

# M<sup>o</sup>SES

## Exploitation workshop on Robotic Container Handling System



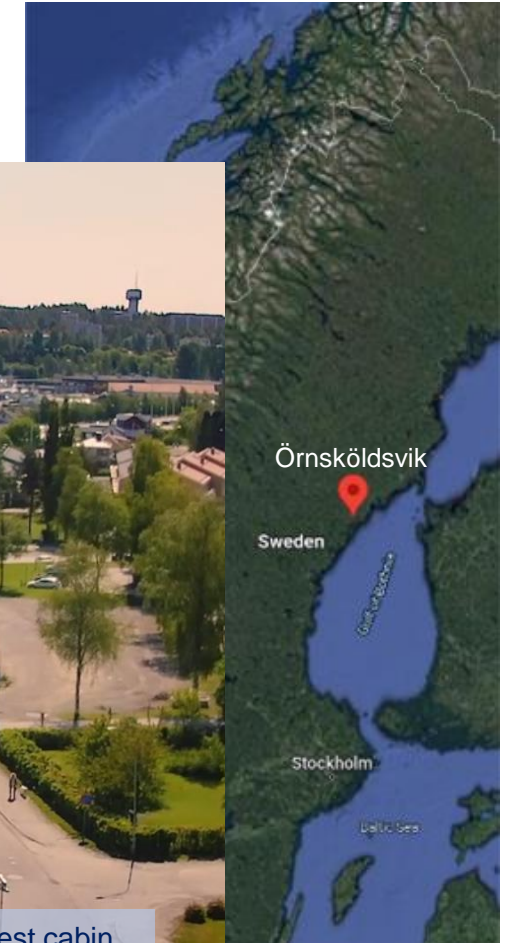
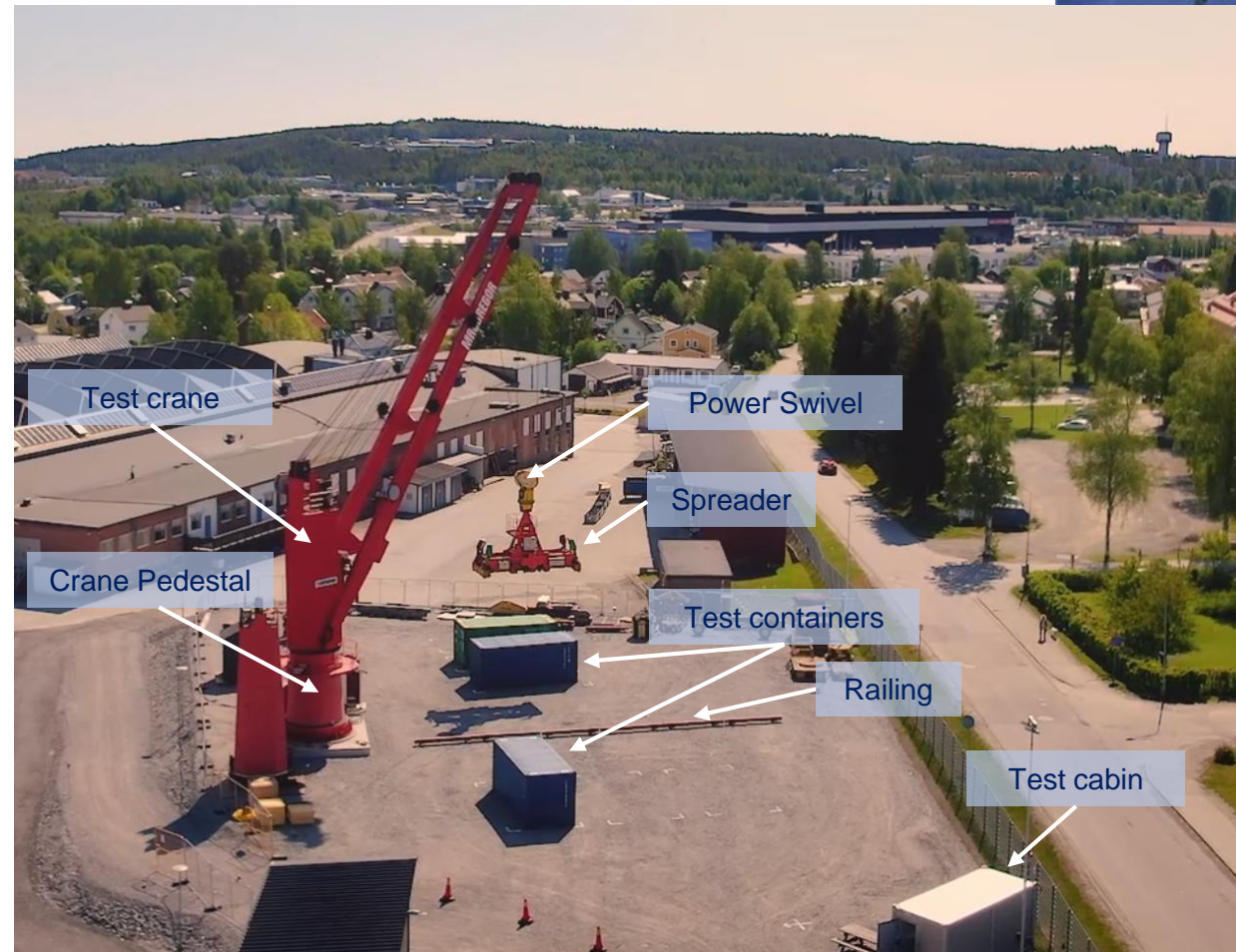
Jonas Renlund, MacGregor

# Agenda

- What we have achieved
- Background
- Robotic crane
  - Overview
  - Sub systems and sensors
- Containers
- History
- C-how
- The video

