

# First Time Right

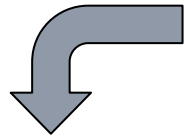
Simulations in Space and Offshore  
18 May 2016

Catina Geselschap, Heerema Marine Contractors  
cgeselschap@hmc-heerema.com

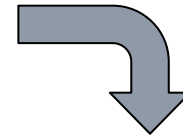
Matthijs van der Kooij, Airbus DSNL  
m.vd.kooij@airbusDS.nl



# First Time Right – in Offshore & Space



Simulations



**1. Hardware-in-the-Loop**



**2. Operator-in-the-Loop**



French Guyana,  
4 June 1996







Paris, 19 July 1996

## ARIANE 5

### Flight 501 Failure

Report by the Inquiry Board

The Chairman of the Board :



Prof. J. L. LIONS

### 3.2 CAUSE OF THE FAILURE

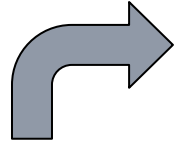
The failure of the Ariane 501 was caused by the complete loss of guidance and attitude information 37 seconds after start of the main engine ignition sequence (30 seconds after lift-off). This loss of information was due to **specification and design errors in the software** of the inertial reference system.

### 4. RECOMMENDATIONS

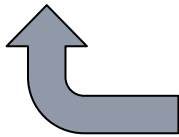
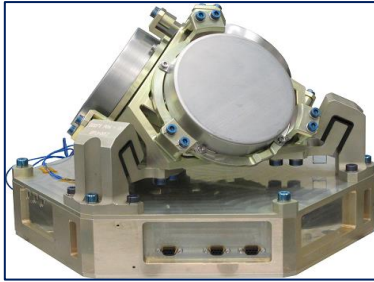
On the basis of its analyses and conclusions, the Board makes the following recommendations.

- R1 Switch off the alignment function of the inertial reference system immediately after lift-off. More generally, no software function should run during flight unless it is needed.
- R2 **Prepare a test facility including as much real equipment as technically feasible**, inject realistic input data, and perform complete, closed-loop, system testing. Complete simulations must take place before any mission. A high test coverage has to be obtained.

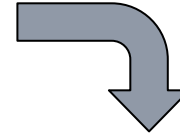
## On-Board Computer



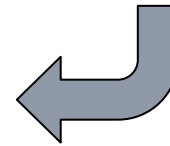
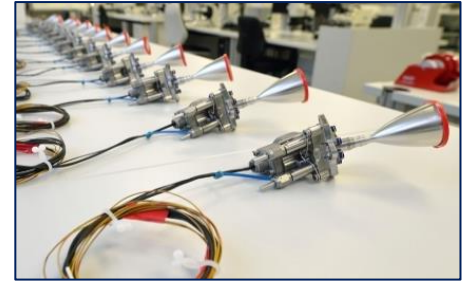
## Gyro's



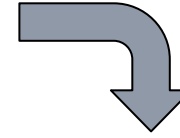
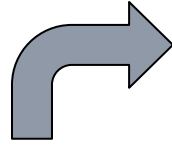
## Real-world physics



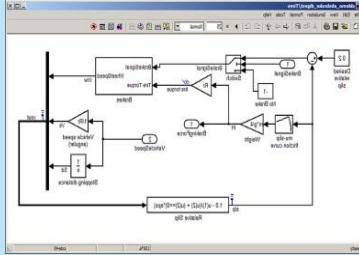
## Thrusters



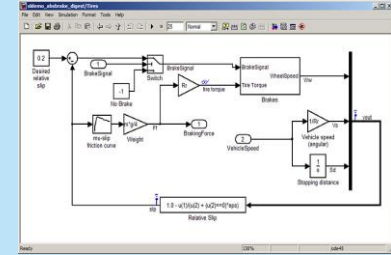
# On-Board Computer



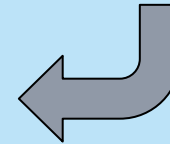
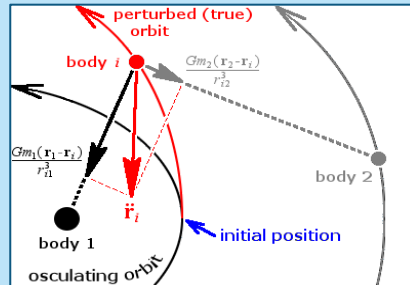
## Simulated Gyro's



