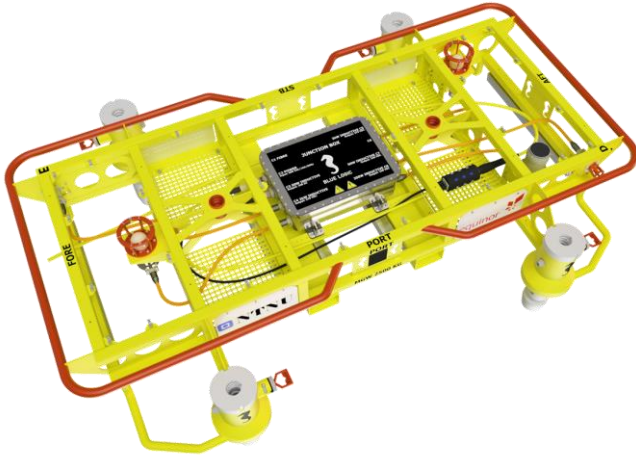
- Reduce CO2 emissions/footprint
- 24/7 Subsea control and surveillance
- Understanding the Ocean dynamic – Environmental Research and monitoring
- Control and management of floating energy production
- Offshore fish farming – Feeding the world
- Remote control – Offshore work is moved onshore – We can settle wherever we like





# One Shape Fits All

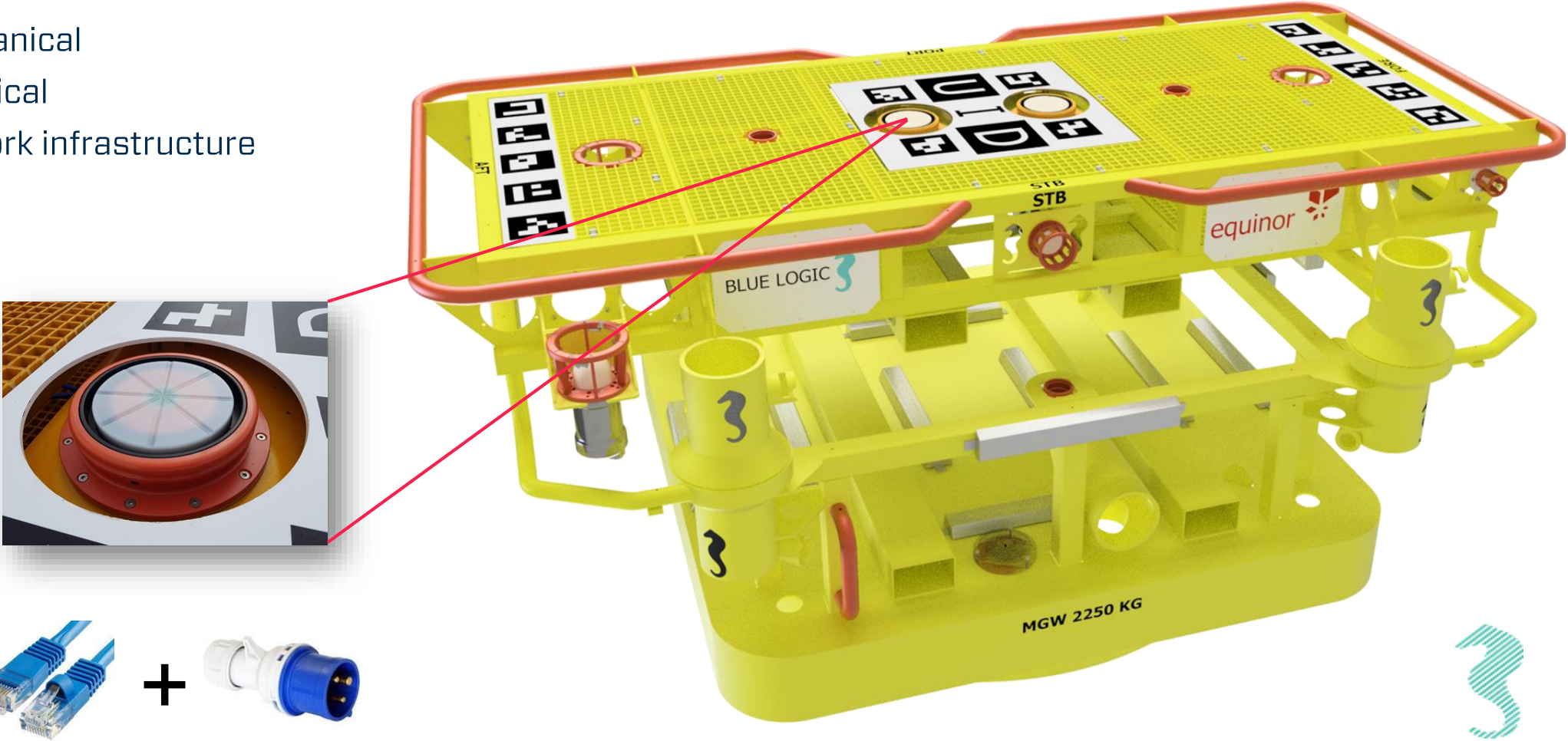
- Flat Standard
- All support the way forward



# One Shape Fits All

Open Innovation with standard interfaces:

- Mechanical
- Electrical
- Network infrastructure





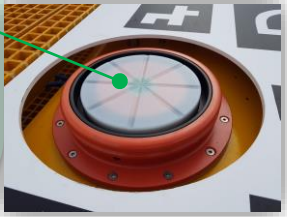
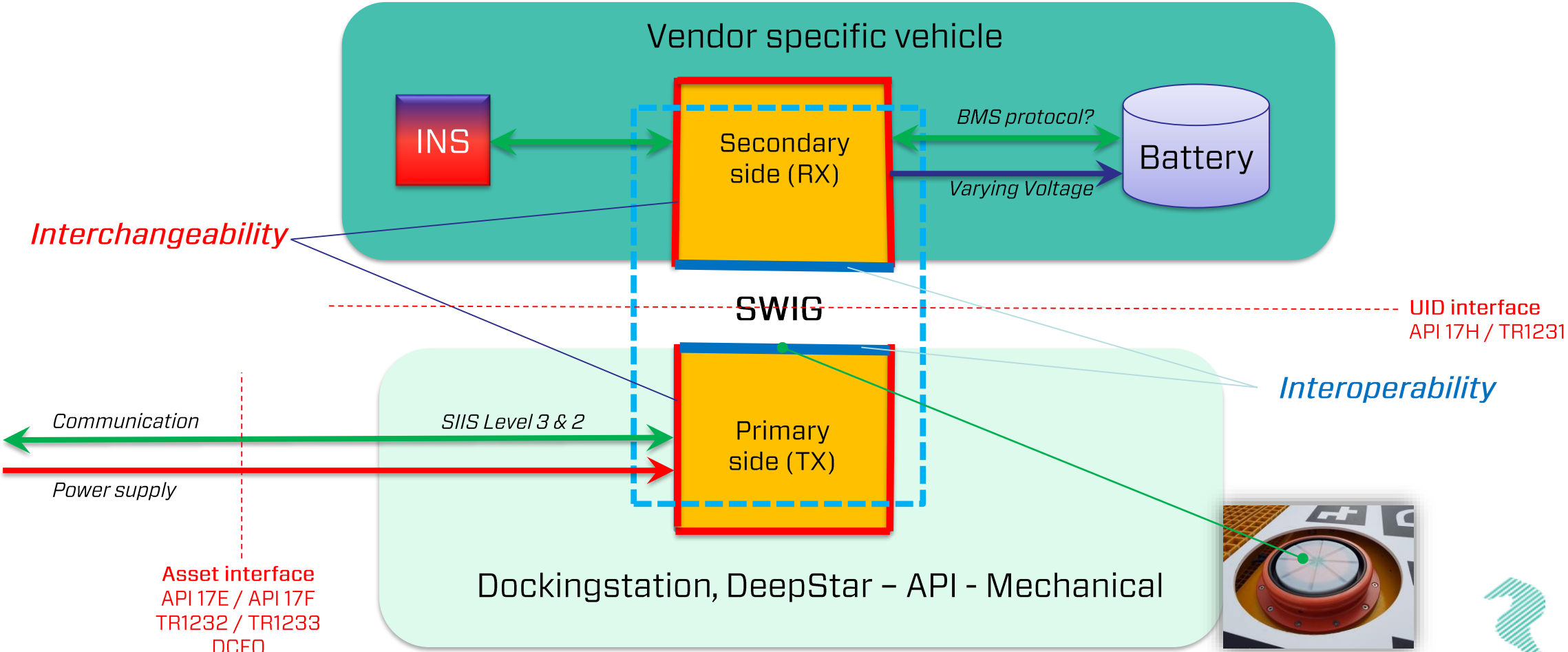
# One Shape Fits All



STANDARD INTERFACE



# Summary of New Interfaces



**BLUE LOGIC**

# Ongoing interface standardization activities

## TR1231 – Appendix

- Blue Logic written the updated TR-Document

## SWiG – Wireless interfaces subsea

- Acoustics
- Inductive charging / Underwater Wireless Power Transfer
- Free space optics

## DeepStar – Asset Integrity – Docking Station Standardisation

- Mechanical interfaces (base structure, superstructure etc.)
- Superstructure design philosophy
- Localization, approach, docking
- DeepStar intend to utilize SWiG results

## API 17H 3<sup>rd</sup> edition

- <sup>13</sup> • Drone Interfaces: Electrical, Mechanical, and Hydraulic



## Power and Communication in one interface:

- SIIS Level 2 and 3 (230kbps and 100Mbps)
- Input Power: 100-250VAC and 145-380VDC
- Output Power: 280-400VDC

# SUBSEA USB – INDUCTIVE CONNECTION





# SAAB Demo in Motala

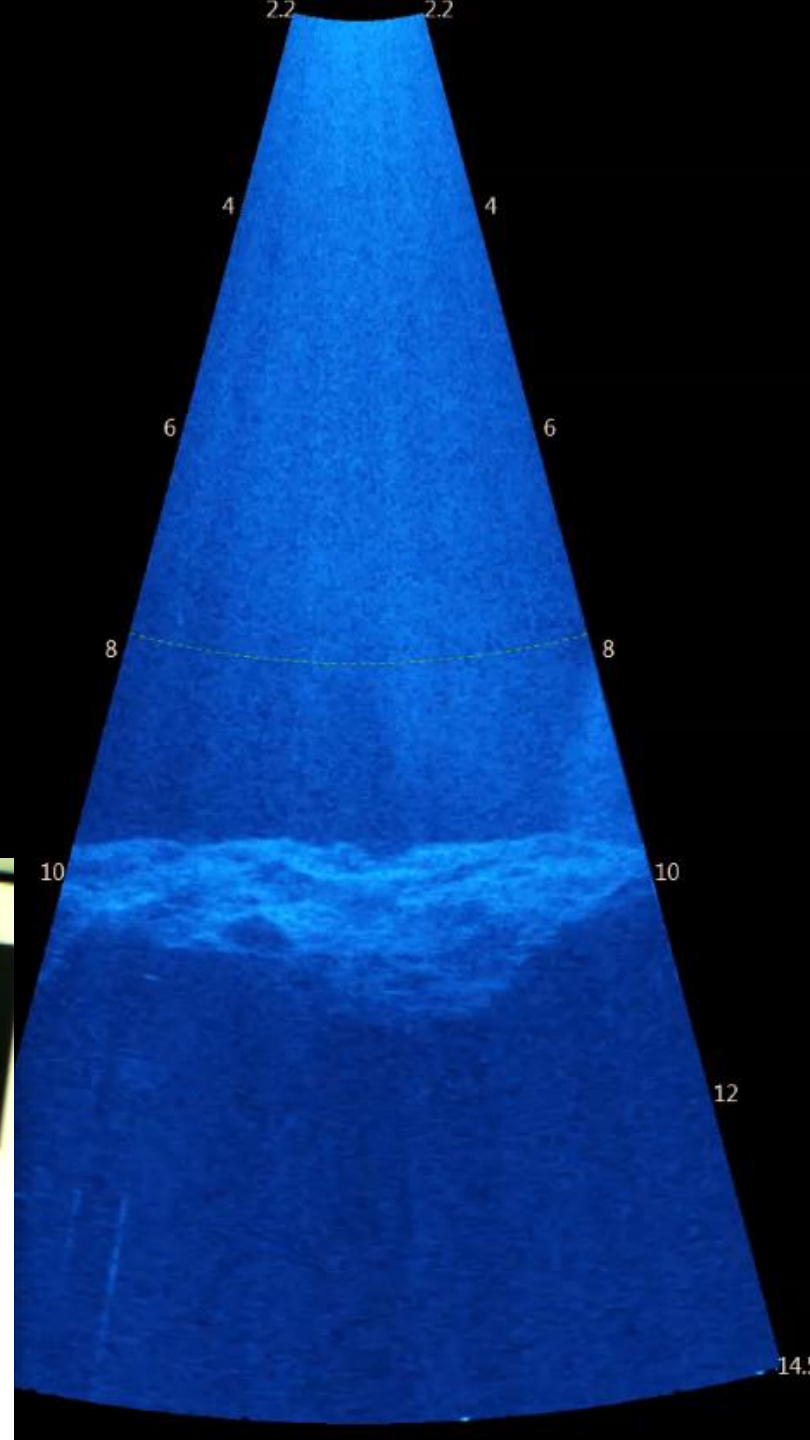
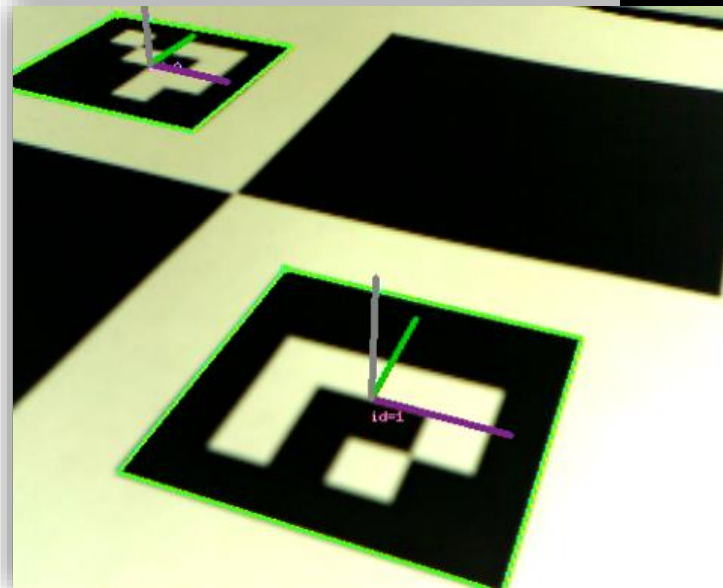


