Advanced Solutions

Addressing Operator Competency Challenges in Process Industries

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Abstract

• If experience cannot be purchased, where do I need to invest to gain it?
  – To answer this question, process industries have been increasingly relying on dynamic process simulation as the preferred solution to improve operator's effectiveness.
  – But, even if dynamic models performance has dramatically progressed within the last decades, have operator's skills followed the same pace?
  – Are we focusing too much on the tool rather than the problem this tool is supposed to solve?
  – This presentation discusses the Challenges on building a Competence Management program, and the potential next steps
Who am I?

• Rafael Coronel is currently Operator Effectiveness Solutions Manager.
• He holds a Chemical Engineer degree from Simon Bolivar University in Venezuela, and a M.Sc. from IFP School in France.
• With more than 14 years experience, his previous responsibilities include working as a Software Solutions Manager at Yokogawa France, Sales Account Manager and Business Consultant for Aspen Technologies at the Paris Office, and Process Engineer for PDVSA in Los Teques, Venezuela.
• He is currently based at the Honeywell Paris office
Competence :

any form of knowledge, skill, attitude, ability, or learning objective that can be described and measured in a context of learning, education or training.
What is a Operator Competency?

Competence Model:

- Defines the relationship between these three major axes:
  - Competency or skill: any form of knowledge, skill, attitude, ability, or learning objective that can be described and measured in a context of learning, education or training.
  - Proficiency level: it refers to the different scales (qualitative and quantitative) that may be used to measure the degree of acquisition of a given competency.
  - Context: it refers to the circumstances and conditions which surround the acquisition or applicability of a given competency.

For example, “Fluent Business English” would be composed of the competency “English”, the proficiency level “Fluent” and the context “Business”.

What do I need to know?
How good do I need to be?
Where will I use these skills?
What is a Operator Competency?

...but, among all the possibilities, which are the required competences and the proficiency level an operator would need, in order to perform a given task?...
What is a Operator Competency?

...and, how the current Operators Profile would map those required competences and proficiency levels?...
What is a Competence Management Program?

...So, a Competence Management Program is the plan helping you to effectively progress the current Operator competences to the required level of proficiency to perform a given task in a given context...
What is a Competence Management Program?

“The deliverable of a Competence Management Program is not an Operator Training System, but a Skilled Operator”
Challenges

So, Which are the challenges?
Some Operator Competency Challenges

Simplified Competence Management Program Workflow

1. Define Operator Profile
2. Define tools, processes and organizational changes required to deliver Operator Competence
3. Deliver Operator Competence using the available tools
4. Did Operator pass tests?
   - No
   - Yes
5. Deliver Certificate
Some Operator Competency Challenges

Simplified Competence Management Program Workflow

Engineer 1

Define Operator Profile

The people defining the operator profile is not necessarily responsible for plant operations.

Engineer 2

Define tools, processes and organizational changes required to deliver Operator Competence

The people selecting and delivering the tools are not often aware of the requested Operator profile

Engineer 3

Deliver Operator Competence using the available tools

Did Operator pass tests?

No

The people involved on using the tools to develop the skills are sometimes not aware of all the available features.

Yes

Certificate
Some Operator Competency Challenges

• Defining the training plan: what is good or bad in operations, or what is the minimum performance level is always a difficult, but is even more complex at the beginning of the project. So let’s wait (it will be operations decision anyway…)

• Writing OTS Specifications: facing the lack of definition in the front end, what are the engineers in charge of writing the technical specifications doing?
  – Overspecifying OTS features (example: simulation speed)
  – Underspecifying OTS features (example: Performance measuring features)
  – Misalignement of OTS Specification and skills expectations.
Some Operator Competence Challenges

So the challenges are:

1. Get the **Support and Alignment** from management, operations, technology and Human Resources team for the competence management program

2. Get a clear **Definition** of what is required, and how is expected to be executed.

3. Find the **Ownership** of the competence management program
Addressing the Challenges

So, what to do next?
First action:
Engrave in a stone the following sentence:

“The deliverable of a Competence Management Program is not an Operator Training System, but a Skilled Operator”
Addressing the Challenges