## Simulated Thrusters

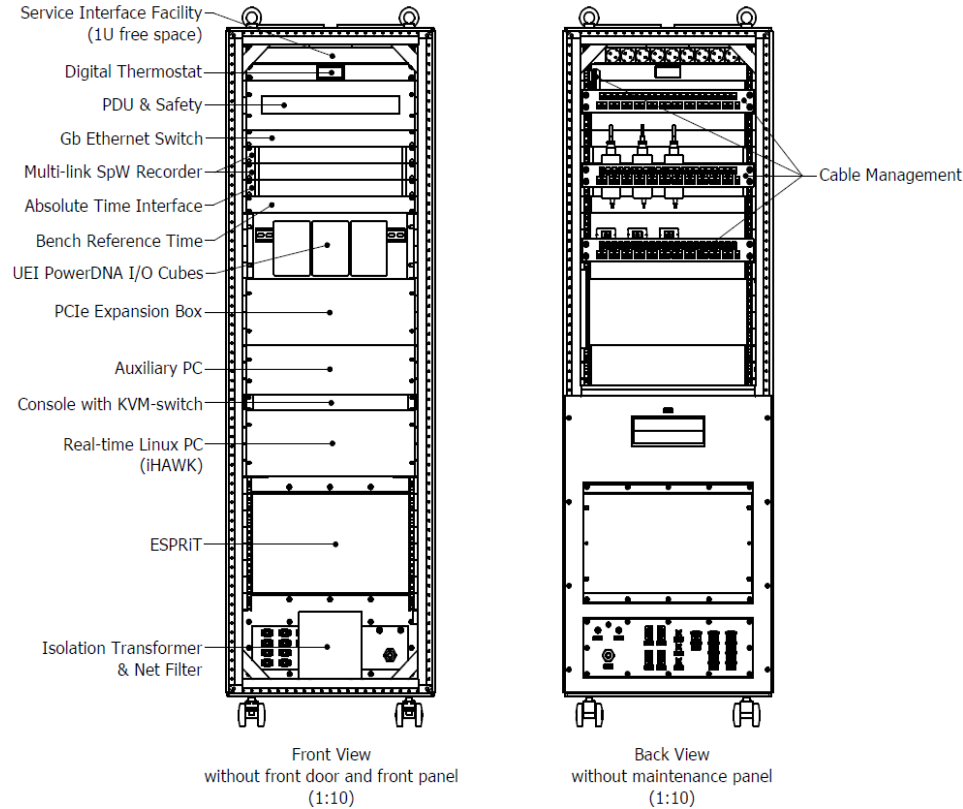


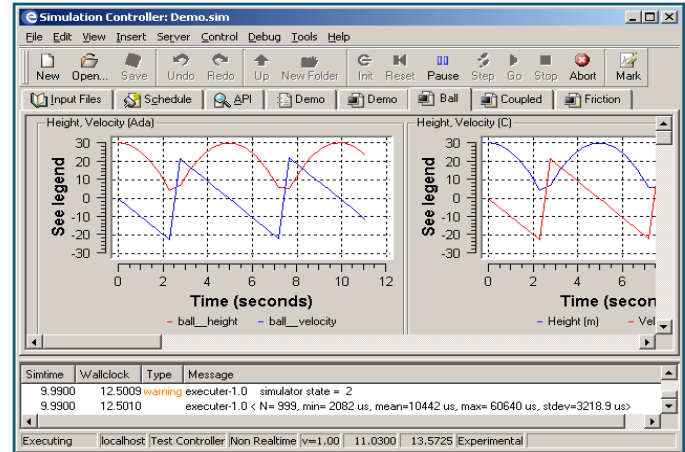
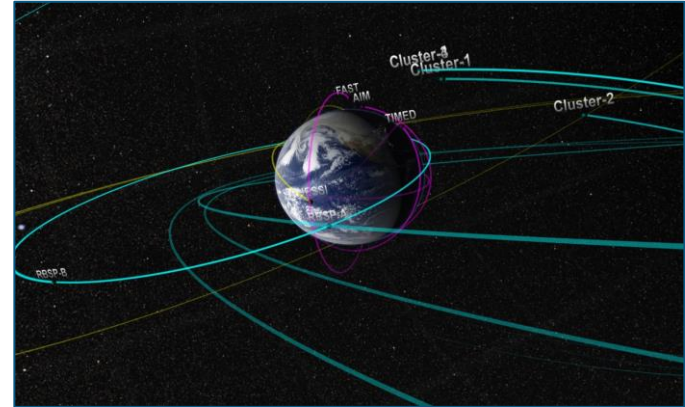
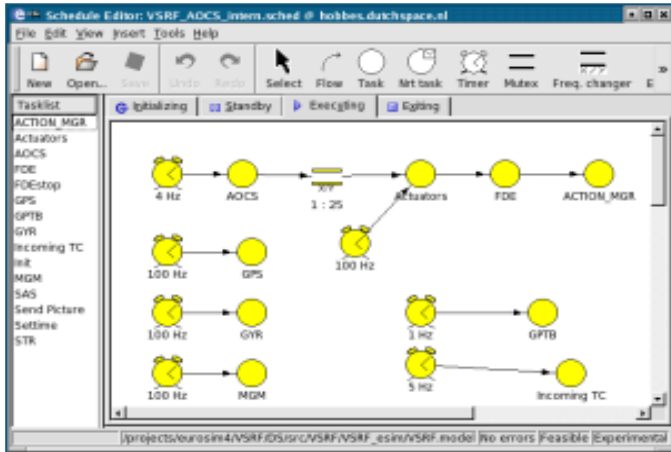
## Simulated Physics



