



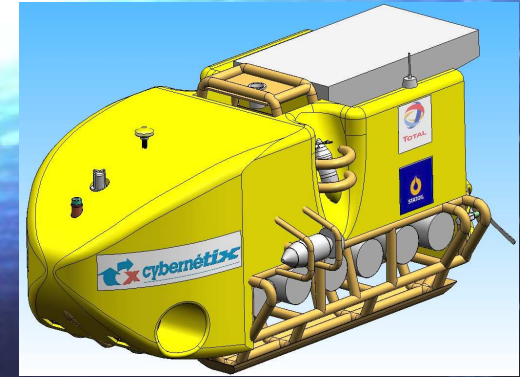
SWIMMER: Hybrid AUV/ROV concept

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CONTENT OF PRESENTATION



1. SWIMMER context and concept
2. SWIMMER background information
3. SWIMMER scope of work
4. SWIMMER system specification and main subsystems
5. SWIMMER key enabling technologies
6. SWIMMER development program
7. SWIMMER commercial IMR Services



1- SWIMMER Context-Concept

⇒ Nowadays, world energy demand continuously calls for the development of new offshore fields

⇒ Exploitation of hydrocarbon reserves is performed in increasingly difficult environment : deepwater, remote, and arctic fields

⇒ Complexity of Subsea Production Systems is increasing with the introduction of Subsea Separation Units, Subsea Gas Compression, Subsea Boosting, and the like...

⇒ OPEX BUDGETS FOR SUBSEA INSPECTION MAINTENANCE AND REPAIR (IMR) ARE ON THE RISE AND WILL CONTINUE TO GROW IN THE NEXT DECADES



1- SWIMMER Context-Concept

Today, subsea IMR operations are conducted from Class-2 DP Multi-Purpose Support Vessel (MSV) equipped with 1 or 2 Work-Class ROV (WROV)

- Significant cost for the MSV
 - ✓ 90% of the total spread cost (typical)

- Availability of the MSV
 - ✓ Time for mobilisation
 - ✓ Weather conditions

- Umbilical management in deepwaters
 - ✓ Increasing size / length (power supply)
 - ✓ Limitation to ROV operations (mechanical constraints)
 - ✓ Reliability (slip rings, connectors...)

... Is it possible to avoid this ?



1-SWIMMER Context-Concept



SWIMMER : Subsea Work Inspection and Maintenance with Minimum Environment ROV
(concept invented by Cybernetix in 1997)

Hybrid system : AUV shuttle deploys ROV close to subsea installations:

- Use of permanent subsea installations
 - ✓ Docking station positionned close to SPS

- No limitation on ROV tasks
 - ✓ Real-time controlled and powered up from the surface after connection to field umbilical

- No MSV-to-SWIMMER physical link
 - ✓ OPEX savings



1- SWIMMER Context-Concept

SWIMMER

- ✓ Performs all light IMR operations that do not require a MSV
- ✓ Remains subsea for extended duration between maintenance

MSV+WROV

- ✓ Performs all operations requiring handling of heavy equipment & modules
- **SWIMMER reduces the workload on MSV by performing all light IMR operations**
 - **MSV can be shared over neighbouring oil fields**
 - **Optimisation and reduction of overall OPEX**

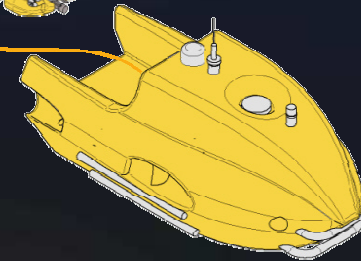
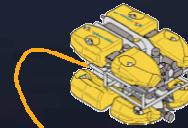


2- SWIMMER background information

1. 2001 Technical feasibility



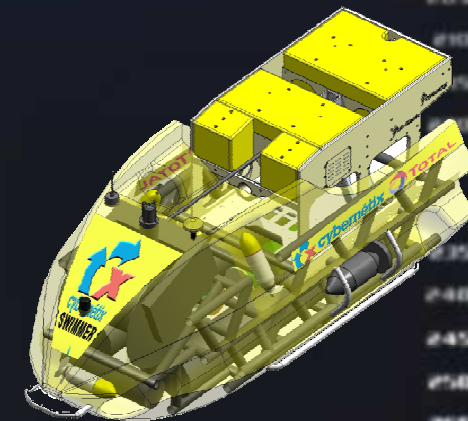
2. 2003 Technical & cost analysis (West Africa)



3. 2006 Technical & cost analysis on Nigerian field



4. 2006 Technical & cost analysis on Block 17



5. 2007-11 Development and qualification of a commercial SWIMMER



StatoilHydro



3 - SWIMMER Scope of Work

Perform light IMR tasks normally assigned to WROV

➤ Planned inspection

- ✓ Visual inspection (GVI, CVI, DVI, structure supporting, UFLR)
- ✓ NDT measurement (wall thickness, cathodic protection)
- ✓ ...

