Improve Process Performance by Validating Systems and Preparing Operations

Maximize efficiency and safety
with Digital Twin technology–Mimic™ Simulation Software.
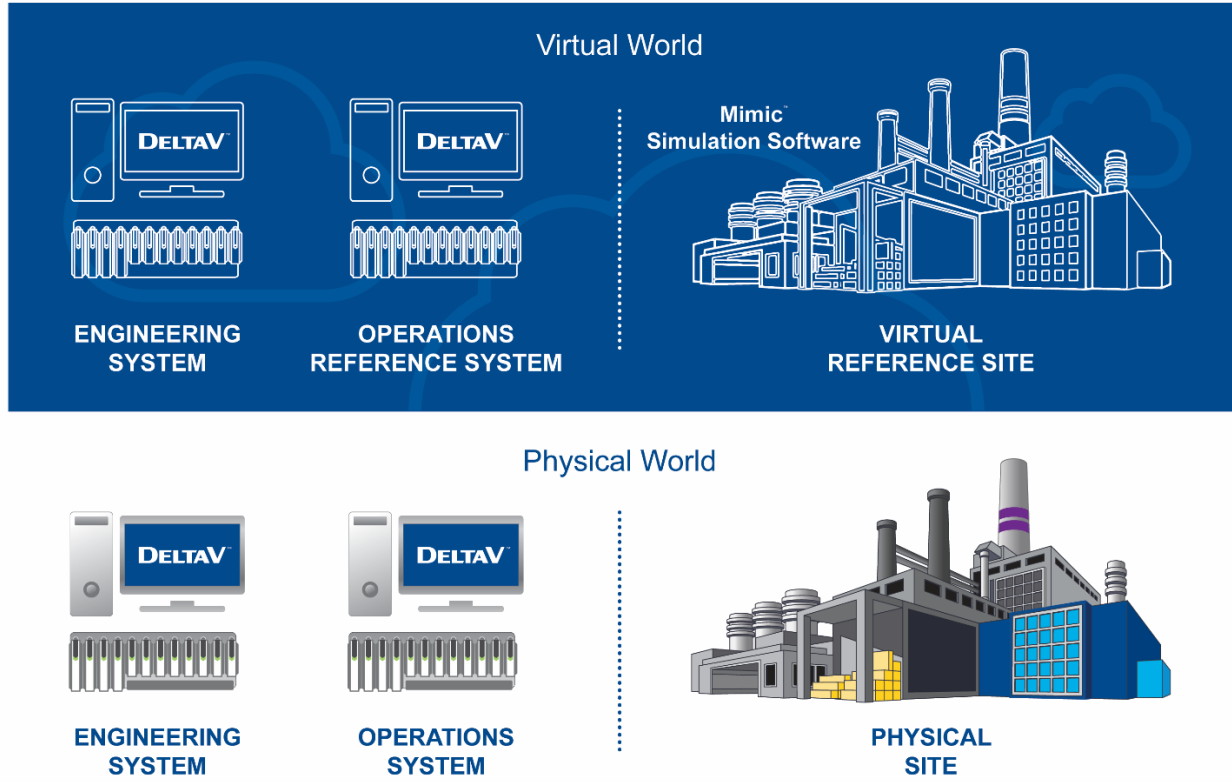
EMERSON™

Achieving production goals in the face of operational and project obstacles

To meet production goals, you need confidence in your control system and operations staff. Modern control system technology offers great promise to improve plant operations. But control system upgrade projects introduce risk, and plant operations may not accept the new system. In addition, experienced operators are leaving the industry faster than they are entering, and you need to capture their valuable knowledge to pass onto new operators.

If you want to improve process operations, improve process control design, and prepare operators, you need a way to accomplish all three without affecting plant production. Using Mimic Simulation Software, these tasks can be accomplished using a Digital Twin of your control system and process, helping you achieve operational certainty and top quartile performance.

Virtual World

ENGINEERING SYSTEM — OPERATIONS REFERENCE SYSTEM — Mimic Simulation Software — VIRTUAL REFERENCE SITE

Physical World

ENGINEERING SYSTEM — OPERATIONS SYSTEM — PHYSICAL SITE

Digital twin technologies — identical processes existing in the real and virtual world — allow you to test process changes, provide hands-on training, and see real-world results without risking production.

Immediate savings and return value was

8x

In a control system modernization project, a processing plant in the Food & Beverage industry used dynamic simulation to upgrade to DeltaV from a legacy distributed control system. The immediate savings and return value from the simulator was eight times the cost of the investment.

