Cyberphysical system applications for FPSOs

Digital twin applications and unmanned platforms

November 2021

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Agenda

1. Introduction
2. A digital twin for training
3. Towards unmanned with Robotics

Introduction

A digital twin for training

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A Digital twin for training - Principles

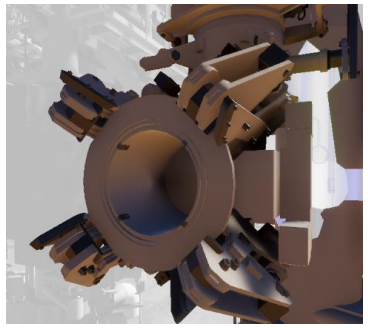
- Digital by design twin of (or a part of) the FPSO
- Synchronized with engineering (can be updated every day, week, …)
- Real time simulation with the digital twin
- Including dynamics, collisions, process model…

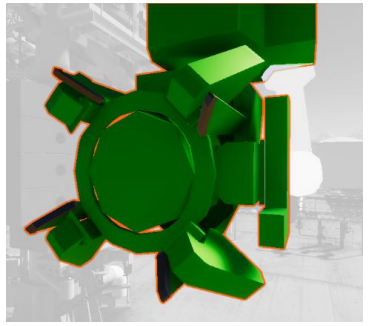
A Digital twin for training - Principles

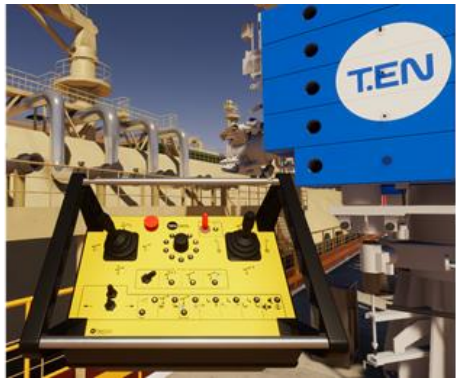
- **Lower uncertainties** of marine operations (mooring, station keeping…)
- Train the operators with the twin **before the sail away**

A Digital twin for training – Design rules

- Accurate physics
  - Dynamics/Hydrodynamics, Collisions, kinematics
  - Realistic contacts (collisions, friction)
- Immersion matters
  - Endorse several operators together
  - Virtual reality
  - Replicate commands
- Reality & beyond
  - Try to replicate the environment
  - Add visual helpers







A Digital twin for training – Some examples

Click on pictures to play video
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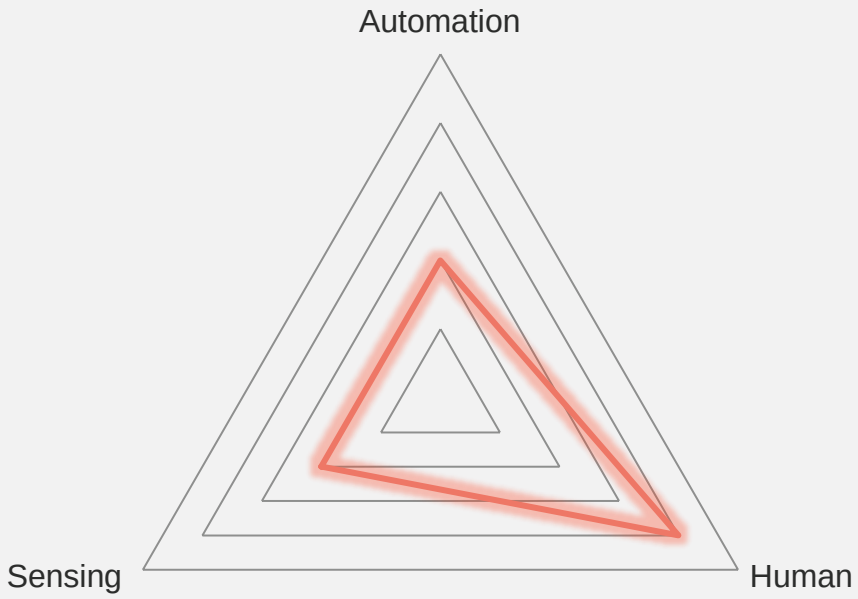
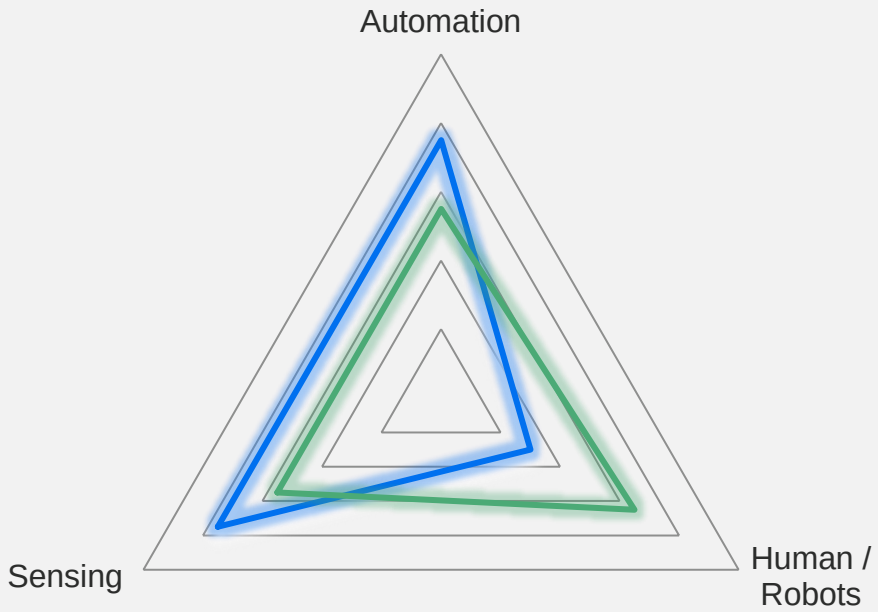
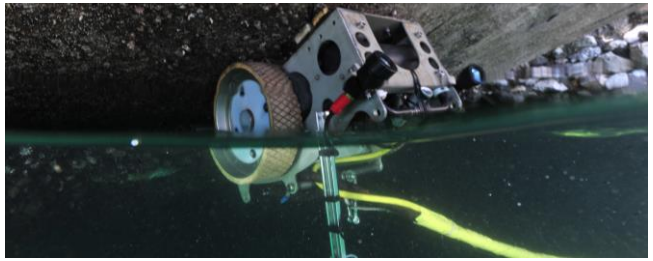
Towards unmanned with Robotics