➤ Planned intervention & maintenance

- ✓ Valve operation
- ✓ Chemical valve
- ✓ Data recovery
- ✓ Cleaning
- ✓ Sampling
- ✓ ...

➤ Other tasks

- ✓ Support to electrical diagnostics
- ✓ Leak detection
- ✓ General failure diagnostics
- ✓ Disconnection of flying leads
- ✓ Pig command
- ✓ ...

➤ Large spectrum of Inspection, Light Maintenance and Repair Tasks

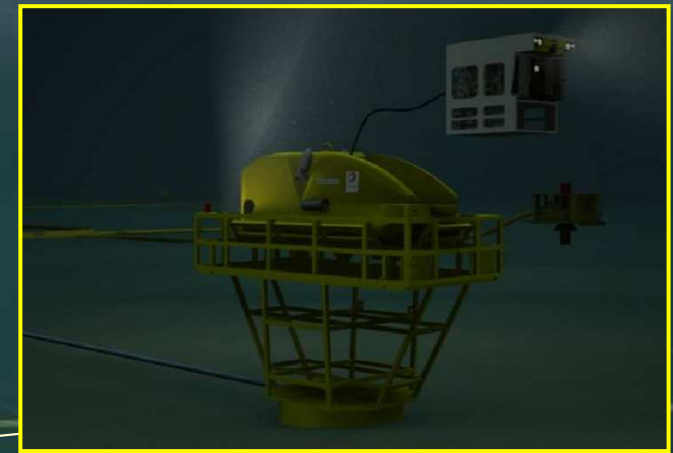
4- SWIMMER main subsystems

Support vessel
LARS & maintenance



FPSO
Power & Control Rooms

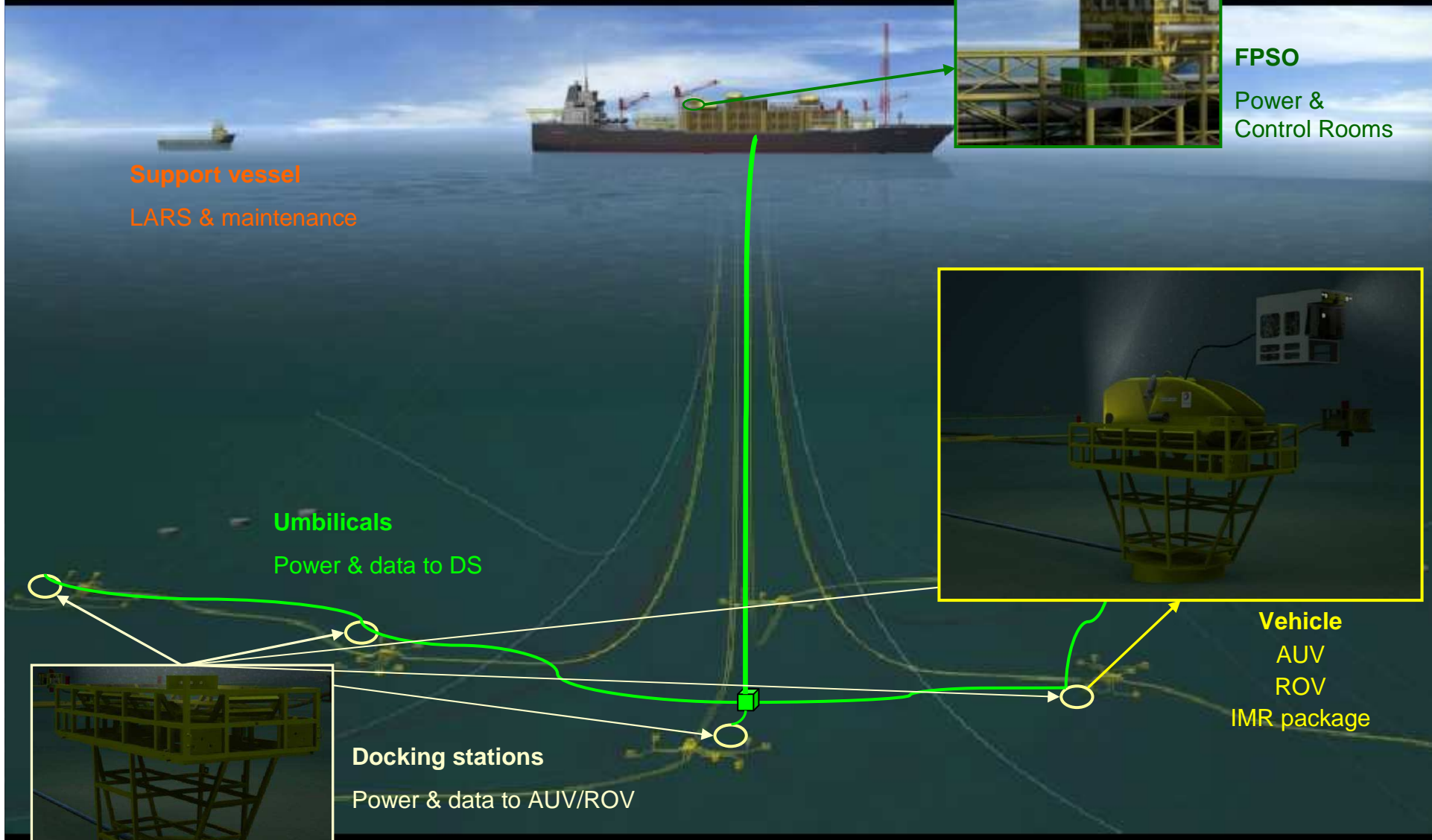