Second Action:
Look at Competence Management from a holistic point of view

Competence Management team

- Define Operator Profile
- Define tools, processes and organizational changes required to deliver Operator Competence
- Deliver Operator Competence using the available tools
- Did Operator pass tests?
  - No
  - Yes
    - Deliver Certificate
Compentence Management: A Holistic Perspective

**People**
- Technical Workforce Performance Improvement programs
- Troubleshooting & optimization skills
- Front-line Supervision Training
- HR policies and strategies
- Leadership Development

**Organization**
- Business goals and objectives creation
- Organizational strategies consulting, design and implementation
- Business KPIs and Value Mapping
- Culture Change and Management

**Technology**
- Improve Asset Utilization
- Lengthen Asset Lifecycles
- Performance Tools for operations and maintenance
- Plant and process training
- Integrate OTS with proven training programs

**Processes**
- Operations procedures & documentation upgrades, updates and rationalization
- Maintenance systems & procedures
- Supply Chain optimization
- Front-end and Back-end Business Process Mapping
- Startup/Shutdown optimization
• **GP’s Performance-Based Analysis™**
  – Process for helping clients achieve business goals
  – Ensures People, Processes, Organization, and Technology work together efficiently and effectively
  – Working in harmony, these factors help companies achieve target performance.
GP’s Performance-Based Analysis™

- Utilizing PBA methodology, investigate:
  - People
  - Process
  - Technology
  - Organization Alignment

Define Problem from Client’s Perspective

Listen
1. Align with Client
2. Probe on performance targets
3. Create initial image of need
4. Plan PBA project

Verify Problem Definition

Look
5. Conduct interviews
6. Observe and gather data
7. Refine visual representation

Determine Root Causes

Learn
8. Perform end-user analysis
9. Perform work process analysis
10. Perform tool and technology analysis
11. Perform organizational analysis
12. Refine visual representation

Recommend Action Plan

Launch
13. Develop implementation plan
14. Present to client
• **Honeywell’s Model-Centric Approach Technology**
  – Based on the Best-in-class UniSim Life-cycle Simulation vision
  – Proven track of more than 20-years delivering operator training technology
Addressing the Challenges

Third action:

Moving from OTS projects to Competence Management projects means embracing the Simulation Life-Cycle
The Simulation Lifecycle Approach

- **Concept Selection**
- **FEED**
- **Detailed Engineering**
- **Construction & Commissioning**
- **Start-Up**
- **Operations**
- **Expansion**

Model

- Tighter design
- Investment Decisions
- Controllability
- Early APC
- Improve Procedures
- Operator Training
- Asset Monitoring
- RTO
- De-bottlenecking
- Operator Tools
The Life Cycle Simulation: Some Theory

Life Cycle Simulation is about:

- PLANNING
- WORKFLOW
- DELIVERABLES
The UniSim Simulation Life-cycle Vision

Deliverables

- Steady State Simulation
  - Heat & Material Balances

- Dynamic Simulation
  - Dynamic Simulation Studies
  - Engineering Simulator

- Operational Dynamic Model
  - Process Training Simulator
  - DCS Check Out
  - Operator Training Simulator
  - Operations Simulator

- Competence Management
  - Competence Management Program
Case Study: Oman Methanol

• MAN Ferrostaal A.G., a leader in the EPC contracting field, received an order to construct a Methanol plant for the Oman Methanol Co. at Sohar in the Sultanate of Oman.

• MAN Ferrostaal primary objective was to provide training to a predominately novice workforce so that operators could become familiar with the process behavior months before actual startup and overcome any unforeseen operational difficulties.