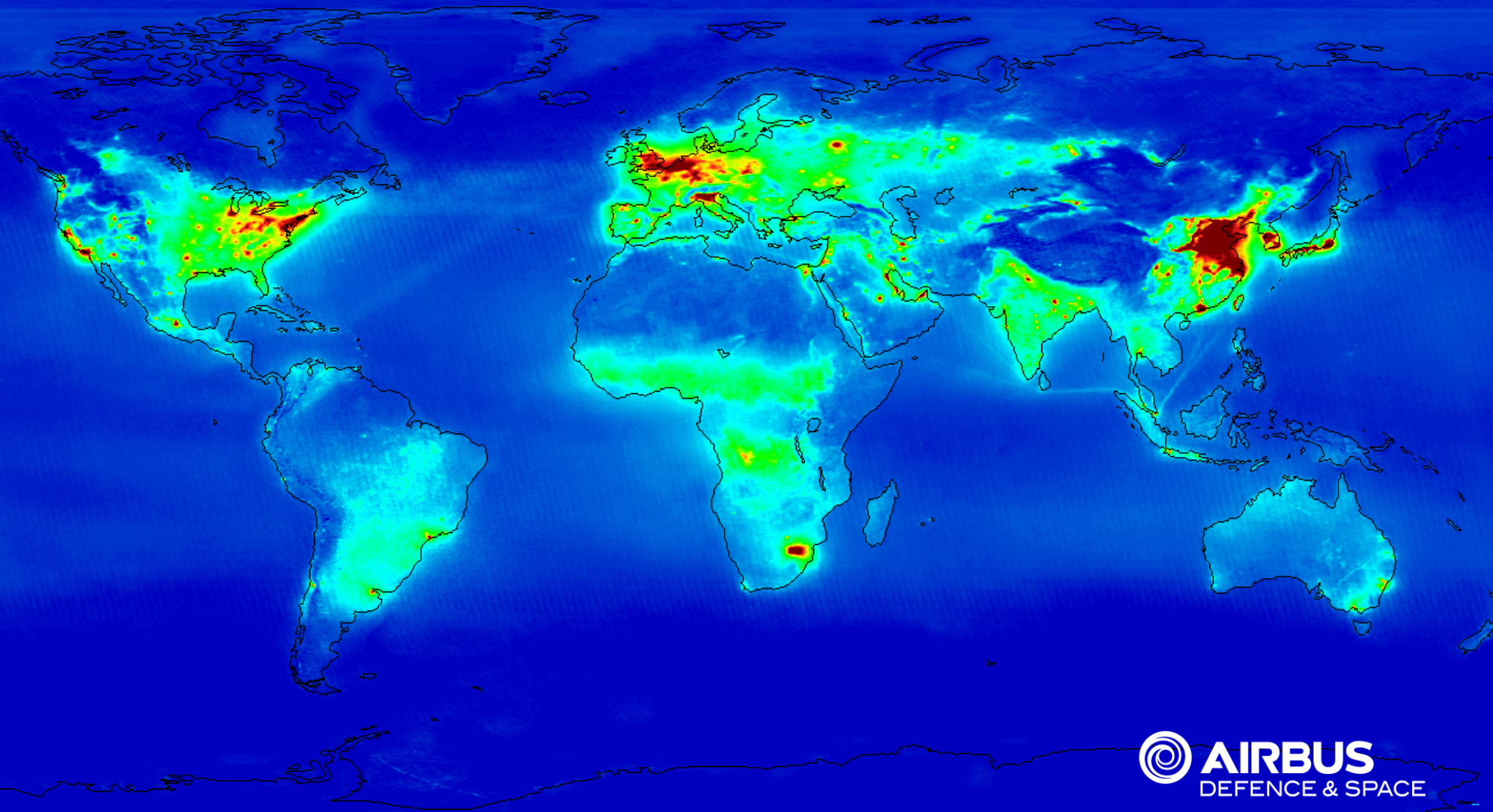
# PC



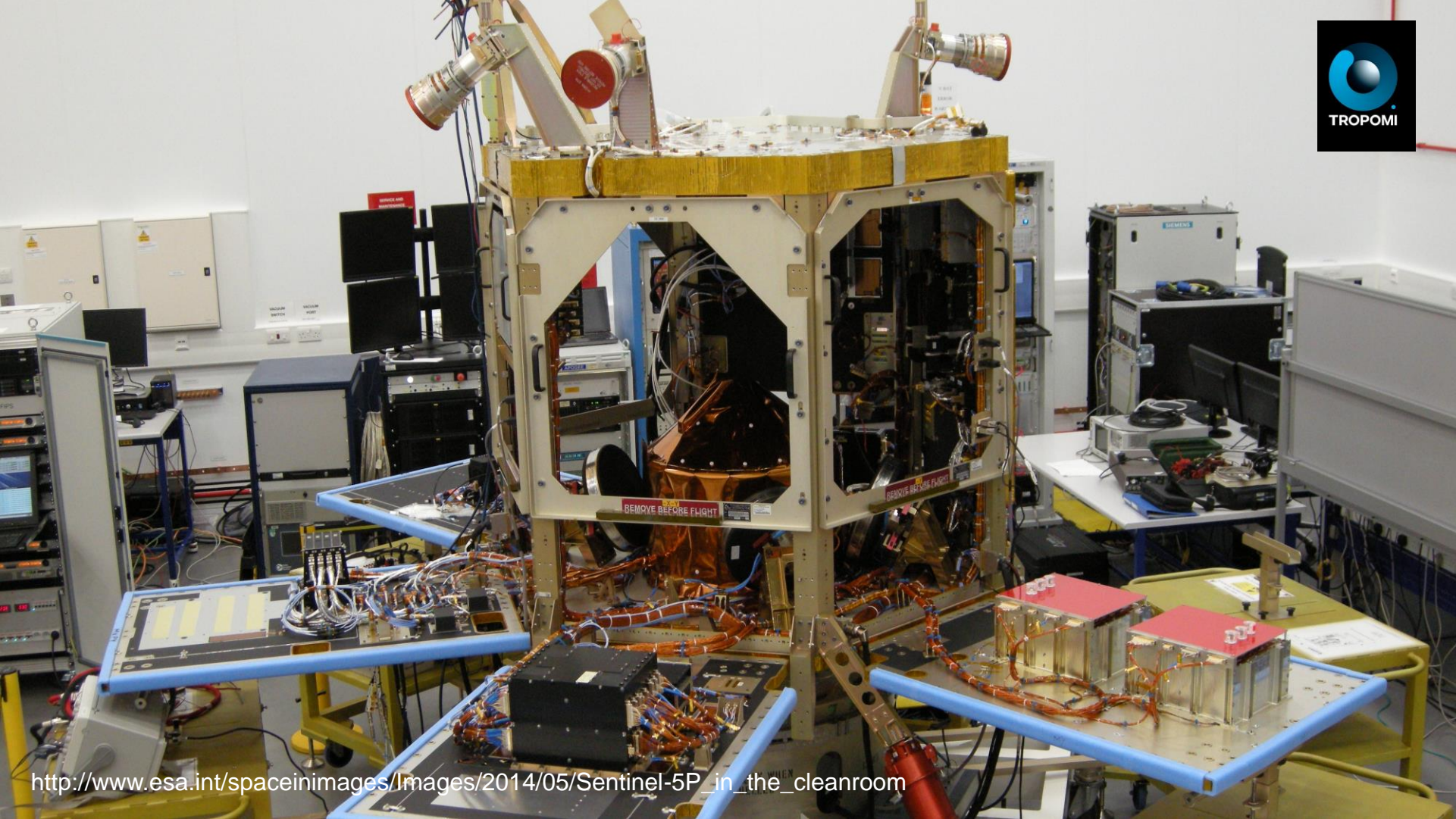






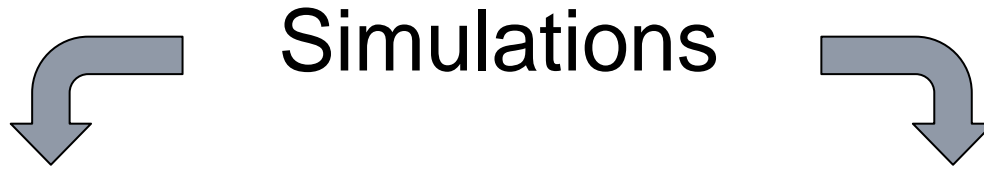








# First Time Right – in Offshore & Space



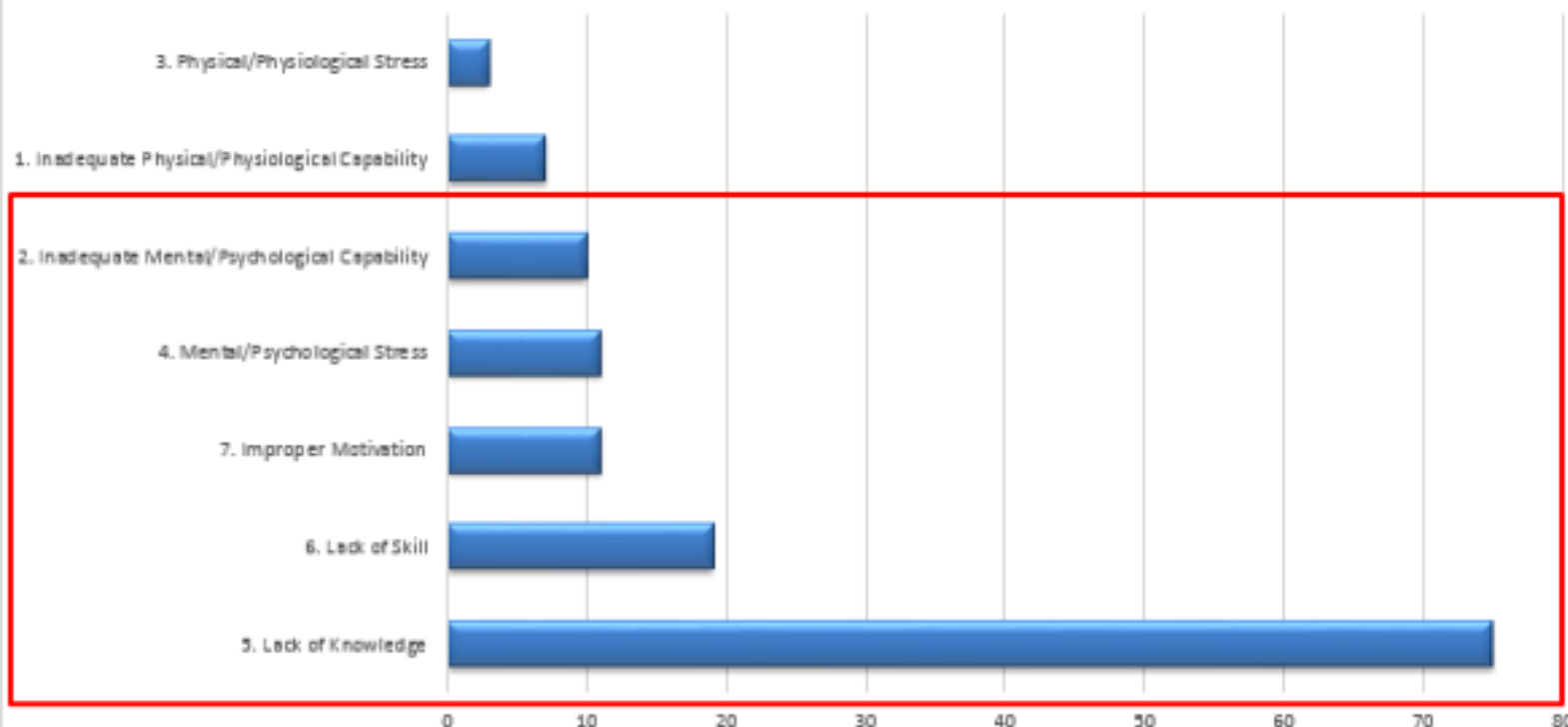
## 1. Hardware-in-the-Loop



## 2. Operator-in-the-Loop



## M-SCAT Basic/Root Causes, Personal Factors @ HMC 2015



### M-SCAT Basic/Root Causes, Personal Factors 2015 (All Assets)

Category Top 5;

5. Lack of Knowledge
6. Lack of Skill
7. Improper Motivation
4. Mental / Psychological Stress
2. Inadequate Mental / Psychological Capability

### Improvement areas 2014

2. Inadequate Mental/Psychological Capability
4. Mental/Psychological Stress
5. Lack of Knowledge
6. Lack of Skills
7. Improper Motivation