# Media References

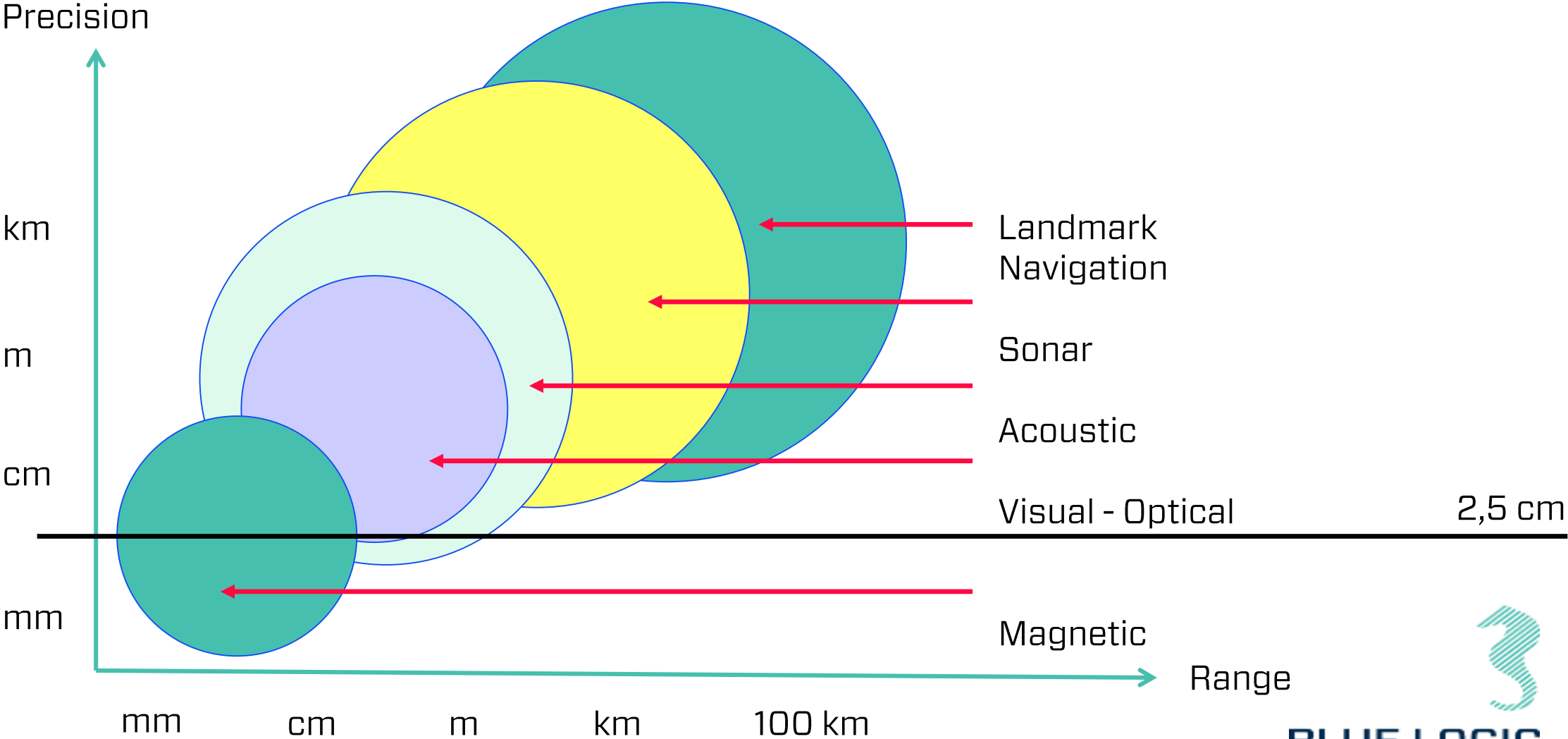
- [Equinor news and video](#)
- [Stavanger Aftenblad](#)
- [Strandbuen](#)
- [NRK Dagsrevyen](#)
- [Teknisk Ukeblad](#)
- [Offshore Engineer](#)
- [SAAB Demo in Motala](#)

# Image Sonar if lack visual

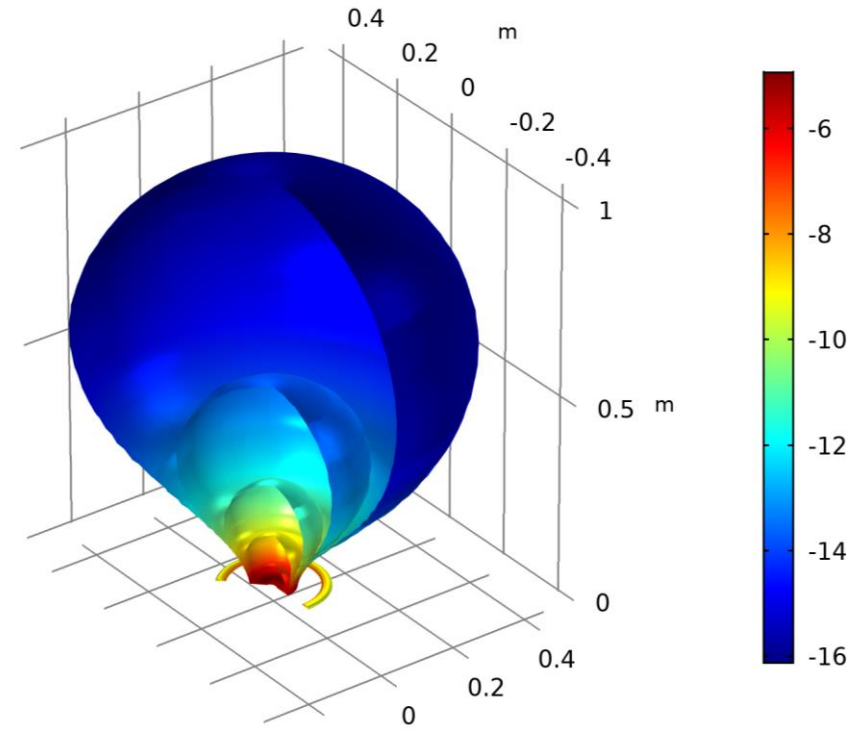
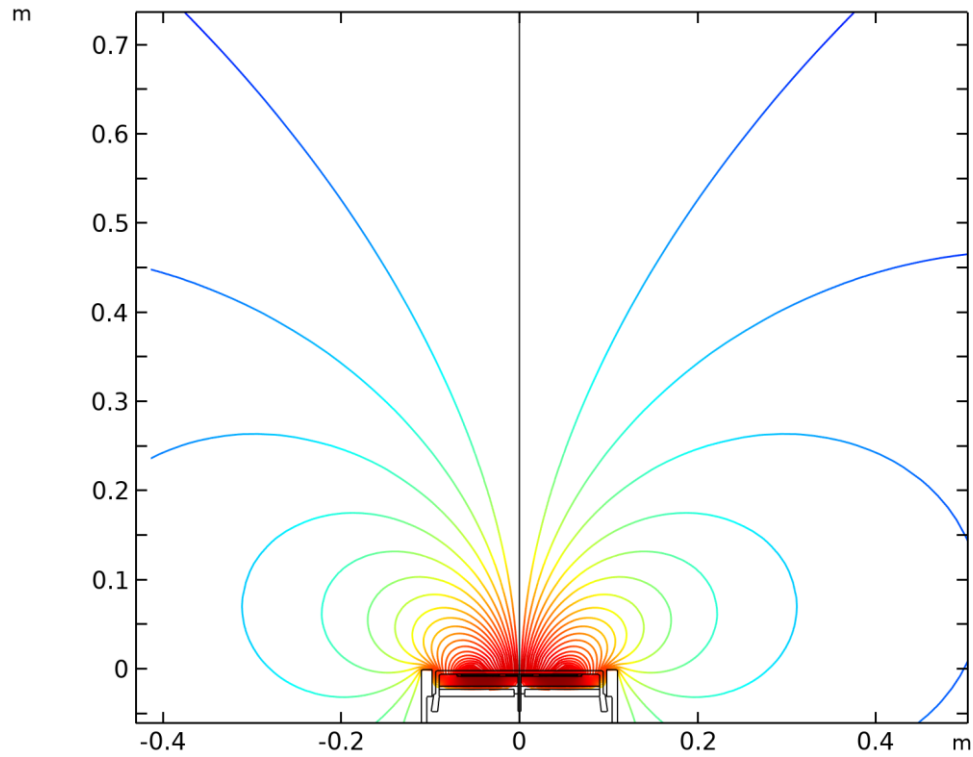
- Use 3D ChaRuCo and Sonar to navigate in zero visual conditions.
- Water cut ChaRuCo (water cut out of metalplate) can be used in case of large deposits from yogurt-texture seabed conditions that is visible by means of Sonar.
- Aruco markers placed on various positions on the docking station to provide visual guidance.
- Using machine vision a single Aruco marker provides 6 DoF information to a vehicle.
- Used for fine guidance to compensate for lack of mechanical guidance.
- Aruco and ChaRuCo are open source, so everyone can use.



