

**“From lenses and mirrors to advanced cameras and image processing,  
the new optronic system for the Royal Swedish Submarines”**

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# Agenda

- Objectives and Introduction
- The Challenge
- Coordinated acquisition
- The Phases
- Land Based Training Site
- Conclusions



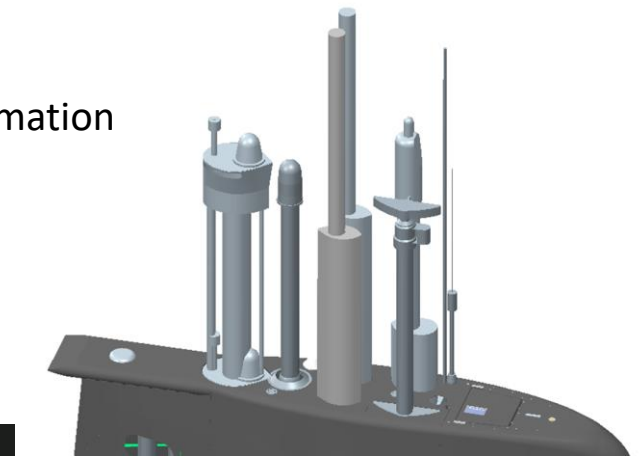
# Objectives and Introduction

- Objectives
  - The different phases
  - Operator perspective
- Introduction
  - Four Submarines – A26 & MLU GTD
    - System #1 MLU GTD – Sea Trials
    - System #2 MLU GTD – Installation
    - System #3 A26 – Verification Q4 2019
    - System #4 A26 – Verification Q4 2020
    - System #5 (LBTS) delivered Q4 2018