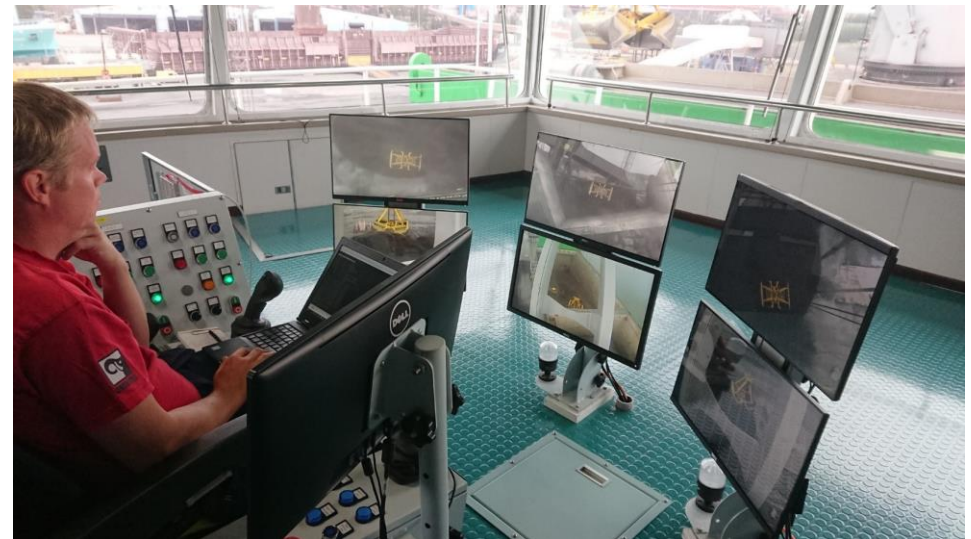
# What we have achieved

- **Robotic crane**  
Spreader, ARC, APC ...
- **Digital Twin**  
C-how with physic engine. Used for Software development
- **Load Sequence (VCOP)**  
Voyage/Container optimization platform
- **Shore Control (IOSS)**  
Intelligent Operator Support System
- **Full scale demonstration**



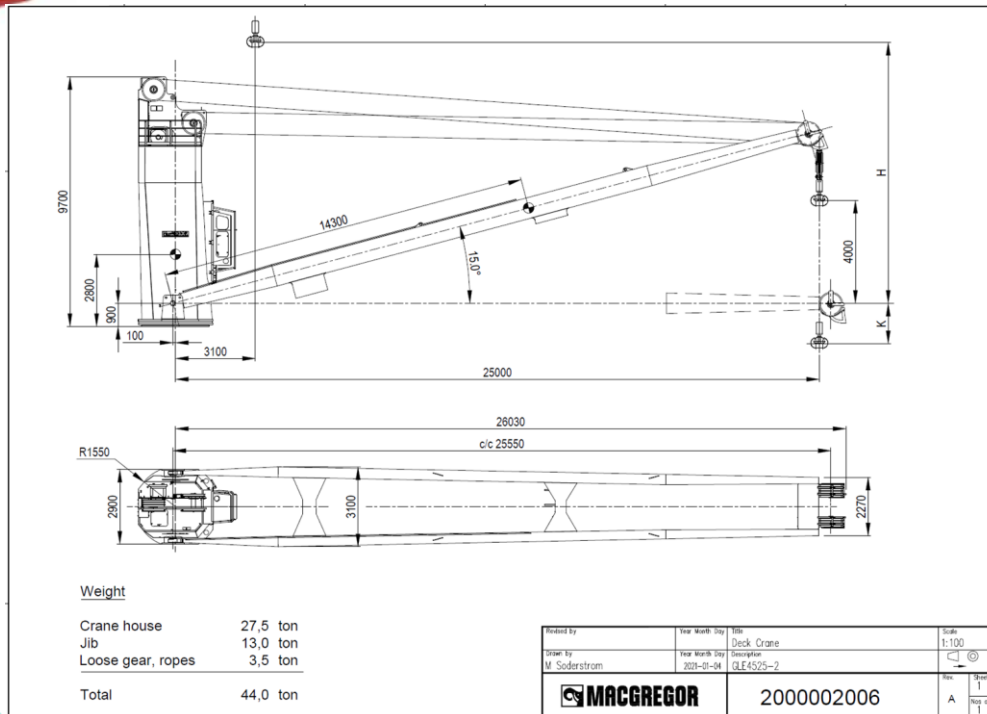
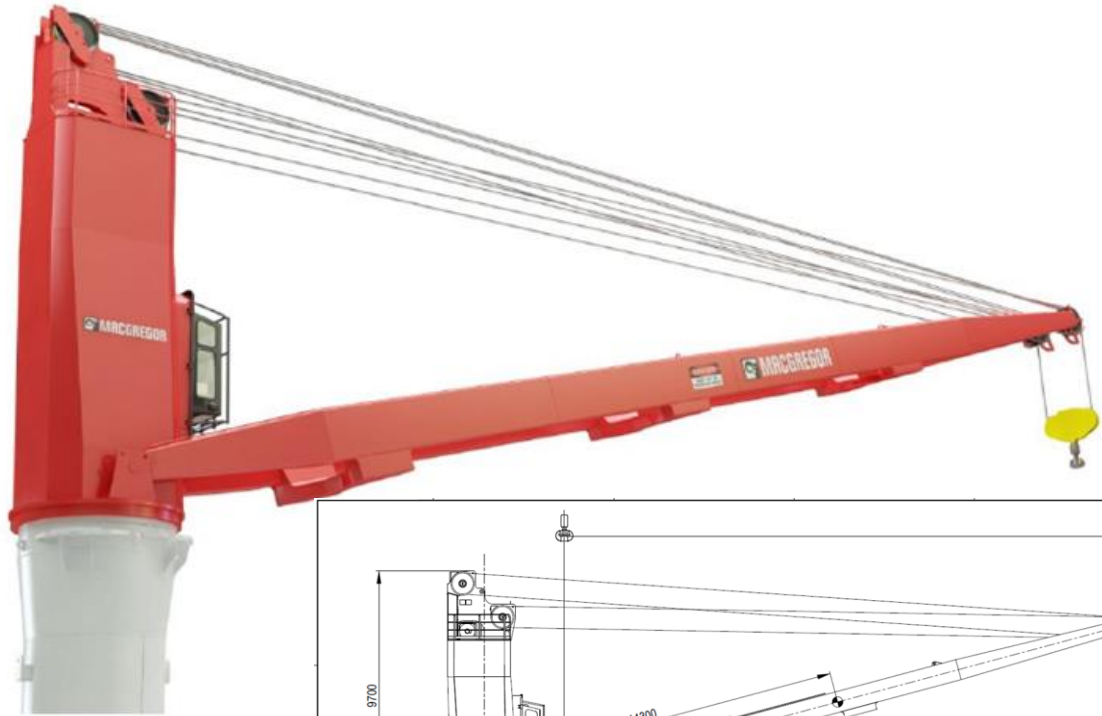
# Background