## *Practice and gain experience in a “safe” environment*

- Train operators
- Project specific simulations
- Support Engineering studies



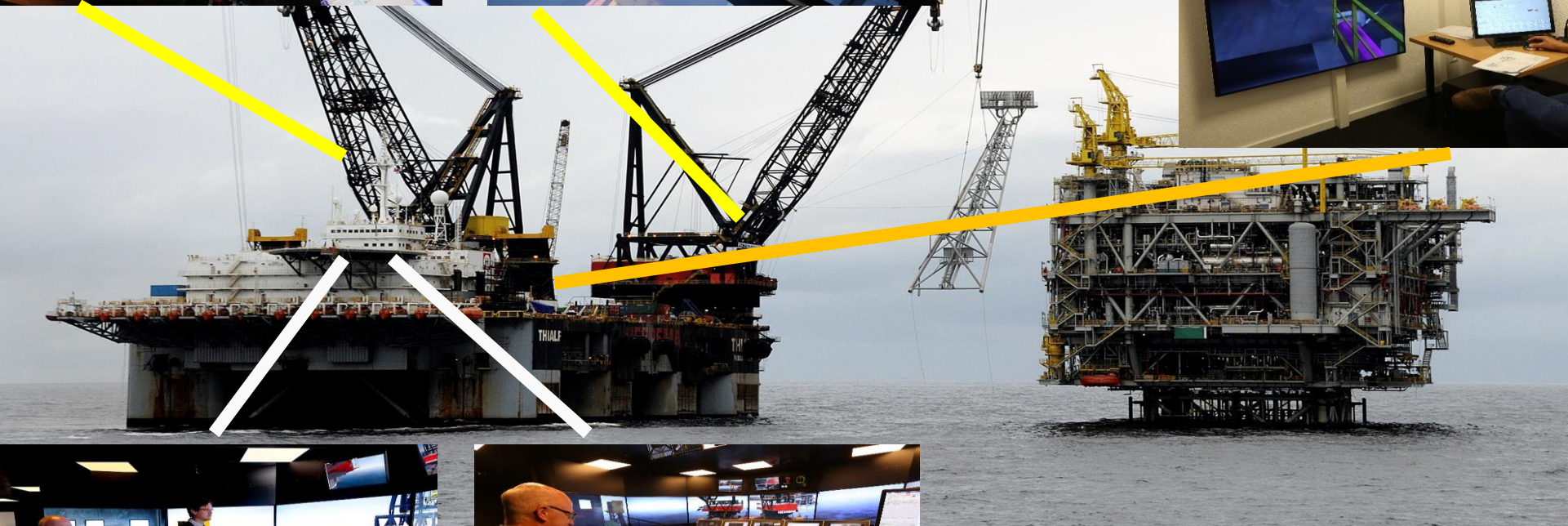
Project #1502510.35947

May 2015



Heerema Marine Contractors

# HEEREMA SIMULATION CENTER





# Simulation vs Reality – 1. Accurate controls





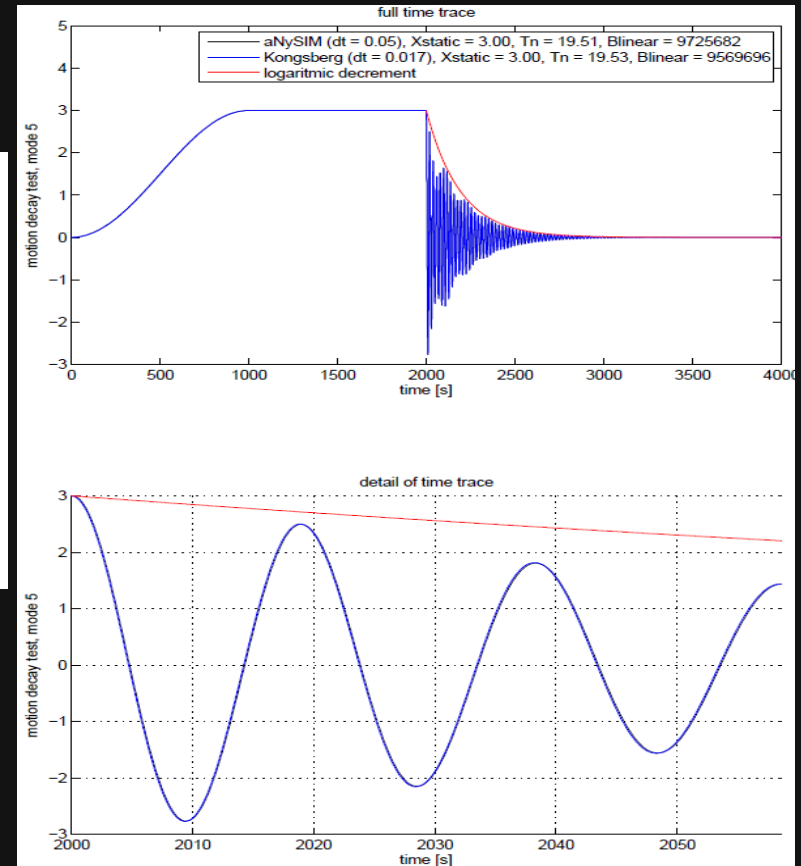
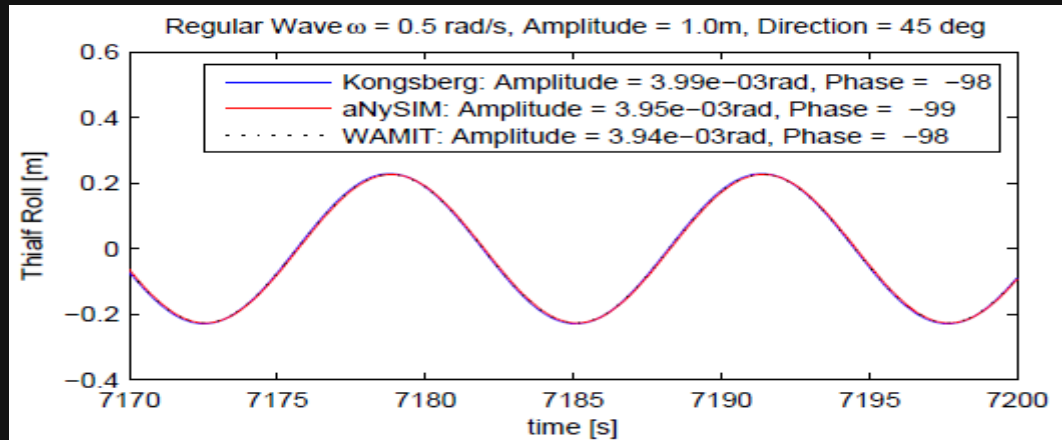




