

**HiPEAC 2020 Conference**  
**22 January 2020 - Bologna**



Horizon 2020  
European Union funding  
for Research & Innovation

# **CERBERO**

**(Cross-layer modEl-based fRamework for multi-oBjective dEsign of Reconfigurable systems in  
unceRtain hybRid enviroNments)**

## **OCEAN MONITORING USE CASE**

AmbieSense: Leszek Kaliciak, Hans Myrhaug, Ayse Goker, Stuart Watt

<http://www.cerbero-h2020.eu/>

## CERBERO Goals

Main project goals of CERBERO Ocean Monitoring use-case are:

- **Validate CERBERO methodology** for development of multi-objective adaptive CPS
- **Contribute to development of CERBERO technologies** for development of multi-objective adaptive CPS
- **Validate developed KPI based adaptation loop**



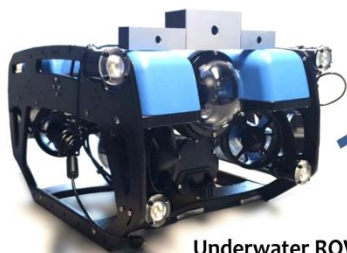
## AS Goals

- Hierarchical adaptive system design:
  - Advanced visual sensing for both users and for marine robots.
  - Visual quality most important for users/ human operators.
  - Sensing of the environment is key for autonomous navigation.
  
- Purpose:
  - To automatically enhance visibility for the users.
  - To enable autonomous navigation - obstacle detection, sense environment, distance to objects nearby.
  - To extend the range of marine robots – day&night, depth.

# The OM solution

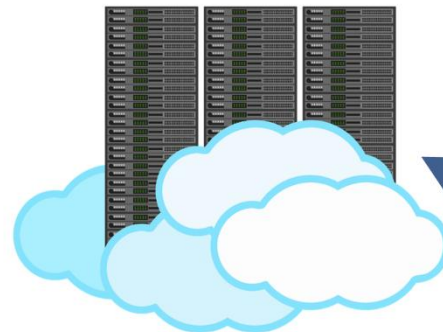


**Adaptive cameras**  
Embedded sensors and monitoring



**Underwater ROVs**  
Open platform for adaptive cameras and sensors

**Umbilical cables**



**Cloud**  
Data archiving  
Hub alternative for always-on environments



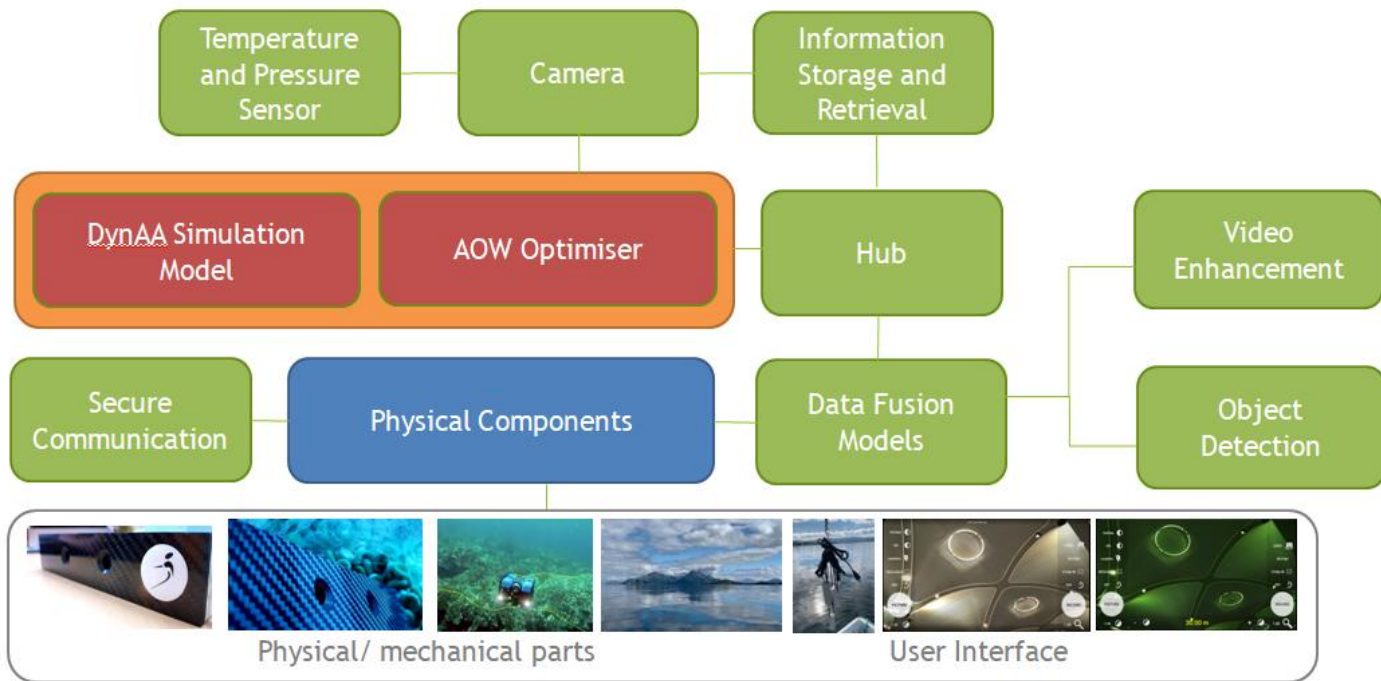
**Monitoring hub**  
Underwater video enhancement  
Image indexing and data logging  
Monitoring and alerting