• The conceptual steady-state models provided the basis for operating training applications and are planned to be used for long-term plant optimization to help the facility stay competitive and meet business and planning needs.
• MAN Ferrostaal accepted the two-stage approach for its Oman plant:
  – **Phase 1**: standalone process model permitting the staff to be trained an entire year ahead of the actual start-up in the fundamentals of the process and its overall behaviour. This process model underwent rigorous testing, was configured with an instructor station and simple PC-based operator screens and then shipped to the Oman facility.
  – **Phase 2**: the simulation model was integrated with and third party DCS and subjected to a full factory acceptance test prior to installation at the site. The process model/DCS integration process was achieved with surprisingly few problems.
Case Study: Oman Methanol - Model Lifecycle

- UniSim OTS Model
- Copy of UniSim OTS Model
- Process Training Simulator (Early Deliverable)
- Instructor Station
- Integration
- Operator Training Simulator
- DCS Database (Control & Graphics)
Case Study: Oman Methanol

Benefit:

- By adopting this phased approach preliminary training was able to start much earlier using the standalone model and operators were able to gain full advantage when the fully integrated OTS system was delivered five months later.
Qarn Alam Case Study

• Major Steam Injection Project in the Gulf
• Many different Players involved for design validation, hydraulic and controllability studies, as in Dynamic Simulation, as follows:
  – End User
  – EPC Contractors
  – DCS/ESD supplier
  – Honeywell Advanced Solutions
  – SPT
• Honeywell was selected as the Simulation provider. Three different plant areas were included in the Simulation scope:
  – Water treatment
  – Steam production (Thermal Assisted Gas and Oil Gravitational Drainage)
  – Hydrocarbon Gathering Facility
• SPT Group scope included Hydrocarbon Gathering Pipelines. Wells and receiving facilities were modelled in UniSim Design.
Case Study: Qarn Alam - Simulation

Objectives

• Dynamic Simulation Model & Studies
  – To validate the process design
  – To check process control strategies
  – To verify the safety and shut down sequences
  – To provide process familiarisation training

• Operator Training Simulator
  – Provides a training facility which accurately replicates
    the behaviour of the process plant
  – Provides a training facility which incorporates real
    plant control and graphic configurations
  – To develop operator skill levels and increase
    confidence and so improve reaction strategies to
    reduce plant disturbances
Case Study: Qarn Alam - Model Lifecycle

- WTP Studies
  - WTP Model (HYSYS Dynamics)
    - WTP Model Convert to USD
    - WTP Model Interface
  - Gas Model (USD Dynamics)
    - Gas Model Adapt for OTS
  - Gas Plant Studies
  - Steam Model USD Dynamics OTS Ready
  - Steam Model Studies
  - Pipelines Model (OLGA)
    - Pipeline Model Adapt for OTS
    - Flow Assurance (Study)

- Models Linked
  - Instructor Station
    - DCS Database (Control & Graphics)
    - OTS Start up

- LOCAL CONTRACTOR
  - SPT / HONEY WELL

- DCS VENDOR
Edited SPT models

Reduced number of wells to only include existing wells

Equivalent Pipes

Future direct Tie in to IM-A/B/C deleted

Geometry Updated

Inlet mass source modelled with three sources for water, oil and gas

Test-lines added to the model

Improved MSV – modelling
- Each Well Tie in modelled with a leak at the outlet to simulate redirecting flow to testline
- Each leak was redirected to the test-line
- Only manual controllers in OLGA. Control dynamics included in USD-model
Case Study: Qarn Alarm - Dynamic Simulation Model
What should be done differently in the next project?

• Having a clear **Owner** leading both the training plan and the OTS project can only help.

• **Defining** a meaningful training plan **early on** and involving all the major contributors is the best approach to guarantee that the OTS will be used effectively and maintained in the future.

• Operations, process and automation personnel must all **Support** the team, but experienced operators and process licensors cannot be left aside either. Having a brainstorming session and consensus on the applicable best practices is not an option, but mandatory.
What should be done differently in the next project?

• **Align** your needs with your specifications rather than maximising the number of advanced features in the OTS technical specification.

• **Measure.** Comparing individual operator’s performance against a pre-defined set of best practices is certainly a better approach than doing nothing. Remember that your final goal is building competences.

• Last but not least, if you would like to really squeeze the entire potential, **Embrace the simulation life cycle** as early as possible in the project, and realistically define the scope of this concept in your project. If you leave it till commissioning, it’s too late.
What should be done differently in the next project?

Remember:

“The deliverable of a Competence Management Program is not an Operator Training System, but a Skilled Operator”
Any Questions