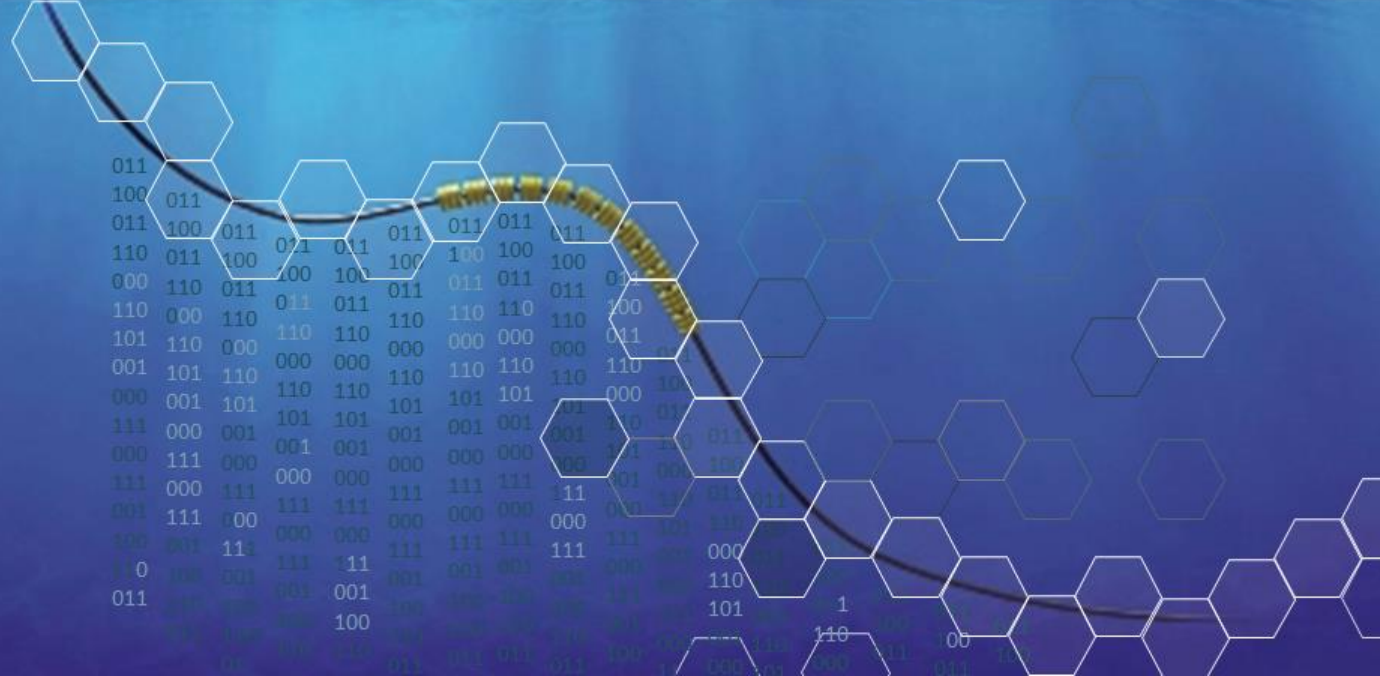




RIMS: a fully integrated technology for long-term riser monitoring

Yvan Albani

Sonsub Subsea Monitoring Solutions Manager – Saipem S.p.A



Riser Monitoring System

Saipem has more than 20 years experience in designing riser monitoring system

