



***A Solution
for the
Missing link in Operator Training:***

**Field Operator Training
with or without
an
Operator Training Simulator**

February 9th, 2017

Prepared by

Henk Leegwater - Managing Director

Mathieu Westerweele - Simulation Expert

Peter Heerschap - Training and Learning Expert

The missing link: field operators involved in OTS training

Operating Training Simulators (OTS) are often compared with flight simulators for pilots of airplanes. Indeed, an OTS is an excellent tool for training the pilots of the process industry (operators) in situations they normally not are exposed to but for which they need to be prepared to handle. Exactly like airline pilots. In aviation they talk about crew resource management: the whole crew is involved in training. However, in the chemical process industry normally only Control Room operators are trained with simulators. The whole team is not involved: missing is the training of the field operator and especially the communication between control room operators and field operators. This communication has proven to be crucial in abnormal situations and therefore need to be trained as well.

As with aircrafts, the operation of a chemical plant nowadays is so stable and highly automated that operators don't have the opportunity to get hands on experience. Therefore an OTS including a Field Operator Module is necessary.

Human Errors

Many companies are suffering from human errors:

- According the famous prof. Trevor Kletz the root cause of the majority of nearly all incidents in the chemical industry is related to human failures.
- The well-known and in safety distinguished Prof. Andrew Hopkins investigated many major incidents like the 2005 explosion at BP's Texas City Refinery and puts the emphasis on human and organizational causes as root causes and also on employee participation.
- The root cause of the worst incident in civil aviation, the collision of two 747's at Tenerife with 583 casualties, were human errors: communication and misunderstandings.

Team Training and Communication



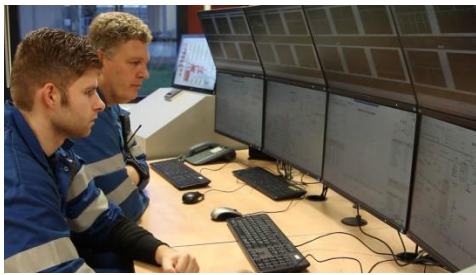
*Communication
between
Control Room Operator
and
Field Operator
is crucial
and needs
to be trained as well!*



The performance of normal operation of a plant (including start-up and shutdown) as well as handling of incidents depends not only on the performance of the control room operator. Also the performance of the field operator and more importantly communication and cooperation between all operators involved is crucial.

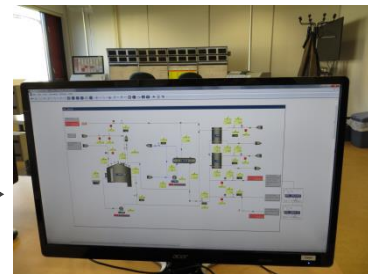
If only control room operators are trained, a crucial aspect is missing.

Traditional Field Operator Training Functionality on an OTS



Control Room Operators training on an OTS: field operations actions performed by the instructor

Communication between Control Room Operator and Instructor: oral, no radio communication involved



Instructor Panel: Field operations handled by the instructor

In the chemical process industry not all operations are done automatically and controlled by a DCS. Field operators are needed for:

- Starting and stopping of pumps, including the handling of surge valve and discharge valve
- Switching filters
- Lining up equipment, like tanks
- Reading gauges, like local pressure, temperature, flow indicators, sight glasses
- Drain valves

In traditional Operator Training Simulators the instructor acts as a field operator: on a screen he performs the actions requested by the Control Room Operator.

Missing: communication over the radio, walking distance and time to the equipment in the field, going to the right equipment, etc.

More importantly: the field operator is not trained at all.

Field Operator Module

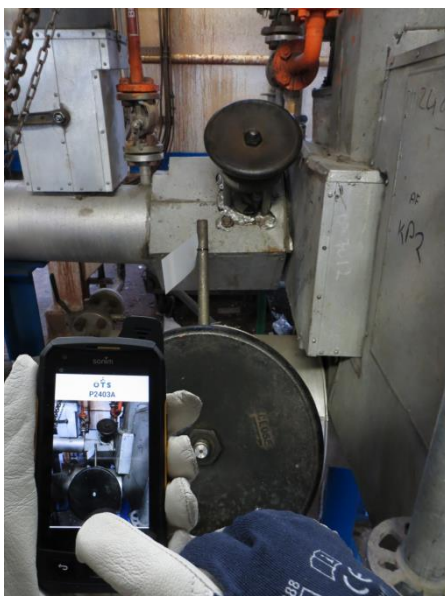
By adding our Field Operator Module to an Operator Training Simulator, the field operator can be involved in training as well. Still the traditional approach remains possible in case field operators are not available or are not needed for the training: the field operator actions are then handled by an instructor on the instructor panel.