Prepare operators for unusual circumstances
Instead of only training on formalized programs designed for typical plant operations, provide a hands-on approach with a simulation of your actual process. Training managers introduce simulated scenarios, process upsets, and equipment failures, allowing operators to experience infrequent plant events and emergency situations in a realistic training environment. Operators gain confidence working in an exact replica of your plant's control system and process.

Test engineering changes before implementation
If you can't test changes, innovative ideas to improve performance are left ignored. Dynamic simulation provides a testing environment for process control and operations improvements before applying them to the real plant. Experiment on the simulated process to determine what changes will make the targeted improvements without affecting the live operation. Deliver the best possible results the first-time changes go into production.

Meet the project schedule and ensure operational readiness
New configurations and technology, coupled with inexperienced operators, can add uncertainty to any project. Developing simulation in parallel to the project provides validation and training opportunities on improvements early in the project. Checkpoints using the Digital Twin throughout the project allow collaboration between the different stakeholders and increase the likelihood of project success.

Prepare operators for unusual circumstances

Your most experienced and best operators can handle almost any situation, and you need to transfer that valuable knowledge to new operators. Most formal training programs equip personnel with the knowledge of how to operate the plant under normal conditions. While helpful, those programs do not provide operators with the skills needed to adapt to an unusual event. You need your operators to be well-versed on any number of incidents that might arise.
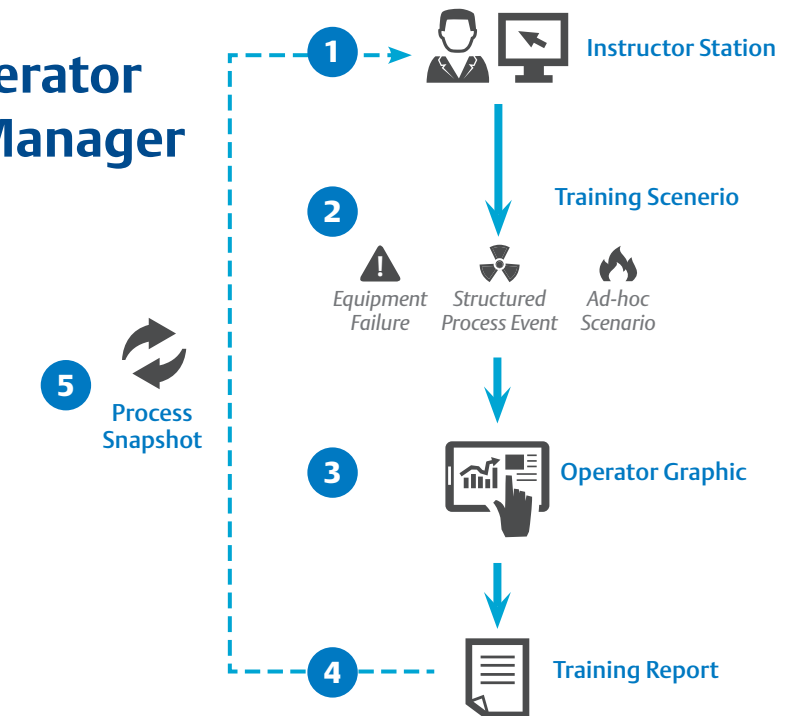
Mimic Simulation Software allows training managers to simulate unplanned process events and malfunctions in a virtual environment. The identical offline system appears and performs just like the actual plant, giving operators the hands-on training typically gained with years of experience. Process Snapshots in Mimic provide a one click restoration of the process and control system to saved conditions, allowing repeated training on key process events.

Mimic Operator Training Manager

1. Instructor Station
2. Training Scenerio
   - Equipment Failure
   - Structured Process Event
   - Ad-hoc Scenario
3. Operator Graphic
4. Training Report
5. Process Snapshot

1 Manage training events from a custom dashboard
The custom instructor station graphic can include process equipment controls, structured training scenarios, snapshot controls and other controls to fit your needs.

2 Trigger events operators typically encounter
Begin a training event with either an automatic process trigger or manual prompt by the instructor.

3 Operators take actions on the exact same screens
The operator reacts with a series of actions or inaction on an operator graphic identical to production.

4 Score the operator performance
Using pre-determined correct actions, the operator's performance is documented in a scored training report.

5 Reset the simulator to quickly begin new sessions
One-click snapshots bring the simulator back to a specific process point or steady state to begin a new session.