Delivered autonomous Bulk cranes for discharging



# Background: Crane with high efficiency and precision

## Robotic container handling system based on GLE crane with Electric transmission



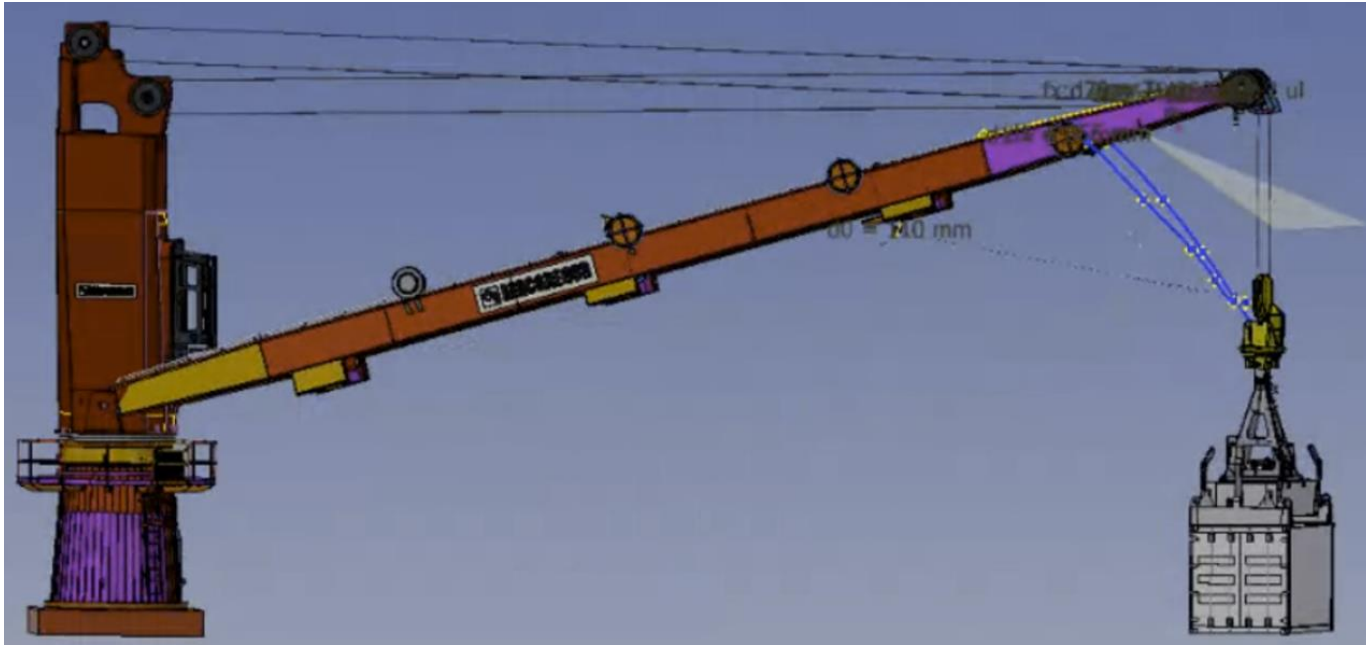
### Electric Crane Type GLE4525-2

Hoisting capacity, SWL	45	ton
- hook operation		
Hoisting capacity, SWL	33	ton
- grab operation		
Hoisting speed, load depending <sup>1)</sup>	20 – 45	m/min
Luffing time, load depending <sup>2)</sup>	48 – 58	sec
Slewing speed, load depending	0,6 – 1,0	r/min
Jib radius, min	3,1	m
Jib radius, max	25	m
Lifting height, H+K	35	m
Rated motor power:		
- Hoisting	139	kW
- Luffing	79	kW
- Slewing	2 x 21,3	kW
Main power supply AC	440	V
	60	Hz
M <sub>max</sub> <sup>3)</sup>	13700	kNm
Q <sub>max</sub> <sup>4)</sup>	880	kN
Weight, total	44	ton
Dimension drawing (crane)	2000002006 rev -	No
Dimension drawing (foundation, C-type)	1000007199	No
Installed power drawing (preliminary)	1000008234	No

Crane designed for max 5° list / 2° trim.

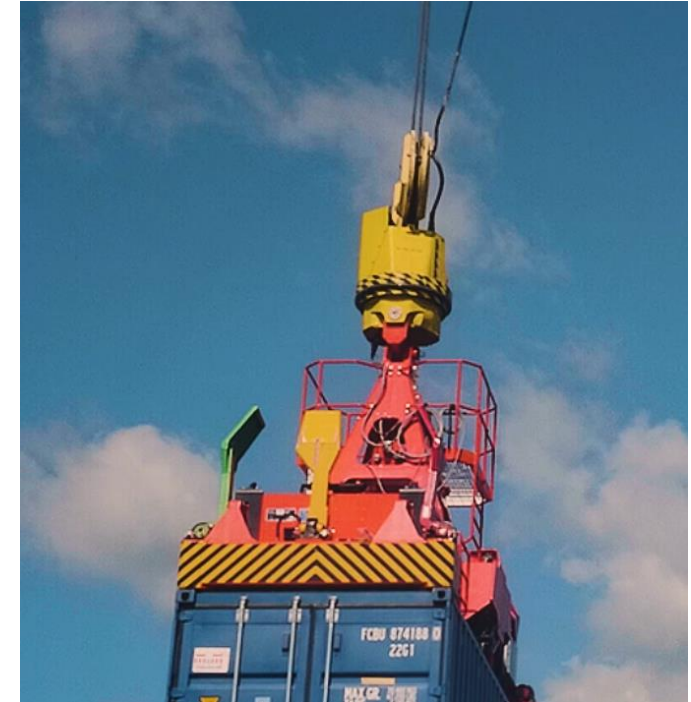
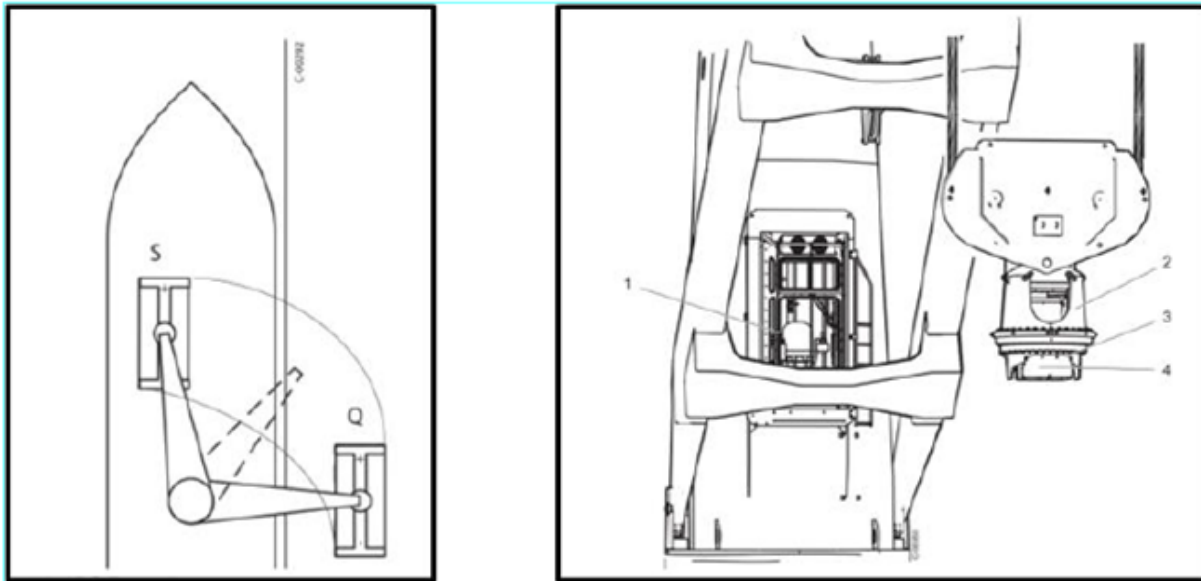
## Background: Swing defeater

