



Mobatec
model-based technology

Brief history of Mobatec

- **2005:** Mobatec founded. Initiative of:
 - Jan Laurens
 - Chemical Engineer, specialist in modelling, polymers
 - Equation Solver
 - Mathieu Westerweele
 - PhD in dynamic modeling
 - Equation Generator
- **2005 - 2012:**
 - Just 2 people
 - Focus: models, consulting, software development
 - Mathieu → coordinator Post-Master Program: PPD
- **2012 - present:**
 - Larger projects => Growth

Mobatec provides:



Mobatec Modeller

State of the art
Dynamic Modelling
Environment



Modelling consultancy and assistance

Model building
Model debugging
Engineering



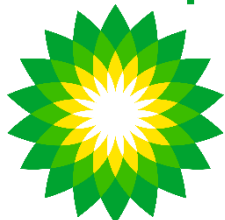
Operator Training Systems

Real time operator training
Control systems testing
MobaTAGnology

Some of our Customers within Process Industry



bp



bodec



PLUKON
food group



Carlsberg

HUNTSMAN

Enriching lives through innovation

lyondellbasell



TATA

سابك
sabic



DAMEN

TU/e Technische Universiteit
Eindhoven
University of Technology
Where innovation starts

Stamicarbon
pure knowledge



nyrstar
Resources for a changing world



SIEMENS



Why Process Modelling?

$$\frac{\partial C_{i,l}}{\partial t} = \left(\frac{1}{r^2} \cdot \frac{\partial}{\partial r} \cdot \left(r^2 \cdot \varepsilon \cdot D_{r,l} \cdot \frac{\partial C_{i,l}}{\partial r} \right) \right) + \sum_{j=1}^n (v_j \cdot R_{r,j})$$



Unit & Process
Model Based Innovations



Dynamic Simulation
Process Analysis



Real Time
Training Simulation



Process Control
Optimal Set-Up

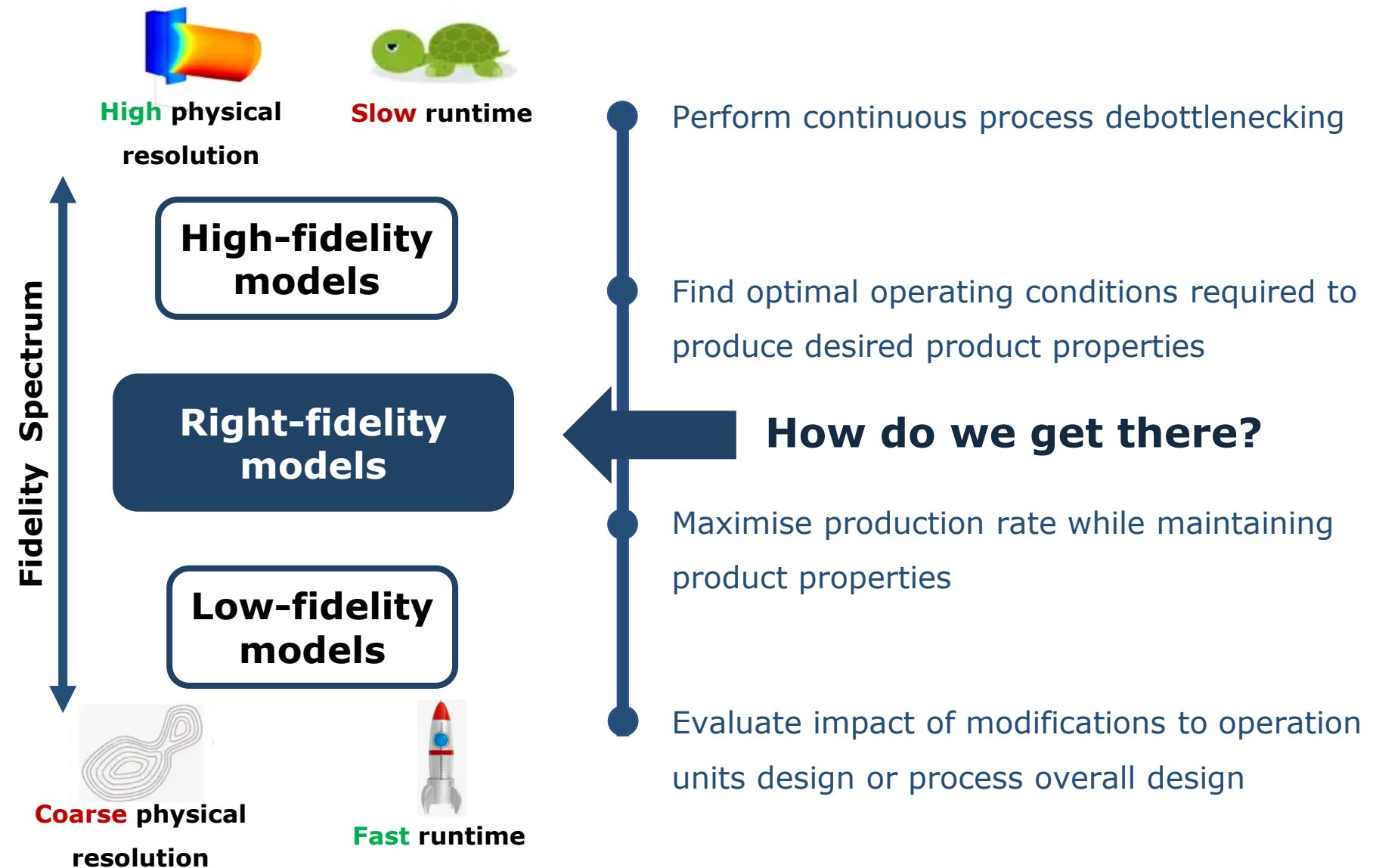


Operational Procedures
Testing & Optimization



Unit & Process
Safety

Why make high (right)-fidelity custom models?



How to Construct a Model



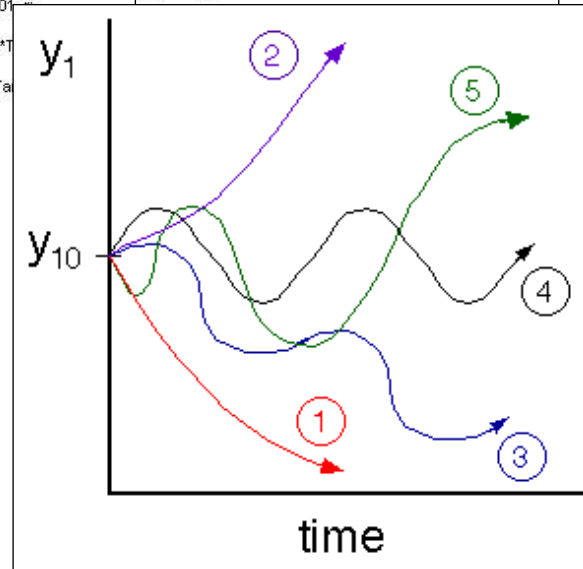
```

/* System Equations: */
/* System Tank (3) */
/* Balance Equations */
pivot = Tank_n_OH;
d(Tank_n_OH)/dt == AcidFlow_Fn_OH + BaseFlow_Fn_OH - Outlet_Fn_OH - Overflow_Fn_OH + Tank_r01_r;
pivot = Tank_n_H2O;
d(Tank_n_H2O)/dt == AcidFlow_Fn_H2O + BaseFlow_Fn_H2O - Outlet_Fn_H2O - Overflow_Fn_H2O - 2*T;
pivot = Tank_n_H3O;
d(Tank_n_H3O)/dt == AcidFlow_Fn_H3O + BaseFlow_Fn_H3O - Outlet_Fn_H3O - Overflow_Fn_H3O + Tank_r01_r;
/* Algebraic Equations */
pivot = Tank_nt;
Tank_nt == (Tank_n_OH + Tank_n_H2O + Tank_n_H3O);
pivot = Tank_V;
Tank_nt == Tank_Dn * Tank_V;
pivot = Tank_Cn_OH;
Tank_n_OH == Tank_Cn_OH * Tank_V;
pivot = Tank_Cn_H2O;
Tank_n_H2O == Tank_Cn_H2O * Tank_V;
pivot = Tank_Cn_H3O;
Tank_n_H3O == Tank_Cn_H3O * Tank_V;
if (Tank_Cn_H3O > 1.0E-14)
{pivot = Tank_pH;
Tank_pH == -log10(abs(Tank_Cn_H3O));
}
else
{pivot = Tank_pH;
Tank_pH == 14.0;
}
pivot = Tank_L;
Tank_V == 1000 * Tank_L * 3.141592653589793 * Tank_d * Tank_d / 4;

/* Reaction Equations in Tank (3) */
/* Reaction 1 (2 H2O <==> H3O + OH) */
pivot = Tank_r01_r;
Tank_r01_r == Tank_r01_k * (Tank_Cn_H3O * Tank_Cn_OH - Tank_r01_kw);
    
```

