Return on Imagination
Peter Henderson, Product Marketing Manager

How Operator Training Provides
Returns on Operations and Improves
Return on Capital Investments
Industry Challenges

Safety
Protect People, Assets and Process
Billions lost per year in Petrochem Industry

Reliability
Improve Availability
Reduce Downtime
Millions lost per year due to unplanned production losses

Efficiency
Improve Productivity
Reduce Cost
Fewer people can make better decisions, faster
Industry Challenges

Errors and inefficiency cost money

- U.S. process plants lose over $20 billion a year from abnormal situations; $8 billion (40%) is directly attributable to human error.

These losses are caused by insufficient employee knowledge, and operator and maintenance worker errors.

Abnormal Situation Management Consortium (ASM)
Operator Competency – What is it?

• **Experience** required to properly perform a specific job – founded upon:
  – **Knowledge** – Fundamental Process Understanding
  – **Skills** - Procedural Training, Practical Skills, Achieved through Practice
  – **Behavior** – Composure, Trained Response, Reflexive Under Pressure
  – **Experiment** – although related, you wouldn’t want to do it in production

• **Expertise**
  – Skills, understanding, knowledge possessed by expert

• **Expert**
  – Possess Reliable Expertise, confident understanding
Customer Value from Operational Readiness

- Preparing Operators for Initial & Sustained Operations
  - Selecting the right operators
  - Providing with the right skills
  - Ensuring or Certifying Operator Competency

- Preparing Plant Assets virtually for Initial & Sustained Operation
  - Process Readiness
  - Automation System Readiness
  - Procedural Readiness

- Benefits from Operator Training Programs are measured by
  - Economic impact from improved Plant Availability which can expressed in
    - $ or days
    - Earlier initial operations and in sustained ongoing operations
  - Number of Incident Free Days
  - Number of Certified Operators
  - Program Maturity & Long Term Commitment

Operators are Mission Critical Assets in Responsible Operations
Value from Operational Readiness

- Profit Generation realized earlier and reliably
  - Typical payback for new projects from faster start-up (3 days)
  - Annual benefits - improved operations & reduced upsets (0.5% savings)
  - Cumulative benefits over 10 years greater than $20 million.
• Do nothing - Gain nothing
  – Comparison - would you:
    • Fly with an untrained pilot or a pilot uncertified for your 747?
    • Feel comfortable living beside a nuclear facility with untrained operators?
    • Receive a medical procedure by an unskilled practitioner?

• Classroom Training, Reading Exercise
  – Conveys process knowledge without practical operating skills
  – No operating experience (a methodical practice of monitoring operating variables, recognizing impending upsets and reacting before plant trips)
  – No test of ability to act under pressure

• Startup with experienced operators from other sites
  – What do you do if your plant is the 1st of it’s kind of operation?

• Operator Mentorship Training in the Control Room
  – On-the-Job Training (OJT)
  – Reduced Curriculum – focus tends to be familiarization at normal conditions
  – There is no latitude to prepare a trainee for startups or process upsets
  – Much more costly to learn from mistakes
  – High travel costs to train in similar corporate facilities
  – Takes a really long time to capture experience!

Alternatives can be your foundation - but we can do better!
What kind of Training Solutions are Customers asking for?
• Accelerated knowledge transfer by process & procedural training!
• Formalized, comprehensive, graduated level Operator Training Program
  – **Entry Level Training** for new operators
    • Result ➔ Finding the Right Candidates
  – **Classroom Training** to present fundamental knowledge of the relationships between process & operating variables
    • Result ➔ Understand Fundamentals
  – **Process Simulator Training** to dynamically reinforce process classroom fundamentals by observation
    • Results ➔ Practical Experience
  – **Procedural Training on a Customized Simulator** to consolidate years of practical control room experience in a concise operations curriculum
    • Results ➔ Skills, Behavior, Practice, Reinforcement, Routine, Free to Learn from Mistakes/Experiment
• Maintained program as plant changes
  • Result ➔ Sustained Training Benefits of Long Term Investment
UniSim Operations Suite R320

- What is UniSim Operations Suite R320?
  - UniSim Instructor Interface, Training Tools & Platform
  - UniSim Design Dynamics R390
  - Control System Simulation
    - Experion PKS R310 & Safety Manager R120
    - Many other DCS/Safety System solutions