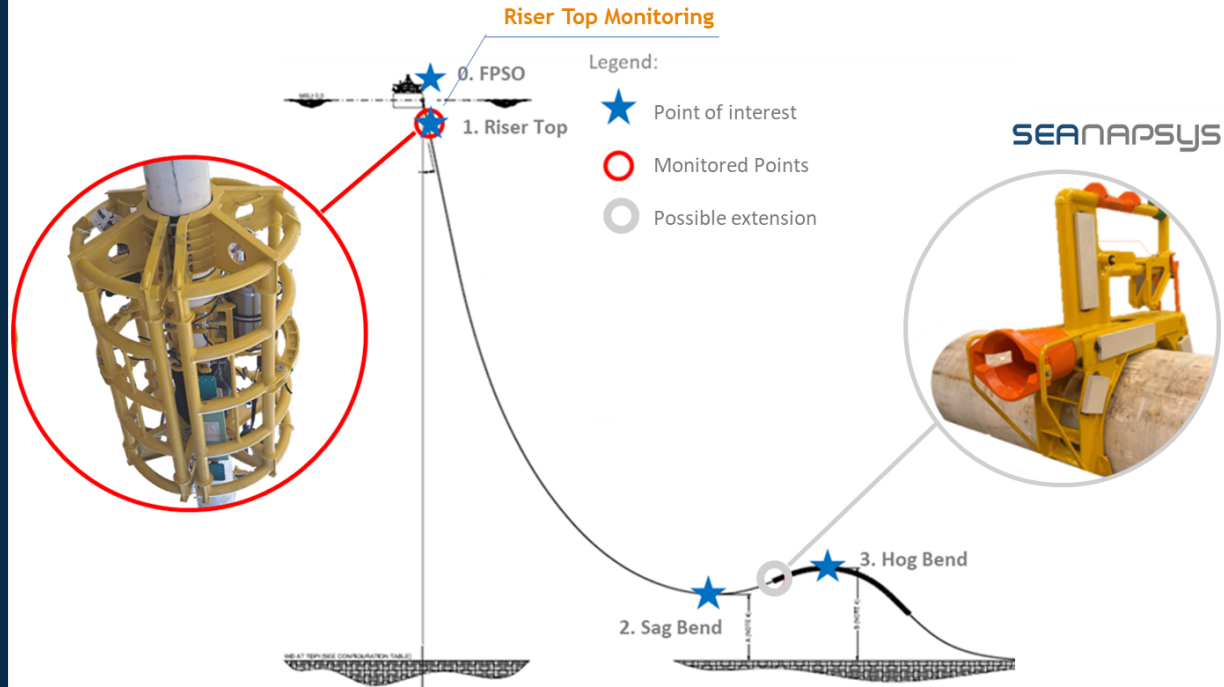
Saipem has recently launched in the market **RIMS** a fully-proprietary riser monitoring system

Key Design Drivers:

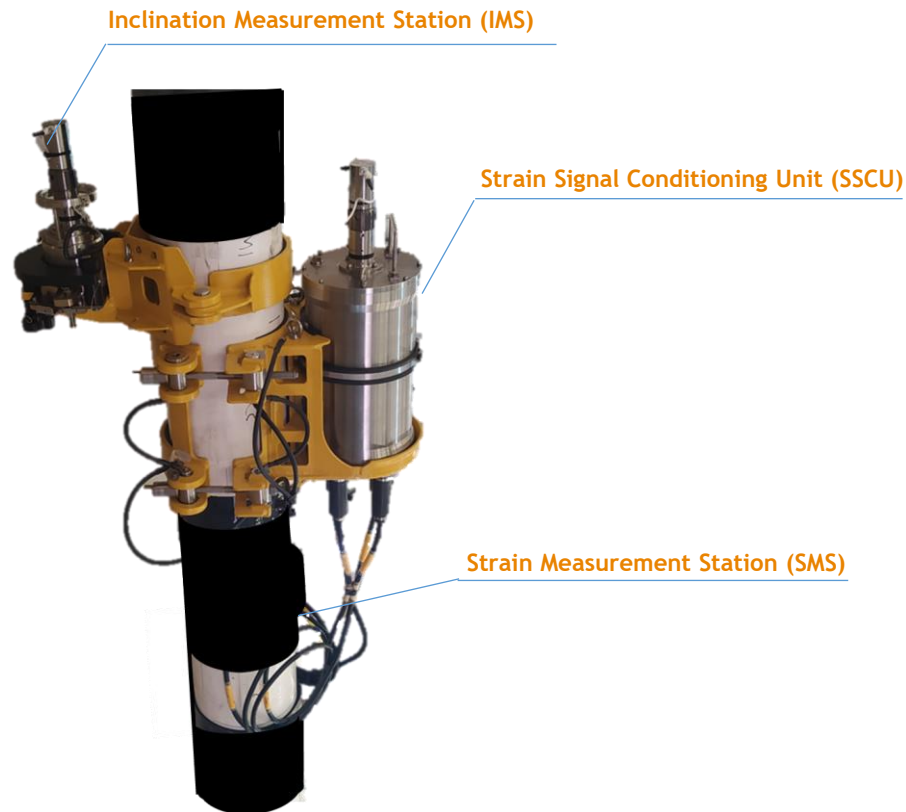
- EPCI Integrated Design
- Flexible Design (open to new Technologies)
- Integration of modern solutions as AI and optical fibers