# Subsea Navigation Accuracy

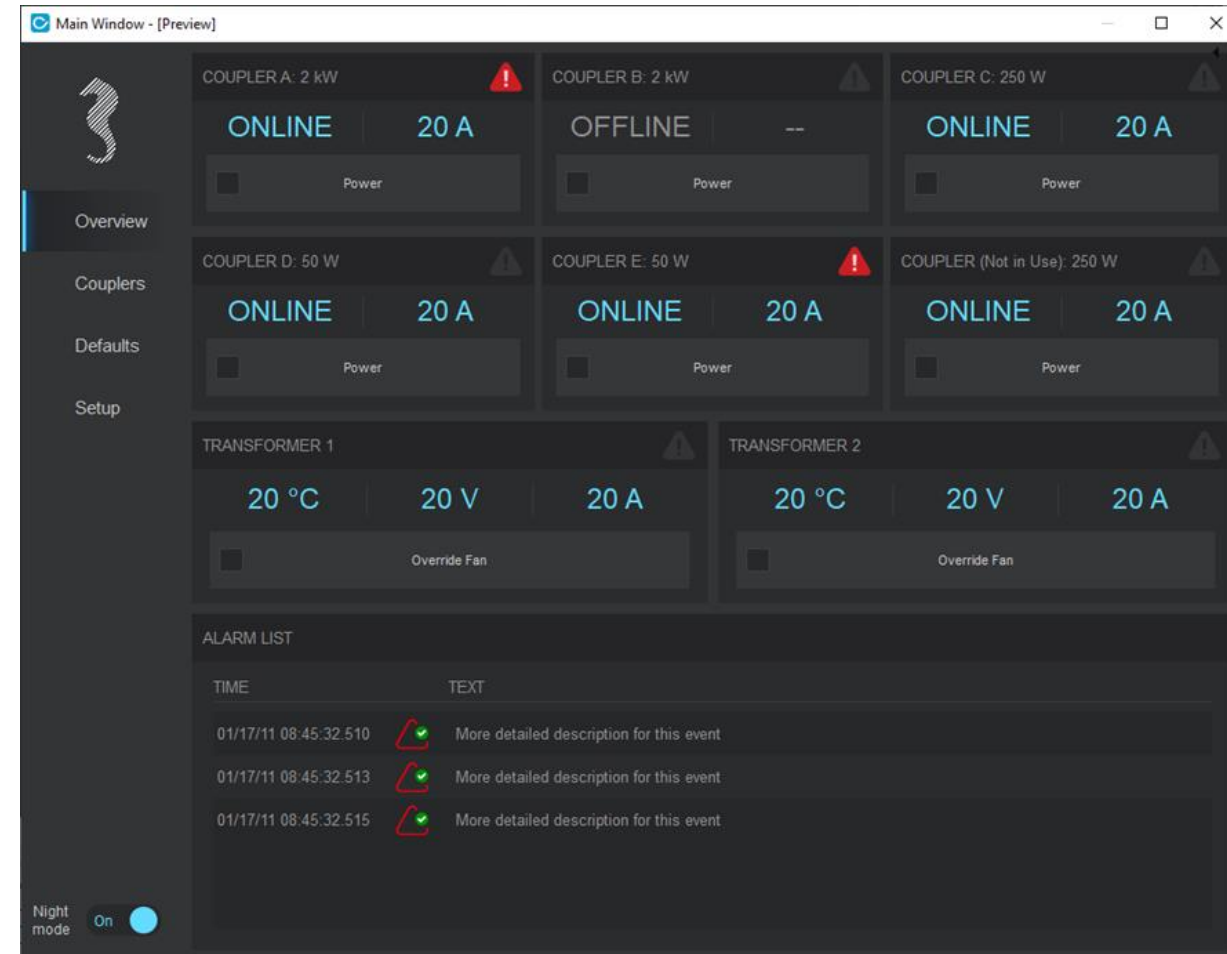


# Navigation - Magnetic Homing



# Distributed control – Power Management

- Battery management
- Power control and load sharing
- Condition monitoring
- Alarm handling
- Communication management
- Authentication
- Analytic connection to cloud
- Distributed remote operator interfaces



Main Window - [Preview]

Overview  
Couplers  
Defaults  
Setup

COUPLER A: 2 kW ONLINE 20 A Power

COUPLER B: 2 kW OFFLINE --- Power

COUPLER C: 250 W ONLINE 20 A Power

COUPLER D: 50 W ONLINE 20 A Power

COUPLER E: 50 W ONLINE 20 A Power

COUPLER (Not in Use): 250 W ONLINE 20 A Power

TRANSFORMER 1 20 °C 20 V 20 A Override Fan

TRANSFORMER 2 20 °C 20 V 20 A Override Fan

ALARM LIST

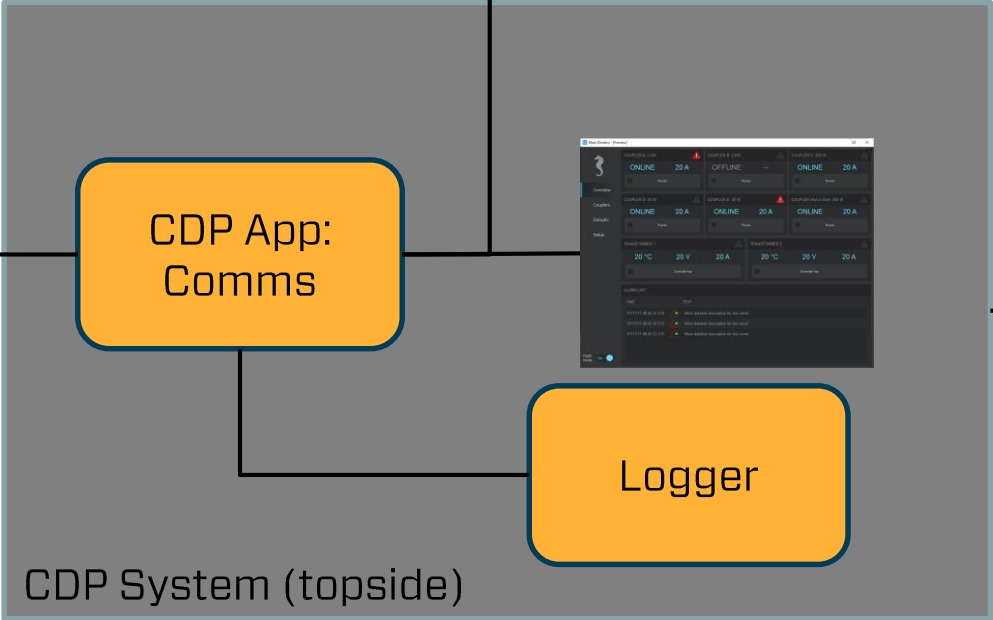
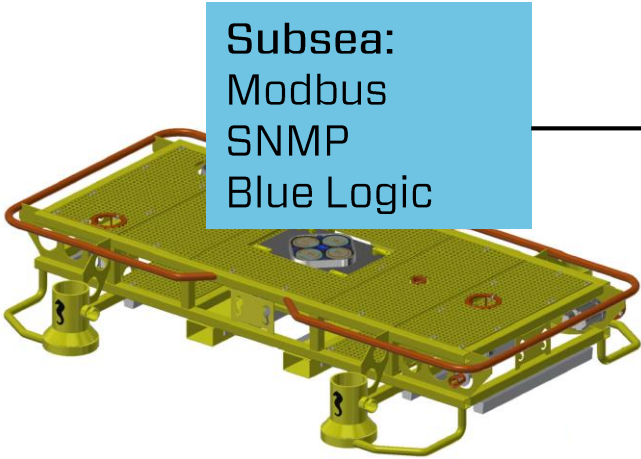
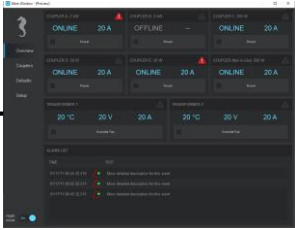
TIME	TEXT
01/17/11 08:45:32.510	More detailed description for this event
01/17/11 08:45:32.513	More detailed description for this event
01/17/11 08:45:32.515	More detailed description for this event

Night mode On



# Condition Monitoring Cloud Service

Additional operating panel



BLUE LOGIC

# 14 years on the market... finally accepted and embraced

FFU 2006 – Statoil IB Centre:

Stavanger Aftenblad | Fredag 3. februar 2006 7

## Vil revolusjonere undervannsooperasjoner

Et nytt patent fra Ifokus Engineering AS skal spare oljenæringen for både tid, penger og miljø.

Inga Sverdrup | tekst

**BESPARENDE:** Under Subsea-konferansen «Et hav av utfordringer» i går, presenterte ingeniørene i Ifokus Engineering for første gang sin lenge godt bevarte hemmelighet. En ny oppfinnelse gjør det mulig å skifte avansert verktøy på miniubåter mens de fremdeles befinner seg under vann.

– Poenget er at overførselen av strøm og kommunikasjon foregår gjennom et patentert prinsipp uten galvanisk kontakt, sier produsent Kurt Thomassen.

### Ett års arbeid

Produktet er basert på et patentert prinsipp for kontaktløs energioverføring utviklet av det norske firmaet WPC i Kristi-

ansand. I ett år og uten statlig støtte har WPC og Ifokus samarbeidet om utviklingen av den multifunksjonelle kobleren.

– Jeg har selv jobbet med slike miniubåter og har sett hvor tungvint det er så fort man skal bytte verktøy, sier prosjektleder og ansvarlig for utviklingen, Lars Gunnar Hodnefjell.

– Nå kan alt gjøres mens ubåten fremdeles befinner seg på dypt vann. Det sparer man enormt mye tid og penger på, sier han.

Ifokus har tatt patent på produktet og håper på at det skal revolusjonere bransjen og bli standard over hele verden.

### Fremtidens teknologi

– Elektrisitet er fremtiden. Det fører ikke til miljøskadelige utslipp, og det har ingen påvirkning for livet under vann. Det har også vært et viktig aspekt når vi har jobbet med dette, sier Thomassen og peker på akvariet der prototypen og gullfis-

ker lever godt sammen.

– Denne typen kontaktløs energioverføring er også mye tryggere for personellet som håndterer slike apparater. Når strømmen overføres, har du ingen åpne elektriske kontaktflater å tenke på, og du har mindre deler som kan gå i stykker, sier Hodnefjell.

Arbeidet med oppfinnelsen har ikke vært diskutert utenfor bedriften før den ble presentert i går.

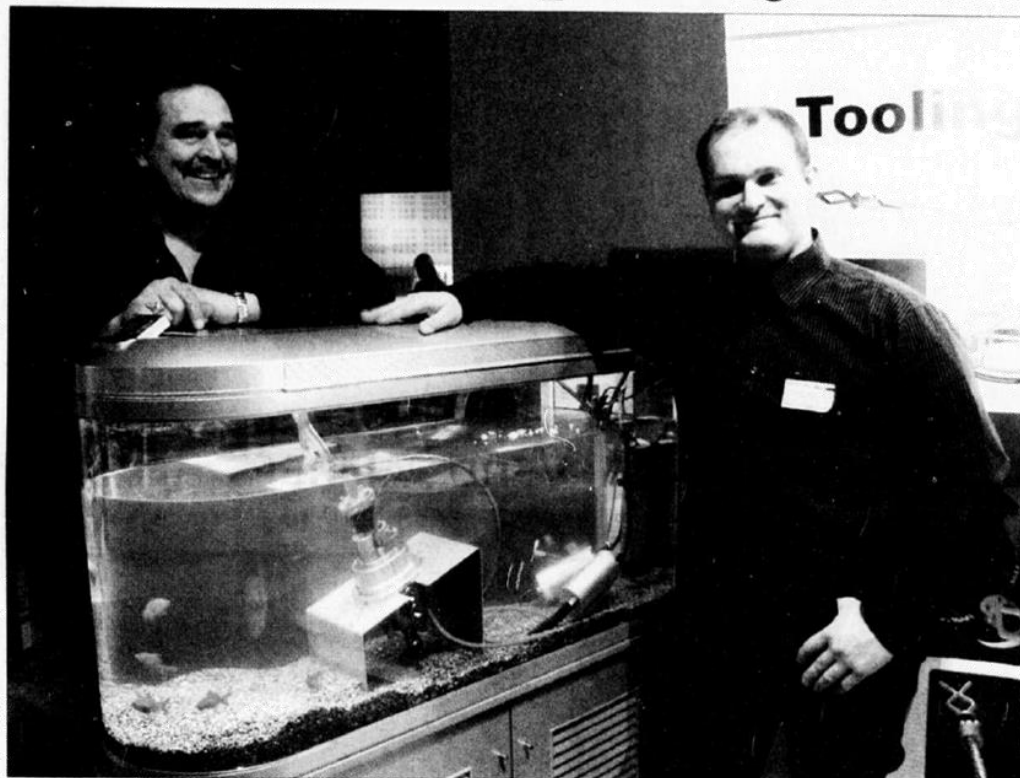
– Vi er veldig spente på reaksjonene, men håper å ha solgt de første i løpet av første halvdel av 2006, sier administrerende direktør John Smith.

inga.sverdrup@aftenbladet.no

### PETTER SMART:

– *Produsent Kurt Thomassen (t.v) og prosjektleder Lars Gunnar Hodnefjell fra Ifokus Engineering, presenterte i går et produkt de håper skal revolusjonere undervanns-bransjen.*

(Foto: Ifokus)