$$H_{Rx}(r_A V) - [UA(T - T_o)]$$

$$A] + r_A V$$





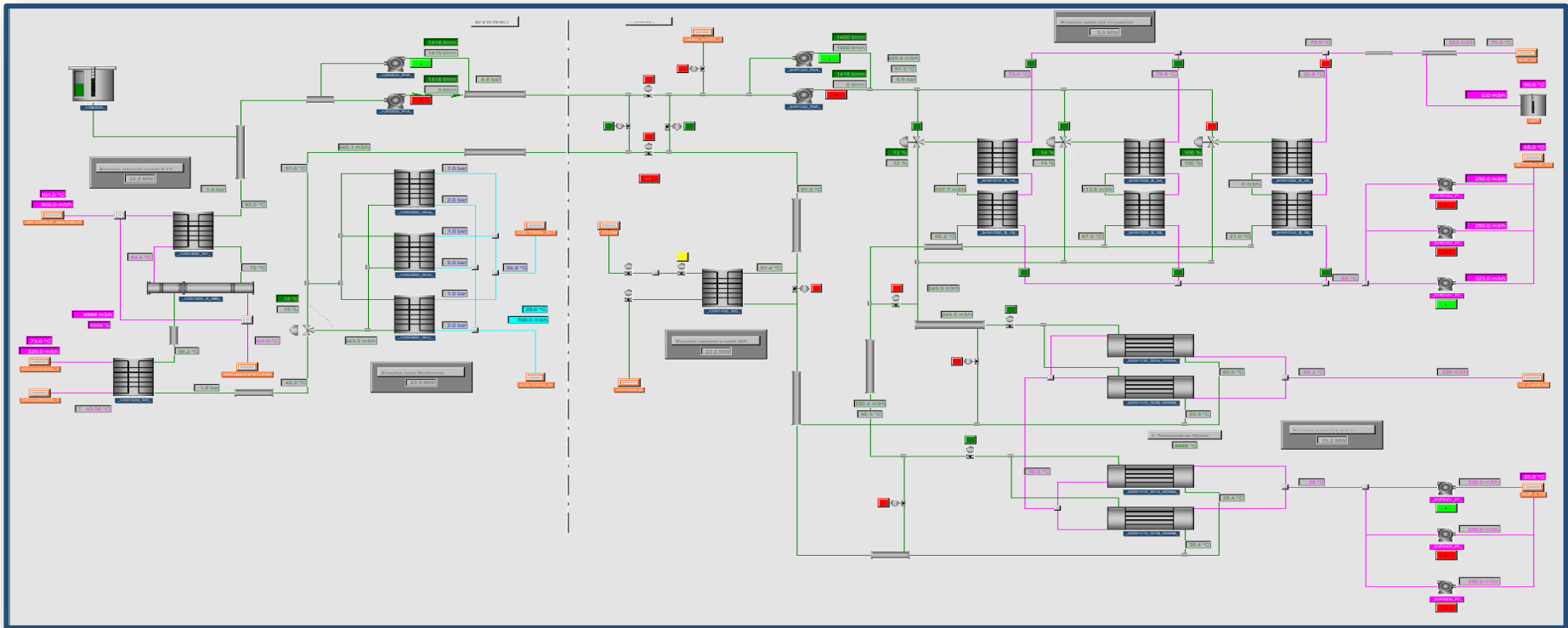
Mobatec Modeller

Examples

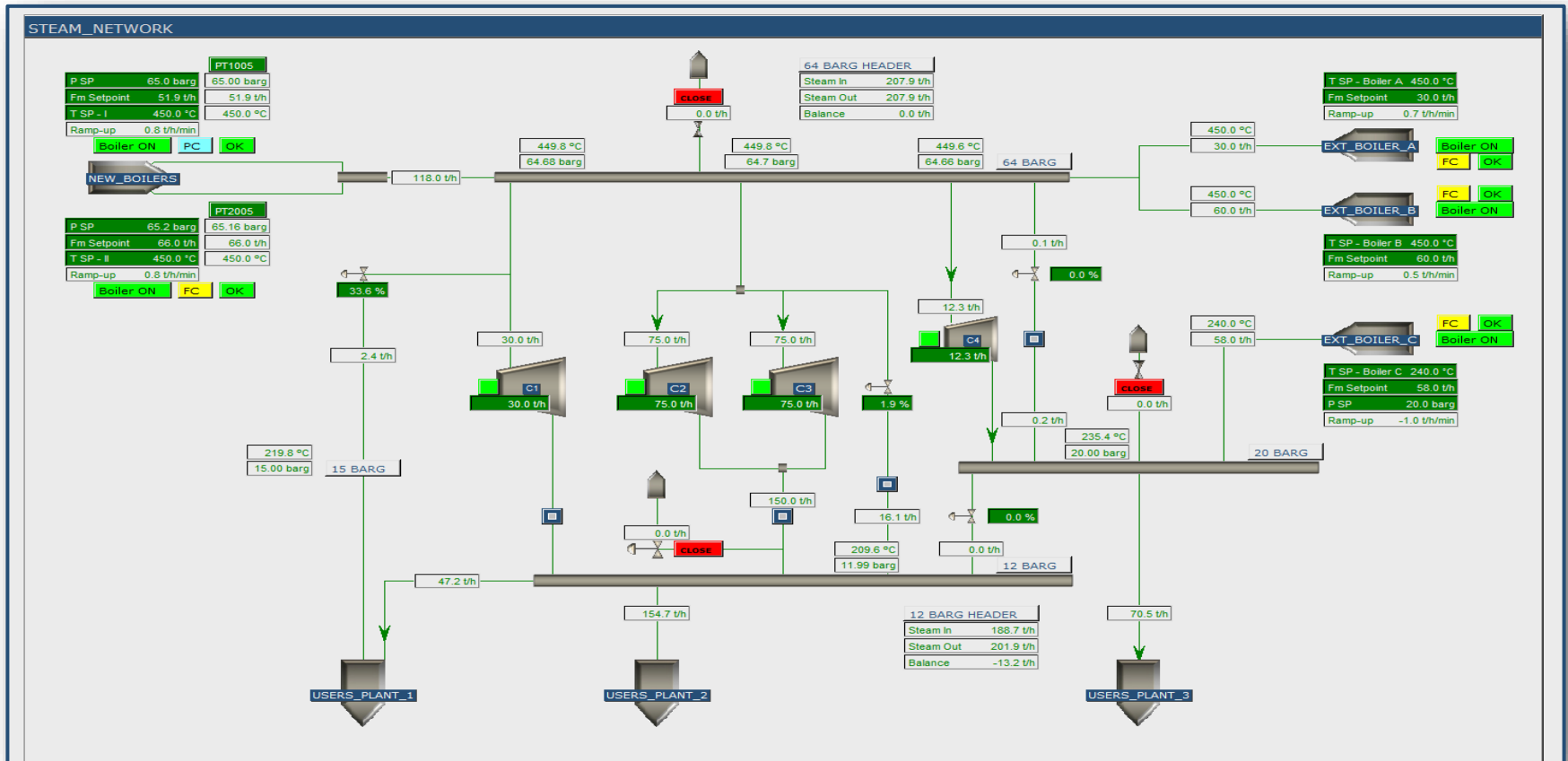
The image shows a woman pointing at a computer monitor displaying the Mobatec Modeller software interface. The software window is titled "Mobatec Modeller" and features a menu bar (File, Edit, Tools, Window, Help) and a toolbar. The main workspace displays a complex process flow diagram with various unit operations and streams. The Properties Browser on the left lists categories such as General, Advanced, Insert Objects, Model Generation and Compilation, Selected Object, System, Connection, Physical Topology, Species Topology, Equations, Parameters, Initial Values, Thermo, Repetitive Structures, Graphics, Text, Button, Value Object, and Preferences. The Properties panel on the right shows a list of connections and a section for equations and variables, which is currently displaying a green checkmark and the text "Equations and Variables OK". The woman is pointing at this section.

Simulation Time: 509.20

Examples



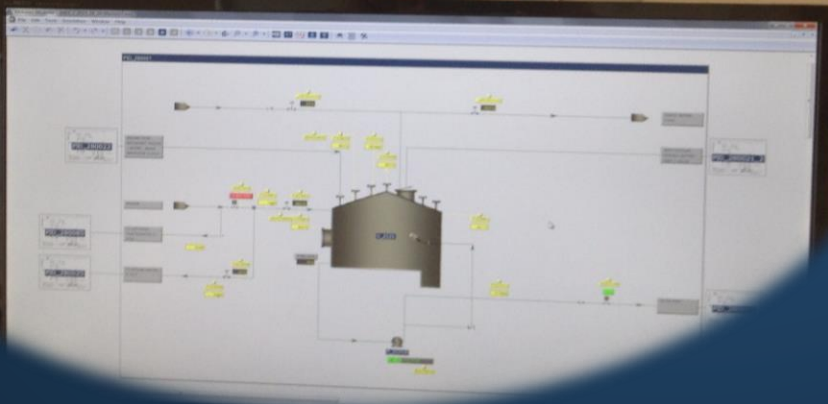
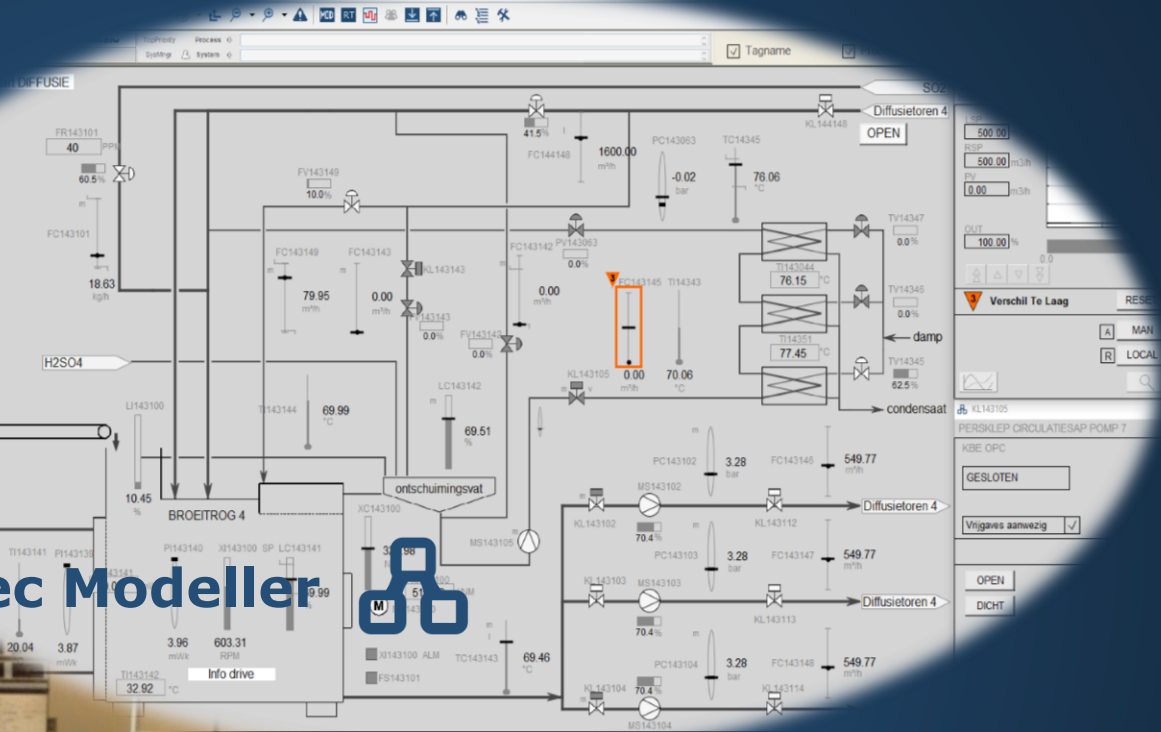
Examples



Operators Training



Mobatec Modeller



Business Case Training simulator

History of most chemical plants

- Built 25 – 50 years ago
- First years exposed to many up sets:
 - equipment failures
 - disturbances from the outside world
- From start-up: low degree of automation

Result

- A lot of hands-on experience

Chemical process industry today

Smooth operation

- Less disturbances
- Greater intervals between maintenance shut downs
- Higher degree of automation

Result

- Lack of hands-on experience

And

- Operating window smaller
- Automation paradox

We expect

- Same professionalism as before

What will be happening?