Riser Top Monitoring

- Tension and bending moment
- Riser surface temperature
- Inclination angles at riser top



- ❑ **Strain Measurement Station (SMS):**
a set of strain and temperature sensors (electrical or optical) for monitoring the tension and bending moment acting at the top section of the riser
- ❑ **Strain Signal Conditioning Unit (SSCU):**
a pressure enclosure including the electronic hardware to acquire the SMS sensors and transmit related data to surface
- ❑ **Inclination Measurement Station (IMS):**
a pressure resistant enclosure including the electronic hardware providing inclination angles at the top of the riser



□ Surface Node:

Cabinet including the instrumentation to collect, process and display the RIMS data

□ Processing Software:

Software design based on modularity, scalability, interconnectivity with third party systems and ease of use by human operators.

□ Diver-less approach:

System designed to minimize the diver's intervention during the commissioning phase, moving the complexity of the installation to the onshore facilities



Qualification basis

identification of requirements to be verified during qualification process

Threat Assessment

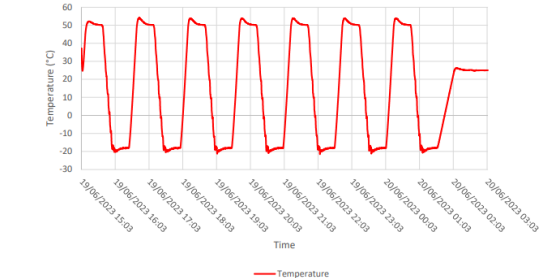
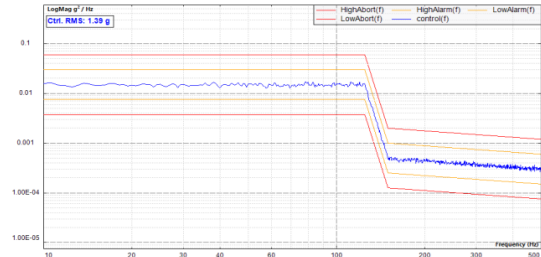
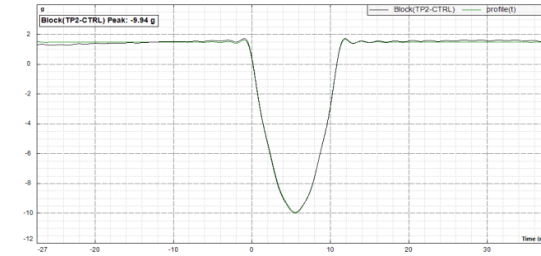
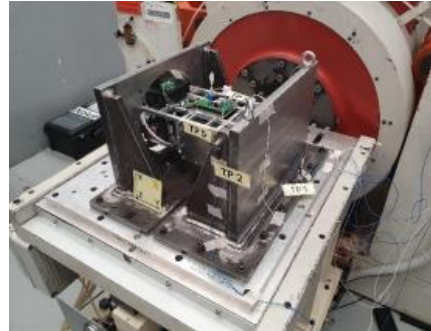
FMECA to identify failure modes, associated risk, mitigating actions and the system reliability and RAM analysis to assess system reliability requirements