Swing defeater - Dampening of cargo pendulation. A laser scanner unit fitted in the jib top, measures and detects movement of the cargo.

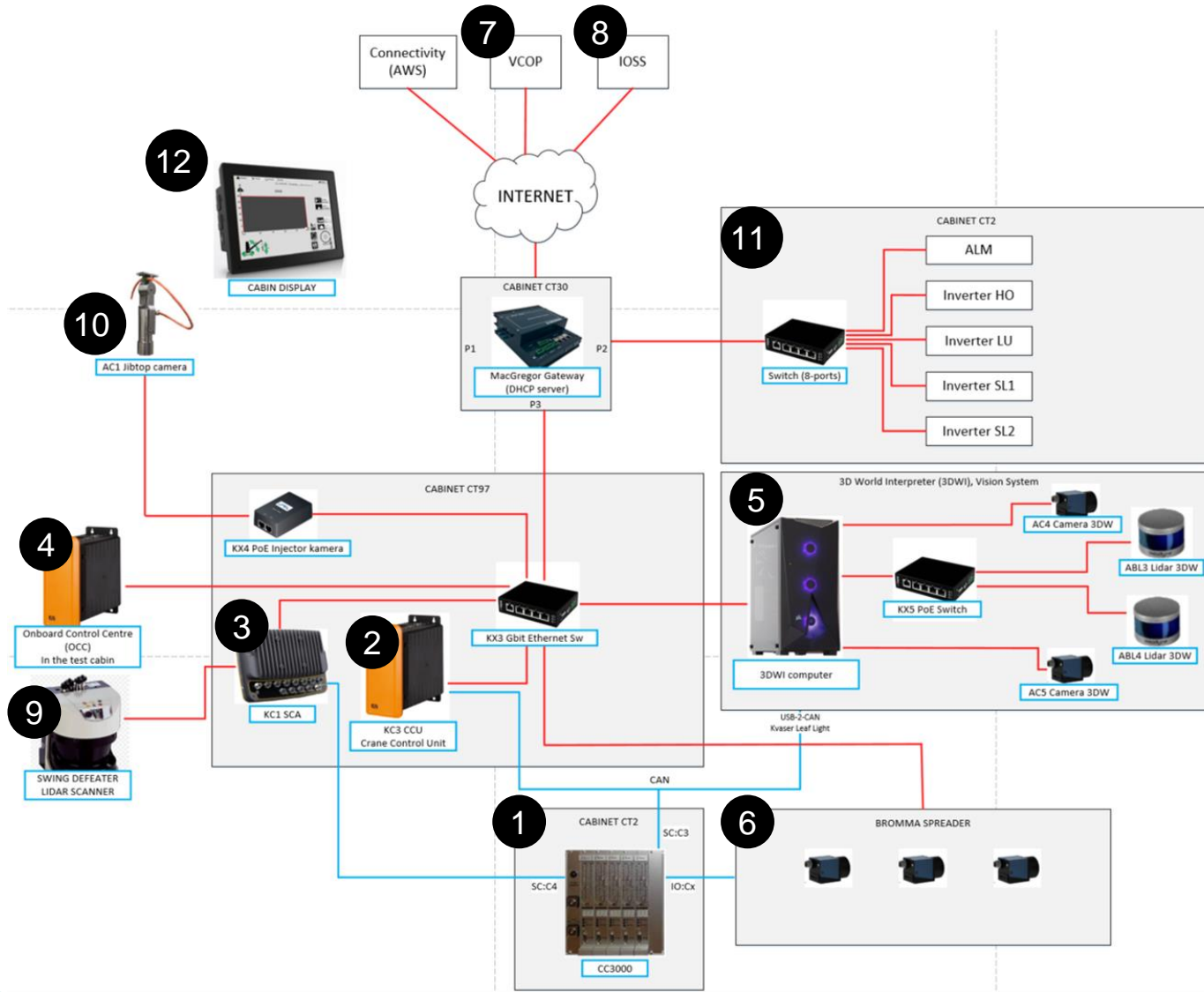


# Background: ARC - Active Rotation Control

The algorithm for ARC is position-based which means that the power swivel at all points tries to keep the cargo at the same desired angular position in the ship coordinate system.



