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"

WEB e-sea
"The Subsea Warehouse"

Other Vendors

Other Vendors

Other Vendors
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
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
Why Autonomous Charging?
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

Shell
equinor
Chevron
AkerBP
vår energi
Lundin Petroleum
BLUE LOGIC

wintershall

Shaping the future.
Summary of New Interfaces

Vendor specific vehicle

INS
Secondary side (RX)
BMS protocol?
Varying Voltage

Battery

SWIG

Primary side (TX)

Dockingstation, DeepStar – API - Mechanical

Interchangeability

Communication

Power supply

SIIS Level 3 & 2

Asset interface API 17E / API 17F TR1232 / TR1233 DCF0

UID interface API 17H / TR1231

Interoperability
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 3rd edition
- 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 metal plate) 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

Precision

km

m

cm

mm

mm cm m km 100 km

Range

2.5 cm

Landmark Navigation
Sonar
Acoustic
Visual - Optical
Magnetic

BLUE LOGIC
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
Condition Monitoring Cloud Service

Subsea:
Modbus
SNMP
Blue Logic

CDP App: Comms

Logger

CDP System (topside)

Additional operating panel

Service PC
Et nytt patent fra Ifookus Engineering AS skal spare olje- nøringen for både tid, penger og miljø.

Inga Særdrup 2006

BESPAREND: Under Subsea-konferansen «Et hav av utfordringer» i går presenterte ingenierene i Ifookus Engineering for første gang sin lange godt bevarte hemmelighet. En ny oppfinnelsen gør det mulig å skifte avansert verktøy på miniatubatter med de fremdeles befinnende (dog på dypt vann). Det sparer man enormt mye tid og penger på, sier han.

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

Fremtidsen teknologi

Elektrisitet er fremtidens energifor- ning, utvikler av det norske firmaet WPC i Kristi-

Et års arbeid

Produktet er basert på et patentert principp for kontaktilas energivervel-
ning utviklet av det norske firmaet WPC i Kristi-

Vil revolusjonere undervannsoperasjoner
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
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
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
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
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
- DEVLOD 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 2nd generation Universal Docking Station to be available by year end.
Questions?

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