# First Installation 15.05.19





# Inductive Subsea Connectors History



2005  
2007  
2008



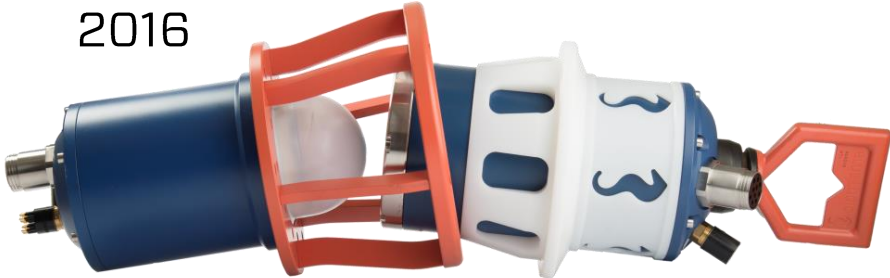
2014



2012



2016



2016



2017



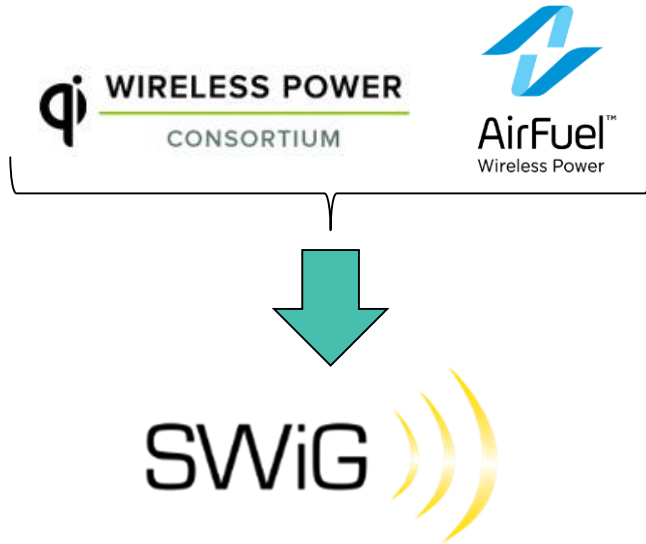
2018



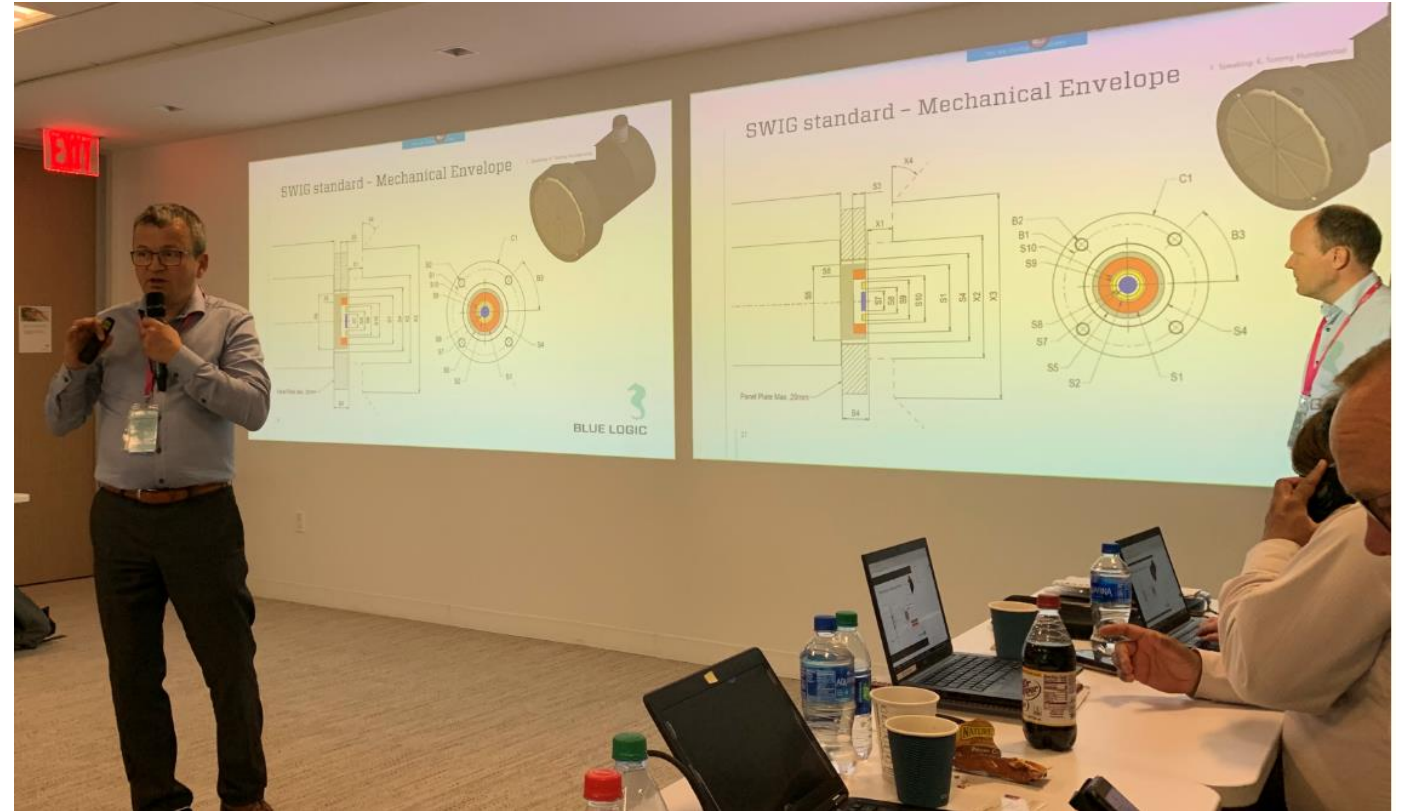
2019

# Technology Philosophy – SWiG Presentation

Standard solutions



- Interoperability
- Standardised Power Transfer



SWiG Meeting, Equinor HQ, Houston Texas, May 2019

# Flat 2,5kW Coil design for SWiG

- Pressure tested to 3600m
- First delivery shipped week 24, 2019





# Example 2kW, 80Mbps Ethernet and 230kbps RS 485



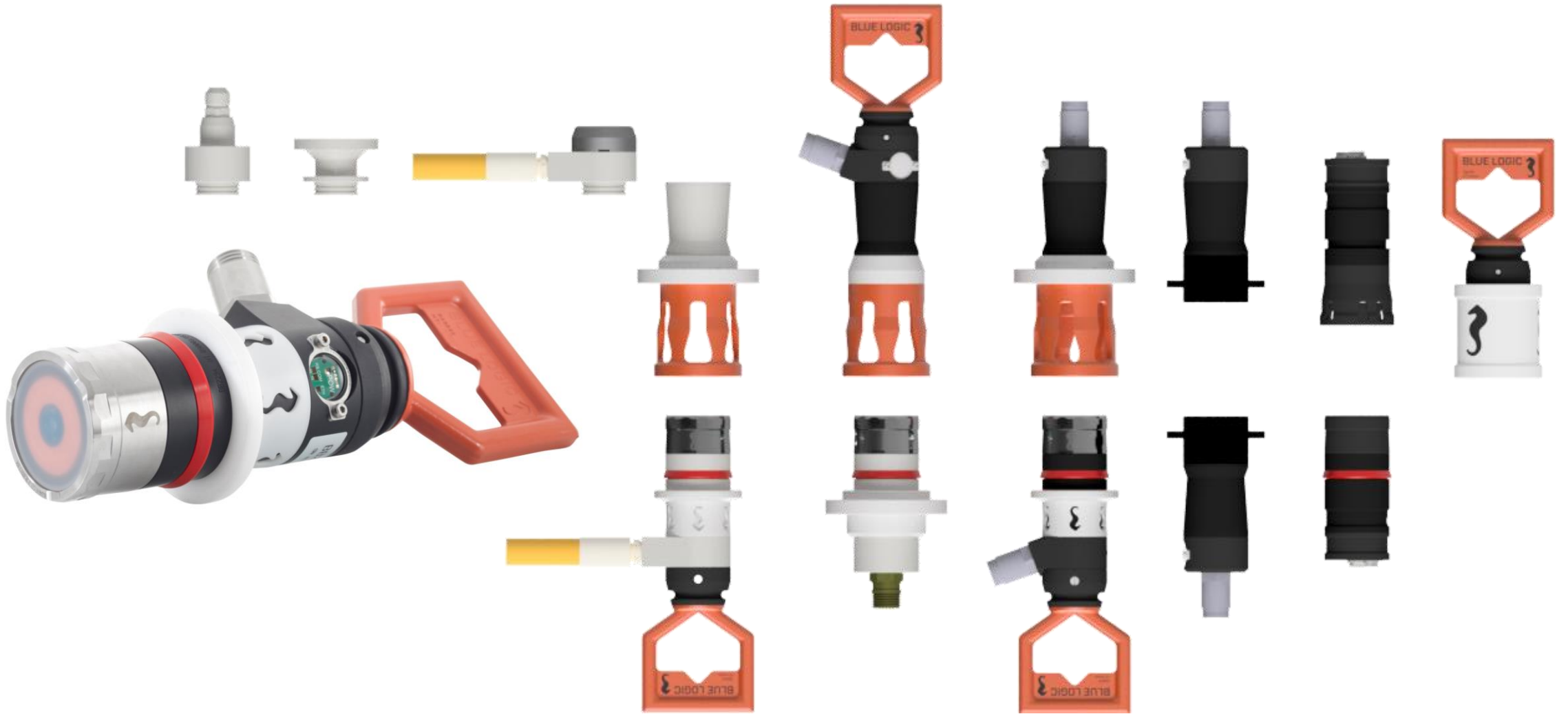
# Example 250W, 80Mbps Ethernet and 230kbps RS 485