Soon

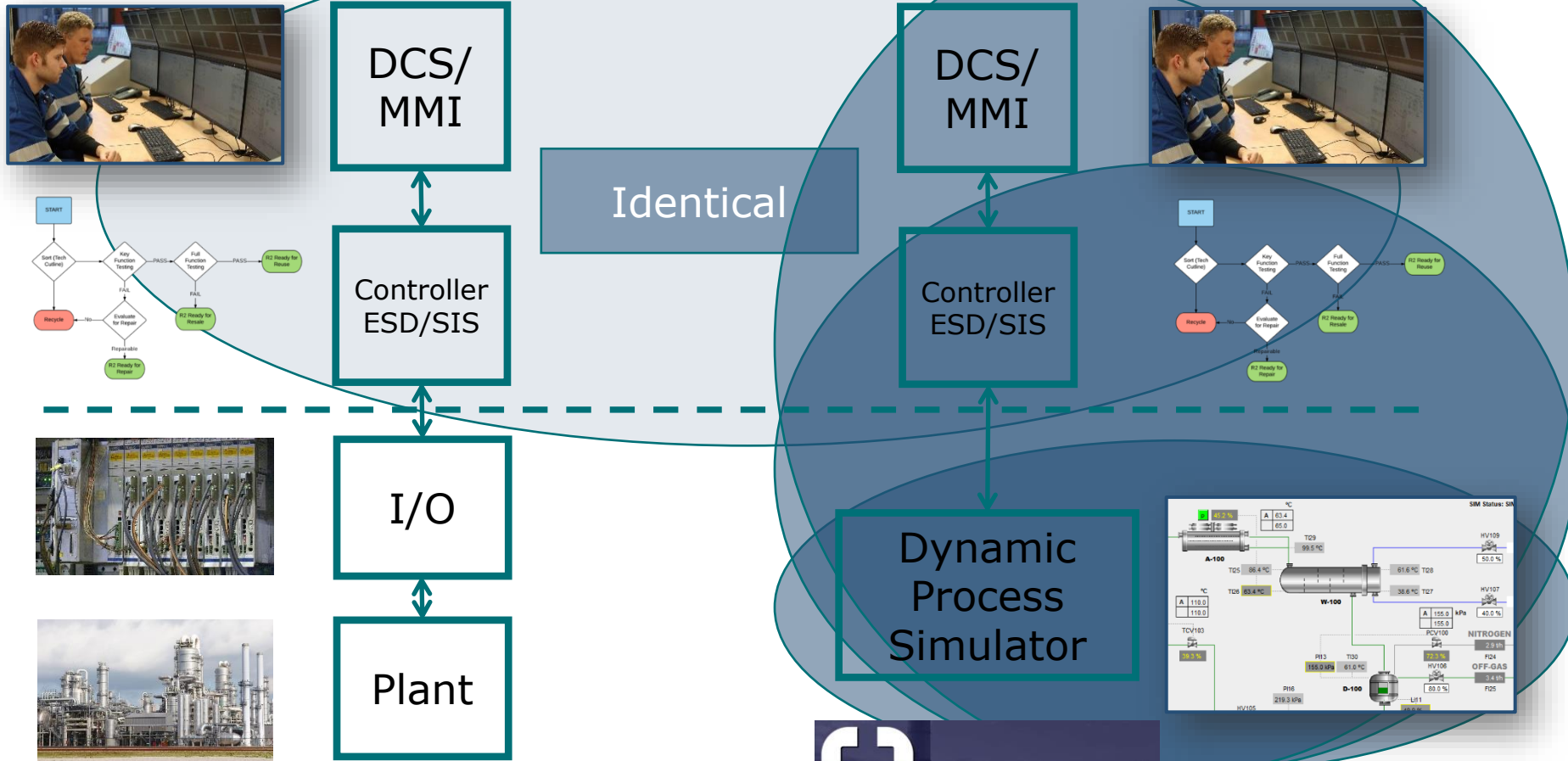
- Experienced operators will retire
- New operators hardly exposed to abnormal situations
- New operators scarce

Society

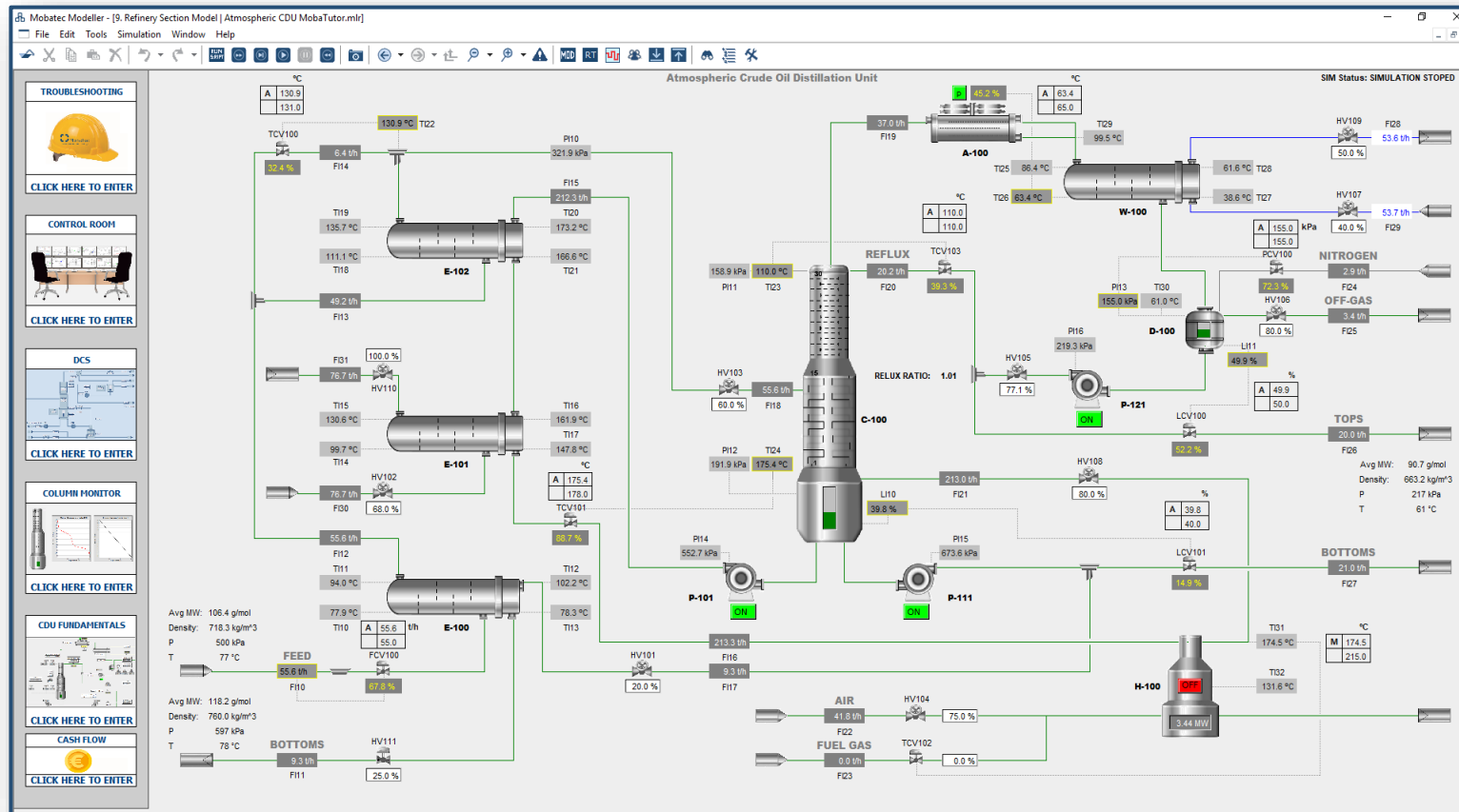
- License to Operate not for granted
 - operator certification
- Companies need to show what they are doing
- Be an attractive and responsible employer:
 - give the operators the right tools

Installation / Plant

Digital Twin (e.g. for OTS)



