Training and Operator Training Simulators

Jan Marco Mosterdijk, Technical Sales Consultant
Vision

AVEVACapability

Operator Training Simulator (OTS)

Extended Reality

Learning Management Systems

AVEVA Connect Cloud

The Digital Twin
Today’s Industrial Landscape – Workforce Perspective

- Years Experience [retirement]
- Staffing Reduction
- Time to Mentor
- New Hires [millennial]
- Tech Savvy
- Regulatory Compliance
- Asset Complexity
- Sophisticated Control and Safety Systems
- Sensors Connected Points

- Cyber-security
- Cloud
- AR / VR
- AI
- Industrial IOT

Workforce

Workplace

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How can we support the correct action

- **Experience**
  - Digitise Training with VR
  - Speed up learning curve
  - Enhance retention
  - Drive best practice

- **Information**
  - AR & VR enhanced mobility solutions
    - Asset Information
    - Real-time 3D AR Maintenance
    - Alarms / Trends / KPI
    - Workflow

- **Prepared to Act**

- **My correct action**
  - My Education
  - My Experience
  - Available Information
  - Other People’s Skills

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The EPC Vision

Operations Life Cycle

Plan and Schedule
Engineer Procure Construct
Asset Performance
Monitor and Control
Operate and Optimize

Asset Life Cycle

Improve Return On Capital
Simulation for process design
Licensor using packages to capture IPR – design, engineering, virtual tours - be a technology partner with your client bring in your specialist knowledge and add value.
Sharing data for engineering
Simulation for studies
Engineering data for control system database builds
Control checkout / Multi Purpose Dynamic Simulation
Collaboration with APC
Commissioning and Reaching nameplate capacity
Train the client’s operations team
Stand out from the competition

Improve Profitability

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AVEVA Capability
AVEVA Experience and Capability

By automation system

- Yokogawa 95
- ABB 54
- Emerson 82
- GE 39
- Honeywell 156
- Schneider Electric 588
- Siemens 10
- Other 89
- Rockwell 31

By industry

- LNG and Gas Processing 68
- Refining 395
- Petrochem, Chemical, Polymers & Fertilizer 229
- Power and Utilities 337
- Other Industries (MMM, F&B, P&P, etc.) 51
- Upstream Oil & Gas, Pipeline 80

Cumulative OTS project

1000+ OTS Projects

Resources around the globe
Operator Training Simulator (OTS)
Why does an OTS work?

“One way of looking at this might be that for 42 years, I’ve been making small, regular deposits in this bank of experience, education and training. And on January 15 the balance was sufficient so that I could make a very large withdrawal.” Captain Sullenberger

Compare an OTS to a flight simulator for training pilots

- Provides realistic look & feel
- Practice scenarios which do not normally occur
- Repetition engrains quick reactions to emergency operations
- Exercises do not put anyone in danger
- New pilots can practice procedures or familiarize with a specific aircraft before undertaking a flight

**Known and evaluated impact of operational trips**

In 2010 ARC industry analysts reported that operator error results in 42 percent of unscheduled plant shutdowns.

US Health and Safety Executive reports 26% of accidents occur due to operational error.

**We learn best by immersive doing and repetition**

Success is widely reported.

![Image of graph showing learning retention rates]

**Typical Capital Expenditure & Operating Expenditure Benefits from OTS**

- Reduced capital expenditure on plant, 10%-30% USD / day
- Reduced OPEX (operation and maintenance expenses), 50%-100% USD / day
- Reduced human error rate (one trip), 90%-95% USD / day
- Improved performance
- Reduced downtime
- Reduced maintenance costs
- Improved safety
- Reduced personnel costs

**Success is widely reported**

- Economic benefits of training simulations in the upstream industry – Dec. 2013
  - Tina M. Komulainen, Ronny Sanberg, Sjur K. Nordseten, and Nivrad Norhus

**Power Plant Error Trips**

- Simulation Represents a 78% Learning Retention Rate and is One of the Fastest Methods to Competency
  - Source: NTL

**AVEVA Survey OTS Best Practices**

- Improved startups
- Enhanced operator performance
- Trip and incident avoidance
- DCS checkout and fault acceptance testing
- Test and proposed operational changes
- Knowledge capture

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What an OTS looks like

< Operator Workstations – Operator Environment >

< Instructor Environment - Process & Control HMI >

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DESIGN & PLC CONFIGURATION

Dynamic Engineering Studies

Design Validation & Capital Cost Optimization

DCS & PLC CONFIGURATION

Controls Pre-commissioning Test System

DCS Control logic configured correctly the first time

PLC/ESD/TMC Logic Configured Correctly the first time

STARTUP

Operator Training Simulators (OTS)

Console Operator Training

Immersive Training Simulator (ITS)

Full Plant Crew Training

OPERATIONS

Training as a Service (Generics & Custom including LMS)

CLOUD / Corporate

CUSTOMER FIRST

Software and Application Support & Maintenance Programs
« ...You don't learn to walk by following rules. You learn by doing, and by falling over.”
— Richard Branson.