50% of experienced and managerial personnel in national and international oil gas processing companies are expected to retire in the coming decade.
–Society of Petroleum Engineers, "The Great Crew Change: A Challenge for Oil Company Profitability", April 16, 2011.

1⁄5
1 in 5 accidents caused by equipment failure in the chemical process industries are the result of human/organizational errors.
–Process Safety and Environmental Protection, "Analysis of equipment failures as contributors to chemical process accidents", January 2013.

Test engineering changes before implementation

Control engineers often develop innovative ideas to improve plant operations. The value of control studies or modernizing entire systems is clear, but without thorough testing and validating, the ideas can be too risky to put into action.

Digital Twin technologies provide a safe way to verify potential changes to the production system. Find hidden errors before they get transmitted to the plant control system by first testing control and operation improvements. Using Mimic Test Bench, control system engineers can automate control system testing and testing documentation development, saving time and money, and ensuring more consistent and thorough testing.
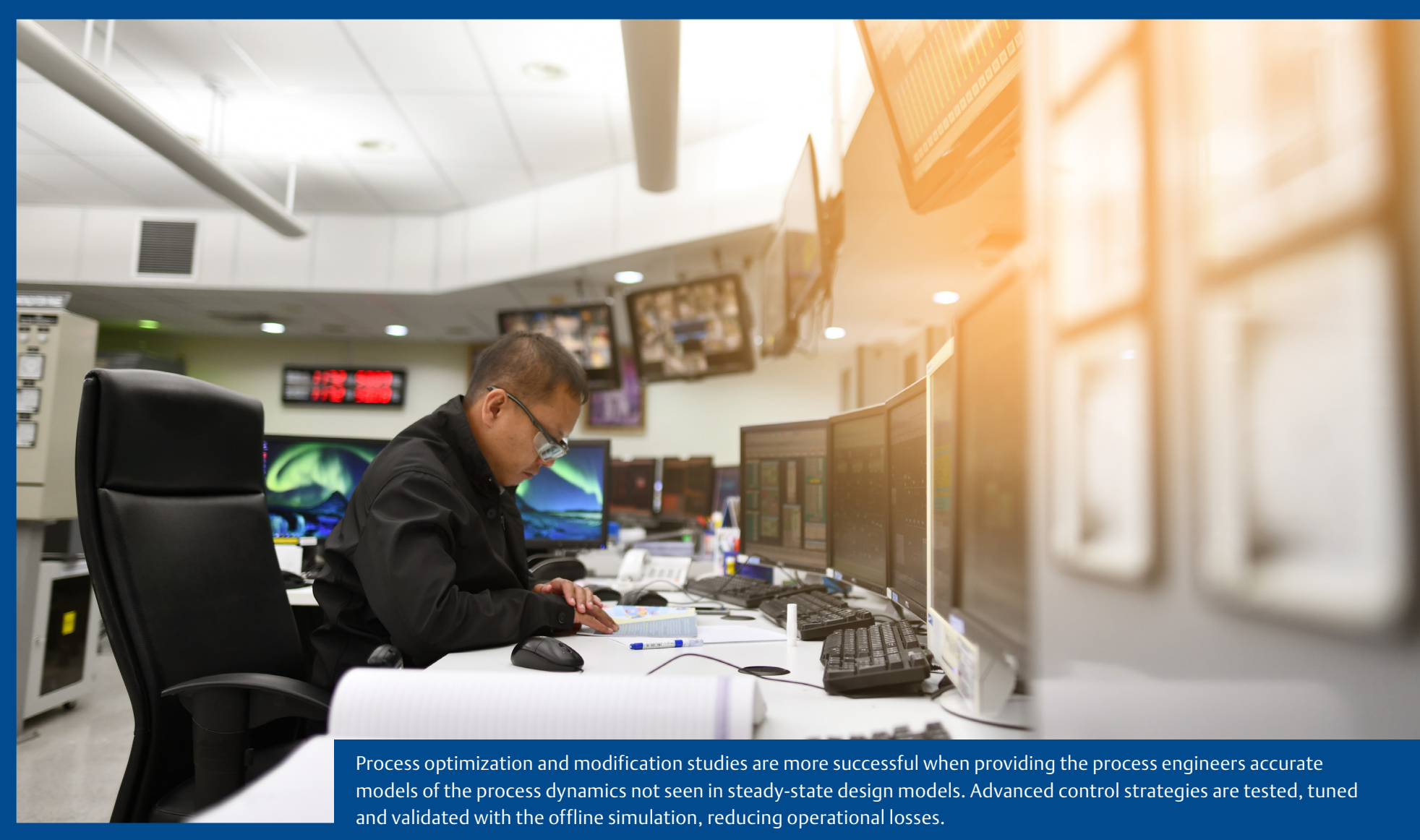
Process optimization and modification studies are more successful when providing the process engineers accurate models of the process dynamics not seen in steady-state design models. Advanced control strategies are tested, tuned and validated with the offline simulation, reducing operational losses.