Simulator Elements



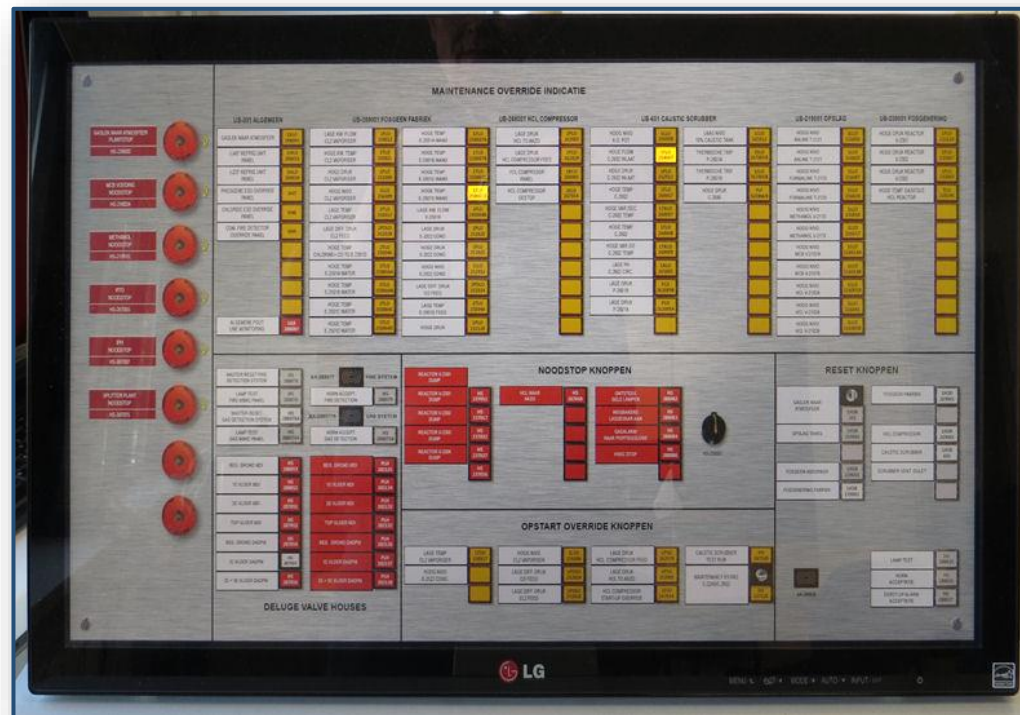
Dynamic Process Model

Simulator Elements



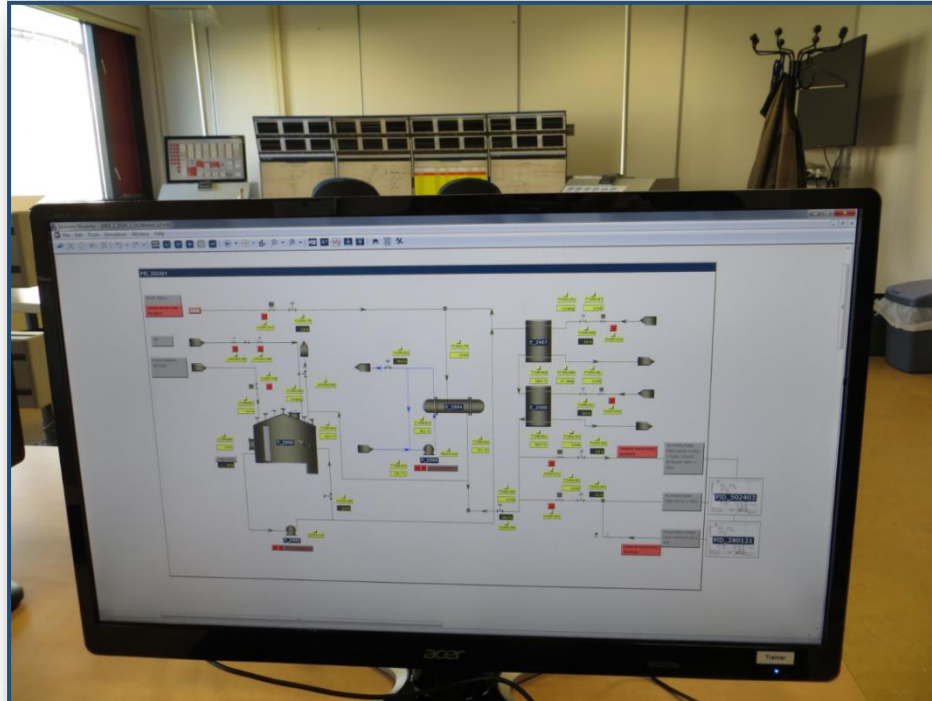
Distributed Control System

Simulator Elements



Push Button Panel

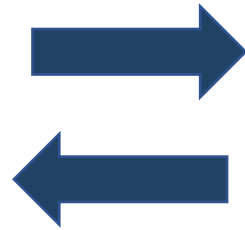
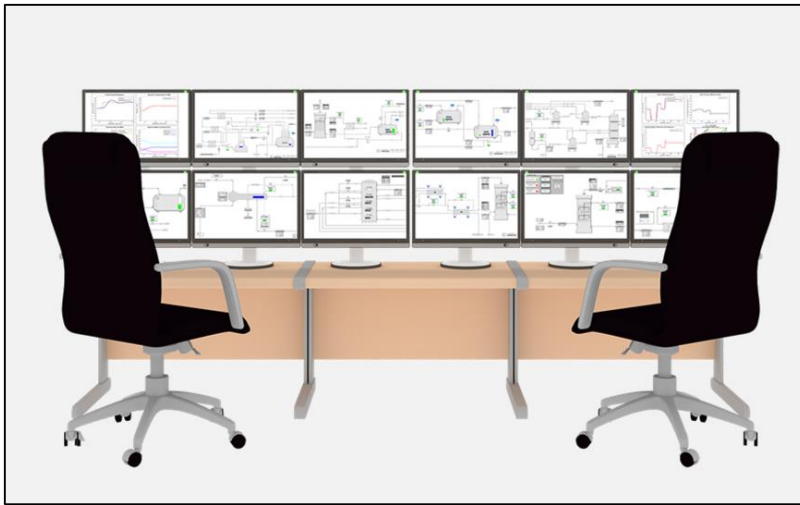
Simulator Elements



Instructor Panel



Field Operations

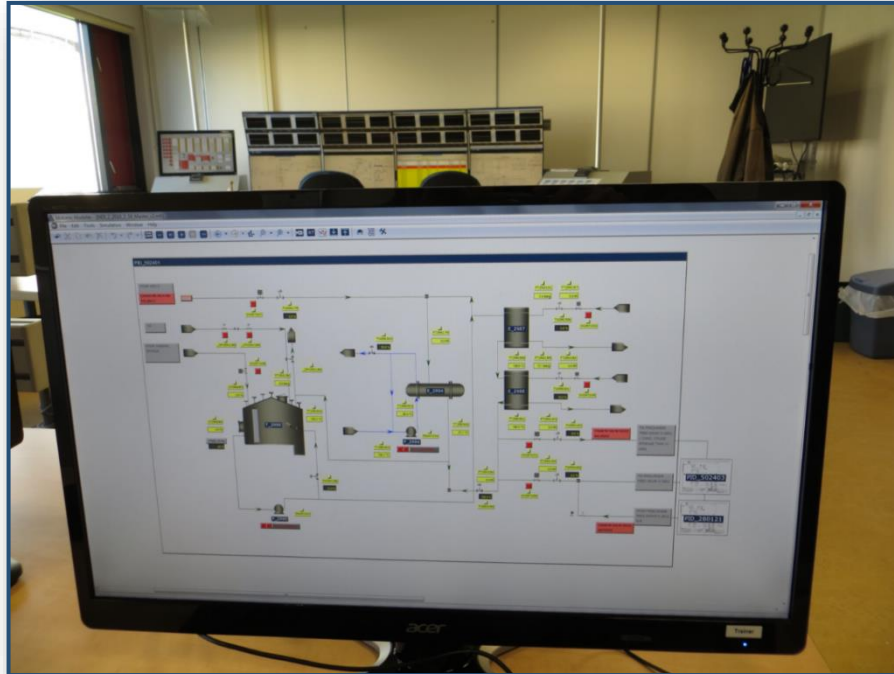


Missing Element (so far) !



Field Operator Involvement in Training

“Solutions” to involve Field Operations

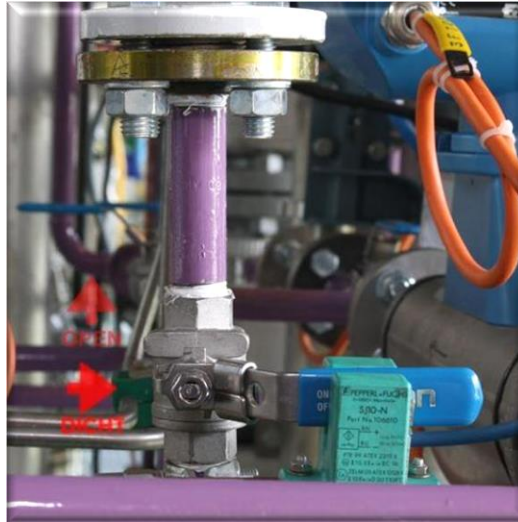


Trainer “is” Field Operator

“Solutions” to involve Field

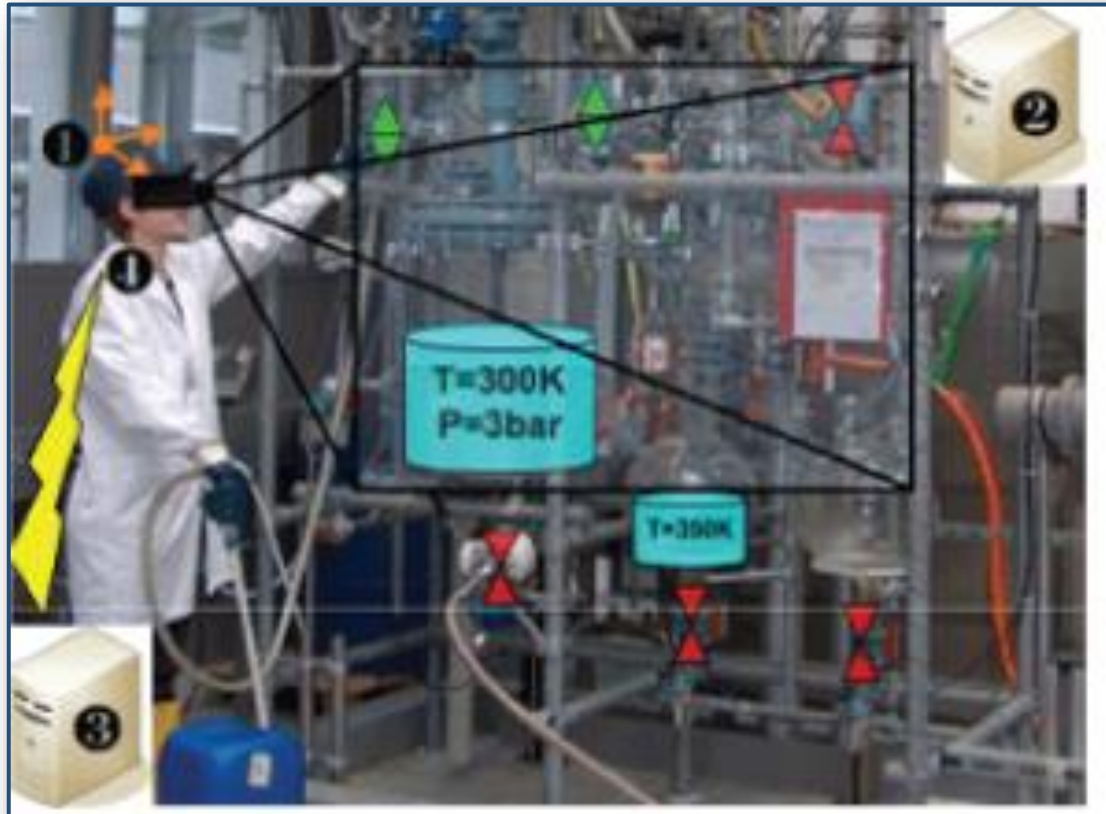
Link to 3D environments

“Solutions” to involve Field Operations



Interactive Photographs of Field

Why not use the Real Plant ?



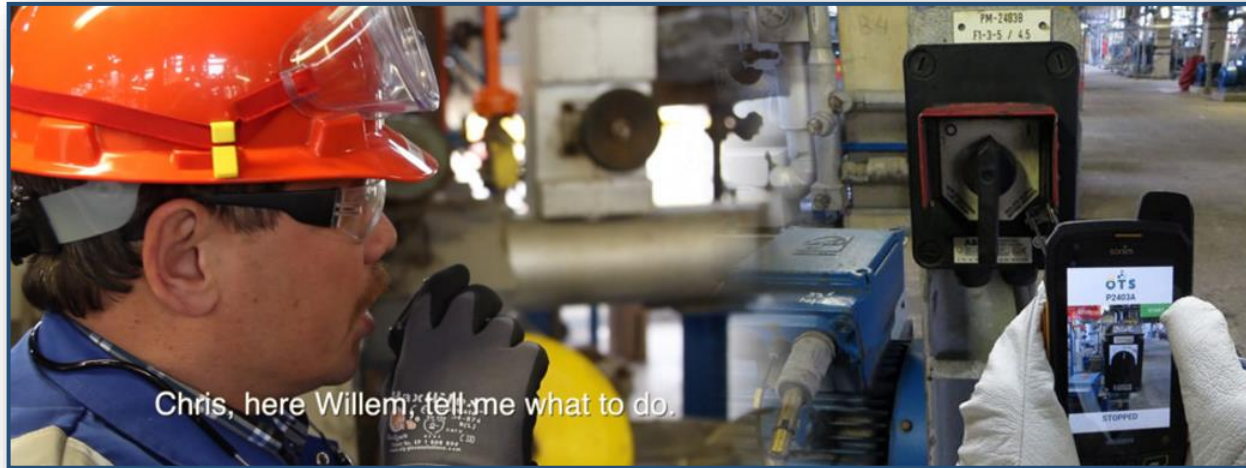
Augmented Reality

Field-operator activities in the simulator



Go to <http://mobatec.nl/tagnology> and play the video

From the Huntsman video



The simulated pump in the OTS can only be operated when the ATEX smart device is close to the real pump in the real plant. The real pump remains unaffected.