- Applications
  - Operator training
  - Process & Equipment Readiness
  - Control strategy verification
  - Operating procedure development

Operational Excellence From Day One and the Life of the Plant
## Safety Reliability Efficiency

### UniSim Design
- **Safe Design**
  - Safe Operating Bounds
  - What-if Scenario - HAZOP
  - Develop Safe Procedures
  - Develop Control Strategy

### UniSim Operate
- **Safe Operation**
  - Procedural Training
  - Operate within Bounds
  - Safe, Correct, Quick Response to Upsets

### UniSim Optimize
- **Safe Control**
  - Control within Operating & Equipment Limits

### Safety
- **Reliable Design**
  - Predict Life of Service
  - Corrosion Planning (Pipe)
  - Catalyst Aging
  - Furnace/Exchanger Fouling

### Reliability
- **Reliable Operation**
  - Recognize & React before Trip
  - Trouble Shooting for Operators

### Efficiency
- **Efficient Design**
  - Capital cost optimization
  - Optimized Process Design
  - Optimized Targets

- **Efficient Operations**
  - Efficiently Trained
  - Faster Startups
  - Operate @ Design Targets
  - Operate On Spec

- **Efficient Control**
  - Increase Yields, Capacity
  - Control to Optimal Targets
  - Quicker Transitions
  - Lower Material & Utility Costs
UniSim Operations Suite User Interfaces

UniSim Engineering Station

UniSim Instructor Station

Experion Station

UniSim Design Dynamic Process Models

UniSim Safety Manager

UniSim / Experion Control Environment

UniSim DCS Interface Experion Server

Scalable Solutions Defined to Match Requirements
UniSim Training Solution Map – Cost : Benefit Ratio

- **Generic Process Model**
  1. Entry Level Training

- **DCS Control Simulation & Station**
  1. DCS Familiarization Training
  2. Control System Assessment

- **Customized High Fidelity OTS**
  1. Procedural Training, Startup / Upsets
  2. Control Checkout
  3. Procedure Development & Validation
  4. Platform for APC Development

**Scalable Solutions Defined to Match Requirements**
Is UniSim Better than the Next Best Alternative?

- **Generic Model Training** – low cost, low benefits → low value
  - Process Fundamentals on Basic Unit Operations
  - Candidate Selection

- **Simplified Control Simulation** – mid cost, mid benefits → mid value
  - Control Fundamentals
  - Control System Assessment

- **Customized Simulator Training** – high cost, max benefits → max value
  - Accelerates Transfer of Knowledge, Skills, Behavior, Confidence through
    - Process & Control Fundamentals – Controls, Graphics, Logic, Alarms
    - Procedural Training – Startup, Shutdown, Process Troubleshooting, Trip Avoidance, Rapid Recovery, Transition to Alternate Production Scenarios
    - Environment to learn from mistakes and experiment in the pursuit of Experience
  - Additional Benefits from Control & Procedural Assessment
  - Plan should consider support and system/model update
  - Investment decision & justification requires plan for the life of the plant
Maintaining Simulator to Sustain Training Benefits

- Only thing that is constant is change!
  - Plant slowly deviates from the Model
  - Simulator Software Evolves
  - System Hardware, Software Evolves
  - Training Requirements Change
  - Instructor Changeover
  - OTS Use Cases Expand

- Training Evolves with Experience
  - Captured incidents are assessed
  - Procedures evolve to avoid incidents
  - Simulator training scenarios updated
  - Remedial training for operators

Small incremental investments protects your investment
Best Practices for Sustainable Training Programs

Plan
1. Identify a Simulation Sponsor from Operations
2. Study Business Drivers & Operating Objectives
3. Identify Risks that threaten Operating Objectives
4. Propose Training Solutions to Mitigate Risks

Execute
1. Scope Simulation for the Training Solutions
2. Create Schedule Identifying all Project Dependencies (Data, DCS)
3. Implementation, Delivery, Training, Turnover & Support