- Slip ring
- Bulk head
- Flange mounted tool side
- Flange mounted ROV

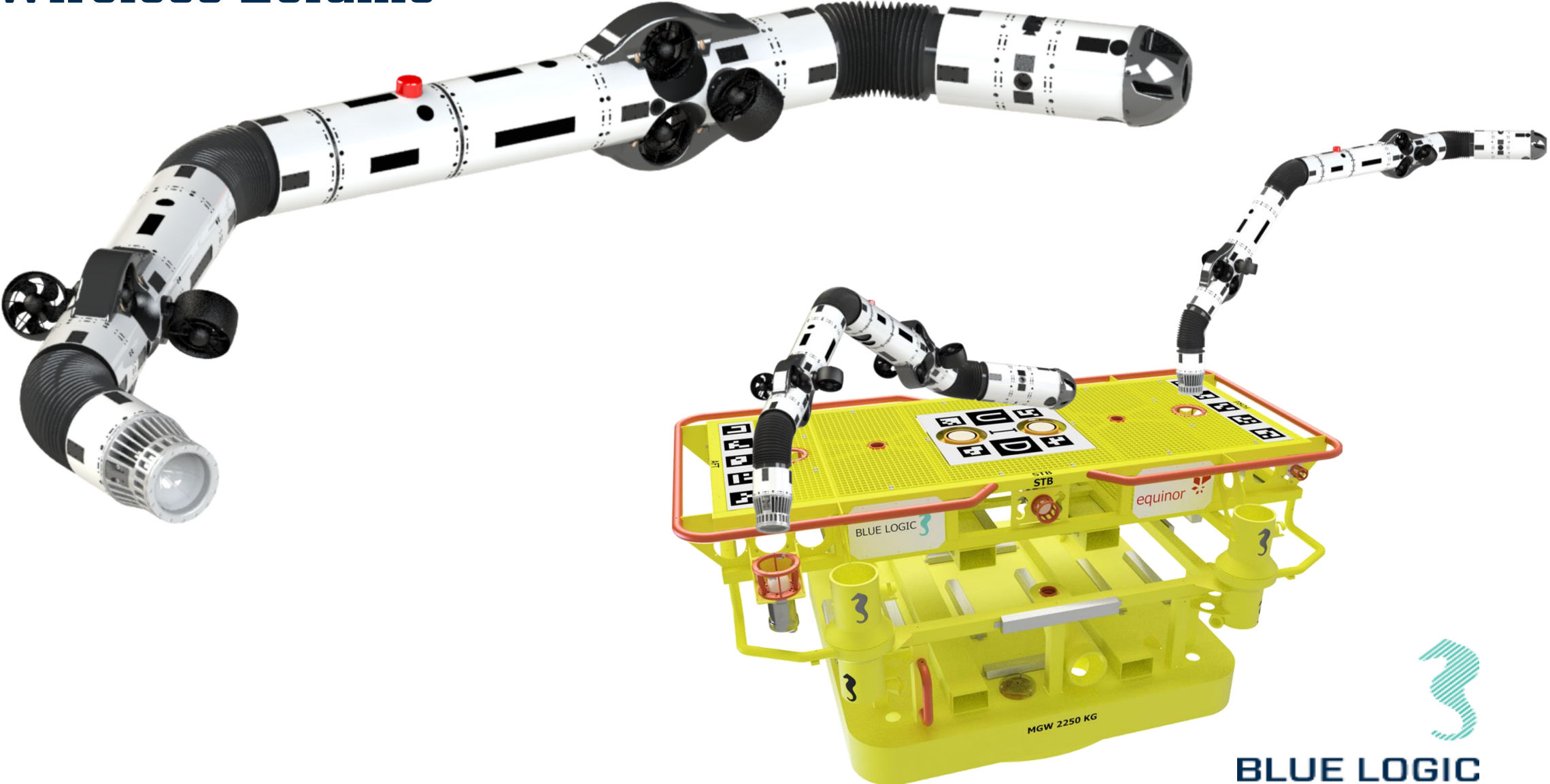


BLUE LOGIC

# Example 50W, 80Mbps Ethernet and 230kbps RS 485



# Wireless Eelume





# Gripen - Wireless Tooling Manipulation

Wireless Tooling Interface



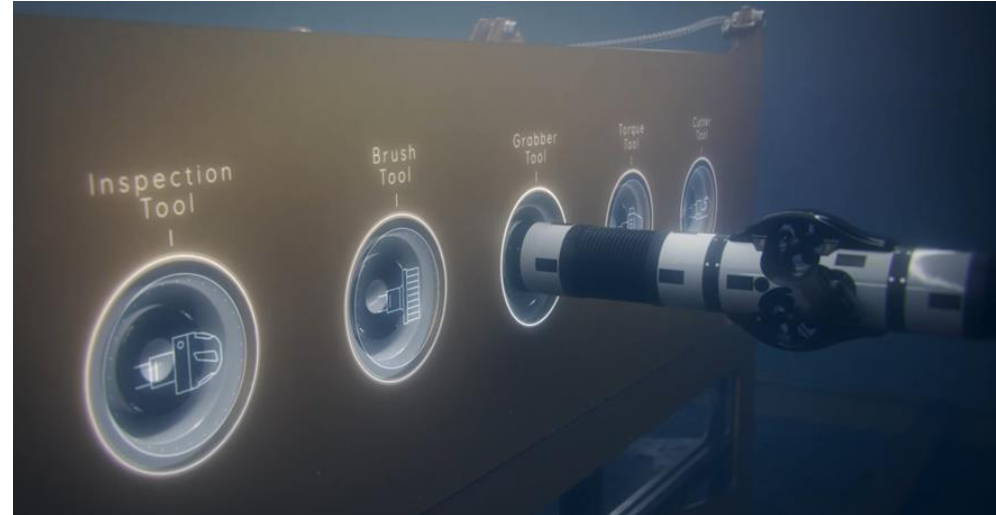


# Wireless Electrical Torque Tool – Standard Interface

Neutrally-buoyant Electrical Torque Tool with buoyancy that can be mounted on a AUV with subsea change out.

Inductive Tool Carrier for Subsea change out of tooling:

- Cutting Tools
- Survey Tool
- CP probe
- Cleaning Tool
- Gripper Tools
- Torque tools
- UPS Power bank
- Tether connection



BLUE LOGIC

# Eelume Tooling



# AUV Operated Electrical Torque Tool



Dry Weight: 17Kg  
Submerged weight: 8,5Kg  
Full 2700Nm



# Equinor news and video



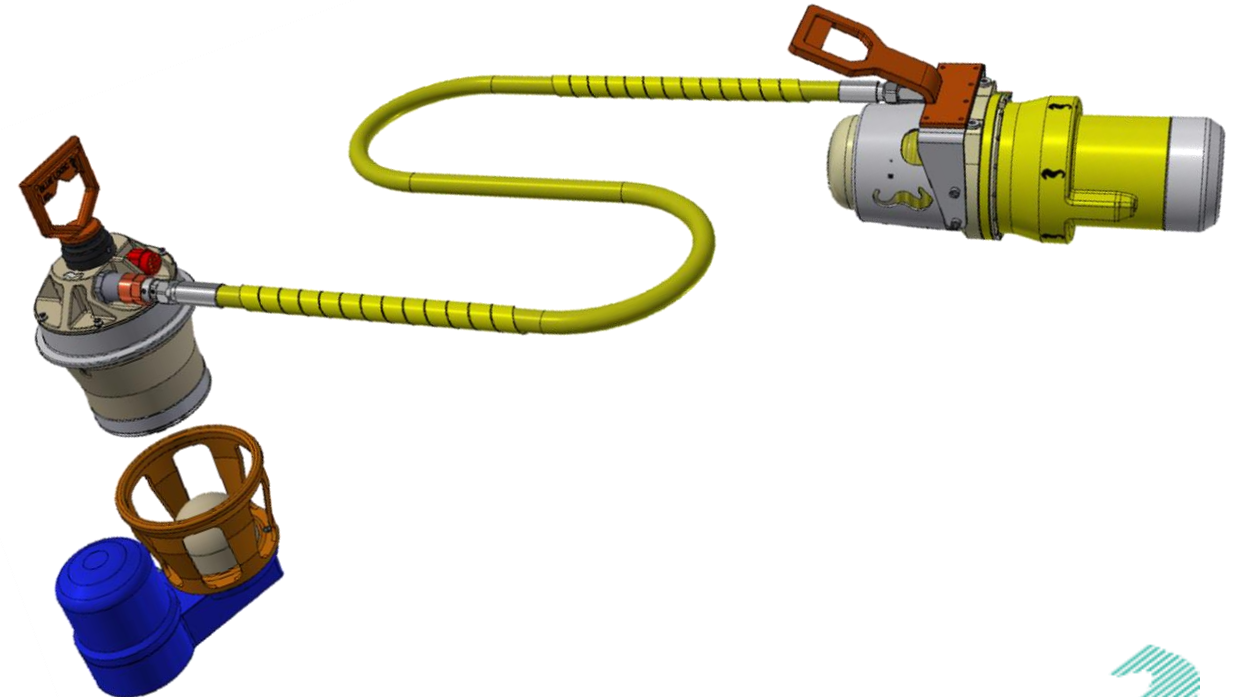
New Drone Scope of Work

# EXAMPLE OF DRONE SOW



# Subsea Actuator Change Out by Air Drone

- Inductive interface
- Light Weight - Flyable by Air Drone
- Installation by Subsea Drone
- Semi-permanent Actuator:
  - 3000 m rated
  - 8 kg in water
  - Full ISO Class 1 to 4
  - 2kW of Peak power consumption
  - Full Torque Signature
  - Upload and down load from Cloud

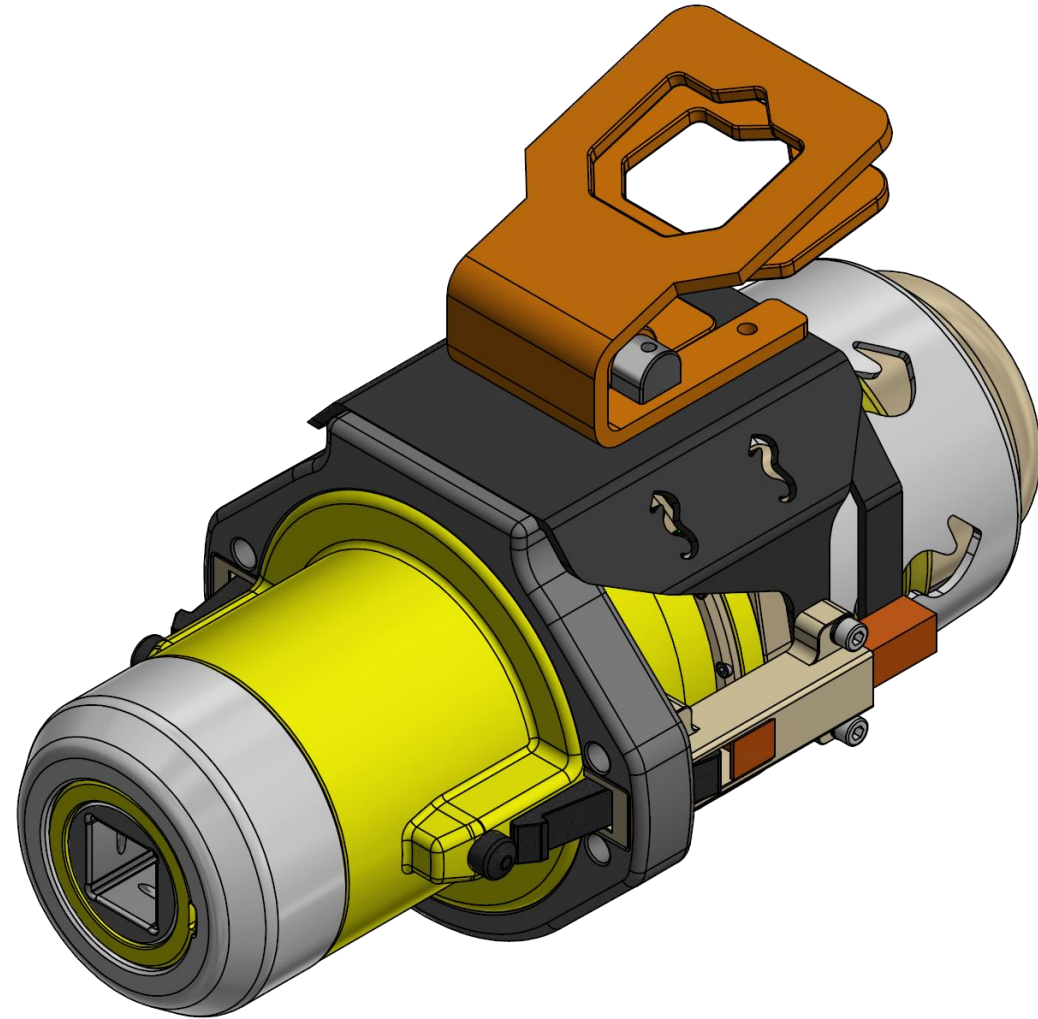


# AUV operated Electrical Torque Tool

(Same as Subsea Actuator)

Semi-permanent Actuator - Torque Tool:

- 3000 m rated
- 9 kg in water
- Full ISO Class 1 to 4
- 2kW of Peak power consumption
- Full Torque Signature
- Upload and down load from Cloud



# Tether connection

- Fibre Termination
- No need of Power
- Pull test up to 15 degrees offset
- Power and fibre communication
- Hyperbaric test to 3000m
- Destructive test to 3,6 ton