If the field operator is involved in a training he is equipped with an ATEX approved wireless field device when going into the plant. With this device he scans a tag near the equipment that he is asked to operate by the Control Room Operator. On the screen of the device a photo or text appears of the switch, valve, gauge etc.

Instead of operating the real equipment in the plant he performs the operation on the device. The device communicates wirelessly with the Operating Training Simulator and the Control Room Operator will notice the effect of the field operation as he would in a real plant.



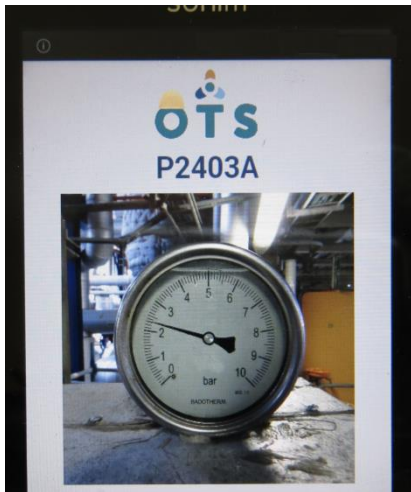
After scanning a tag at the pump switch in the field, the field operator will be able to operate the simulated pump switch on his ATEX device that communicates wirelessly with the Operating Training Simulator.



After scanning a tag it is also possible to get an overview of different valves. By clicking on the screen the valve to be operated can be selected.

After that the simulated valve can be operated.

In case of a discharge valve after a pump or a valve in a steam line it is crucial to open it gradually to prevent pressure shocks in the plant. This is possible with a slider rule on the screen.



After scanning the tag of a local indicator, the simulated value is presented on the screen of the ATEX field device.

Example: Local Pressure Gauge

Advantage of this approach: the operator crew is working together as it normally does, including radio communication with the real background noises, walking distances and time. Also misoperations are possible, e.g. operating the wrong valve, pump switch, reading the wrong gauge.

In fact, the only difference between real plant operation and simulation is that the field operator does not need to operate the equipment physically, but on a touch screen at the place of the equipment in the field (and of course no production loss after misoperations)

The Field Operator Module of OTS.expert can be coupled to both to the Operating Training Simulator of OTS.expert as well as to the Operating Training Simulator of other brands.

Now, not only Control Room Operators can be assessed, but also Field Operators and team work.

On the instructor panel all simulated actions in the field are immediately visible.

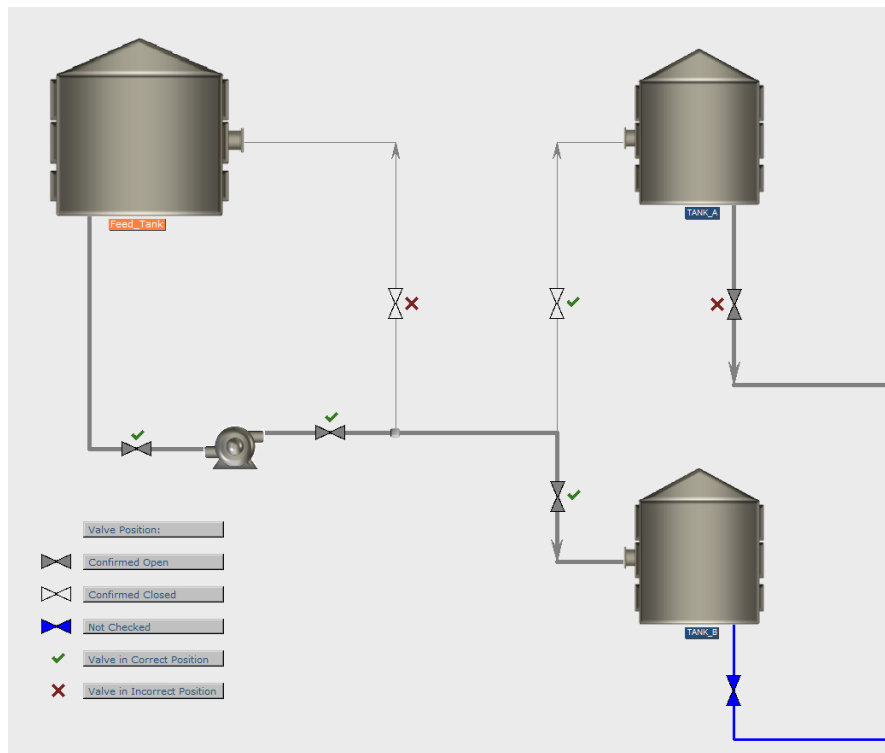
Stand-alone option of Field Operator Module by OTS.expert