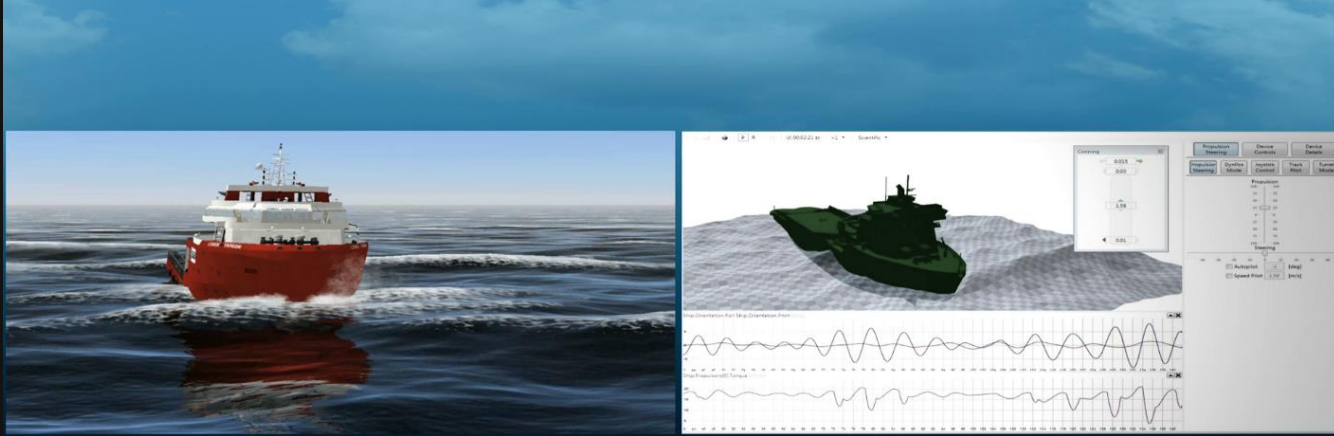
# Simulation vs Reality – 2. Accurate behavior of equipment