Technology Qualification Plan

includes all the qualification activities required to reduce/mitigate the risk associated to the Threat Assessment outcomes

Qualification Tests Execution

Full-scale stress testing on prototypes, built for the purpose, to demonstrate the robustness and reliability of the RIMS design



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Document: VR2343601BSP_0.doc Issue: 0

Environmental Test Report
N. 2 ELECTRONICS RACK (SAIPEM)

Page: 1 of 167

TEST REPORT Climatic Test

Equipment Under Test (E.U.T.)
SSCU

Report n°	: REP013327_ENV
Customer	: SAIPEM S.p.A - Via Luigi Russo, 5 - 20138 Milano (MI) - Italy
Addressee	: SAIPEM S.p.A - Via Luigi Russo, 5 - 20138 Milano (MI) - Italy

ENVIRONMENTAL TEST REPORT N. 2 ELECTRONICS RACK (SAIPEM)

Issued: Monday, June 27th, 2023
Elaborated for: IASLAB S.r.l.
Address: Via Bela Barta, 20/A
Comune "La Fara Center"
44124 - Ferrara
Test began on: June 21st, 2023

❑ Fabrication Tests

Execution of ESS tests on RIMS subsea equipment, dedicated FAT for the remaining equipment (e.g. EFL, topside cabinet, etc.)

❑ Calibration Tests

Each instrumented riser string has been calibrated according to ASTM E74 guidelines

❑ Integration Tests

Extensive test session to demonstrate the capability of the system to operate as a whole

❑ Installation

RIMS assembly transferred offshore and deployed subsea. Surface equipment installed on board of destination FPSO



NEEDS



DATA QUANTITY: LIMITED MEASUREMENTS POINTS

only a limited number of points can be monitored, some critical points cannot be easily instrumented
-> need to extract all the possible information from the very limited available data

LIMITED OBSERVATION PERIOD

high-quality monitoring data may not be available throughout the life of the asset
-> Need to guarantee monitoring information the longest time possible (fault tolerance)
-> Capitalize on data collected during the first years to create a solid base for future assessment