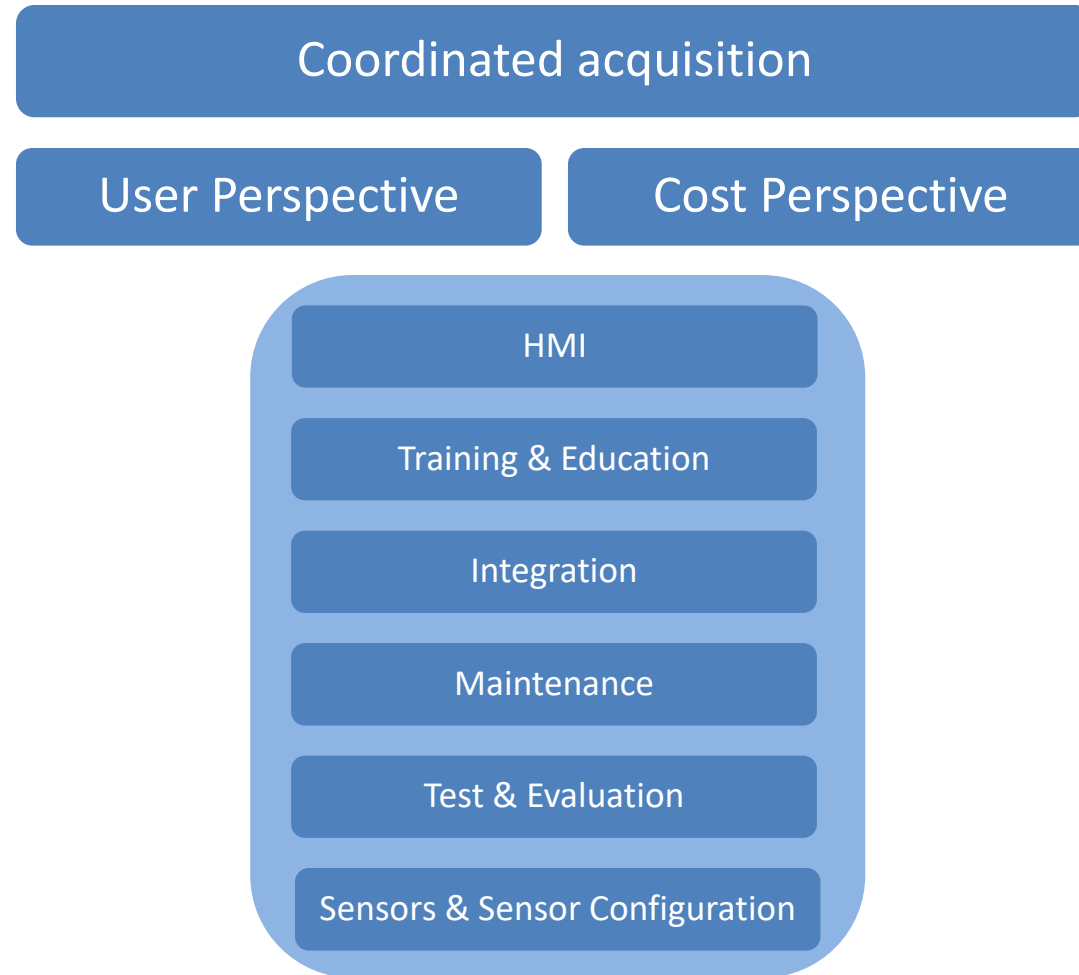


# The Challenges

- Optronic System is nothing new, but...
- The eye is such a unique and fantastic sensor
  - The eye's dynamics and spatial perception
- Cover the Periscopes functionalities?
  - Navigation & Manoeuvring
  - Visual Intel
  - Ranging
  - Fast orientation and direction
- Achieve a better combined functionality for visual gathering information
  - Multiple sensors
  - Enhanced Image Processing
  - Optimized HMI



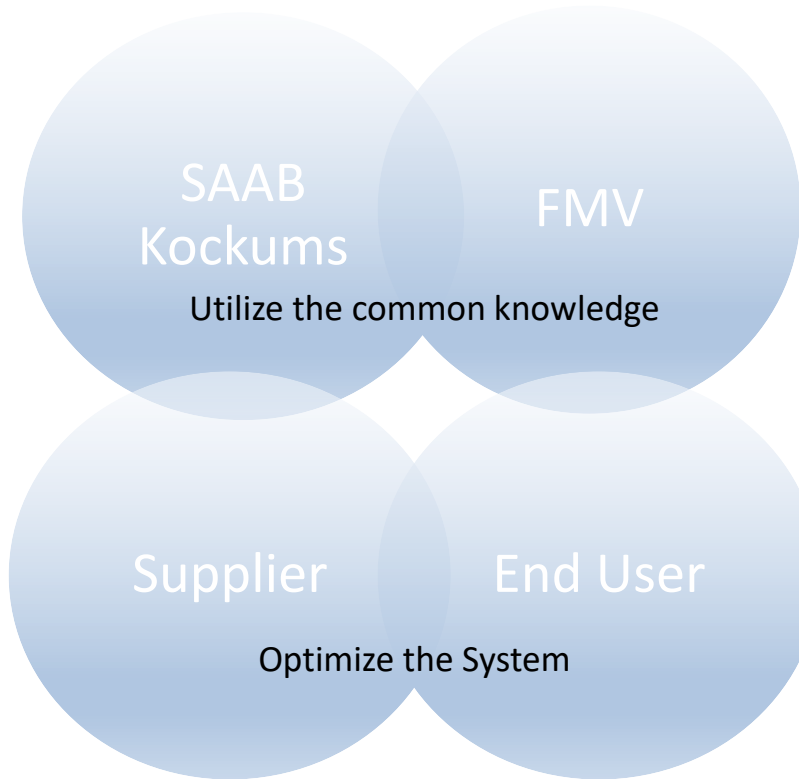
# Coordinated Acquisition



# The Phases

Close cooperation – the way to succeed

- Concept Phase
- Procurement and Evaluation Phase



-Requirements  
-Procurement  
-Evaluation

- Design Phase
- Test and Evaluation Phase

-Functions  
-HMI  
-Integration

# Procurement and Evaluation Phase

- 4 suppliers
  - RFQ evaluation
- 3 Suppliers
  - Concept Presentation – Supplier visits
- 2 Suppliers
  - Live Camera Tests / Tech- & Cost discussions / HMI
- 1 Supplier
  - Contract
  - HDTV Live Camera Test