Reflect
1. Follow Up - Recognize Earned Benefits
2. Communicate Earned Benefits to Justify Re-Investment
3. Extend Simulation to New Problems – APC development, Incident Assessment, Process Debottlenecking, Plant Updates

Flawless Execution and Hand Off To Operations
### OTS Program Benefits – A Sustainable Work Practice

<table>
<thead>
<tr>
<th>Customer</th>
<th>Industry</th>
<th>Models</th>
<th>OTS</th>
<th>Sites</th>
<th>Program (Years)</th>
<th>Benefits</th>
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</thead>
<tbody>
<tr>
<td>Syncrude Canada</td>
<td>Synthetic Crude Production</td>
<td>22</td>
<td>6</td>
<td>3</td>
<td>20+</td>
<td>Initial/Refresher Training for Expansion Training for Control Modernization 500 + operators Bitumen Minning &amp; Extractions Heavy Oil Upgrading Utilities</td>
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<tr>
<td>Suncor Energy</td>
<td>Synthetic Crude Production</td>
<td>30</td>
<td>7</td>
<td>4</td>
<td>16</td>
<td>Initial/Refresher Training for Expansion Training for Control Modernization 500 + operators Heavy Oil Upgrading Utilities</td>
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<tr>
<td>Ras Laffan LNG</td>
<td>Liquified Natural Gas Production</td>
<td>18</td>
<td>3</td>
<td>1</td>
<td>12</td>
<td>300 operators, 1500 man-days annually Additional Benefits from Lifecycle Modeling Enhanced Process, DCS &amp; Procedures Startup several days early Never missed a delivery Result ==&gt; World Class Reputation</td>
</tr>
<tr>
<td>Shell Canada</td>
<td>Gasoline</td>
<td>10</td>
<td>3</td>
<td>3</td>
<td>10</td>
<td>75 operators</td>
</tr>
<tr>
<td>Petro-Canada</td>
<td>Gasoline Production</td>
<td>9</td>
<td>2</td>
<td>2</td>
<td>6</td>
<td>all operators from units trained Classroom Operations &amp; DCS Montreal, Edmonton Developments inMississauga</td>
</tr>
<tr>
<td>Comalco Alumina Refinery</td>
<td>Alumina Production</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>25+ operators, 160 hours each 4800 hours over 4 month curriculum, Additional Benefits DCS/Logic enhanced, procedure update, major process design update, Result ==&gt; Smooth Startup</td>
</tr>
</tbody>
</table>

**Benefits Measured in Production – Credibility through Longevity**
Has UniSim been Responsible for Customer’s Success?

• Honeywell can claim that:

• Simulator based operator training is just 1 of many valuable strategies clearly adopted by many of our customers which they leverage in building their world class reputation.

• Their experiences with simulation have been strong enough to accept it as a repeatable best/work practice in their business.
Interesting Recent Verbatims from Customers

- **Customer Needs**
  - "We need more than a training simulator"
  - "We need a training solution that:
    - captivates the operator throughout the entire training experience
    - manages enrollment/engagement of many trainees, provides training curriculum that guides trainees through challenges, captures their actions, assesses their abilities against consistent evaluation criteria, archives the result as evidence of competency"

- **Accelerated Knowledge Transfer**
  - "Classroom & control room mentorship is a slow process - you may never see a startup"
  - "Operators trained on OTS were independent in 1 year instead of 3 years without OTS"

- **Operator Confidence**
  - "If I can run the simulator, then I know I can control the unit"

- **Operator Competency**
  - "Operators lose their edge to APC"
  - "For operator certification through Procedural Training we require a customized OTS"

- **Financial Impact**
  - "Operator Training can save ½ day in a 3 day startup"
  - "Production loss due to operator ~ 1 day/yr"
  - "Converting a below average operator to an above average operator improves our bottom line by $250k"  
    - American Petroleum Institute
UniSim in Action

- UniSim will be featured in several Demo Room areas
  - Operate Safely & Efficiently (OSE)
    - UOP CCR Demo
    - Operator Training & AMS Graphics
  - Manage Plant & Enterprise Production (MPEP)
    - Energy Dashboard
  - Engineer the Process & Control System
    - UniSim in Design
    - UOP Collaboration on Master Models
    - Advanced Energy Systems
    - Advanced Bleaching