Umbilicals
Power & data to DS

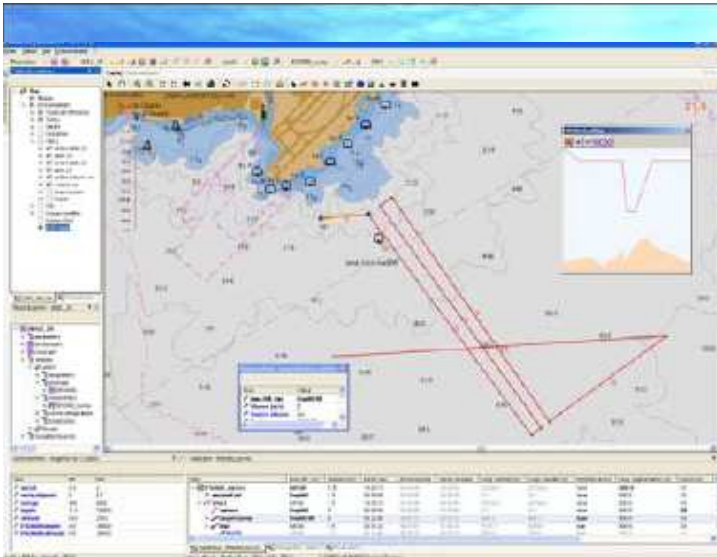


Vehicle
AUV
ROV
IMR package



Docking stations
Power & data to AUV/ROV

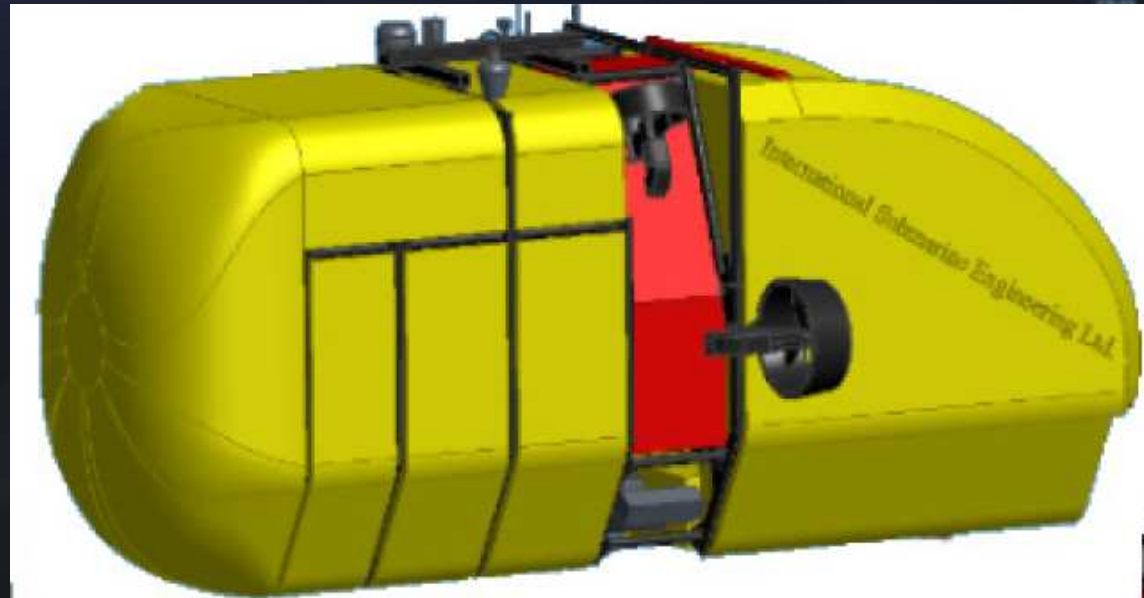




4 - SWIMMER main subsystems

AUV SHUTTLE

- 1500msw
- 20-km range
- 1.0 m/s longitudinal velocity
- 4 DOF
- Redundant high-grade navigation sensor
- Acoustic tracking
- Acoustic positioning
- Obstacle detection
- Emergency functions





4 - SWIMMER main subsystems

ROV/TMS



SWIMMER ROV specifications & IMR worklist