# System overview



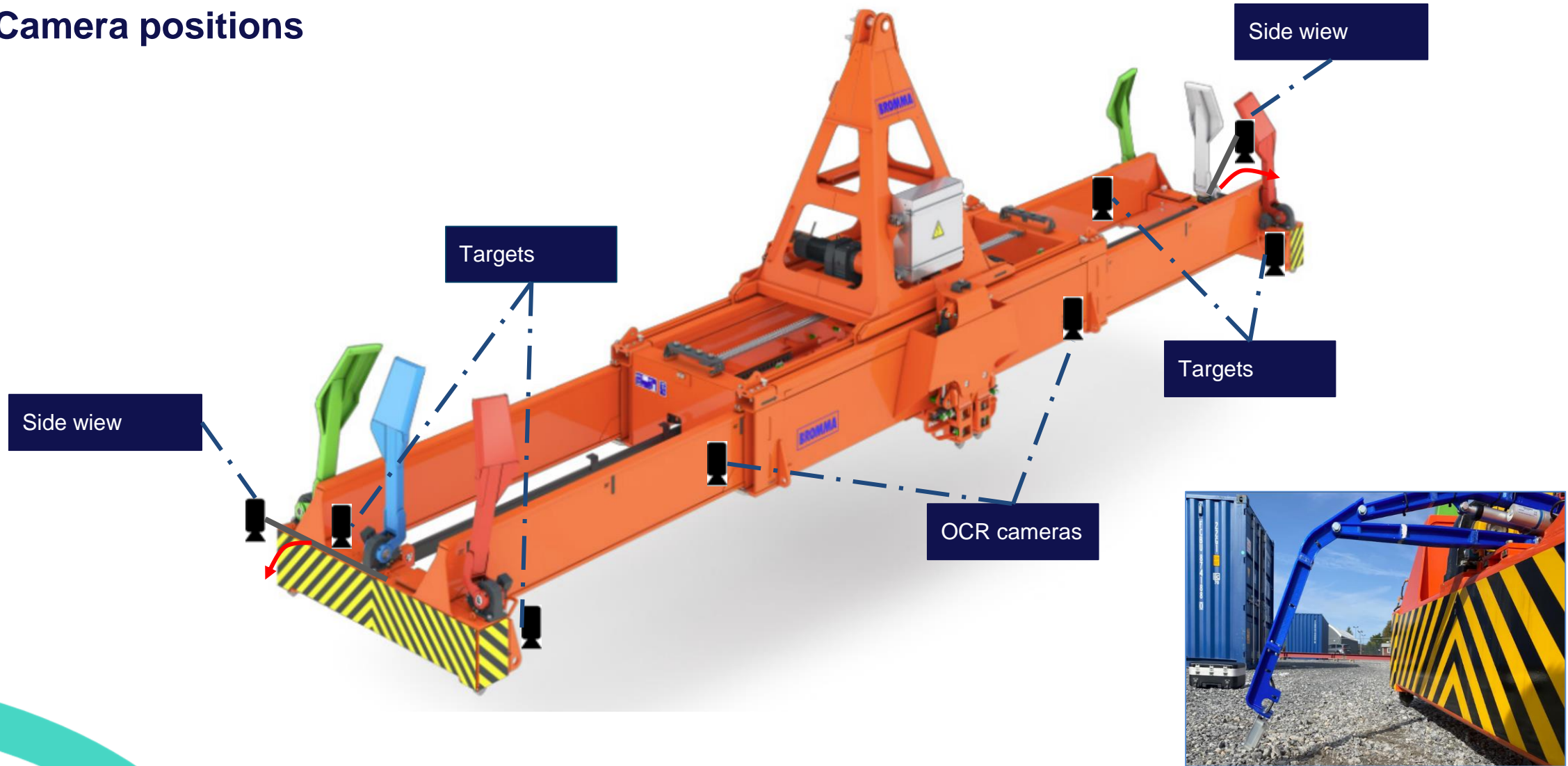
1. CC3000 Crane Control
2. **CCU** Crane Control Unit NEW
3. SCU Sensor Computer Unit
4. **OCC** Onboard Control Centre NEW
5. **3DWI** 3D World Interpreter NEW
6. **Bromma Spreader** NEW
7. **VCOP** Voyage/Container optimization NEW
8. **IOSS** Intelligent Operator Support NEW
9. Swing defeater (Lidar) NEW
10. **Jib top camera** NEW
11. GLE - transmission
12. Cabin display
13. ARC Active Rotation Control

