

**“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



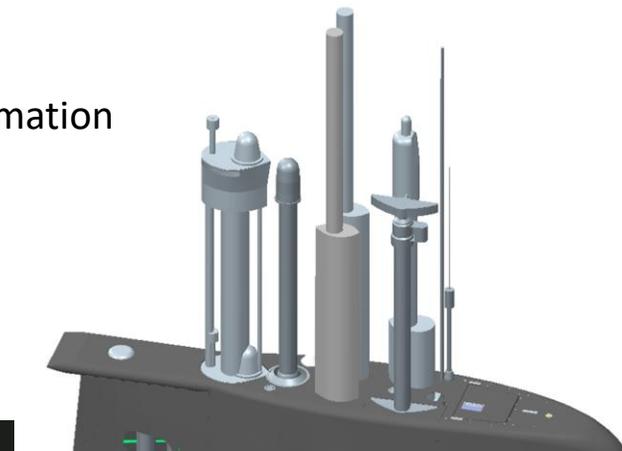
Objectives and Introduction

- 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

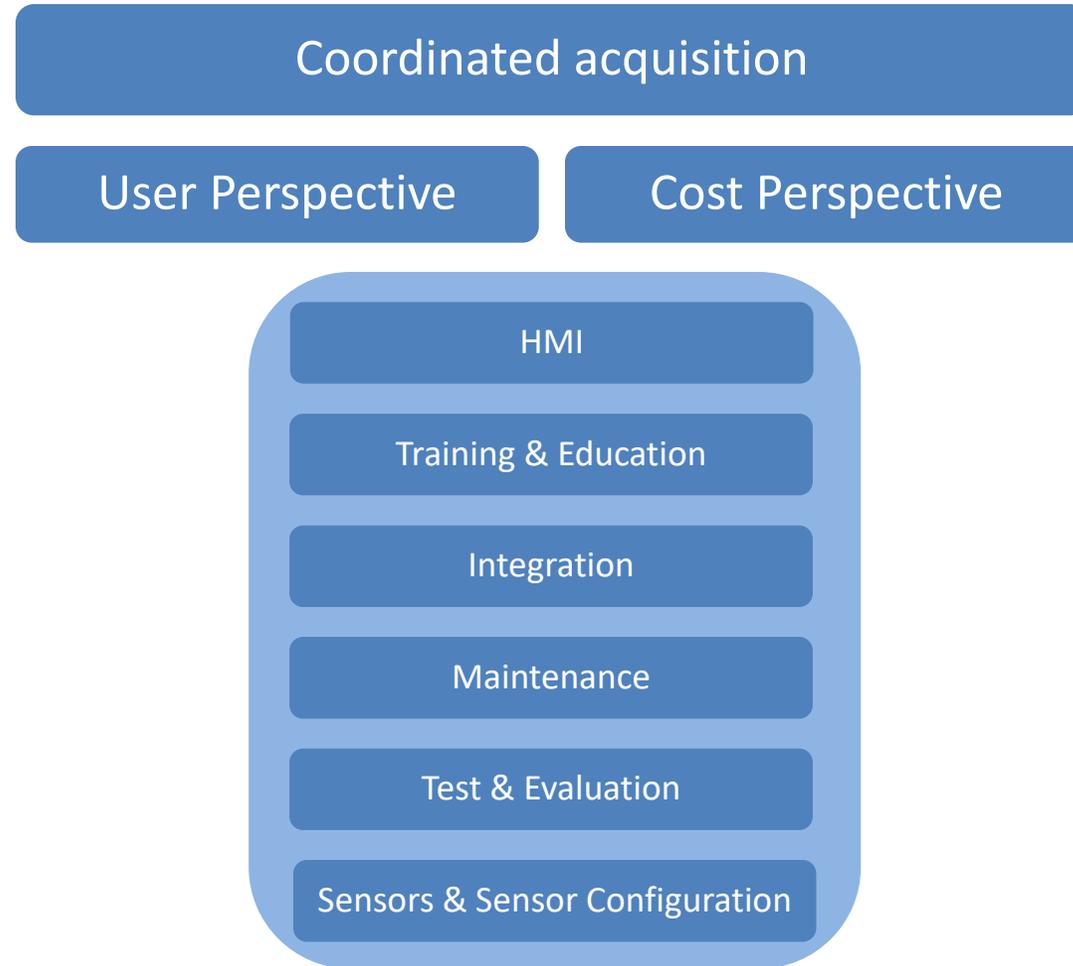


The Challenges

- 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