From the Huntsman video



Valves can be opened and closed while sliding a ruler to control the speed.

From the Huntsman video



The simulated pressure will be shown on the ATEX smart device only when in the neighborhood of the real pressure gauge.

Field-operator activities in the simulator



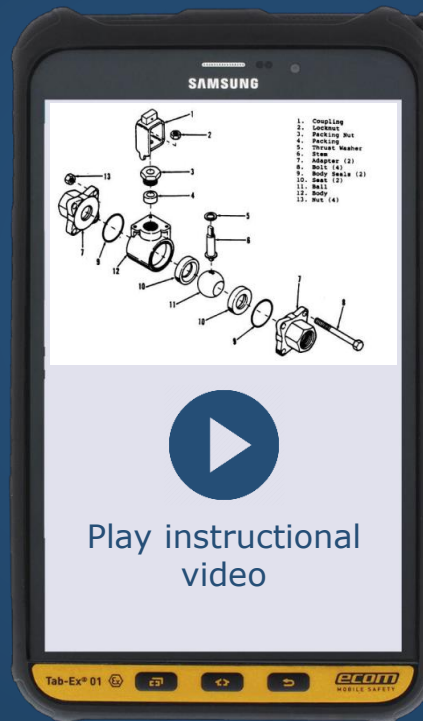
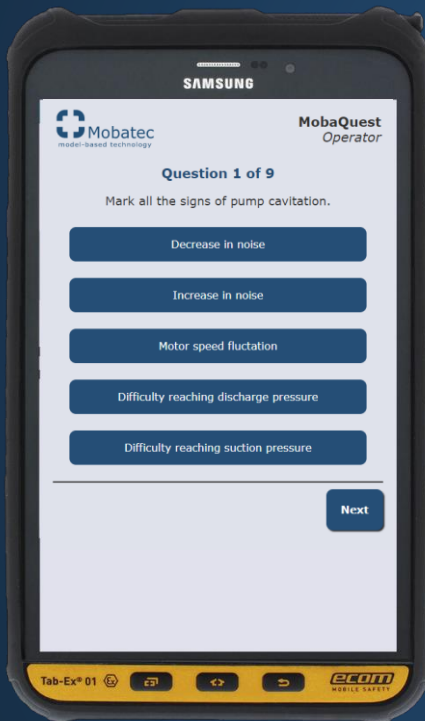
Field-operator activities in the simulator



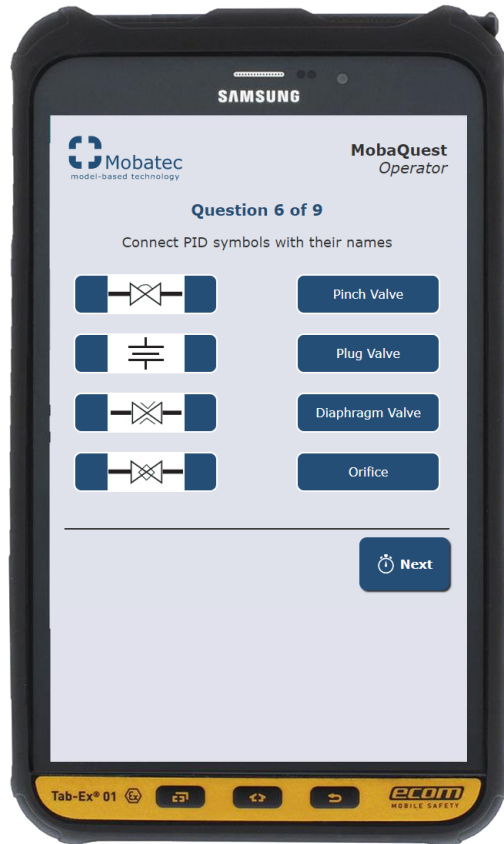
Operations Support



Platform that offers operators everything they need on-site.



Knowledge check



The problem

- ☐ Lack of time for training sessions
- ☐ Operating window becoming smaller
- ☐ Experienced operators retiring

The solution

- ☐ **Constant knowledge checks**

Have your operators knowledge checked by tests **tailored** to your plants specific operations.

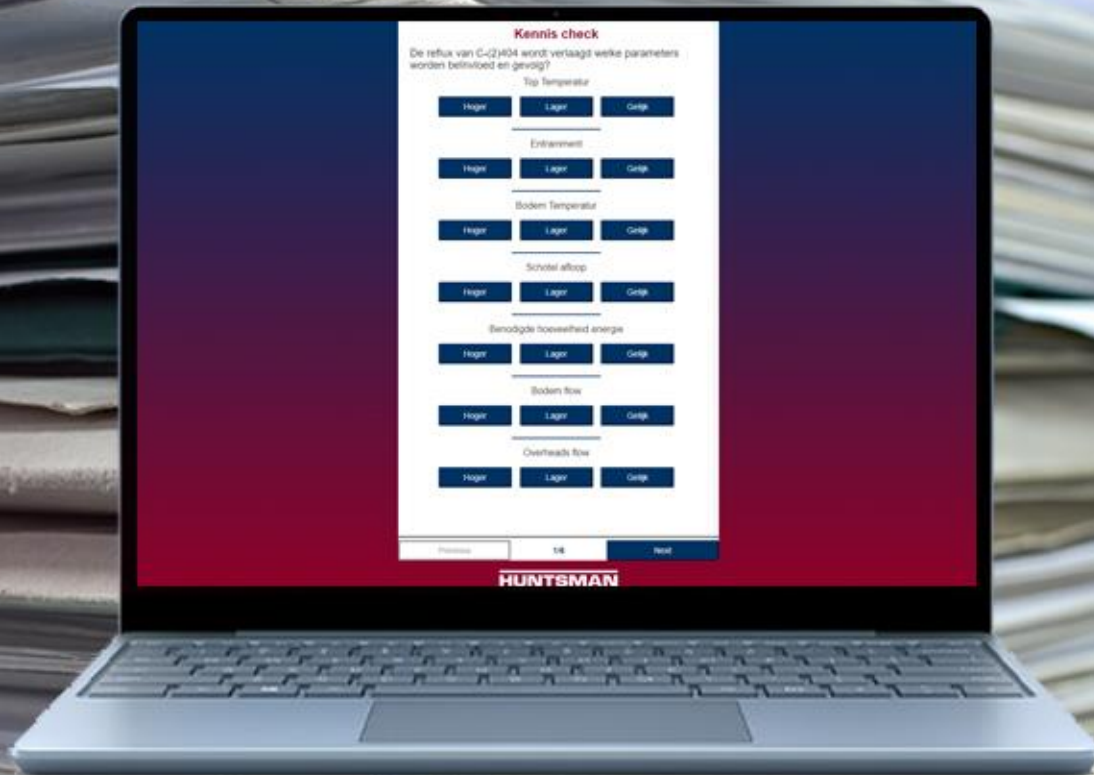


Mobatec
model-based technology

MobaQuest

Digitize your knowledge

No more pen and paper.
Conserve resources by digitizing



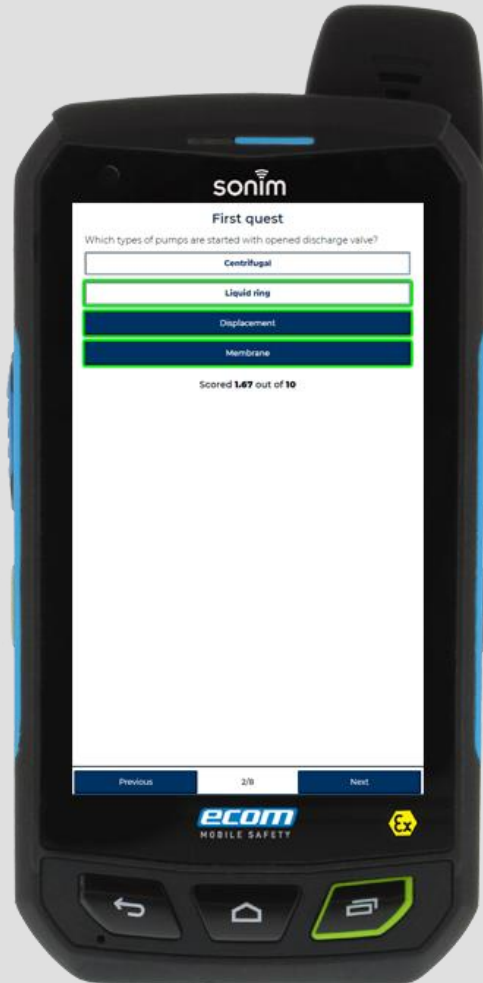
No classrooms needed.

Test operators on any device on any location



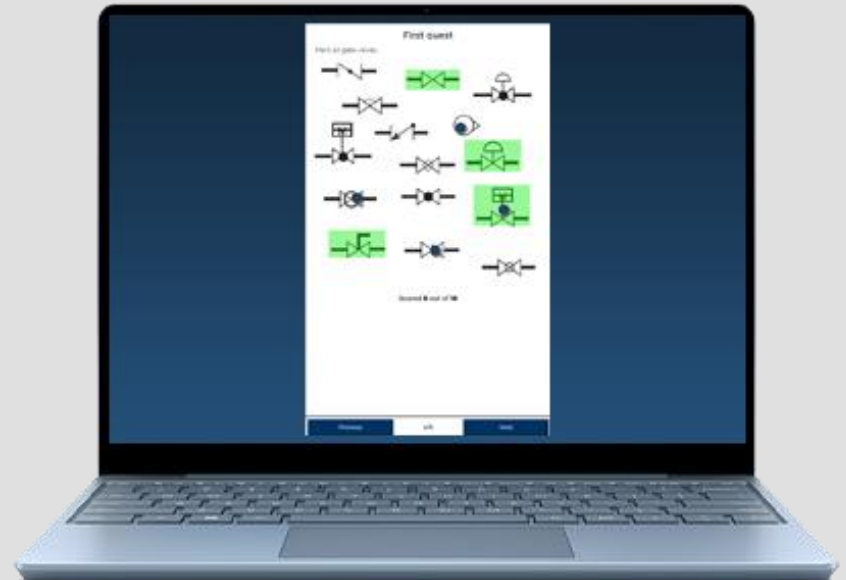
Automatic grading.