# Use case development

## Steps in the development of the use case:

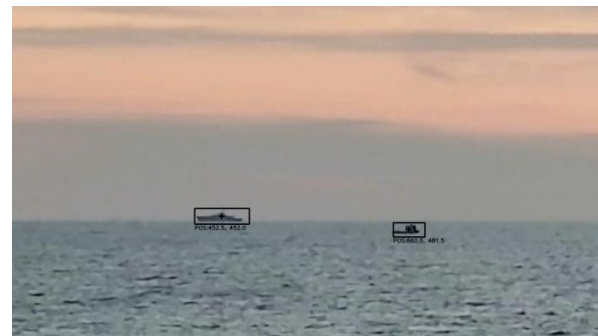
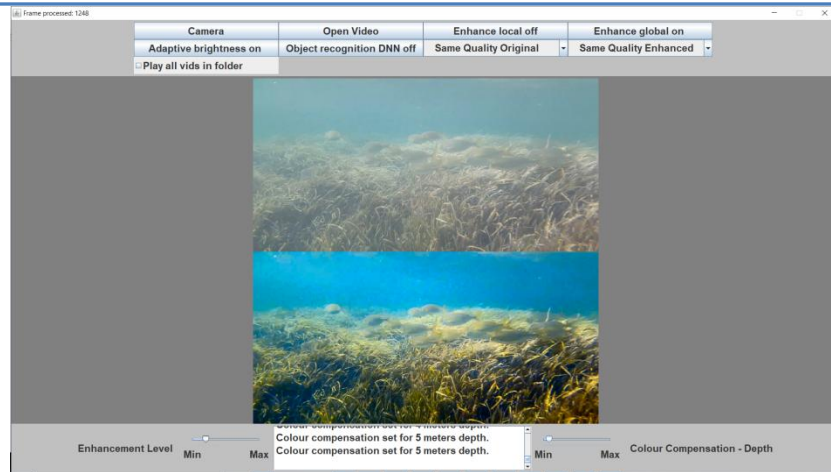
- **Requirements gathering**
- Development of **adaptation approaches** with **scenarios** which require adaptation (initiated by human and environmental triggers)
- **Extend CERBERO technologies by development of information fusion technologies** to enable adaptation and support the use case
- **Integrate CERBERO tools and technologies** into Ocean Monitoring

## Skeleton of CERBERO tools for Ocean Monitoring use case



## CERBERO Fusion Technologies to enable adaptation:

- Image enhancement level adaptation to different environmental conditions
- Colour adaptation to changing water depth
- Adaptation of object characteristics for tracking purposes based on motion and deep learning detector



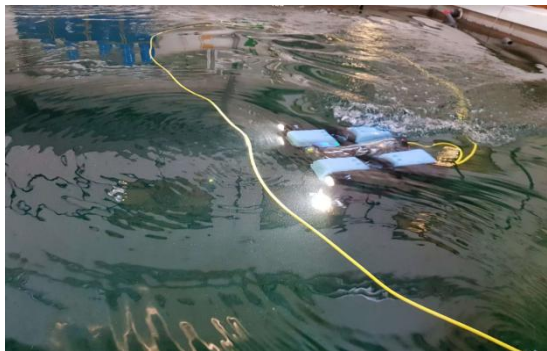
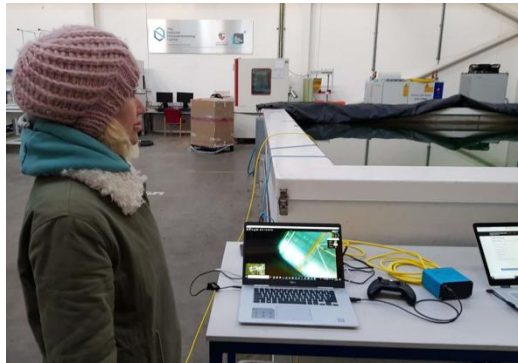
## DynAA and AOW:

- DynAA helped to assess alternative design configuration choices to ensure that the chosen hardware platform met the required KPIs
- AOW helps to optimise the image enhancement model. It can be used to adaptively select the appropriate combination of algorithms to ensure the best result dynamically.



## OM Testing:

- Pool testing
- Pressure chamber
- Arctic Ocean





# M36 DEMONSTRATOR

# VIDEO