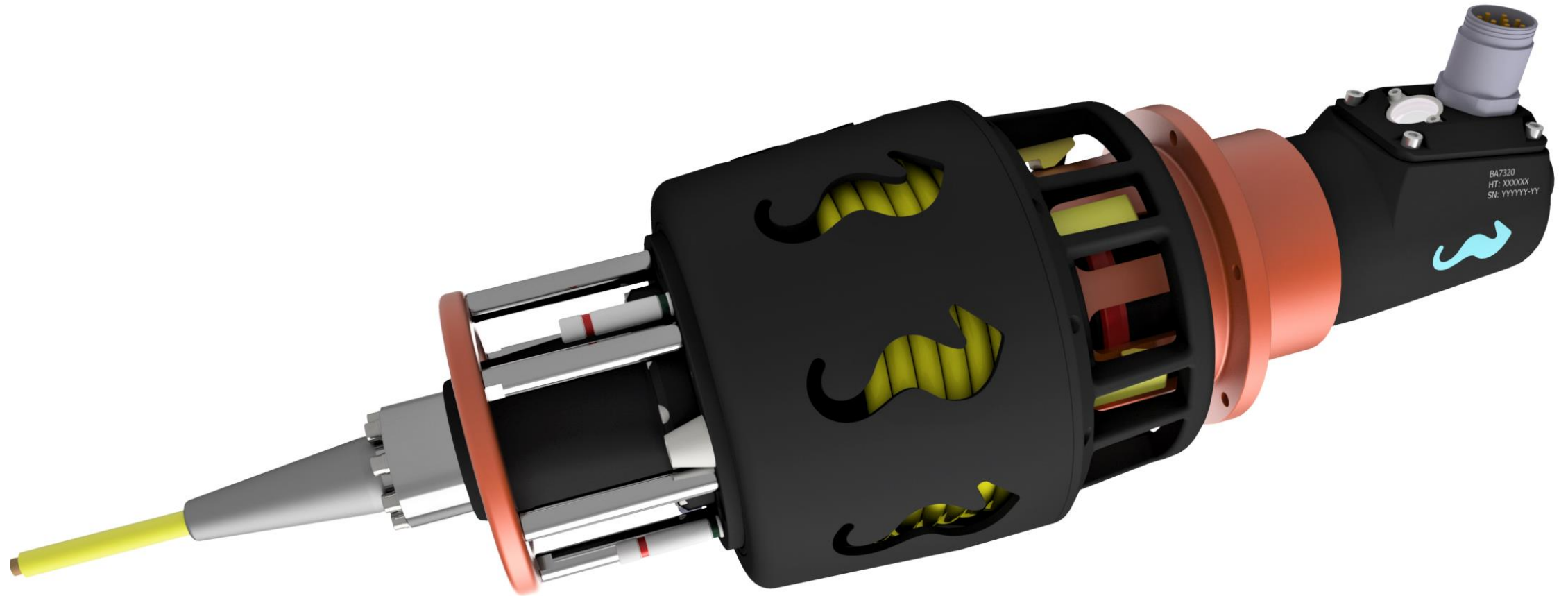


# TMS Fibre Connection

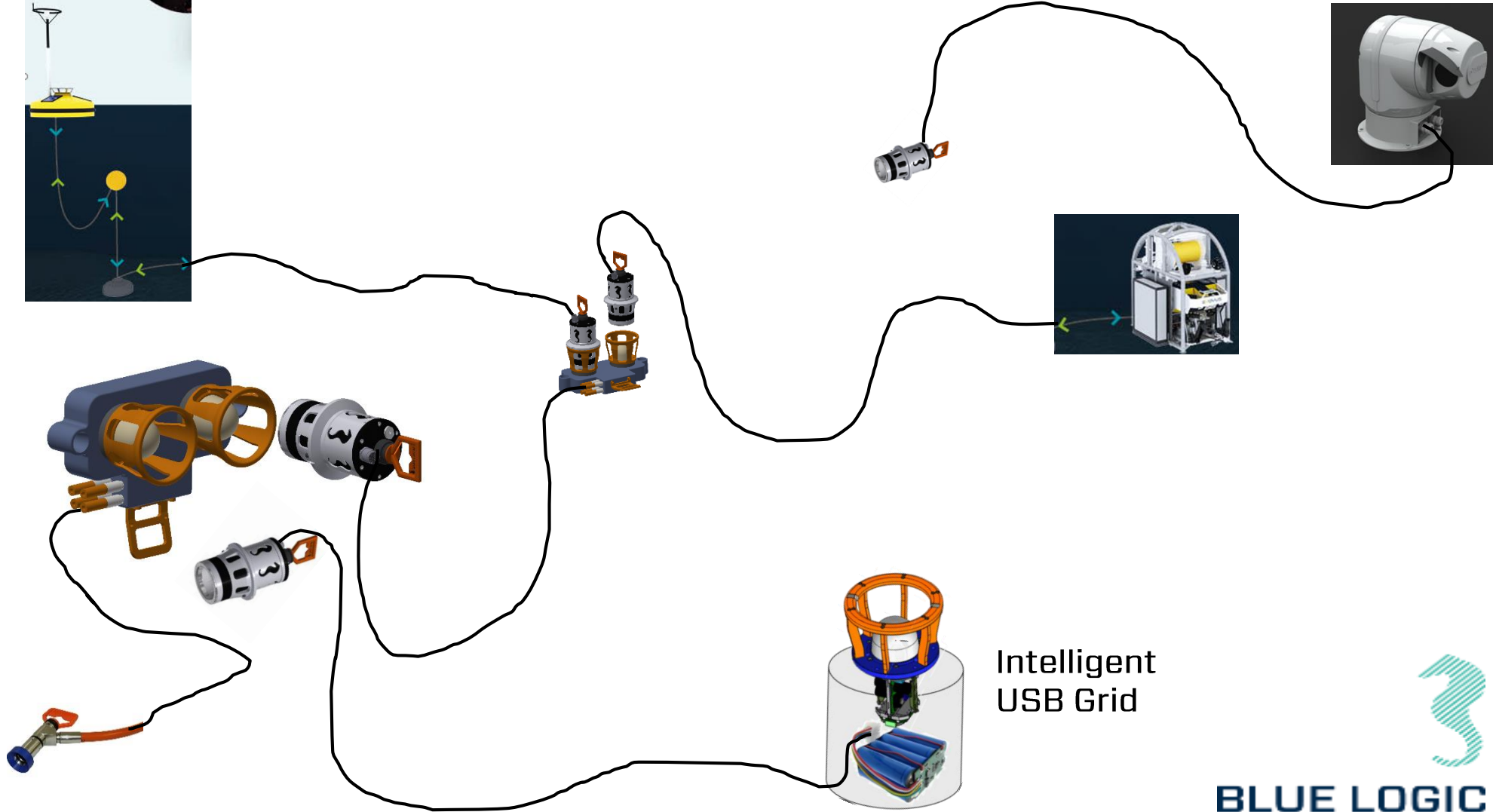




# UID Tether operated Mechanical Connector



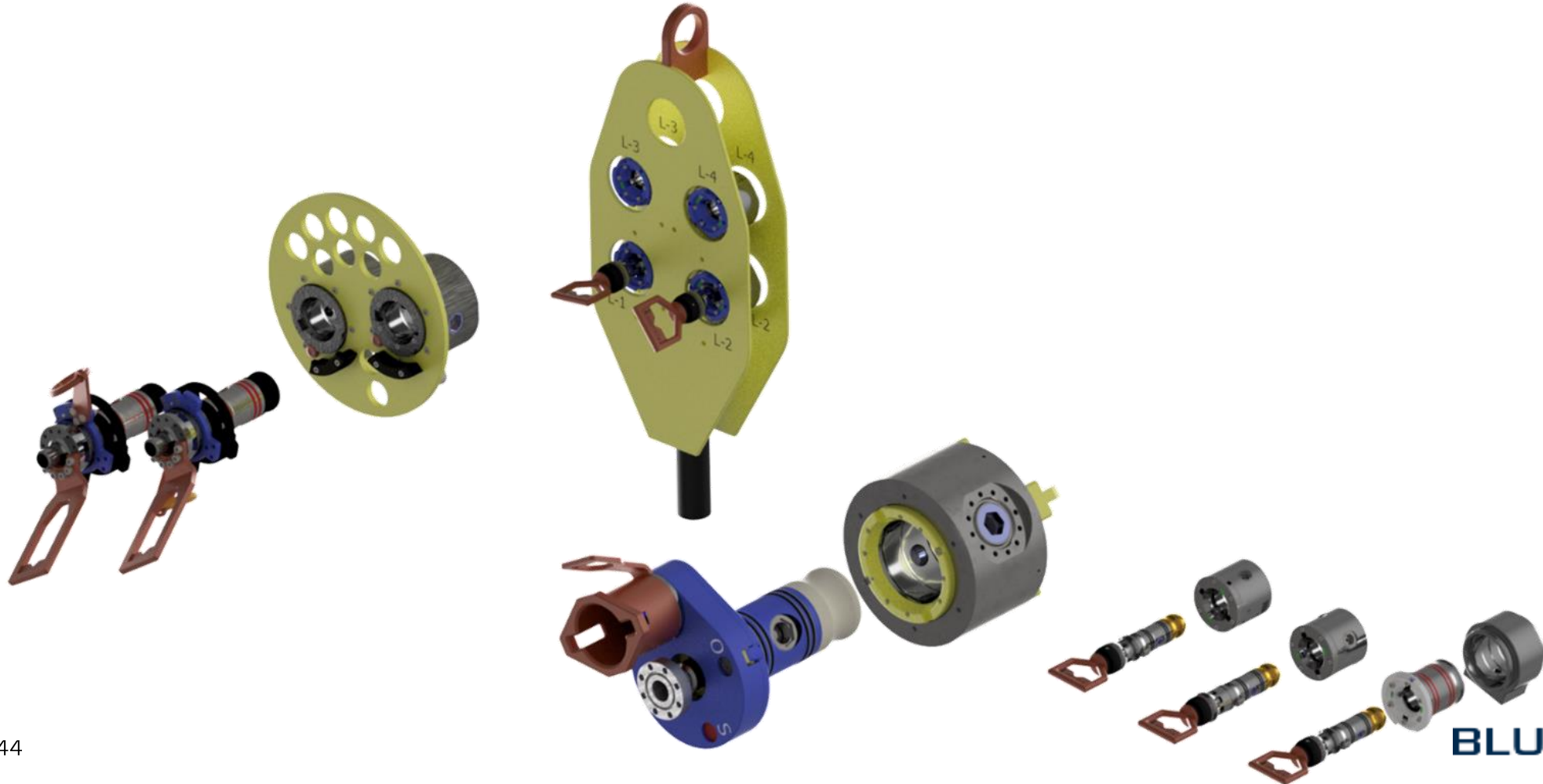
# Subsea Utility Drone Grid - Plug and play



# Drone friendly umbilical termination jumpers

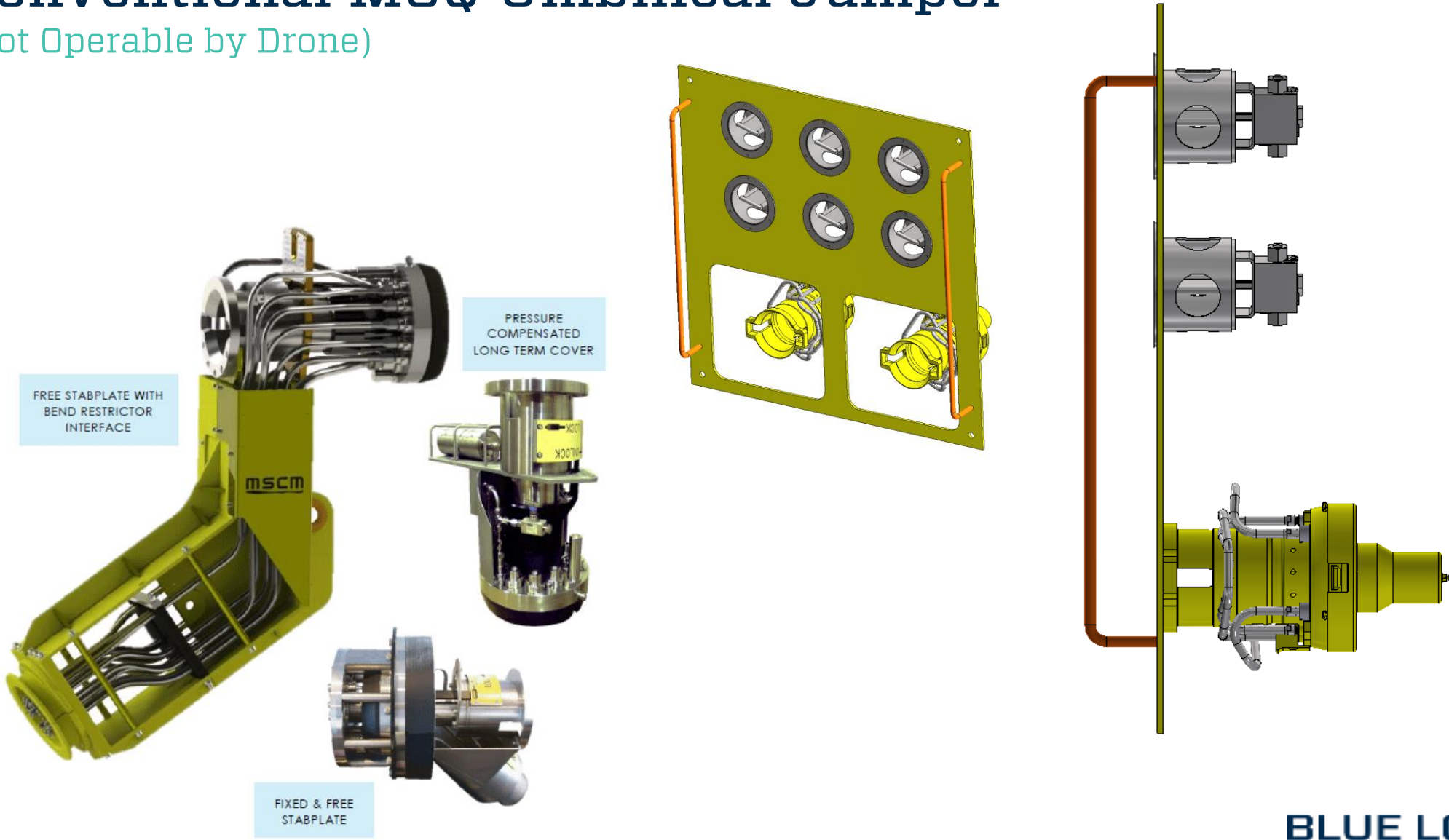
Single Port Quick Connector Building Blocks