- light WROV
- All-electric (except manipulators)
- Long-term deployment
- Specific tooling package, with room for evolution

Selection of **OCEANEERING TOMCAT** SWIMMER-specific WROV & TMS system

OCEANEERING





4 - SWIMMER main subsystems



ROV Tooling (1/2)

Installed into ROV body

- 7-F & 4-F Orion & Rigmaster manipulators
- HP water pump
- CP probe
- UT probe
- Ifokus 3Stab (hydraulic, electric, data) hot-stab tool





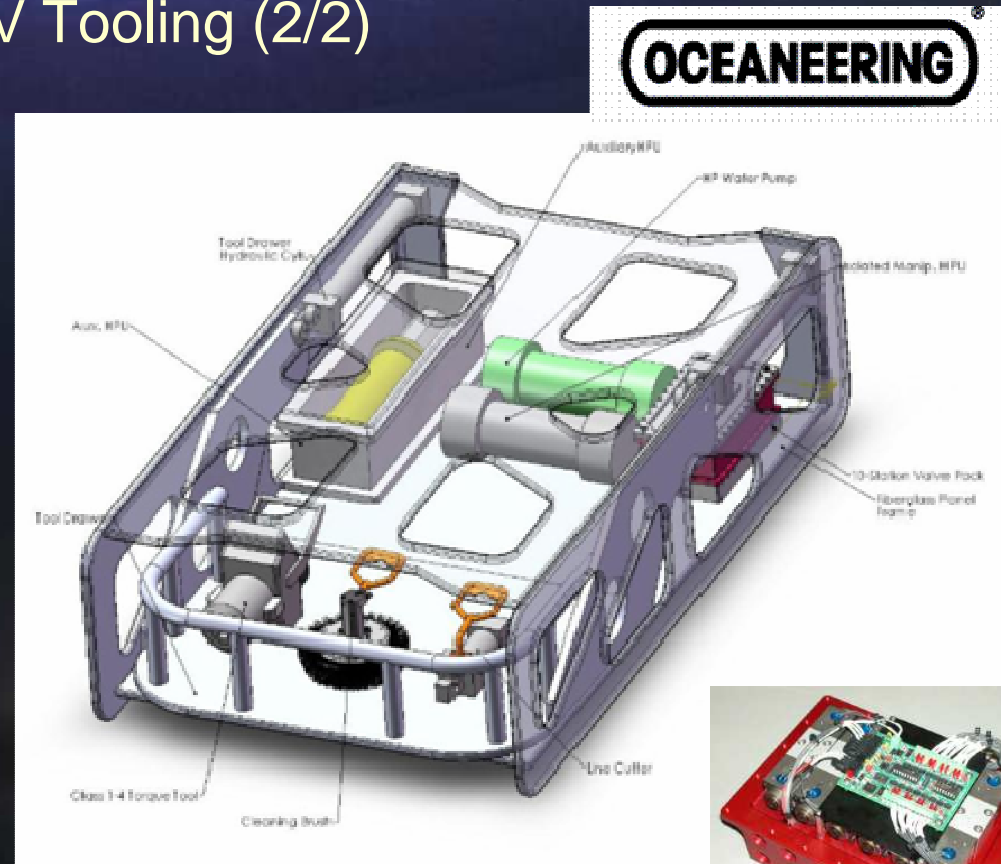
4 - SWIMMER main subsystems

ROV Tooling (2/2)