OPPORTUNITY

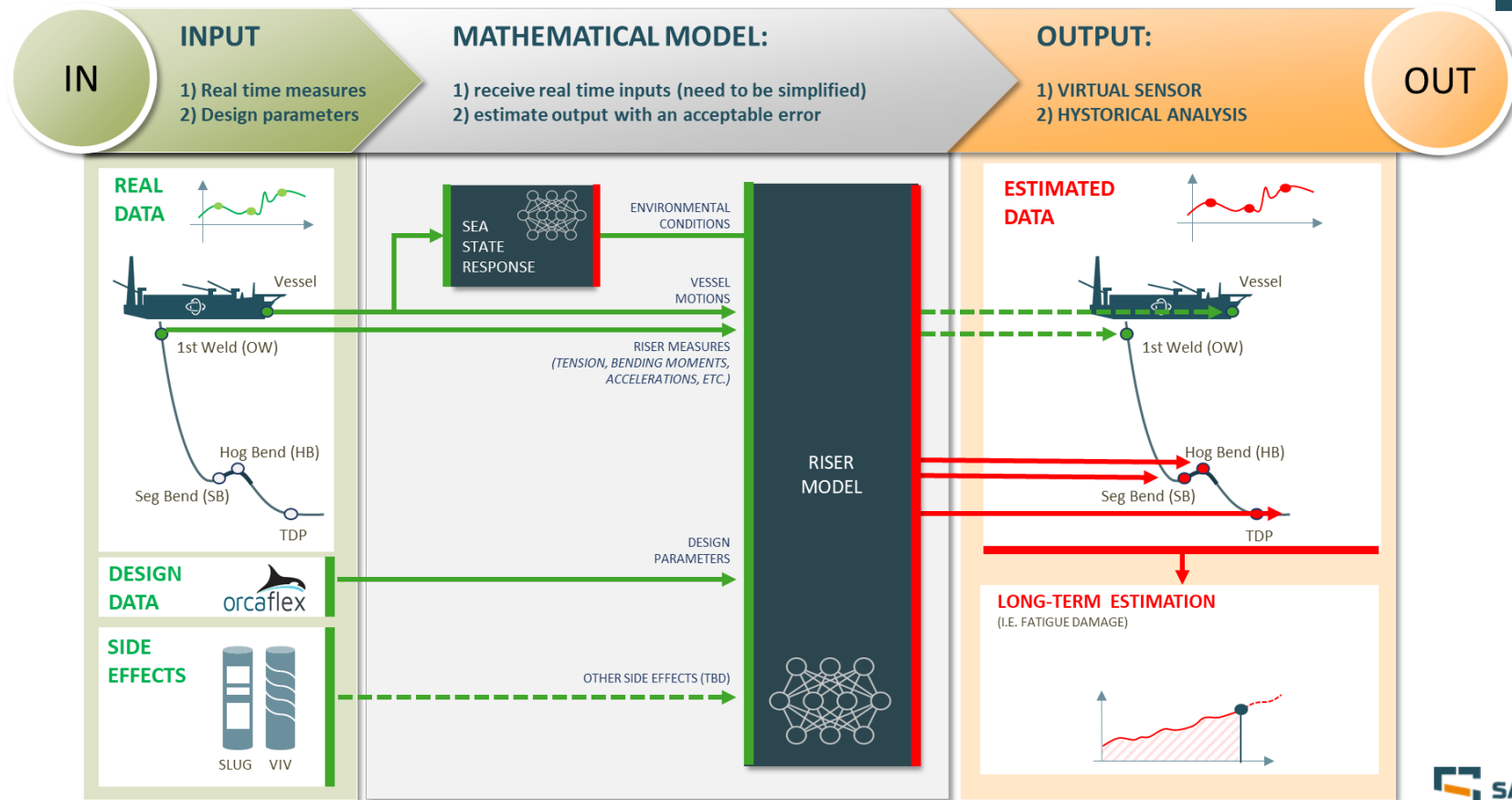


1. TO DEVELOP AN ADVANCED DIGITAL TWIN, leveraging on:

- **EXPERIENCE / CAPABILITY**
experience in Riser Engineering, Construction, Installation
- **NEW TECHNOLOGIES**
data science technologies enable a deep transformation of monitoring systems

2. ENABLE NEW DATA INTERPRETATION SERVICES

possibility to offer advanced data-centric services





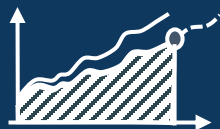
NEAR
REAL-TIME
ANALYSIS

Virtual sensing

EXTRACT MORE INFORMATION
LESS COMPLEXITY & MORE FAULT TOLERANCE

Real time Advanced Diagnostics and Alerting

IMPROVE DIAGNOSTICS
ADVANCED ALERTING



HISTORICAL
ANALYSIS

Historical analysis and prediction

CUMULATED STRESS
PREDICTION & REMAINING USEFUL LIFE

Riser design feedback

“FIT-FOR-THE-PURPOSE DESIGN”

SEANAPSYS

SUBSEA IOT PLATFORM

Seanapsys is a flexible platform
of highly configurable
acquisition / communications nodes
to support
distributed underwater wireless monitoring

SUBSEA WI-FI

Provide the field with
subsea Wi-Fi
communication that can be
interfaced also with
Hydrone operations

WIRELESS SMART ASSET

Perform local data
processing (edge
computing) enabling
smart asset creation

DISTRIBUTED MONITORING

Network of nodes for
large scale monitoring
(e.g. reservoir, seismic,
geophysics, and the like)



WIRELESS
SMART ASSET



SUBSEA
WI-FI



DISTRIBUTED
MONITORING

Combination of **RIMS** maturity and robustness and **SEANAPSYS** highly configurability and flexibility.