Operators know where they made mistakes instantly and know how good they did.



Automatic grading.

Instructors don't need to take time to grade the tests, they can focus on other stuff.



A better testing environment.

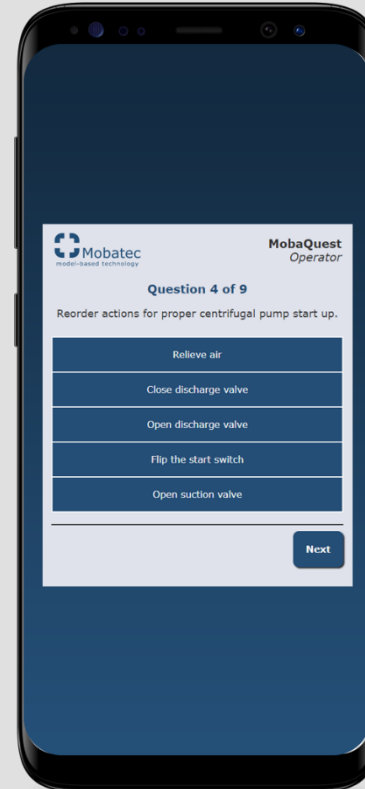
Multi choice



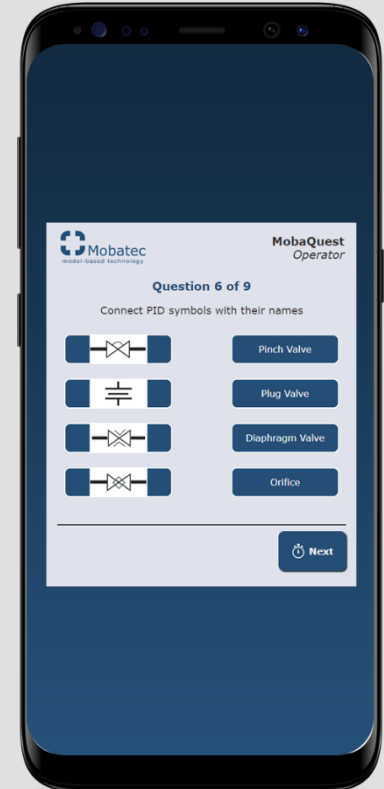
Tap on image



Reorder actions



Connect the dots



Any interface that is needed can be developed for you quickly

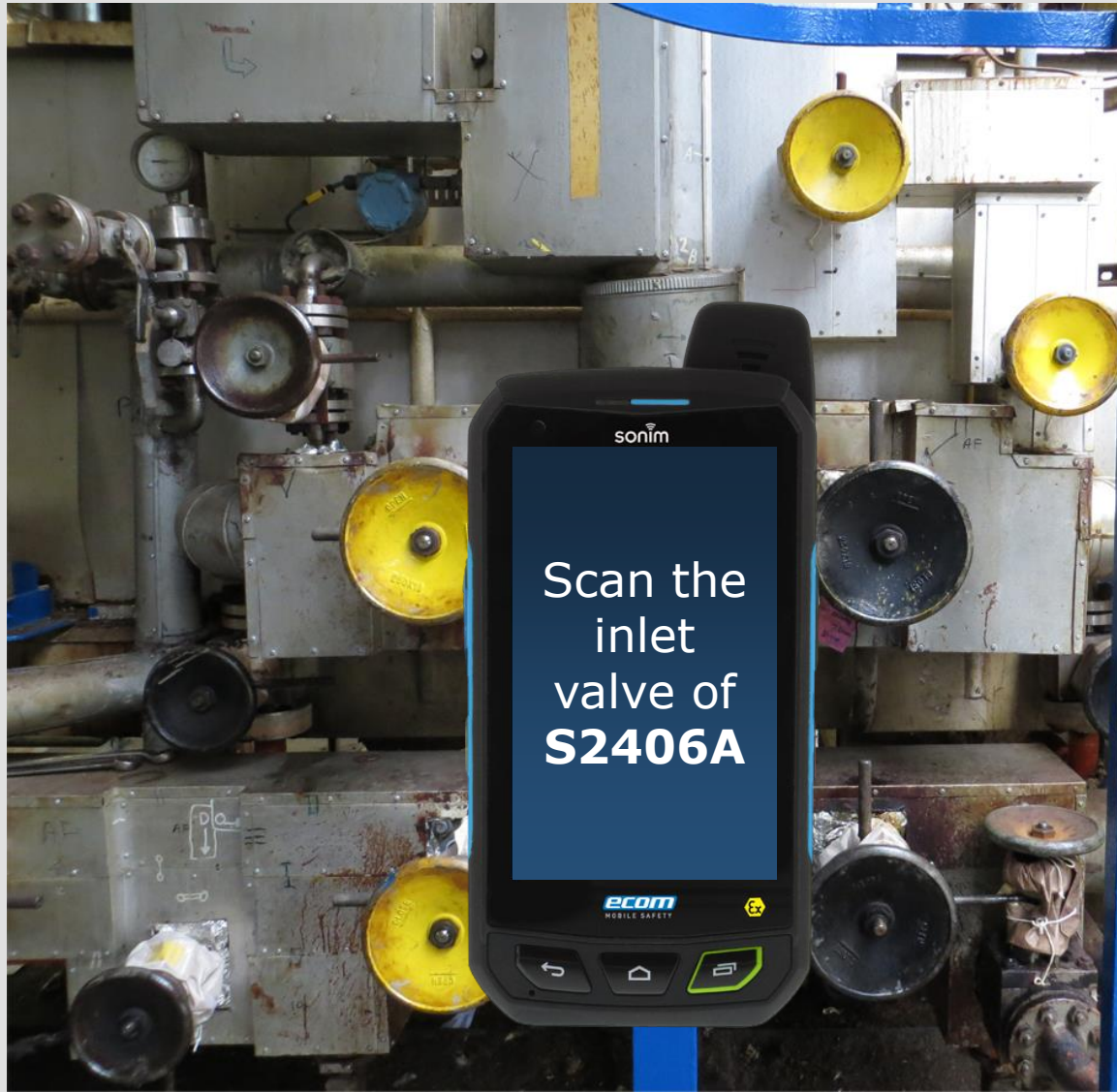
A better testing environment.

Pop up questions during a video



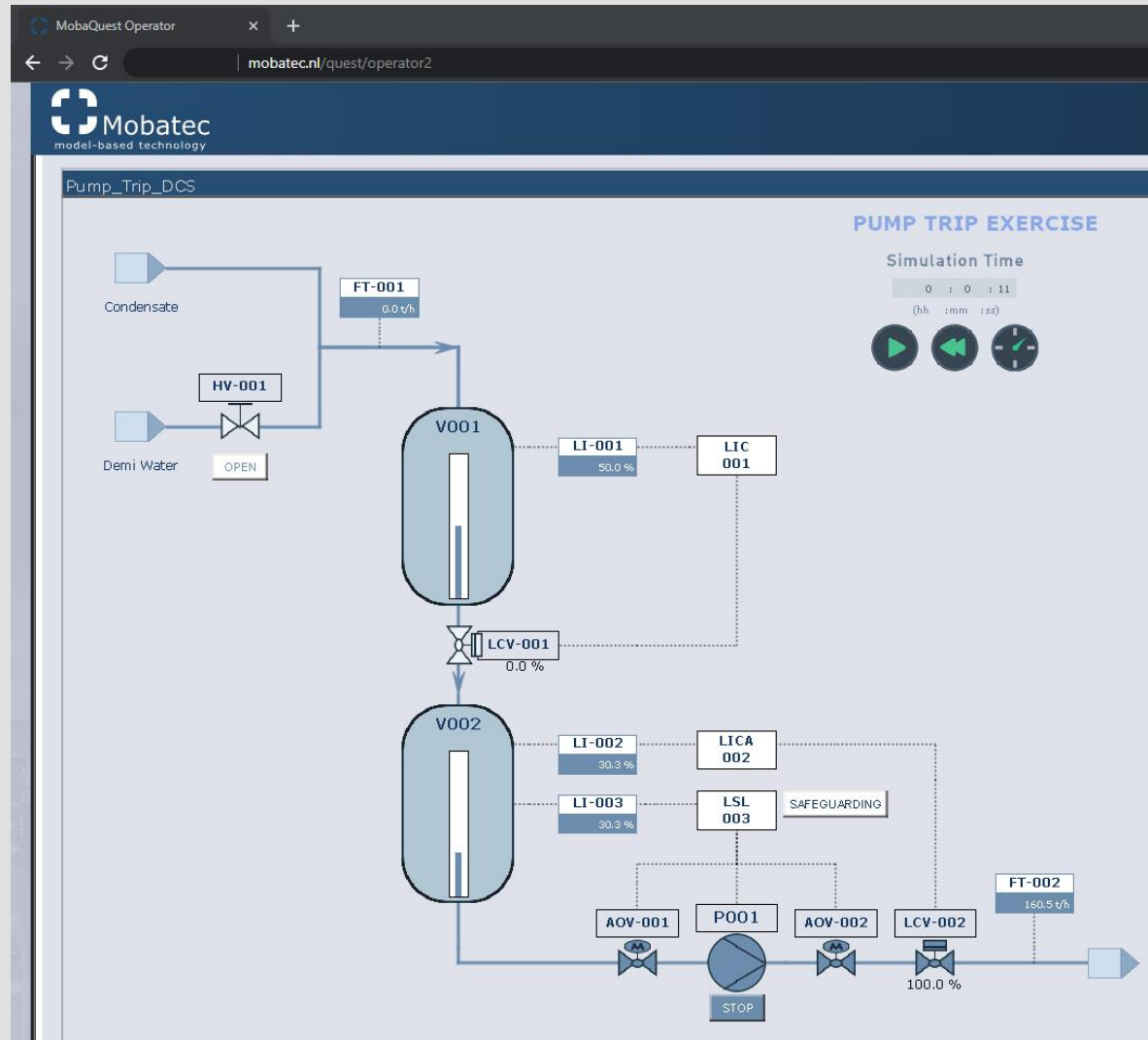
A better testing environment.