2", 1", 3/4", 1/2", and 1/4" Full bore Flow Area



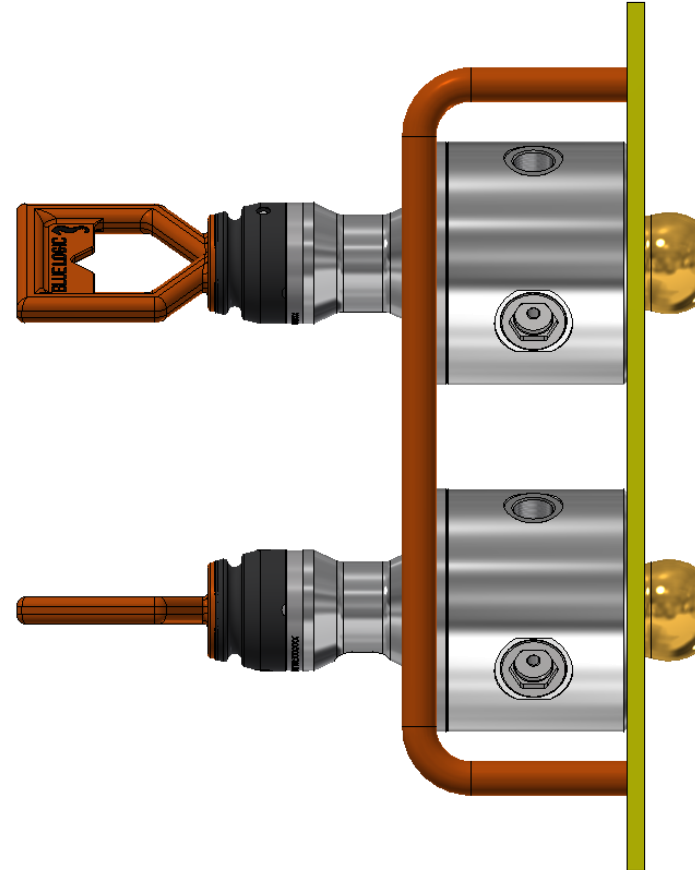
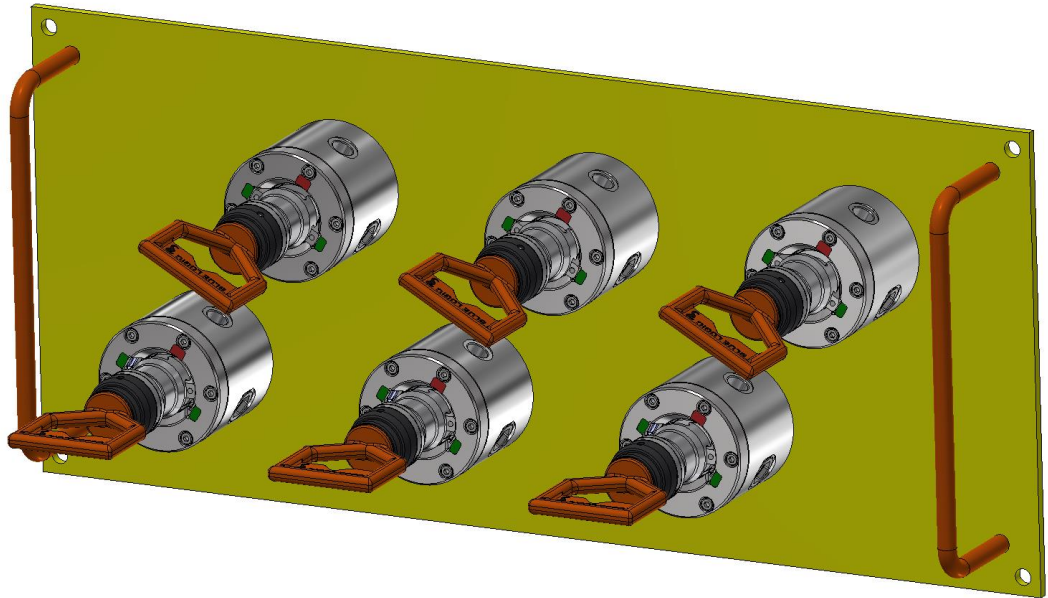
# Conventional MCQ Umbilical Jumper

(Not Operable by Drone)



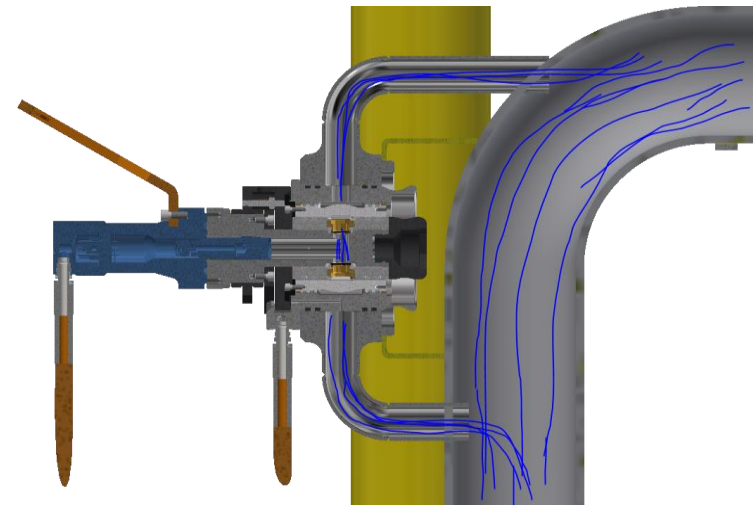
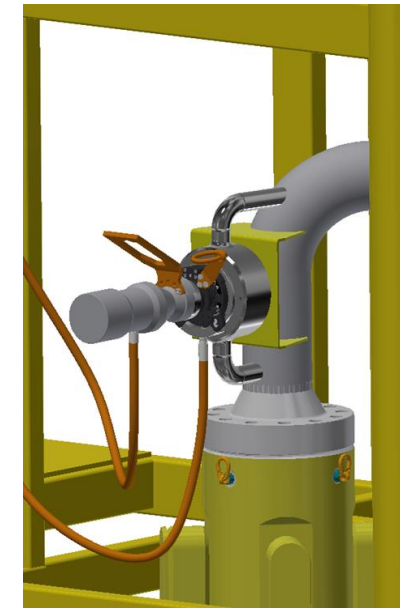
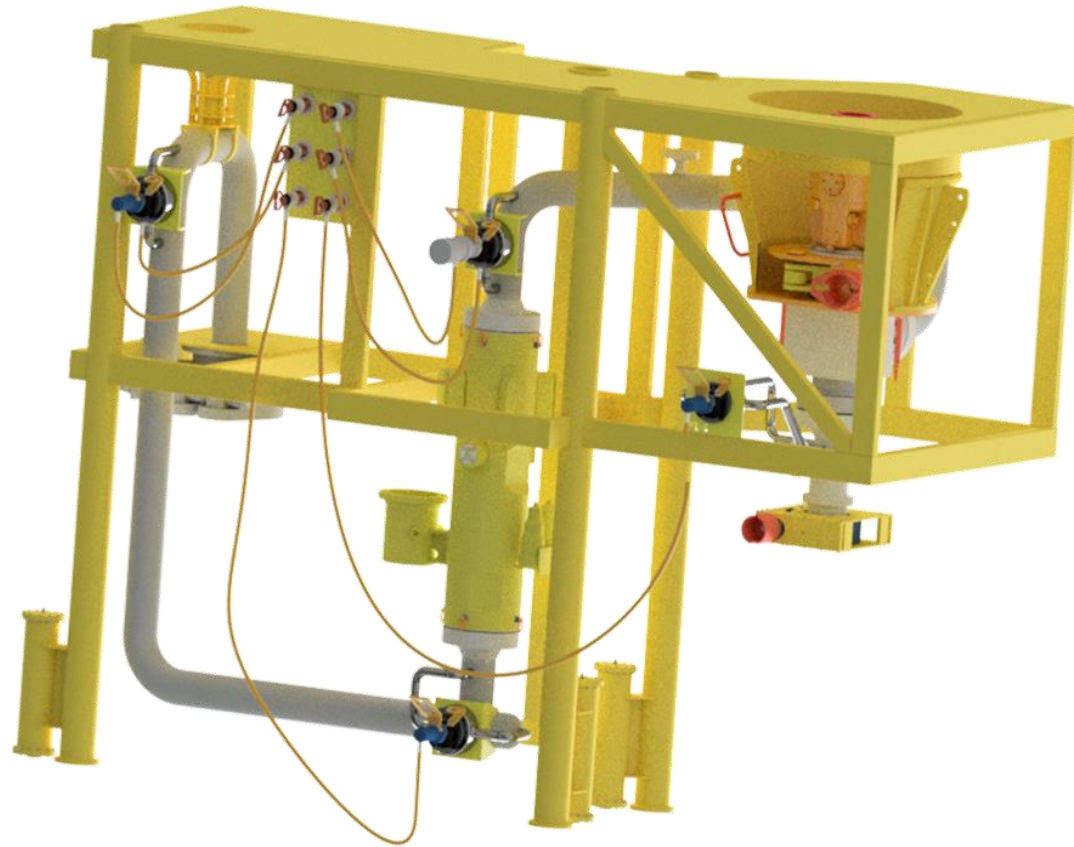


# Valve Stab MCQ Umbilical Jumper System



# Drone Replaceable Sensors

Multi purpose pipeline penetration



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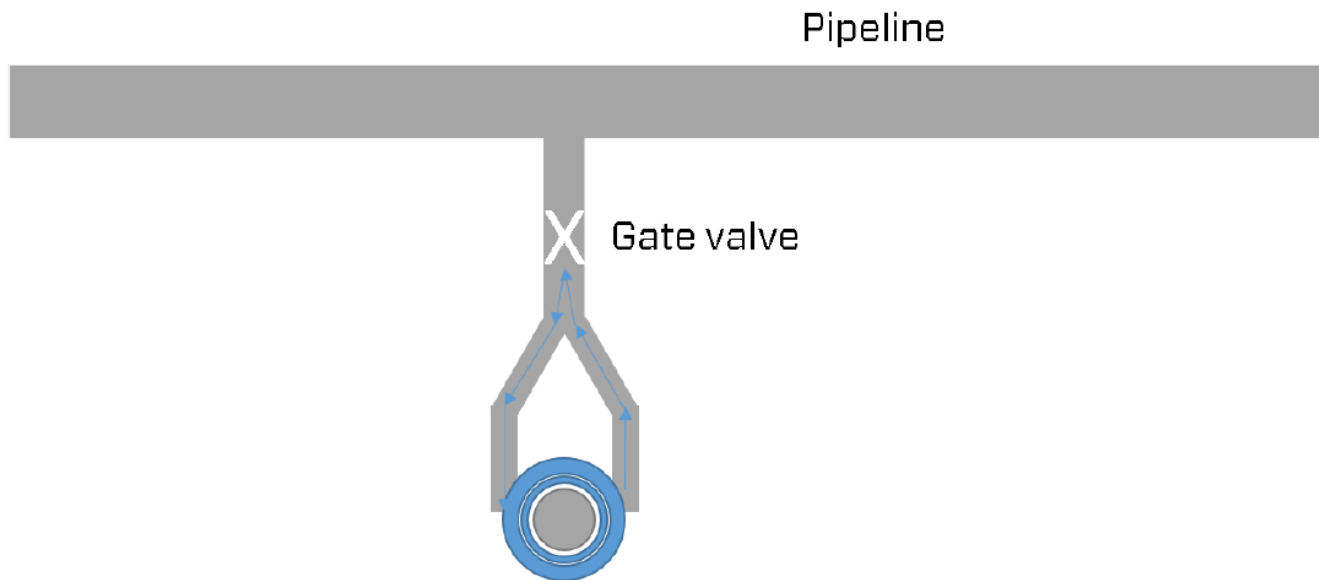
# EAB – Permanent Connection for Utgaard WP10



