# controllation

controllab

Knuckle Boom Crane Si

Scenario P + &

# From simulation to real value ! Designing the future with digital twins

### Who are we?

Christian Kleijn, Paul Weustink and Frank Groen all graduated from the University of Twente as engineers in Mechatronica and Control Systems.

Founded in 1995, **Controllab** is the university spin-off with a first assignment in the high-tech industry for OCÉ printers.

Huisman equipment was one of the first-movers in the offshore industry with a simulation assignment for a J-lay system.

### controllab



Now with over 150 years of in-house experience, we're known for building the highest quality simulation models and we can guarantee first-time-right delivery of your machine control software.



# High-Tech Systems

**Dredging** 

## **MARKETS WE OPERATE IN**



### Offshore

## **CUSTOMERS WE HAVE SERVED OVER THE YEARS**





testing Feasibility

**HIL-Simulation** testing control software **Training simulators** improve skills

### Hardware-In-the-Loop (HIL) Simulation

#### Your real machine



With HIL-simulation, a real machine is exchanged with a simulation model.

This allows us to **test the control system** of your machine. We will run all tests and **visualize your machine** under **real-world conditions.** 

## **HIL-SIMULATOR SETUP**



### **Delivered by Controllab**

#### PC:

Complete software package with accurate, physics based simulation and real-world scenarios.

#### **DISPLAYS:**

3D camera views of your machine, graphs with sensor and actuator data.

### **Reference project: DEME - BOOM LOCK**



The **Boom Lock** of **Deme** is a crane handling system for the safe and easy handling of wind turbine blades in high wind.

The control software will monitor the motion of the boom and hoist and run the tag lines automatically. This software was tested using a HIL simulator and delivered first-time-right.



### **Reference project: MARIN - TOWING TANK**



VSE was responsible for the retrofit of the electric drives and controls of the towing tanks of the Maritime Research Institute Netherlands (MARIN).

Using a HIL-simulation provided by Controllab, VSE tested the control software in advance. The retrofit was successfully carried out requiring 2 days less than planned.



## **Reference project: MACGREGOR – COLIBRI™**

### MACGREGOR

The **MacGregor Colibri™** is a double arm crane that can be placed on top of a knuckle boom crane to provide motion compensated cargo lifts.

Controllab provided a HIL-simulation model to develop and test the control system of the Colibri. The Colibri is now fully operational on more than 10 ships.



## **Reference project: TATA STEEL - STEEL CRANE**



For **Tata Steel** we have created a HIL-simulator to test the operation of their cranes in the BOS plant.

The HIL simulator is an important tool for testing and adjusting new software. It is used not only for the medium loading crane, but also for the initial testing of new software for other cranes in the plant.





### **Benefits of HIL-simulation**

- First-time-right operation of your control software at the FAT and SAT.
- Any real-world scenario can be simulated and test to verify your control software
- Test scenarios that are too dangerous or too expensive to do on a real machine.
- Get instant feedback on software failures and test fixes.
- Early approval of certifying bodies.



**Design & feedback** testing Feasibility

with real-world conditions





#### Assessment

What scenarios must be reviewed? Which standards and regulations?



#### **Simulation**

Validate, monitor and report operation & performance



#### **Design Alternatives**

Propose, test and validate performance of alternative designs

### **DEME - BOOM LOCK**



The **Boom Lock** of **Deme** is a crane handling system for the safe and easy handling of wind turbine blades in high wind.

The operation of the crane was simulated and showed a design flaw. Under some conditions the hoist block could get stuck. A redesign was made for the catcher and verified with simulations. The catcher was built and has operated without failures.



### **Copal - Container Unloading**



**Copal Handling Systems** develops containerunloading robots. The robots can unload containers automatically.

Controllab created digital twin of the C2 robot to analyze the movements under loads and accelerations.



### **MOTION COMPENSATED PILE GRIPPER**



For a China based customer, we have carried out a **feasibility study** for a motion compensated pile gripper.

The gripper was modeled to the specific requirements of the customer and coupled with models of the ship, crane and monopile.

Using simulations, the performance of the gripper was validated under all sea conditions. The performance was monitored using a set of variables (power, speed, accuracy).

### **SMST – MOTION COMPENSATED GANGWAY**





Controllab **designed** the motion compensation software for the Tab-M gangway of **SMST**.

The gangway is operated by gravity compensated luffing cylinders and a telescoping motor. Using a **digital twin** of the gangway coupled to the control PLC, Controllab tested the software under all conditions. This allowed us to ensure maximum safety and optimize the performance of the gangway.

Over 10 gangways are now in active service.



### **Benefits of design & feedback**

- Improve machine performance and operation using a real-world simulation model
- Design & control feedback / proposals of a full operational system, which can be assessed under exact same conditions (this includes drives, electric- & hydraulic actuators, sensors and full control software)
- Early involvement & (pre)approval of certifying bodies.



Training simulators improve skills

### **TATA STEEL - Steel Crane Simulator**



### TATA STEEL

**Tata Steel** was looking for a method to train 20 employees how to operate a **new steel crane**.

A training simulator was chosen because it would not interrupt the production process in any way and therefore also no off-hire costs due to this training.

Training on a simulators is much **more extensive** due to all the real-world scenarios that be simulated, of which some are practically impossible on a real machine.

During the early trials it was found that especially the emergency training was highly appreciated by operator and staff.

### **VAN OORD - Boat landing Tool Simulator**





**Van Oord** was in search for a method to reduce the stress levels of their boat landing tool (BLIT) operators.

A simulator for the tool was developed by Controllab and coupled to the controls of the real machine along with real-world scenarios.

The operators can now be trained on this simulated BLIT in scenarios they might encounter, giving them **more confidence** of running the actual machine.

### **ALLSEAS – Eagle access**





The **Eagle Access** is a remote-controlled passenger transfer system which delivers faster drop-offs and increases the deploy-ability of service vessels.

Controllab developed a training simulator, which allows crew and operator to be trained under various realworld conditions using the radio control unit.

Nowadays these operators are fully confident while standing on deck and operating the machine in a safe and controlled way.

### **ADANI - Cutter Suction Dredger**



# adani

**ADANI** was looking for a portable simulator that can be used in their office and on-board of their vessels.

The simulator, which is developed and built by Controllab, teaches operators the basics of the dredging process on a Beaver class cutter suction dredger.

The starting point of this training is focusing on the economy-side of the dredging process and next to that a strong focus on safe working + damage prevention.

### **ALLSEAS - Game Based Simulator**



**A**llseas

Controllab developed a training simulator for Tensioner operators from **ALLSEAS**.

The simulator is game based, which ensures a more intuitive approach.

Trainees learn to operate a tensioner by playing levels. After each successful level played, a new level will present more difficult operations.

Trainees "play" the game until they completely master the machine and **ready for working safely** on the real machines.



### **Benefits of Training Simulator**

- A mobile- and real-world training simulator can be used in various processes:
  - Initial assessment of your operator (e.g. during application)
  - Operational training (confidence)
  - Safety training (simulate emergency scenarios)
  - Certifying bodies assessments
- Increase efficiency on your real machine
- No risk of damaging the real machine.

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Start the voyage www.controllab.nl info@controllab.nl