Location questions with MobaTAGS (find stuff in the plant)

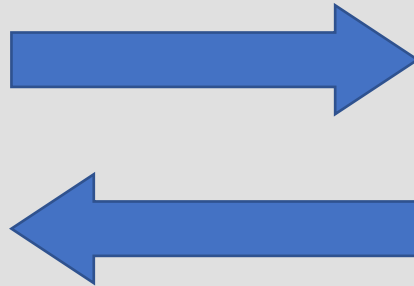


A better testing environment.

Simulation questions (operator response on the DCS)



Simulation questions (operator response on the DCS)



No more test organization.



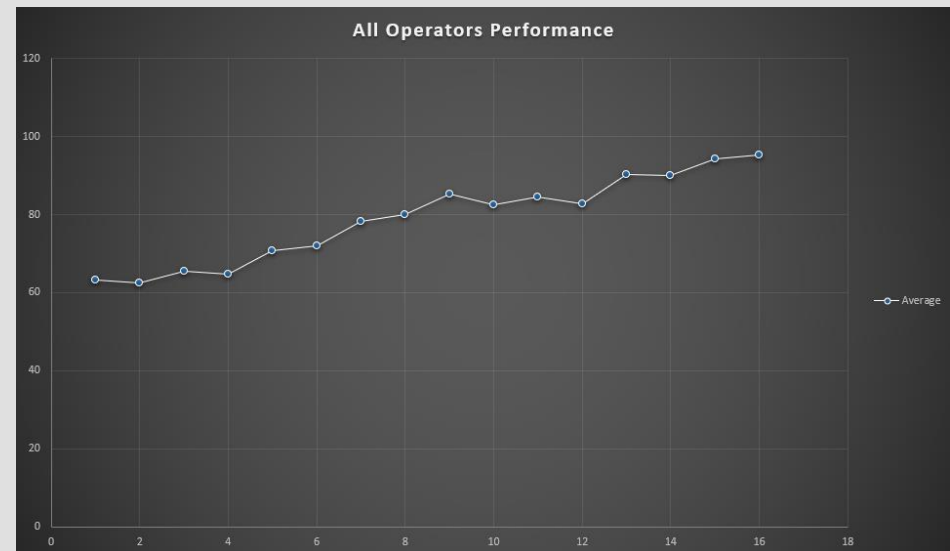
Do these
tests



Do other
tests



Track the knowledge improvement of your staff



Demo

www.mobatec.nl/quest/operator

E-mail notification system

The screenshot shows an Outlook email client interface. The top bar includes a search box and navigation tabs: File, Home, Send / Receive, View, and Help. Below this is a ribbon with various actions like New Email, New Meeting, Delete, Archive, Move, Reply, Reply All, Forward, and Move to. The left sidebar shows the 'Favorites' section with links to Inbox (258), Sent Items, Drafts, and Deleted Items (69). Below this is the 'milos.ivankovic@mobatec.nl' account section, also showing Inbox (258), Drafts, Sent Items, Deleted Items (69), Archive, and Clutter. The main pane displays a list of emails, with the selected email from 'MobaQuest' expanded. The email content includes the MobaQuest logo, the sender's name and email address, the subject 'An operator did a test', and the body text 'Willem Lans scored 100 points on a fire hazard test.' At the bottom of the email content are two buttons: 'Review test' (dark blue) and 'Certify' (green).

File Home Send / Receive View Help

Search

New Email New Meeting Delete Archive Move Reply Reply All Forward Move to: ? Unread/ Read

✓ Favorites

- Inbox 258
- Sent Items
- Drafts
- Deleted Items 69

✓ milos.ivankovic@mobatec.nl

- Inbox 258
- Drafts
- Sent Items
- Deleted Items 69
- Archive
- Clutter

> Conversation History


- Junk Email [1]
- Outbox
- RSS Feeds

> Search Folders

✓ Groups

You have not joined any groups...

MobaQuest Notification System



MobaQuest <mobaquest@huntsman.com>

Subject: An operator did a test

Willem Lans scored 100 points on a fire hazard test.

[Review test](#) [Certify](#)

Integration with any existing system OTS, ERP etc.



Do everything yourself

An interface is provided such that all can be done within your company

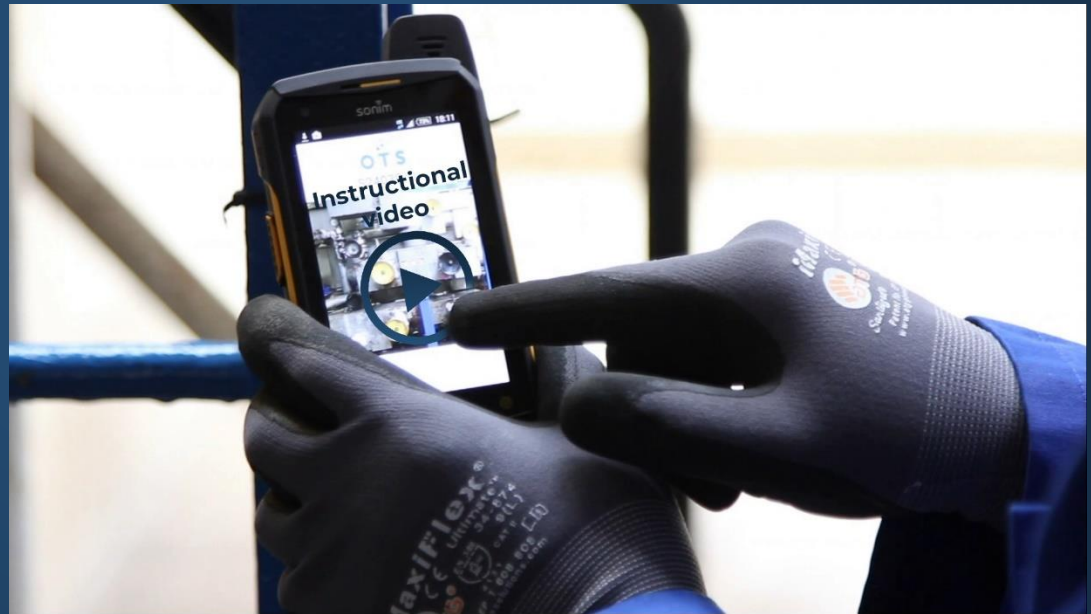
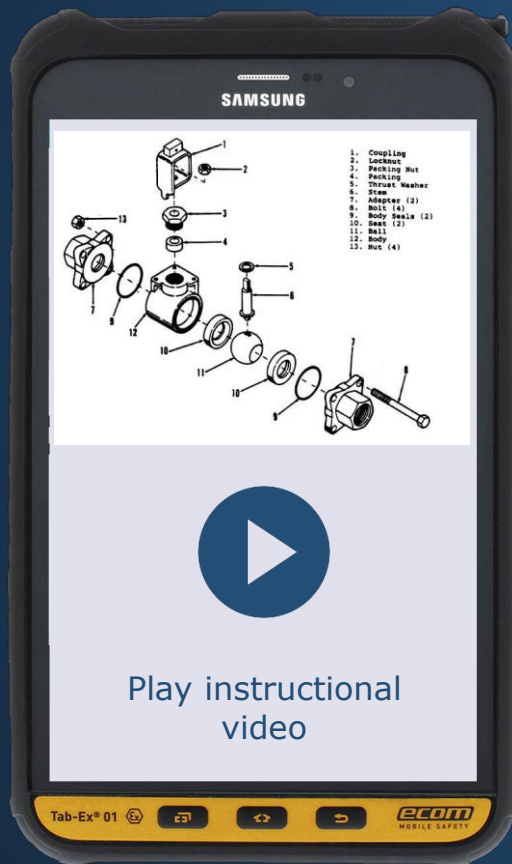


Bonus feature:

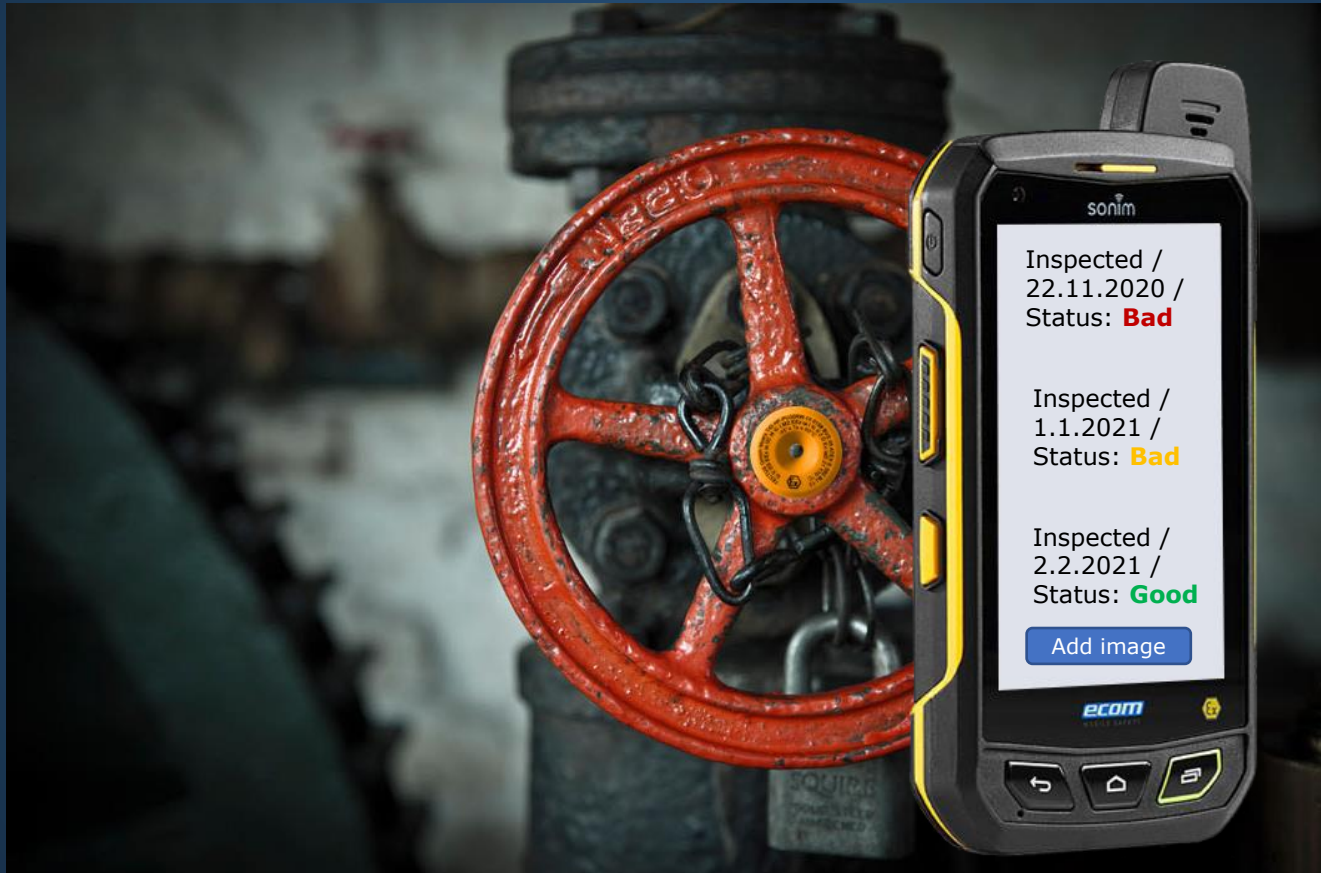
Offer field operators everything they
need on-site

Instant multimedia in the field

Assembly videos. Images, to do lists which lower maintenance time and work needed



Instant historical data in the field



Operational tools

❑ Field Instructions

Provide operational tips and instructions during operation to minimize errors and losses (i.e. list actions of a specific pump start up, filter bypassing procedure, video on proper compressor start up etc).