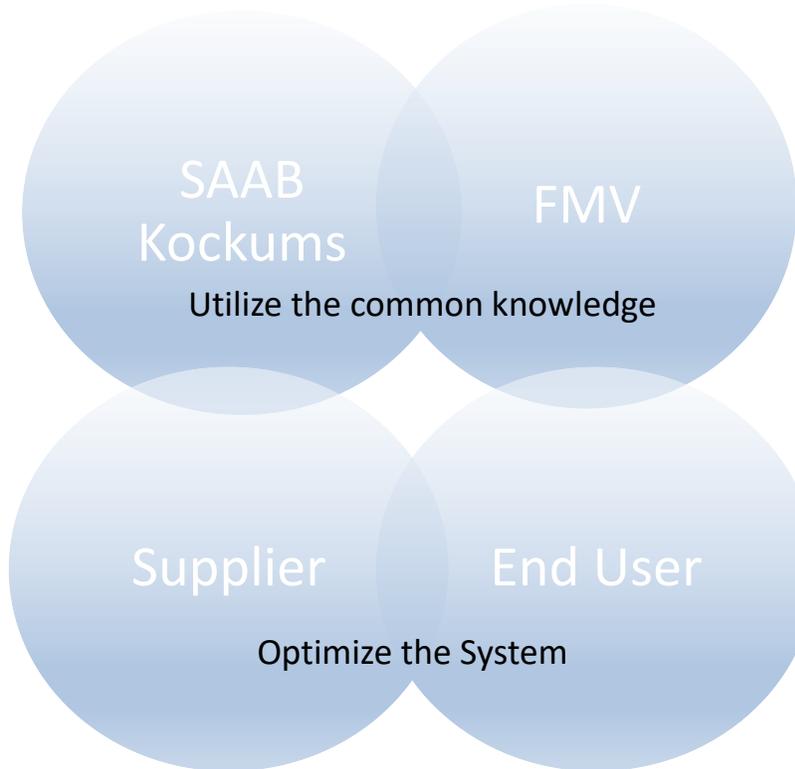
Coordinated Acquisition



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

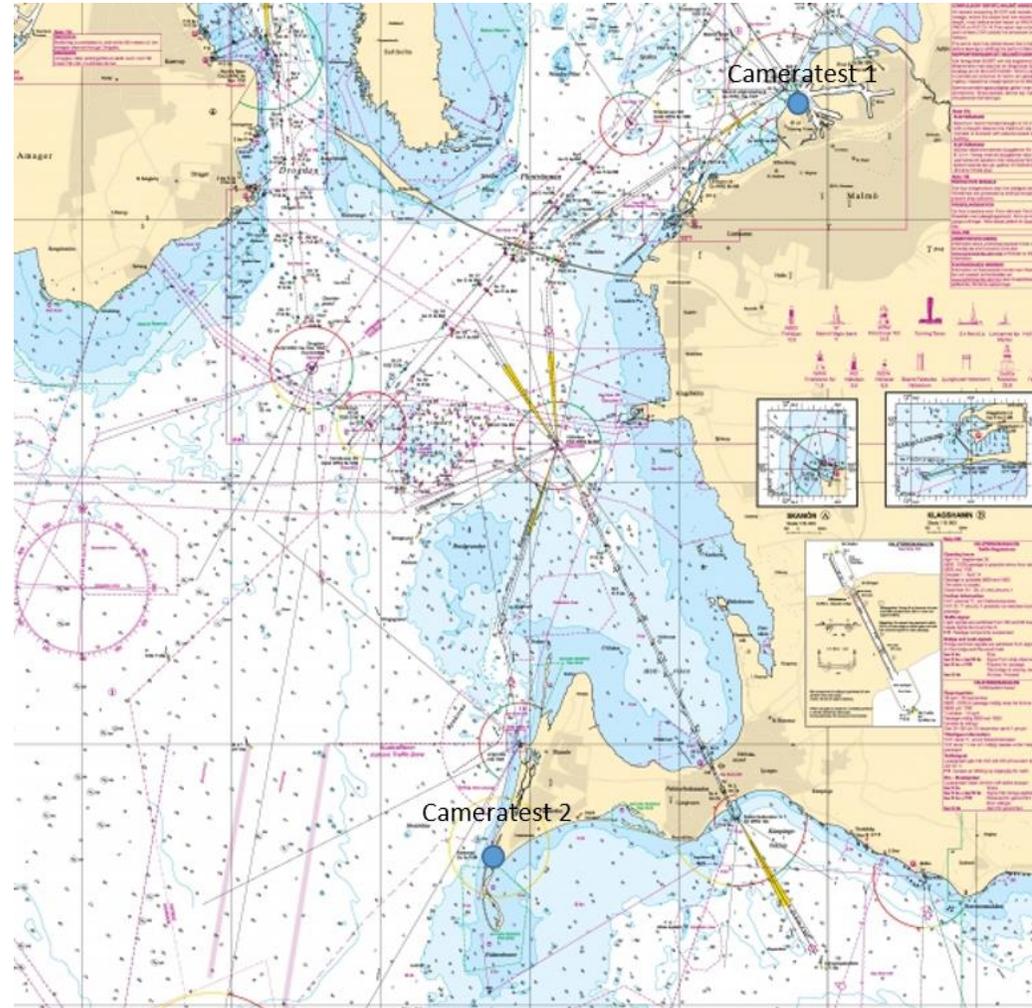
Procurement and Evaluation Phase

- 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)