Unmanning Requirements







Which Robots ?

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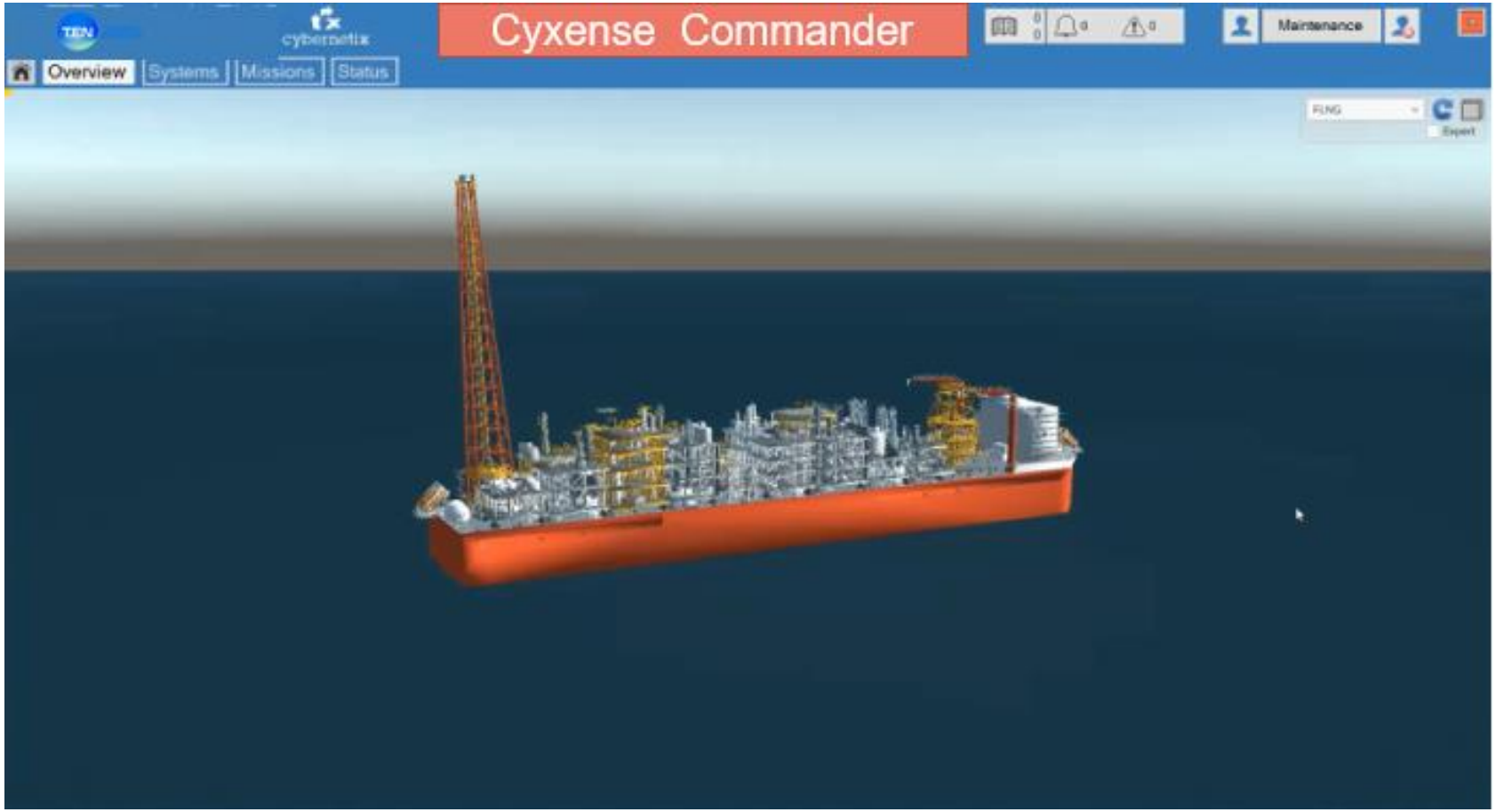
Robotics Missions Supervision System