SEANAPSYS

1. Battery powered (low power consumption)
2. Local data acquisition, processing and storage
3. Though water communication (SWIG compliant)
4. Multi operational modes supported

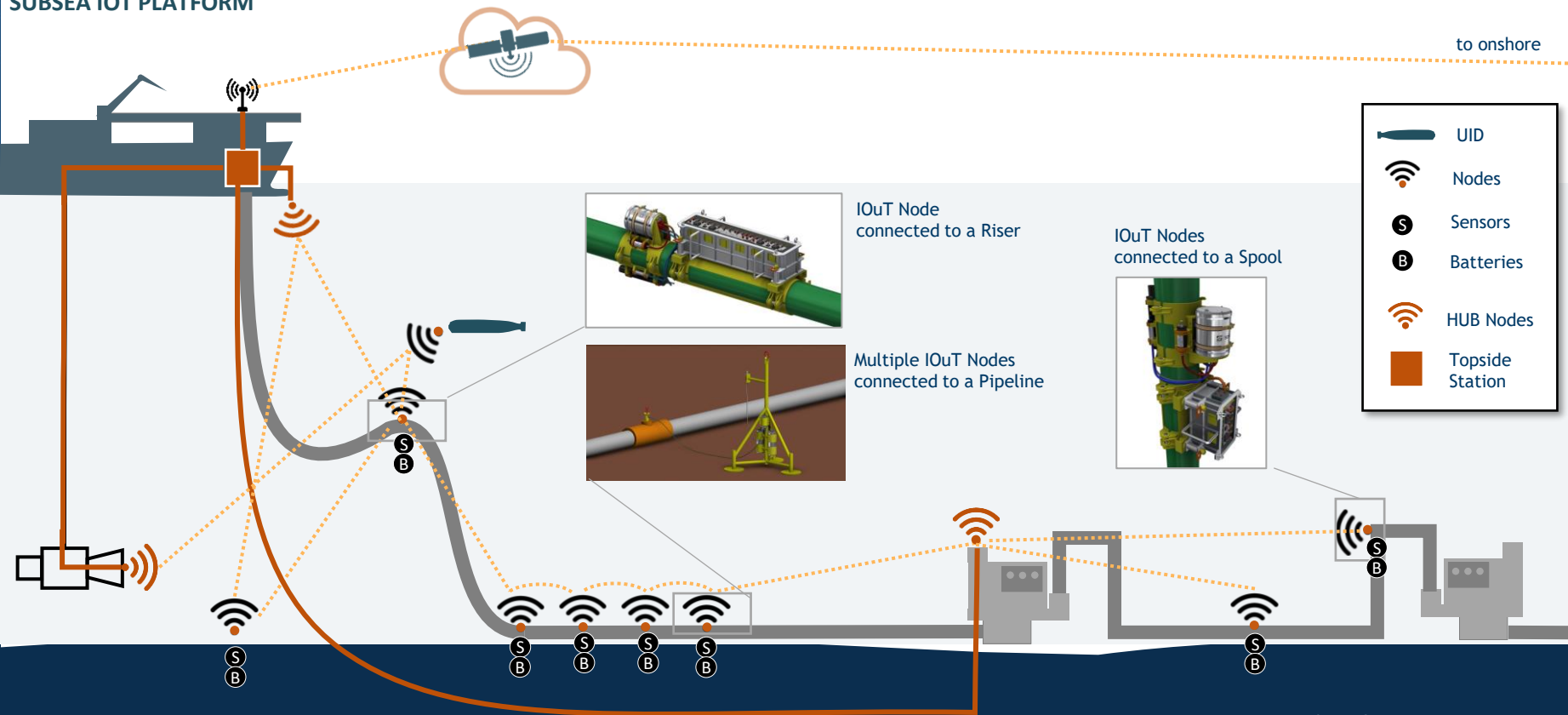
Inclination Measurement Station (IMS)

Strain Measurement Station (SMS)

Strain Signal Conditioning Unit (SSCU) / Seanapsys Node

SEANAPSYS Possible evolutions

SUBSEA IOT PLATFORM



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Thank You!