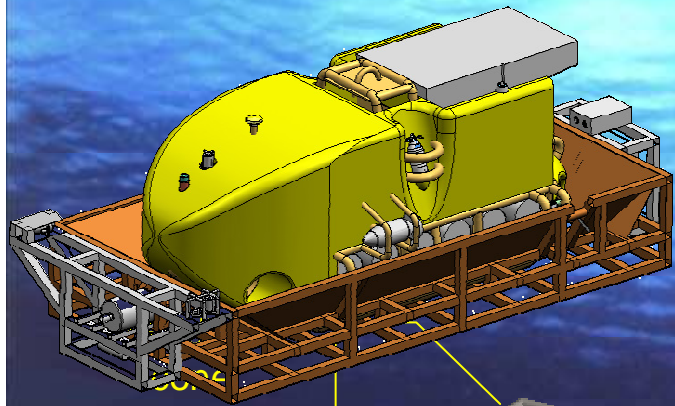
Installed in sliding drawer

- Auxiliary HPU for tooling
- Isolated HPU for manipulators
- Class 1-4 torque tool
- Cleaning brush
- Wire cutter
- Room for additional tools





4 - SWIMMER main subsystems



Video Transfer

Docking station

Power canister

Guiding sphere

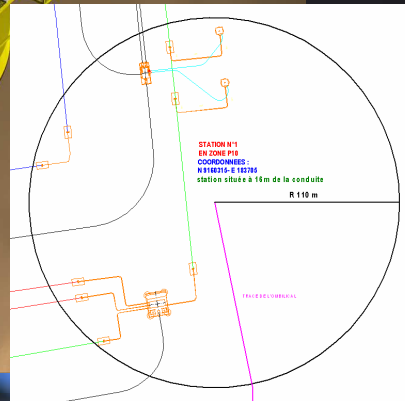
Electronics canister



Data Transfer

Antenna mounting board

Supporting structure & foundation





5 - SWIMMER key enabling technologies

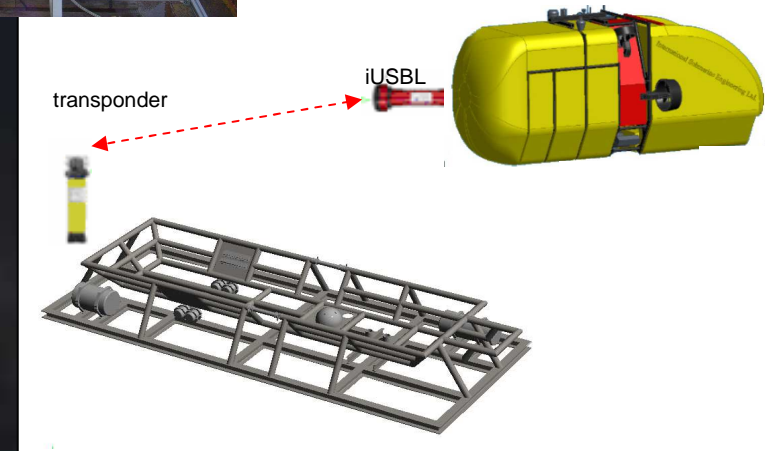


AUV shuttle payload: Automated Docking

Development of iUSBL-based guidance control

Successful trials with Autonomous ROV in pool

- Global robustness
- Approach wrt to the field configuration
- iUSBL on-the-fly reconfiguration
- Coherence of the transponder measurements (with other transponder, INS data, rejection of aberrant measurements, filtering...)