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Client Control Room

One software managing a fleet of robots to execute a wide range of Operation, Inspection and Maintenance missions

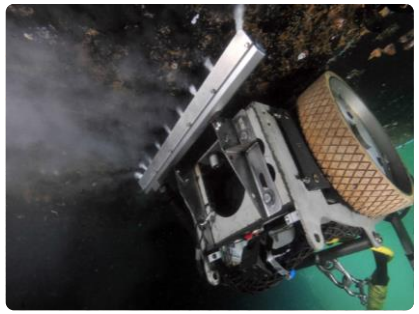
Standard communication protocols

Cyxense® Commander

1 – Alarm & Data management
2 - Mission planning and navigation
3 – Remote control and Dexterous manipulation

Heavy IMR UGV

Inspection UGV



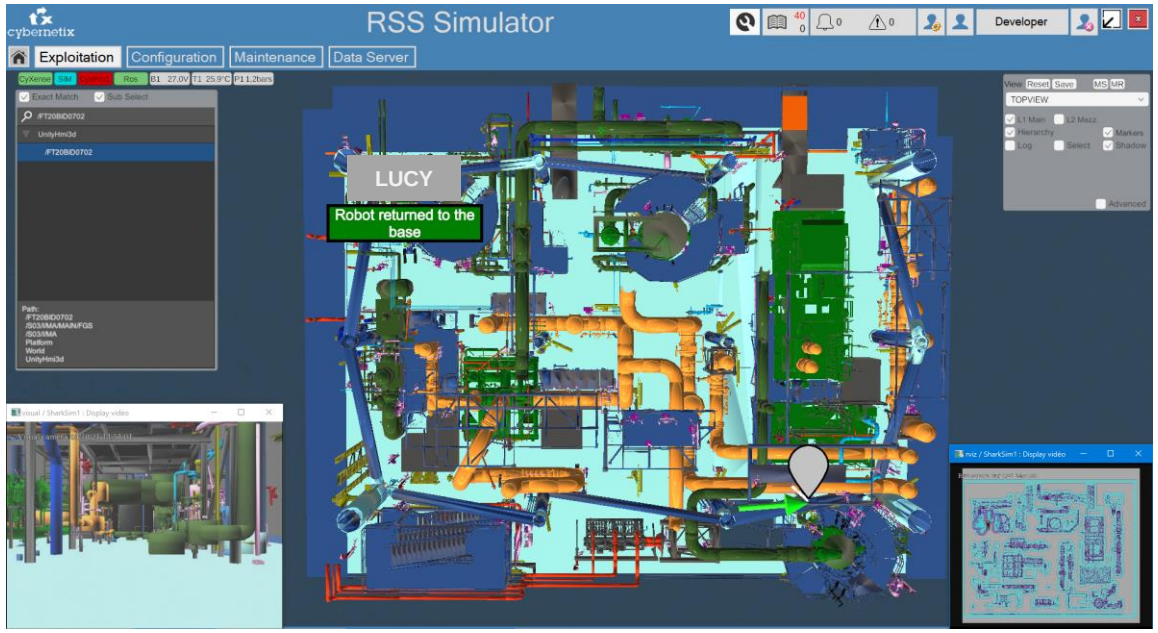
Hull Cleaning & Inspection

Subsea Inspection AUV

Aerial Drones

Simulation Capabilities

- Verify Equipment Accessibility
- Choose the best suited robots, according to the tasks to be executed
- Prepare and execute different missions
- Verify Mission feasibility and time of execution
- Calculate the related costs
- Evaluate alternative solutions
- Prepare training sessions for future operators



➢ *All this before any physical deployment of a robotic solution!*

Robotics Deployment

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Q & A