Ethernet  
CAN

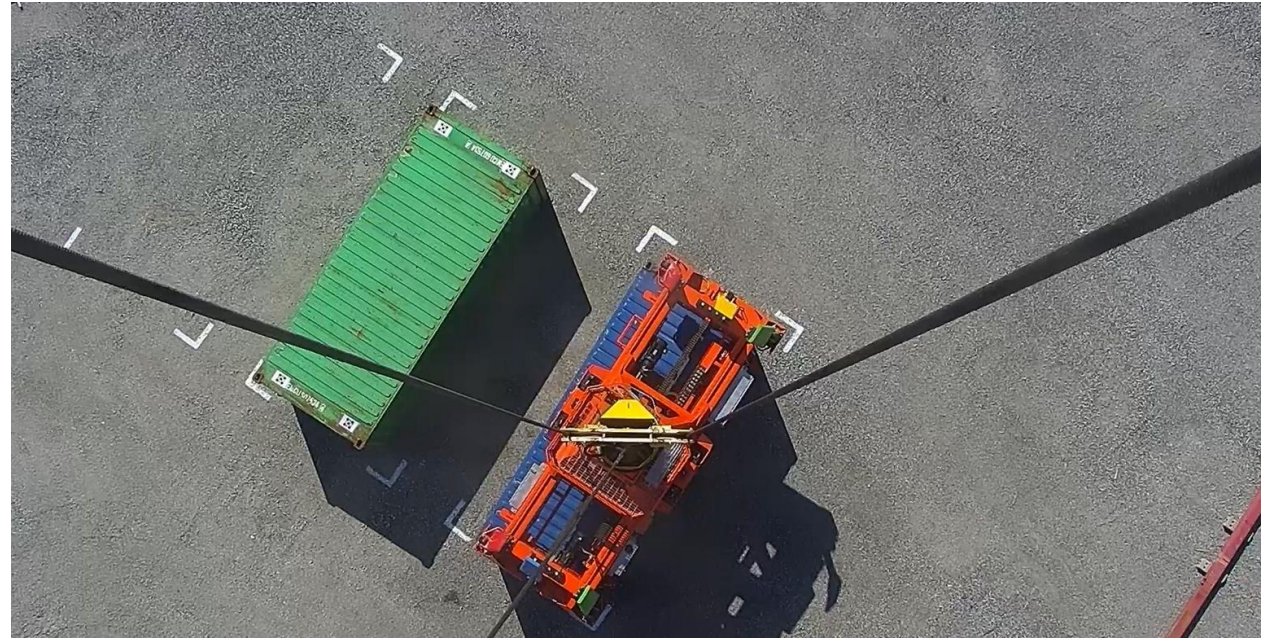
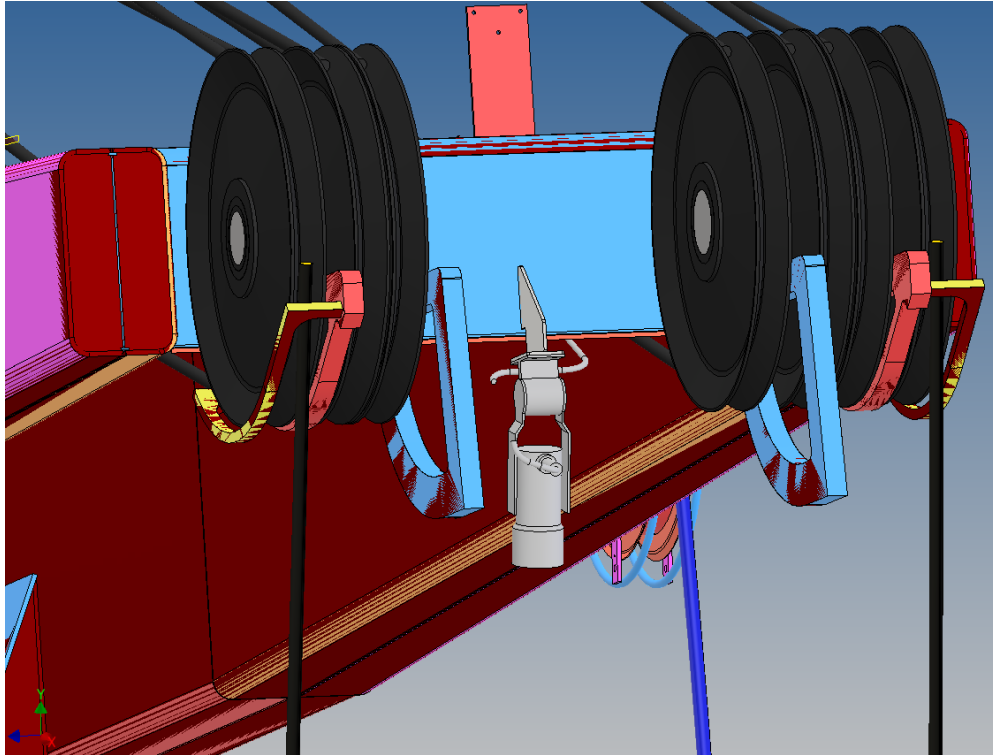


# BROMMA Spreader

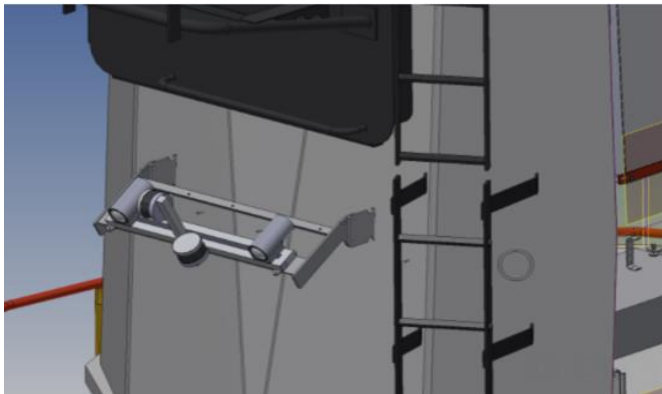
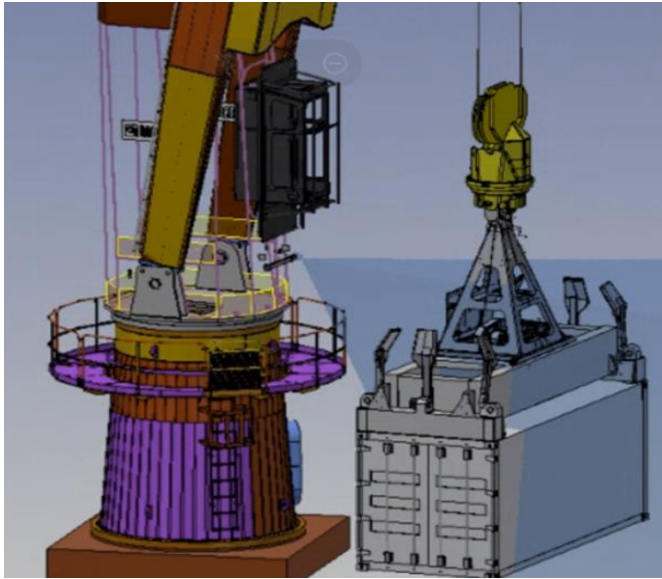
## Camera positions