« ...I hear and I forget
    I see and I remember
    I do and I understand..”
— Confucius.
Scalable graphic user experience

- Point to point navigation to 360 Photo Spheres
- Interactive 3D objectives for training actions.
- Real-time 3D VR with CAD quality graphics context
- Full ITS training System Features
- Photorealistic VR environment.
- High sensation Immersion and “real world” training experience
Interactivity

3D VR
Dynamic Plant
Trainee (Field)
Trainee (Control Room)
Extended Reality: Augmented and Virtual Reality
Extended Reality Training

Team Training

Panel & Field

Equipment

Process and Procedural

Maintenance

Behavioural

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Delivering Simulation Learning, not just technology

- Training Services – Learning Programs designed and developed by Subject Matter Expert’s.
- Full Training and Documentation Services from Virtual Reality to Standard Operating Procedures.
- Enabling Simulation integration with Learning Management Systems.
- Onsite Learning and Instructor Services
- Recognized as a Leader in Simulation Learning - Winner of 2015 R&D 100 Award for VR Simulation Training

Global Learning Team
- NA – Baltimore
- APAC – Beijing, Seoul
- LA – Brasil, Argentina
- ME – Cairo

Minimizing Time to Autonomy through innovation in experiential Simulation Learning Design
Training content development for OTS

Table 3-1 Lesson 1.0 Format

<table>
<thead>
<tr>
<th>Section</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>This section lists the learning objectives that the trainee should be able to satisfy after successfully completing each system description.</td>
</tr>
<tr>
<td>Process Overview</td>
<td>This section will also provide an overview of the system flow paths and major components covered. The major unit/system are discussed. The process section. These drawings will be shown to illustrate these concepts.</td>
</tr>
</tbody>
</table>

Self-Study – What-if Scenario

What-if Scenario – EOP 06 – Loss of Process Air

1. What effect will a Loss of Process Air have on the following parameters with no operator action when operating at Steady State – CV’s feed valves all changed?

- Value Lowers
- Value Rises
- Value Lowers to new safe Equilibrium
- Value Rises to new safe Equilibrium
- Value Cycles

Review – What-if Scenario

What-if Scenario – EOP 06 – Loss of Process Air

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Training content development for Immersive Training
### AVEVA Connect – Voice of the Customer

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>We need simulation software usage to be more flexible</td>
<td>Enable flexible and scalable pricing and usage models</td>
</tr>
<tr>
<td>Built-in secure file repository with version control</td>
<td>Access from modern web browser</td>
</tr>
<tr>
<td>We need a central storage to put our content files</td>
<td>We want a collaborative workspace</td>
</tr>
<tr>
<td>Online support backed up by Customer First program</td>
<td>Intuitive user access management</td>
</tr>
<tr>
<td>We want products to be easier to support and maintain</td>
<td>Create managed instances and delete when finished, protect IPR</td>
</tr>
</tbody>
</table>

**AVEVA Connect**  
The power of Simulation Solutions on-demand, anytime, anywhere.
AVEVA Connect - Enabling Global Training

Student Management

- No limit to number of Student

Category: Refinery Courses
- HGU: x3
- CCR: x50

Category: Power Plant Courses
- CDU: x20
- XYZ: x50

AVEVA Connect built in technology
- Patented technologies of automation of application and content management
- Built from the ground up to support
  - Multi-Tenancy
  - High Availability
  - Scalability
  - Accessibility
- Design with highest level of Cyber Security protection
AVEVA Connect: For Training
Integrated Simulation Learning Platform

- Software application to plan, implement, and assess a specific learning process.
- “Online” course Repository for eLearning, questions, activities, and training resources.
- Assess performance
- Manage activities and users
- Structure training
- Schedule and execute training
- Tracking of training progress
Advanced Visualisation Platform

Any hardware, any O/S
Any AR, MR or VR devices

Design Review
Digital Twin Creation
Engineering Vision
Asset Vision
Workforce Upskill
Digital Maintenance
NexGen Command Centre
Applying the digital twin
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