# Simulation vs Reality – 3. Accurate hydromechanics







Accurate hydrodynamic modelling



# Operator experience – training

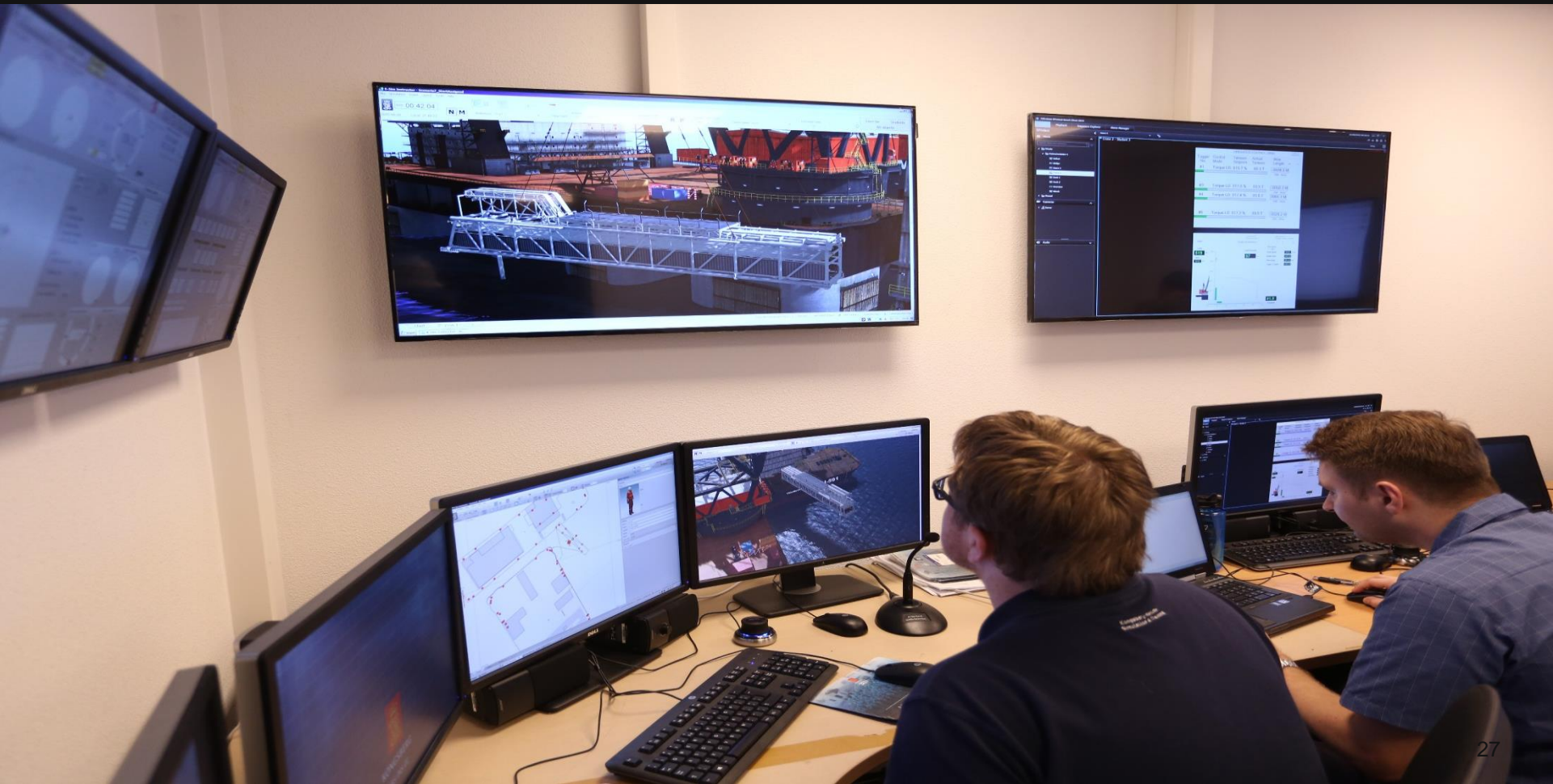




# Operator experience – knowledge sharing



# Operator experience – communication



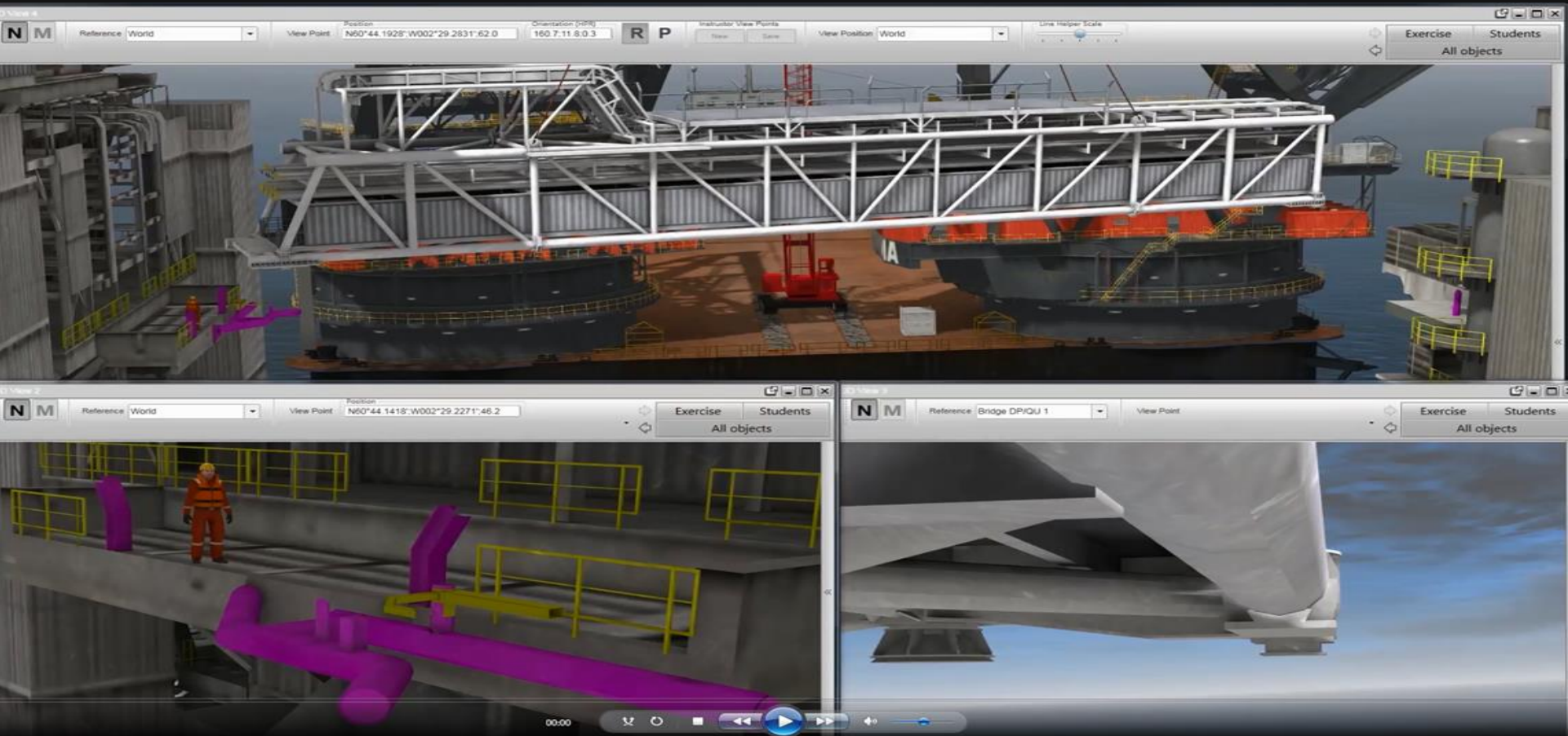


# Operator experience – offshore mindset





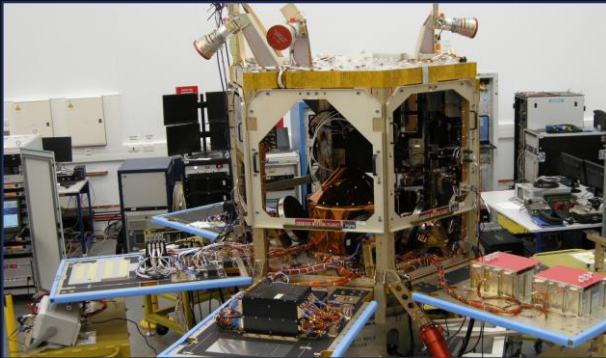
# Operator experience - Hazid



***Practice and gain experience  
in a “safe” environment***

# Simulations in Space & Offshore: Questions & Thank You

## 1. Hardware-in-the-Loop



Matthijs van der Kooij  
[m.vd.kooij@airbusDS.nl](mailto:m.vd.kooij@airbusDS.nl)



## 2. Operator-in-the-Loop



Catina Geselschap  
[cgeselschap@hmc-heerema.com](mailto:cgeselschap@hmc-heerema.com)