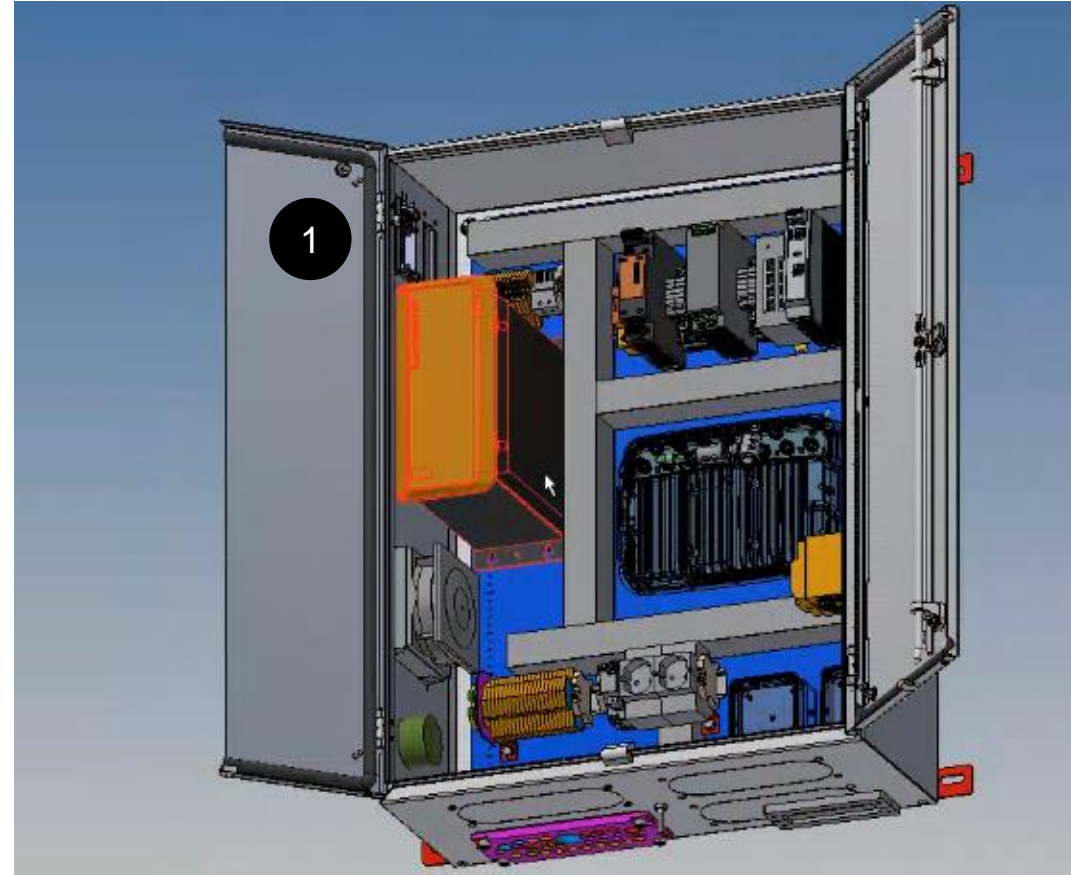
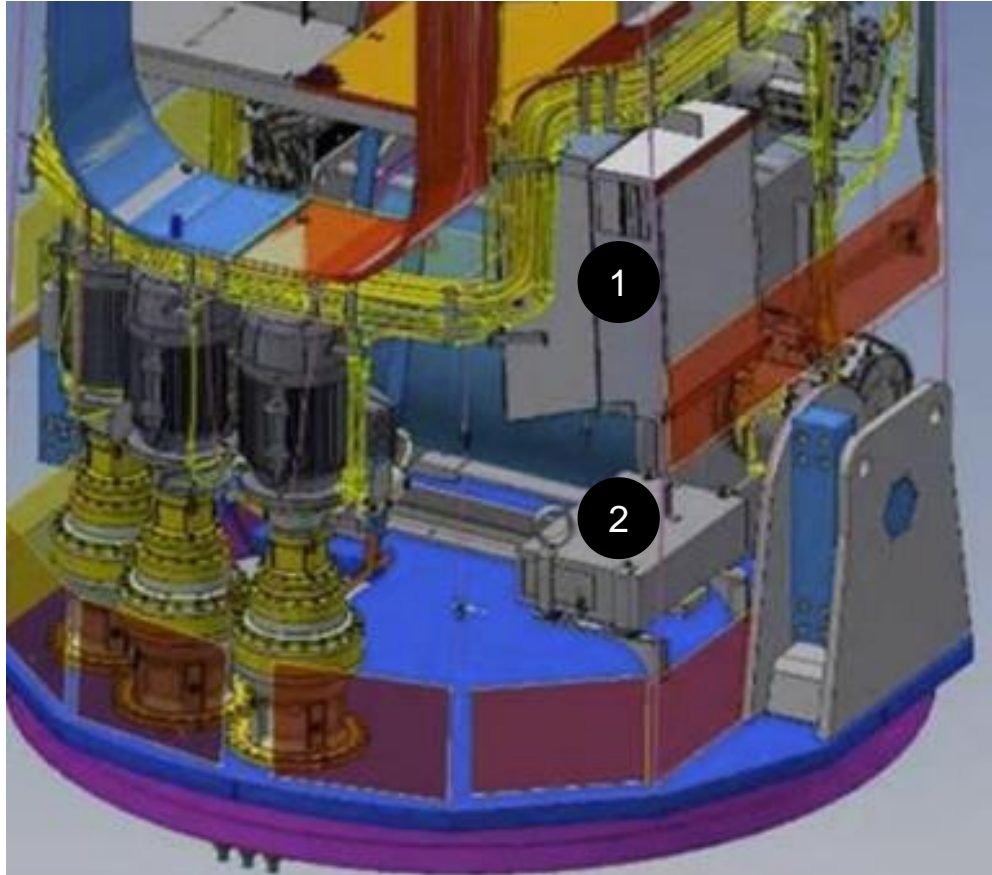
# Jib top camera



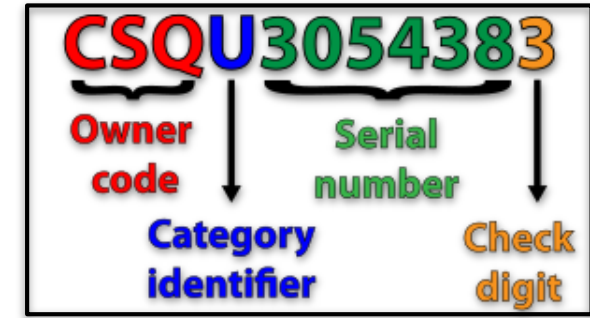
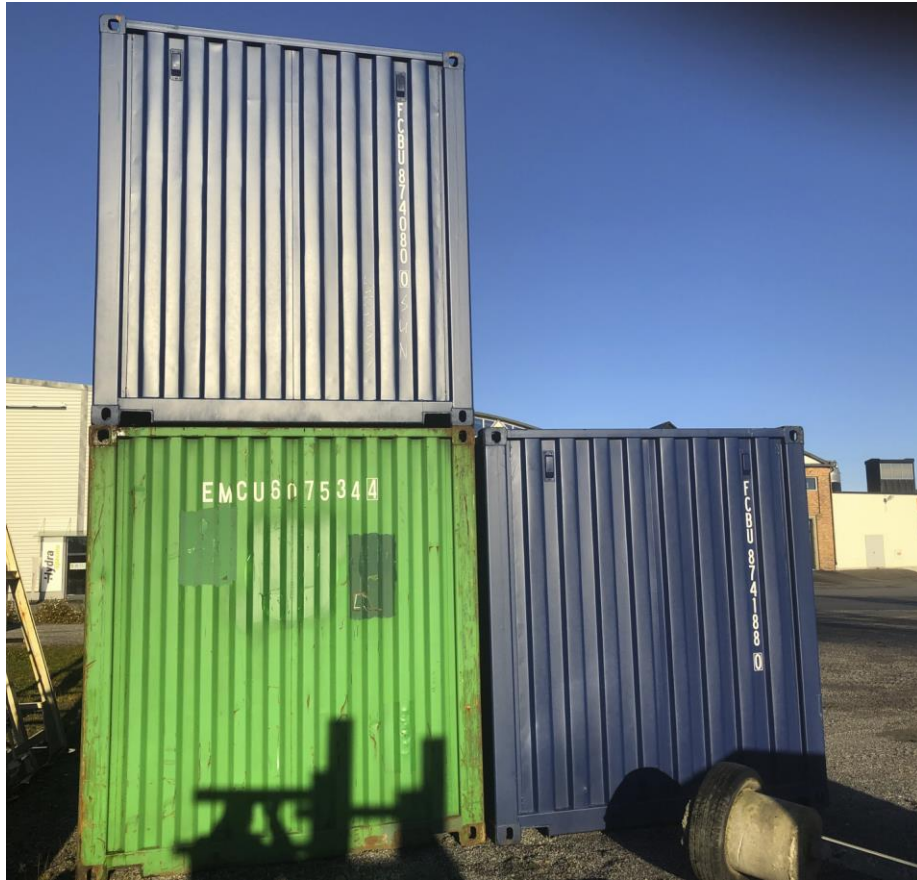
# Sensor suite