2011

2012

2012

2013

2014

2015



# Procurement and Evaluation Phase

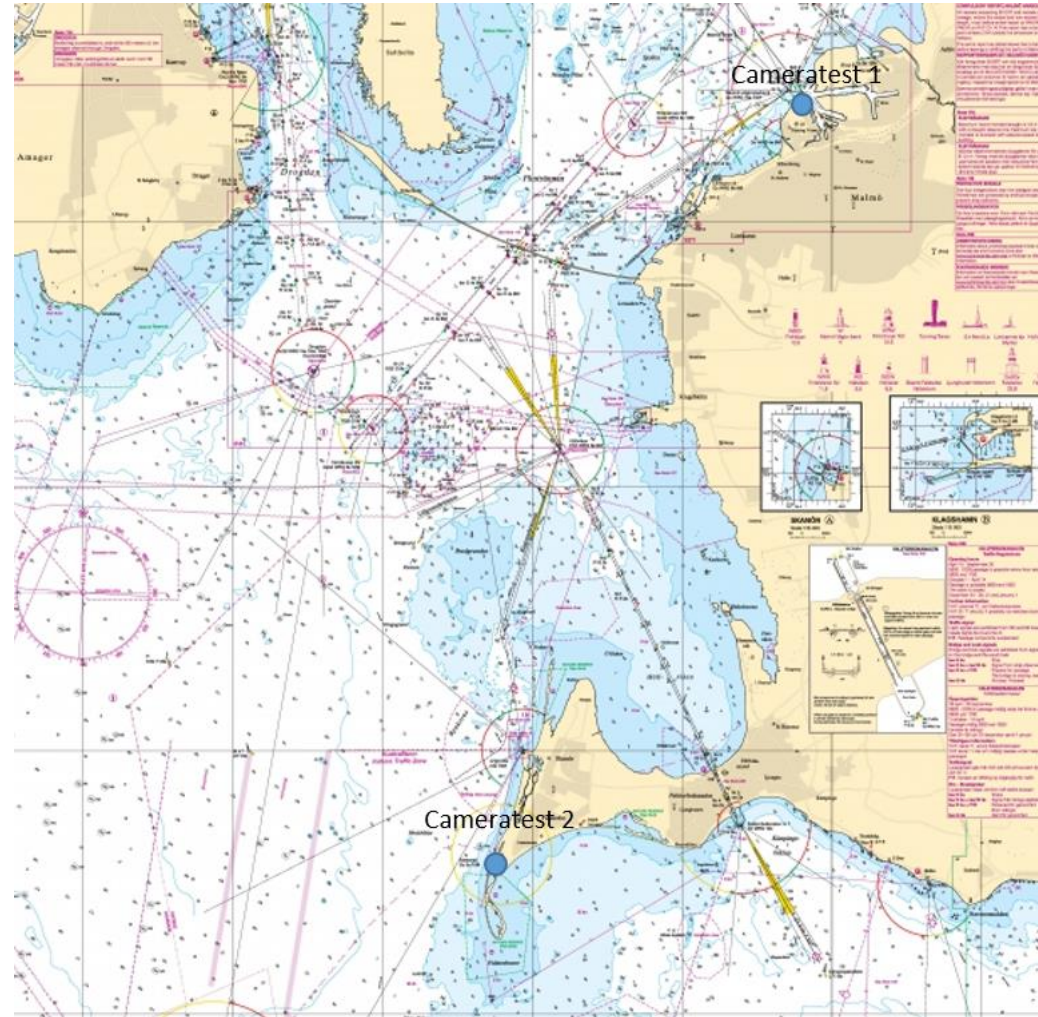
- Two remaining suppliers
- SWIR or LLLTV?
  - SWIR Live Camera Test
  - Cost
  - Safety





# Procurement and Evaluation Phase

- Two remaining suppliers
- SWIR or LLLTV?
  - SWIR Live Camera Test
  - Cost
  - Safety
- IR & HDTV Live Camera Tests



# Design Phase (Camera Selection)

- Selected Supplier
- HDTV Camera Selection
  - Pre-CDR
  - Three different Cameras
  - Compared recordings
- Reflections
- Dynamic
- Colours
- Performance in different light conditions



# Design Phase (Camera Selection)

- Baseline 1; Nbr 1
- Baseline 2 Nbr 3
- Baseline 3 Nbr 2. (selected)



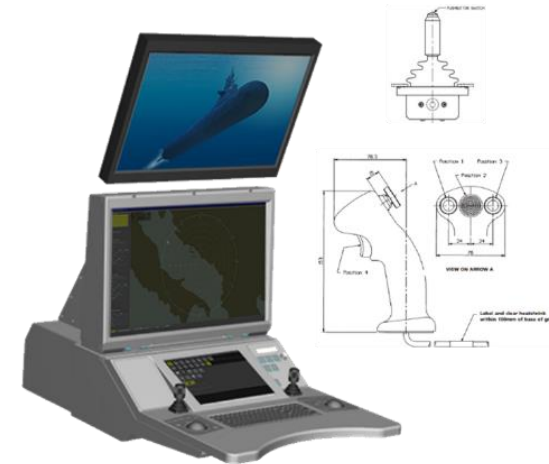
# Design Phase (Consoles)

- Four “different” consoles
  - Modified Multi-Function Console (MFC) No2 MLU GTD
  - New MFC No6 MLU GTD
  - MFC A26
  - Officer of the Watch (OOW) MFC A26
- Joystick position?
- Work position?