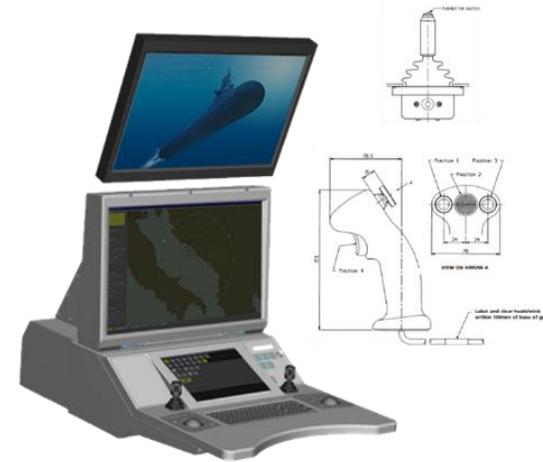
Design Phase (Consoles)

- 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

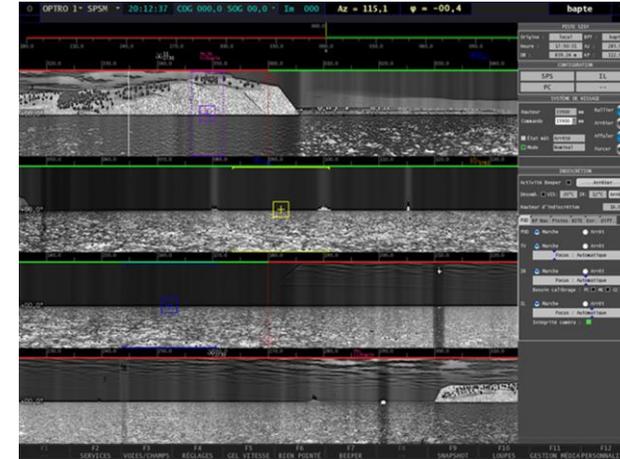


Design Phase (Console "direction"...)