# Hydrate friendly RFO interface

## 2.3.3. Dual Port Receptacle with replaceable insert

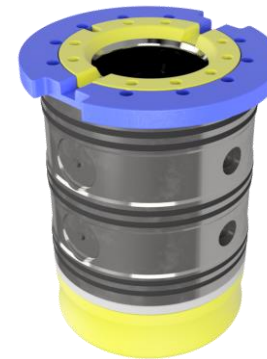
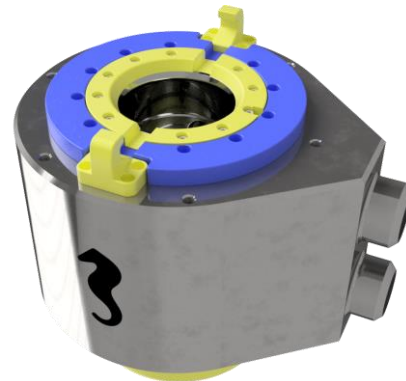
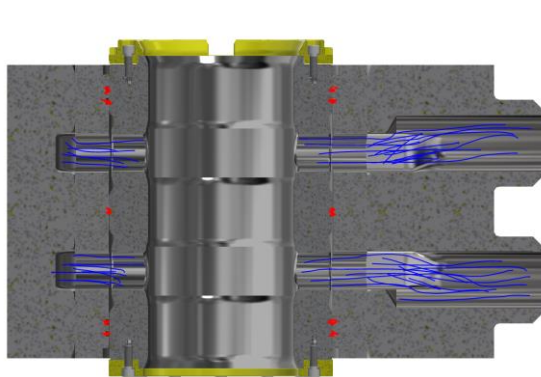
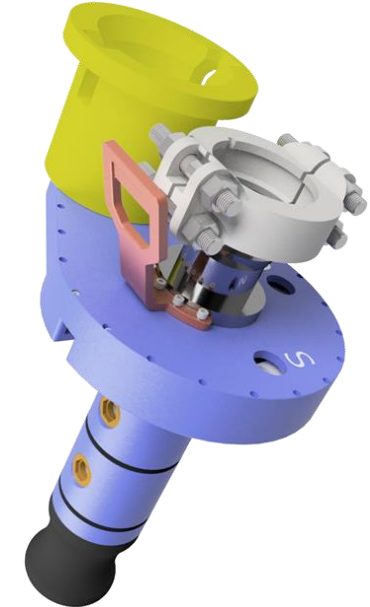
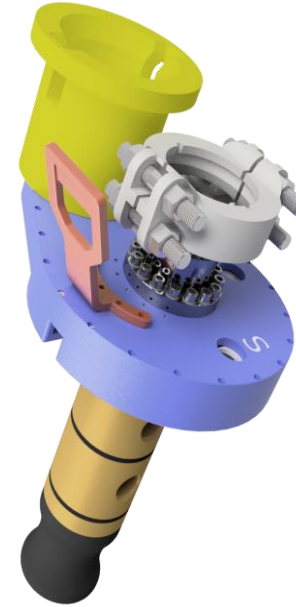
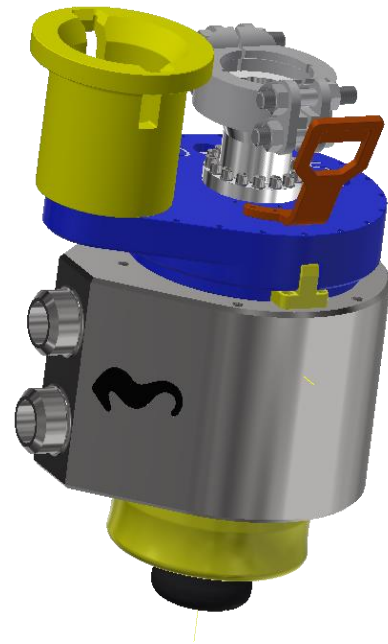
A dual bore receptacle with similar nominal bore in both ports was concluded to be the best solution. Using replaceable seal insert in the receptacle, life time issues of polymeric seals are reduced or eliminated.



*Figure 4: Concept schematic of flushing of pipe (recommended solution)*



# Valve Stab RFO Concept



# Manipulator Handle - New API Type

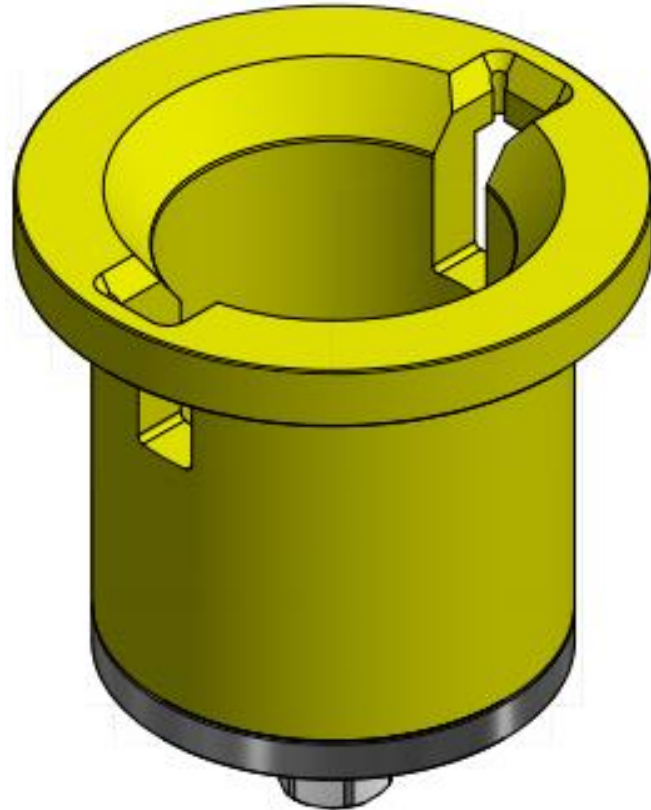
Easy configurable

- 2-Way Handle
- 3-Way Handle
- 4-Way Handle



# ROV Bucket Class 4

- Permanent ROV Buckets
- Stainless Steel Version
- DEVLON Version



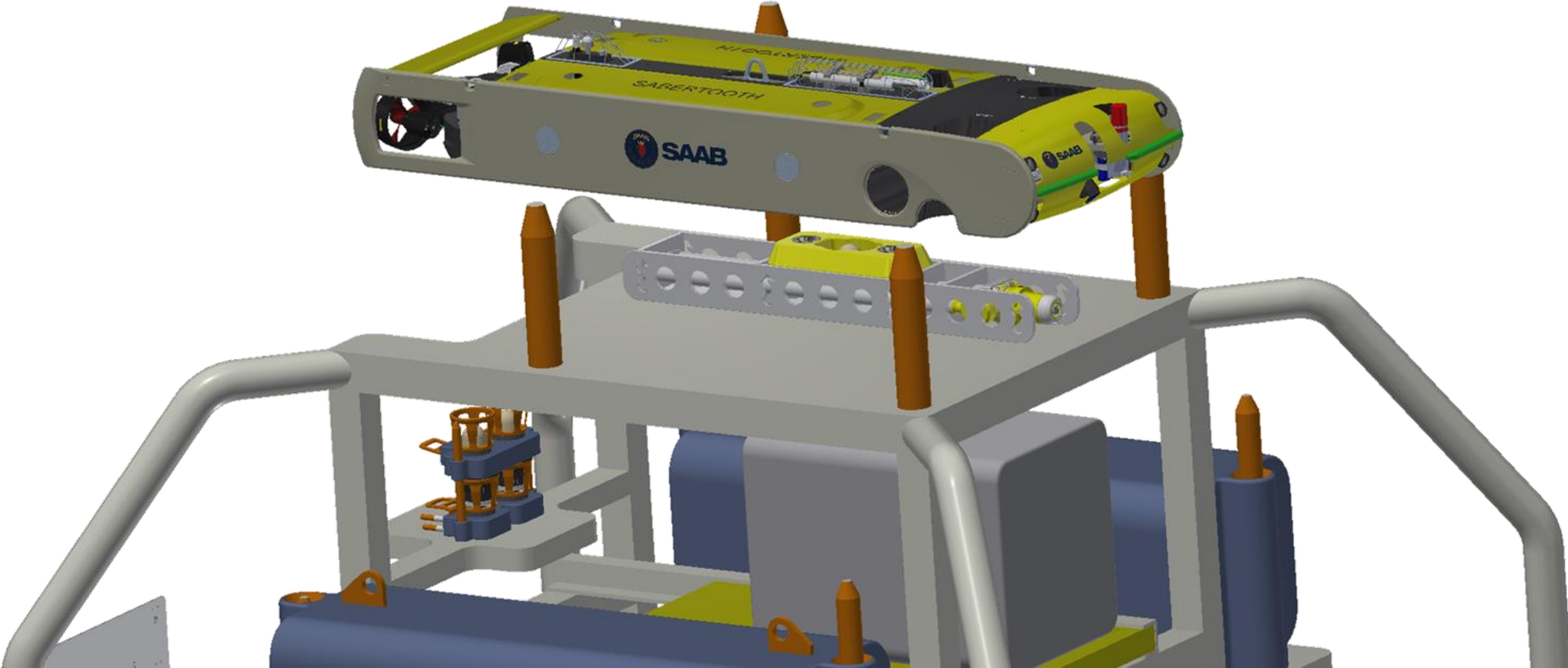


# MultiDog

13,5 Ton

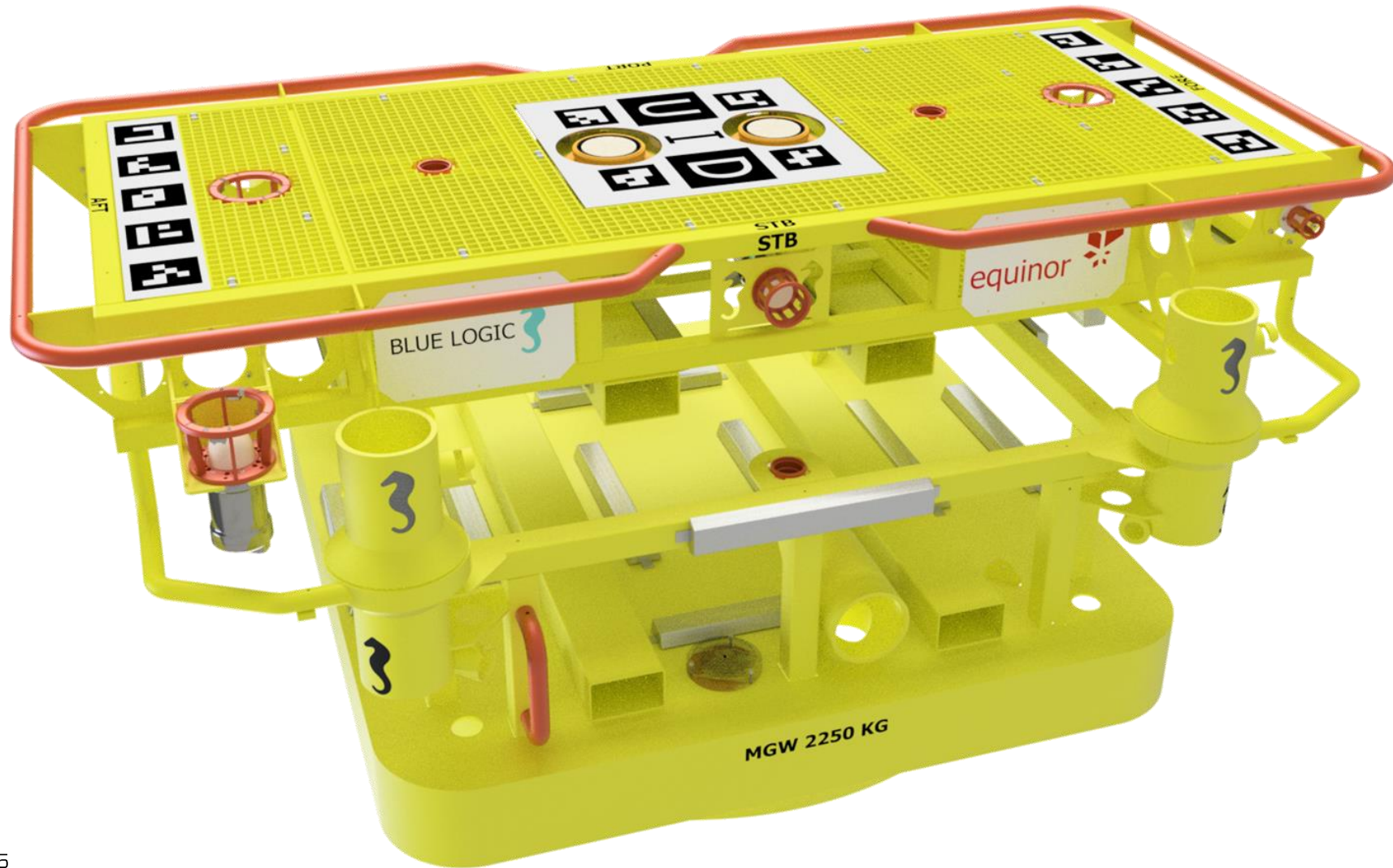


# Electrical Torque tool Skid Mounted





# Universal Docking Station = One Shape Fits All



# Summary

- Åsgard ordered the first Docking Station – Started the snowball effect
- In the last 12 months we have worked with SWiG, DeepStar, and API to agree an open standard for autonomous drones:
  - Standard Docking Interface
  - Standard Charging Interface
  - Standard Tooling Interface
  - Standard Skid Interface
- 3D model of the Universal Docking Station is available to all as OPEN INNOVATION.
- All industry Front Runners have contributed in making the Universal Docking Station possible in this short time.
- Feed back from all testing and design will be included in 2<sup>nd</sup> generation Universal Docking Station to be available by year end.

# QUESTIONS?

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**BLUE LOGIC**

Creative  
Subsea  
Solutions