**New Console**



**Modified Console**



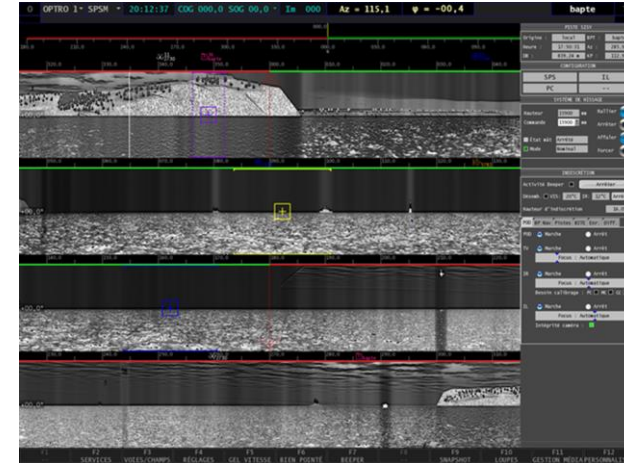


# Design Phase (Console "direction"...)

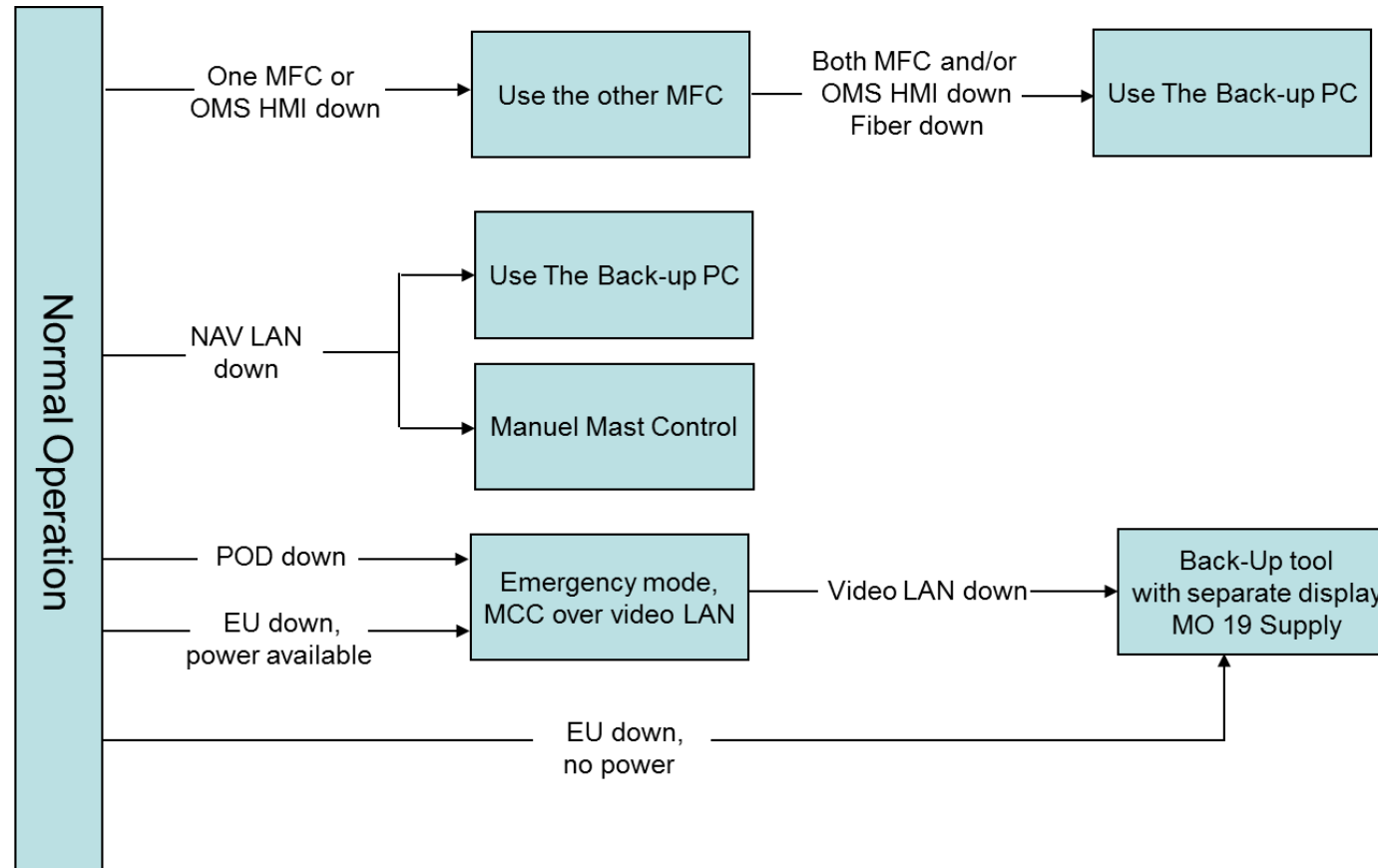


# Design Phase (HMI)

- HMI Workshops SK-FMV-Safran-Sub Reference Group
  - HMI-layout in general making it user friendly
  - Implementation of new functions
  - Optimize and align the HMI with other Combat Systems
- Optimize the HMI for the new features
  - Auto Tracking
  - Alerts
  - Interval Track Management and Operator Support
  - Image Fusion
- Safety
  - Live and Recorded Image/video
  - Avoid misguidance