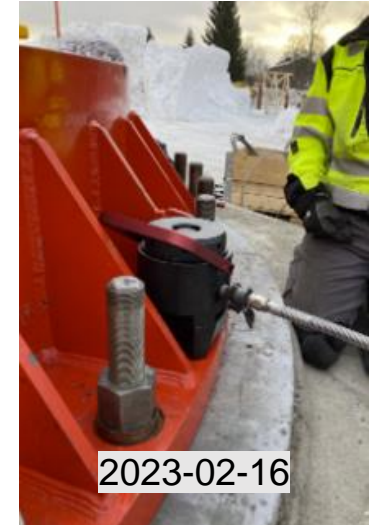
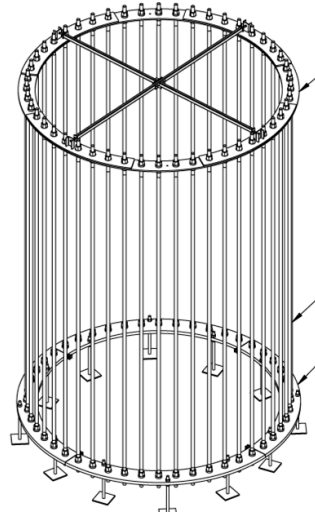
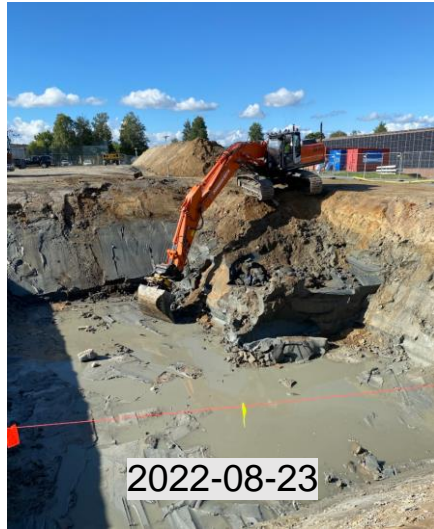
- 1 Crane Computer Unit (CCU)
- 2 3D World Interpreter (3DWI)



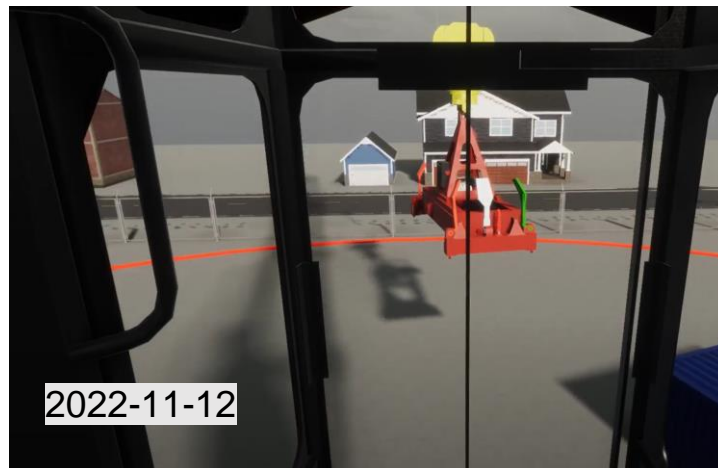
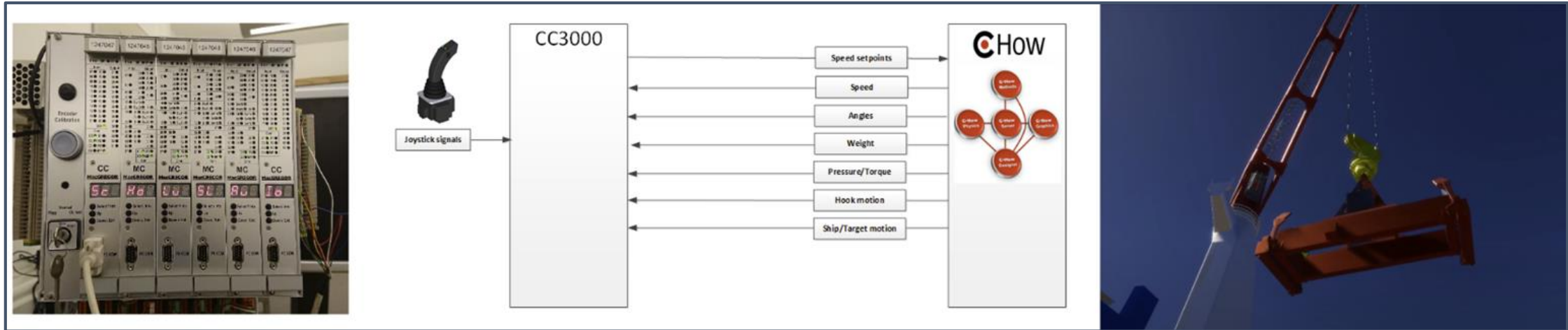
# Containers



# GLE - Installation (history)



# C-how



# Moses video





# MOSES

## Thank you for your attention!



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