❑ LOTO

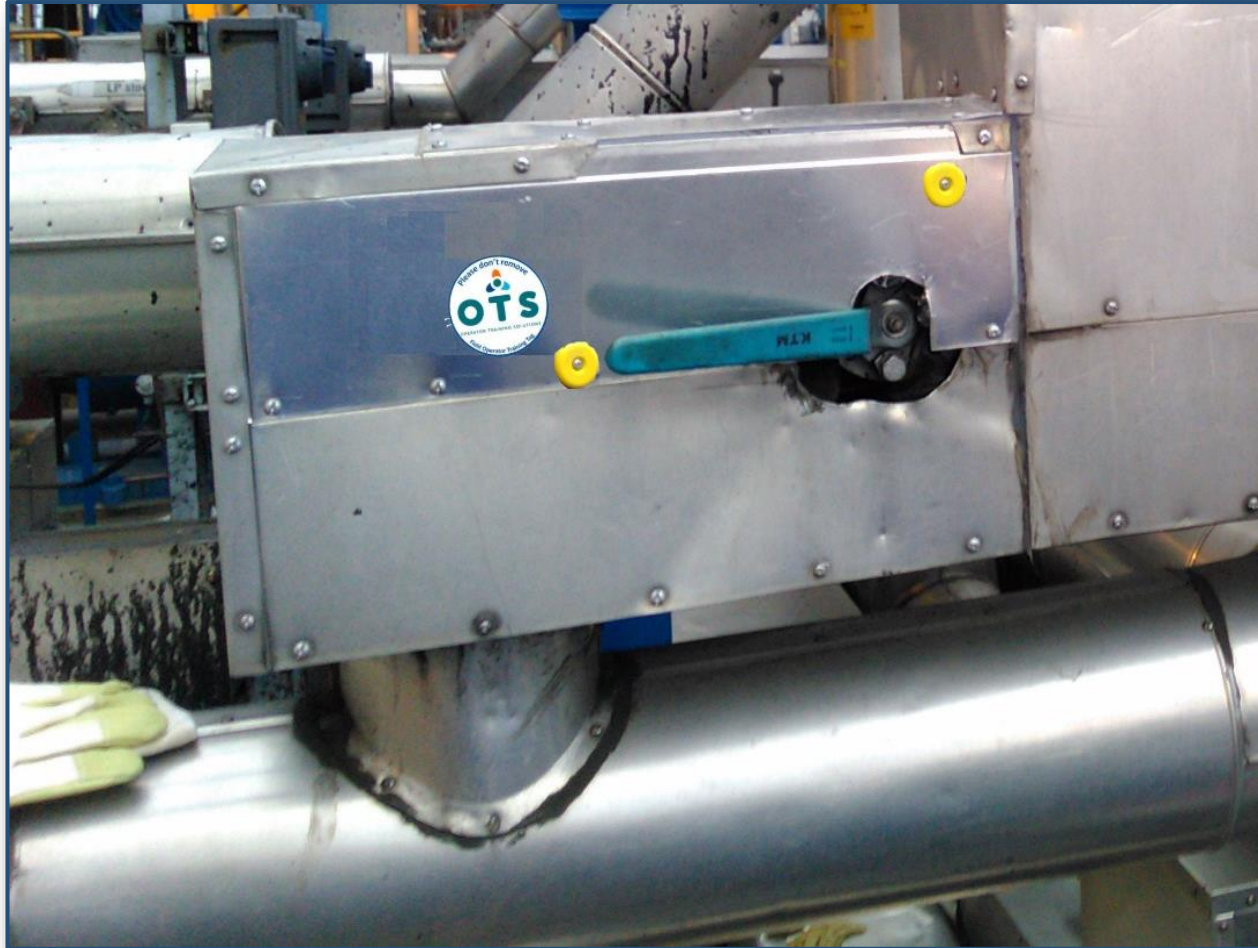
Modernize lock out-tag out by placing it on a screen so it can show much more information than a plate. (reason for danger, lock out history, tag out history, duration of lock out etc.)

❑ Custom tool

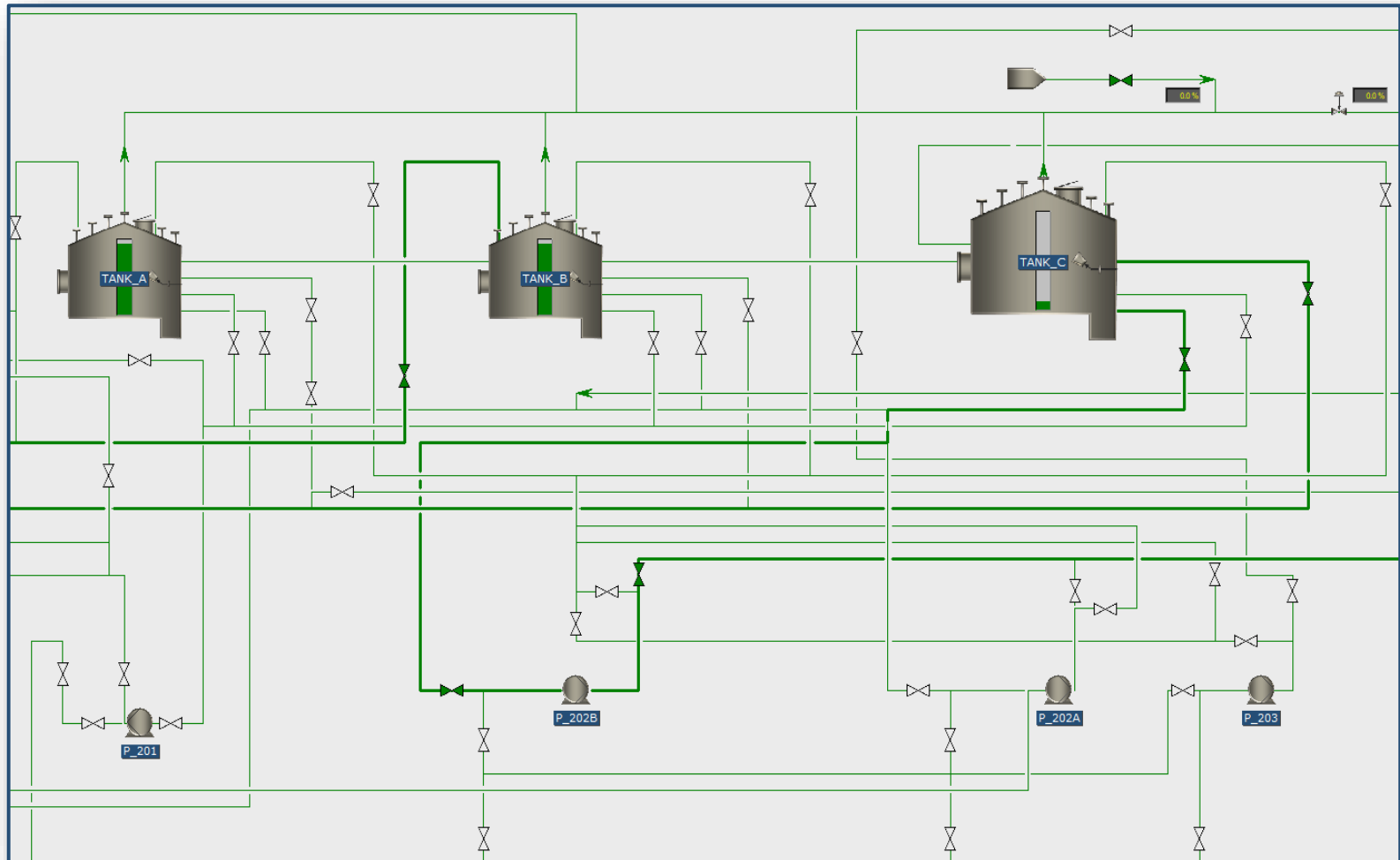
Each plant is specific, we offer development of tailored tools.
Anything is possible.



Spin-off Idea: Use App for Operations



Spin-off Idea: Use App for Operations



Let's wrap up

Digital knowledge checks

- No more pen and paper
 - *save resources and go greener by using PC's, Tablets or phones*
- No classrooms, do tests anywhere
 - *Minimizes human contact during the pandemic*
- Translate current paper tests yourself
 - *an interface to create the tests is provided, everything can be done from inside your company*
- Automated test grading
 - *Free up senior operators to do more important stuff*
 - *Operators who have done the test know right away where they have made mistakes*
- Better testing environment
 - *Modern interfaces with multiple choices, drag and drop, connect the dots, find stuff on an image and add a description (IP21)*
 - *Video questions (pop up questions during a video)*
 - *Location questions (see how long it takes an operator to find a specific valve)*

Digital knowledge checks

- Track operator knowledge digitally
 - *Get graphs or traffic lights on operator knowledge*
- A notification system
 - *Get notified when someone has done a test along with their grade*
 - *Issue notifications when operators are due for a test*
- Digital certification
 - *Certify operators from anywhere with the press of a button*
- Integrate with any systems
 - *MobaQuest integrates with any existing systems that are used (training simulators, ERP's and other software)*

Instant data in the field

➤ Multimedia

- *Assembly videos on-site will lower the time needed for the work to be done*
- *Take images to track equipment status (how big the leak is or so)*
- *Record and share any issues that were found instantly*

➤ Historical data

- *Pull up equipment's maintenance history instantly instead of running back and forth and browsing through a lot of data*
- *See images that were taken in the past (see if the leak is getting bigger or so)*

➤ To do lists

- *Make a to do list on an ATEX device when heading out in the plant*

Thanks for the attention

We hope to help you save resources and create
a better working environment with MobaQuest!



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www.mobatec.nl