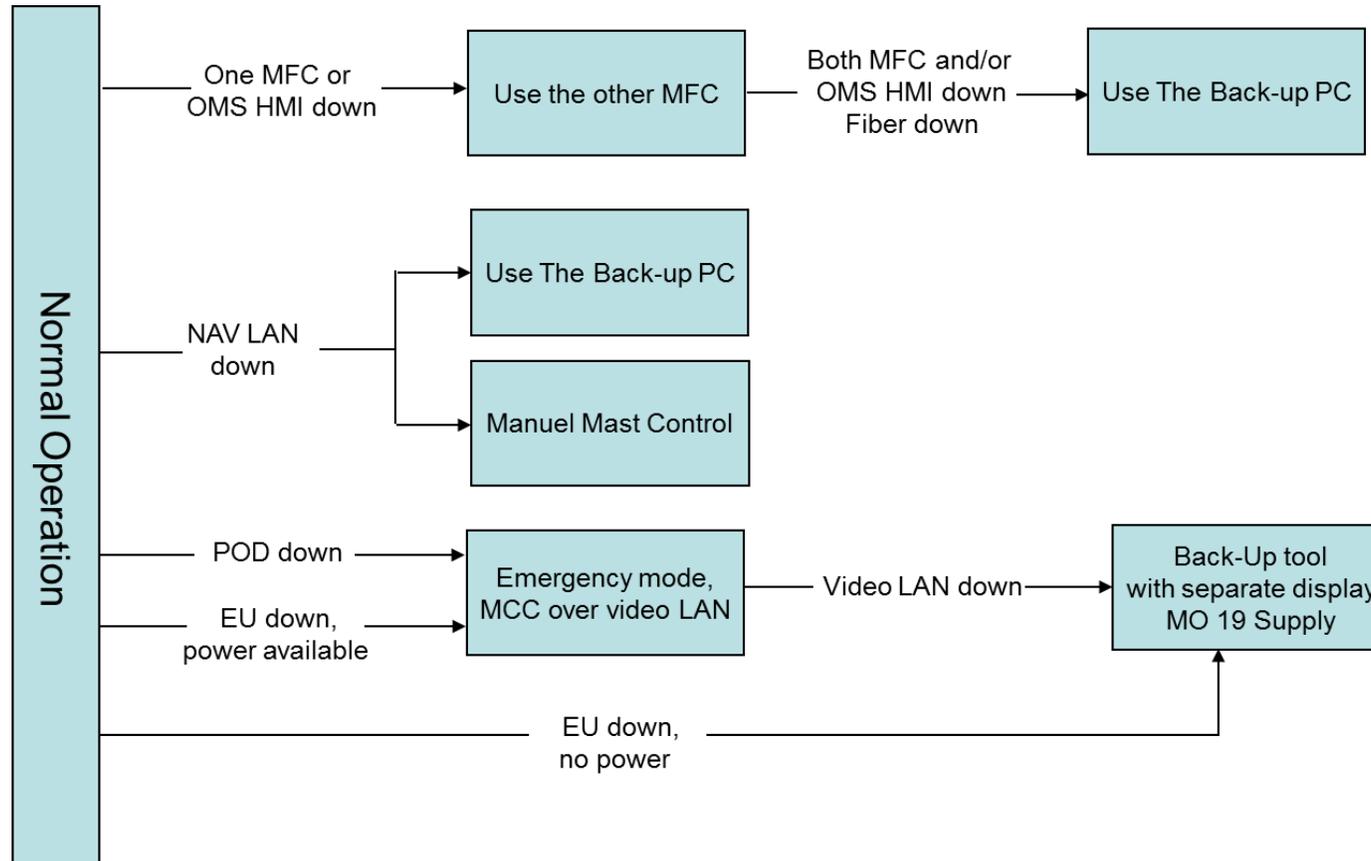


Design Phase (HMI)

- 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

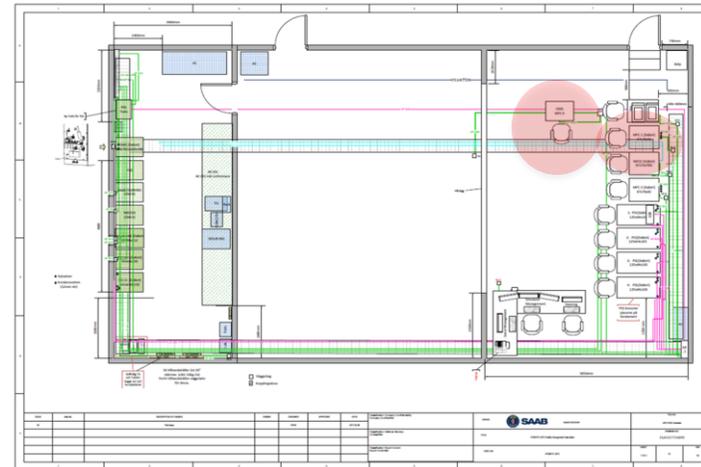
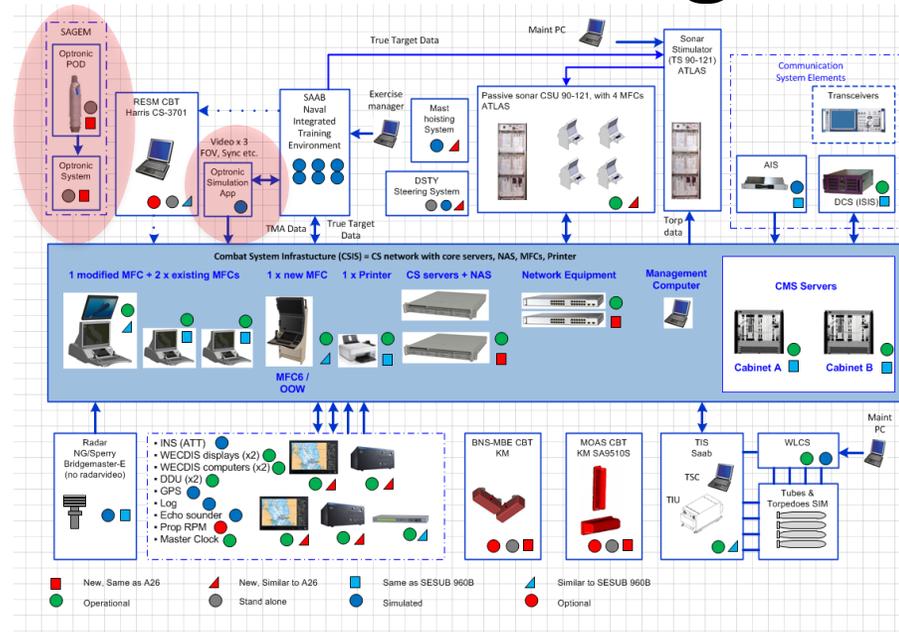


Redundancy



System #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?**