5 - SWIMMER key enabling technologies

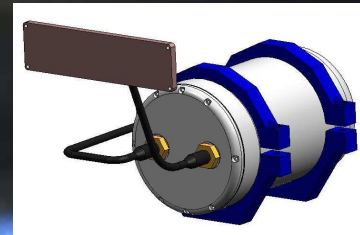
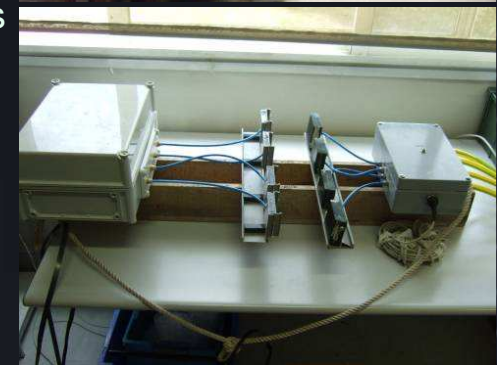
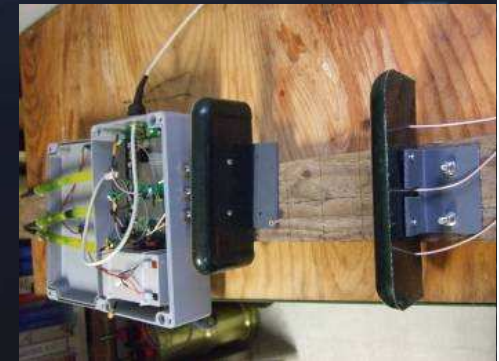
AUV shuttle payload – Wireless communications with DS

Telemetry and video transfer systems provide real-time video & telemetry feed back to the operator through the DS, for ROV operations and AUV data upload/download

TELEMETRY TRANSFER Ethernet MIMO WIFI modem (2.4 Ghz) & directive antennas

VIDEO TRANSFER up to 4 simultaneous video signals AUV to DS & directive antennas

Trials results: In fresh water, the operating distance obtained between antennas was about 20 cm. In seawater, the operating distance obtained is decreased but compatible with the application (close distance between DS and AUV shuttle)





6- SWIMMER development program

- ✓ 2007-2009 : Specification and general design of commercial system
- ✓ 2009-2011 : Development and qualification of first SWIMMER unit
- ✓ 2012 : Commissioning on first offshore deepwater block. As of today, target is a west angola block operated by TOTAL (where STATOILHYDRO is a partner)
- ✓ 2012-20xx : Commissioning on other fields. STATOILHYDRO potentially interested for its own remote or arctic fields.



7- SWIMMER commercial IMR Services

In 2008, CYBERNETIX and OCEANEERING have launched a collaboration:

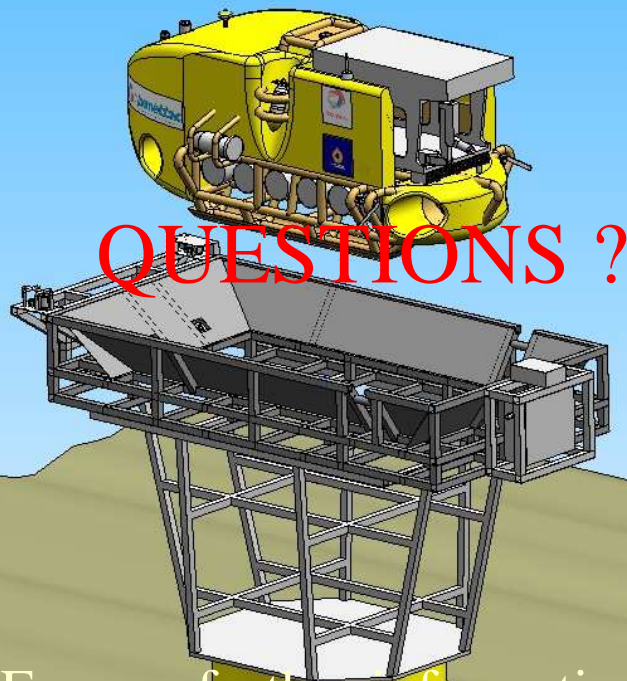
CYBERNETIX and OCEANEERING are combining their strength and experience into the framework of worldwide teaming agreement to provide Operators IMR services for deepwater, arctic, and long range offset fields.

CYBERNETIX and OCEANEERING are setting up an Integrated Services team to provide SWIMMER associated services. The work will be performed by personnel from the Integrated Services team from Cybernetix and Oceaneering.

Operations will be performed in accordance with a subsea assets' maintenance plan defined by Operator and/or SPS suppliers for planned intervention, and also on-demand in case of unscheduled requests.



END OF PRESENTATION



QUESTIONS ?

For any further information,
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