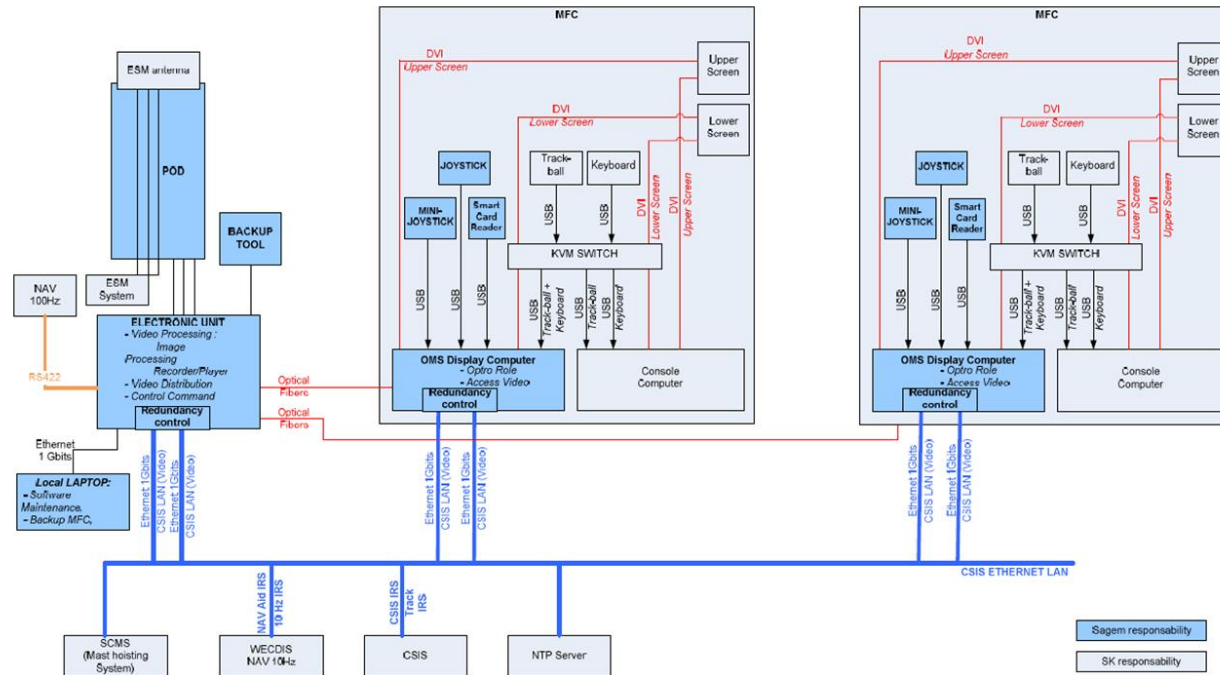
# Redundancy





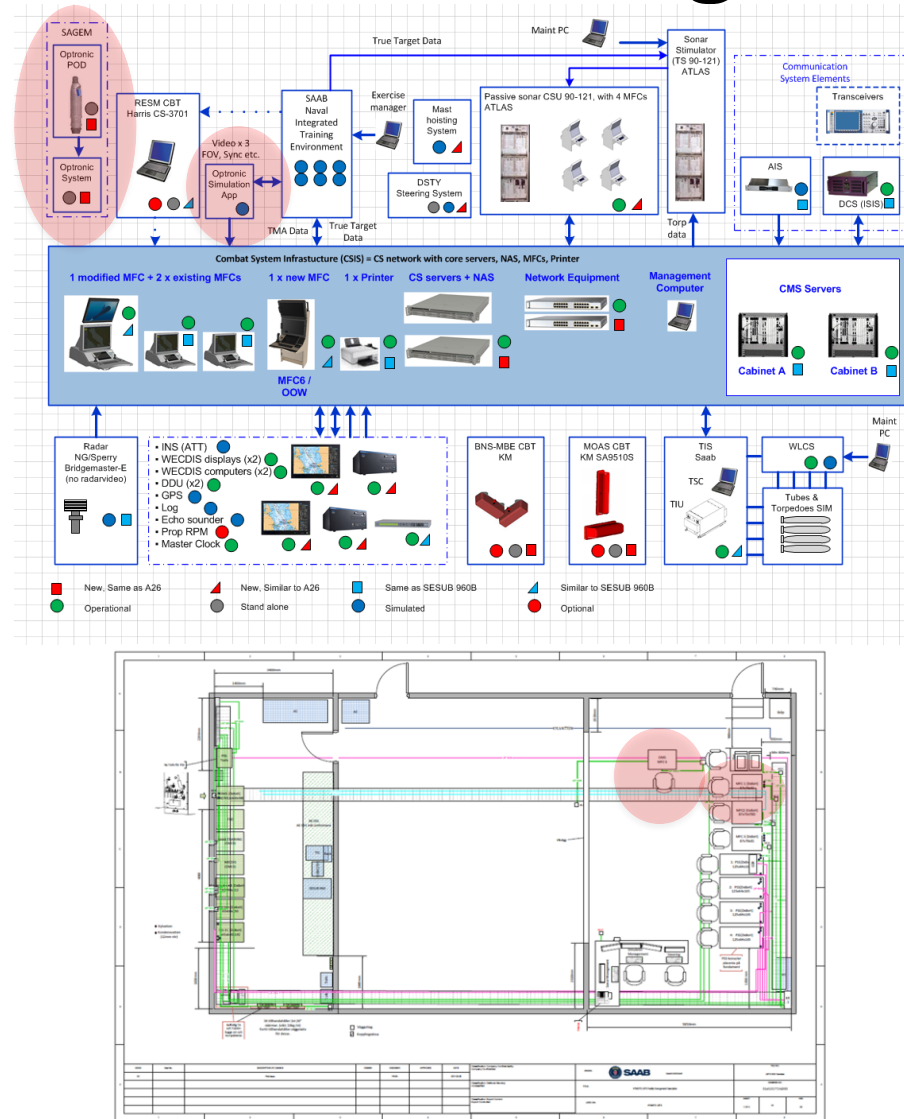
# System Overview

- SENSORS
  - HDTV (dusk / dawn / daylight)
  - HDIR-camera
    - Medium Wave (3-5  $\mu\text{m}$ )
  - LLLTV (to approx. 900 nm)
  - Laser Range Finder (LRF)
  - Mission Critical Camera (MCC)
- Two OMS-consoles
- Back-up Tool
- RESM ANTENNA LOAD
  - Modular mechanical interface for RESM Antenna (a “cover” when not mounted)
  - GPS



# System #5: The Land Based Training Site

- Training & Education
  - Operators
  - Technicians
- Reference System
  - "Real systems"
- New Optronic System
- Based on MLU GTD configuration
- Spare Parts
- Risk Reduction



# System #5: The Land Based Training Site





# System #5: The Land Based Training Site



# Conclusions

- Cooperation
  - Supplier / Sub supplier
  - FMV
  - End user
- Live Camera Tests – Rapid camera technology development
- Training facilities
- Operator Perspective
  - Increased availability
  - Sensors – Functions - Options – Redundancy
  - Optimized HMI

- Failure is not an option...**QUESTIONS?**