1. Training

The Field Operator Module can also be used without a Training Simulator for learning the setup of the plant (new operators) and making the right line ups. Especially in situations where the knowledge of the field operator is critical like the setup of manifolds and product movement operations. Small mistakes can lead to high costs especially in tank farms where contamination is always a serious thread.

2. Operations

The Field Operator Module can also be used in operations to check and register the position of valves. This makes it possible to check if the field operator has set the valves in the right position according the procedures e.g. before starting up a plant or a unit. This simple layer of control improves significantly the reliability and process safety. The incidents mentioned earlier would probably not have happened if this protection layer would have been in place.



Example: lining up tanks. After scanning the local tag the field operator inputs the position of that valve (closed or open) on the ATEX device. On a dynamic P&ID, or in a live updated spreadsheet, immediately can be seen which valves are checked, which valves are not yet checked and also a list of deviations (difference between actual position and needed position) can be generated.

Note: the lay out of this example is according HMI-standards. All symbols and colors are possible.

Brown field versus Green field

In case of training for the startup and operation of a new plant (green field) before the construction phase is finished, the plant is not available for training. If 3D CAD files are available we can connect our Operating Training Simulator to the 3D CAD virtual reality of the plant for training purposes.

Even in green field situations however the Field Operator Module has its value: to get the field operator acquainted with the lay-out and position of equipment in the field.

In brown field situations those 3D CAD files are mostly not available, but the plant is.

Costs and benefits

The investment cost of involving field operators in training with an OTS is roughly 20% of the costs of a HiFi operator training simulator of the plant. The leverage: for an additional 20% three times as many operators can be trained (assuming the amount of field operators is twice of that of control room operators). More importantly: the whole crew/shift will be trained, needed to cope with abnormal situations and incidents but also for rare standard operations as start-up and shut down.

The order of magnitude of the cost is (much) less than one day of production loss.

Proof of Concept

Since the approach of OTS.expert is highly modular and scalable it will be possible to do a rather small project in a plant at low cost (~ Euro 30 000) as a proof of concept.

People

Henk Leegwater, Managing Director of OTS.expert, is not only a former plant manager of a naphtha cracker but also a highly recommended consultant in the industry, both on boardroom and plant level. He is very much involved in implementation of projects and improvements and innovations. As a pilot he also makes the connection with the training world of aviation.

Peter Heerschap, Training and Learning Expert of OTS.expert, acted as a Learning & Development Advisor for Shell in The Netherlands and abroad, with specific focus on training of operators and technicians. After his career within Shell he founded the company Training Event Management of which he is the CEO.

Mathieu Westerweele, Simulation Expert of OTS.expert, is co-founder of Mobatec and the architect of the Mobatec Modeller, the engine of the Operating Training Simulators of OTS.expert. This modelling engine is considered to be best value and lowest cost in the industry. Mathieu is constantly promoting better use of dynamic process models of any kind of process on any scale.

Company

Operator Training Solutions bv (OTS.expert) was founded to solve the problems many operating companies have with their Operating Training Simulators: after a while they are not used anymore, because:

- They don't reflect the plant anymore:
 - new DCS graphics, control etc. are not changed in the OTS
 - plant modifications are not implemented in the OTS
- They are not needed for operator certification as for airline pilots
- Training programs are not challenging

OTS solved these problems.

OTS has adopted the Zero Fly Time (ZFT) principle and Crew Resource Management from the aviation industry. With the delivery of the high fidelity simulator, all operators – both in the control room and the field – can be trained simultaneously in normal operations and emergency response. For the training of field operators we make use of ATEX devices. The plant is then used as a learning facility. Our unique Modeller allows you to adapt the system independently of any supplier by yourself. If the plant is adapted or extended, you can test all changes with the simulator before being copied to the real plant.



OTS.expert is connecting two worlds