Identify configuration regression errors before implementation
Changing the control system configuration introduces risks of regression errors. Repeat the tests in the simulation after any control system configuration change, as an effective means of identifying and eliminating those errors.

Reduce testing time and cost
Tests can be repeated for all control modules without user intervention. Start scripts from the user interface, via a command line, or as a regularly scheduled task.

Improve testing consistency
To feel confident in the testing, you need a baseline from which to test. Develop a testing script once and then run it on all control modules. It enforces complete and consistent control system testing.

Automate documentation
Program test logs for each script to automatically save in a specified location, providing a permanent record of the tests. This automated report can be used to support validation and reduce qualification phases.
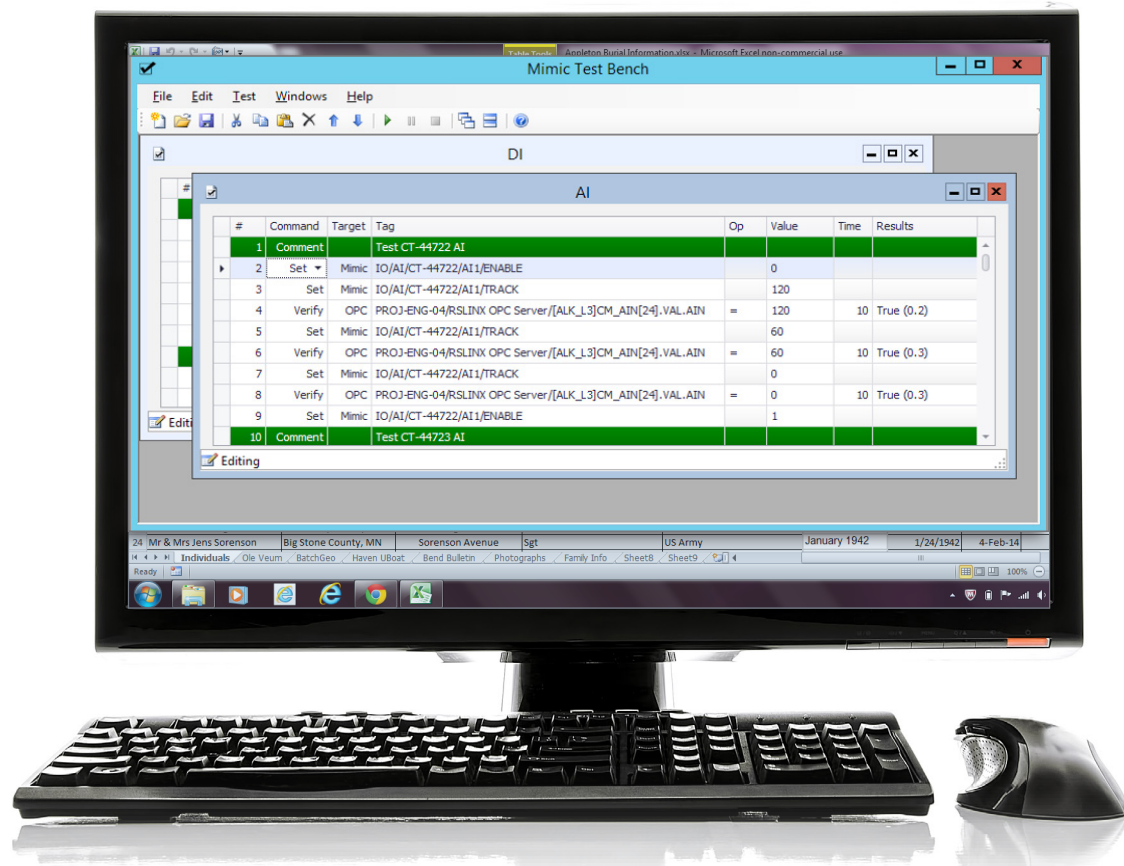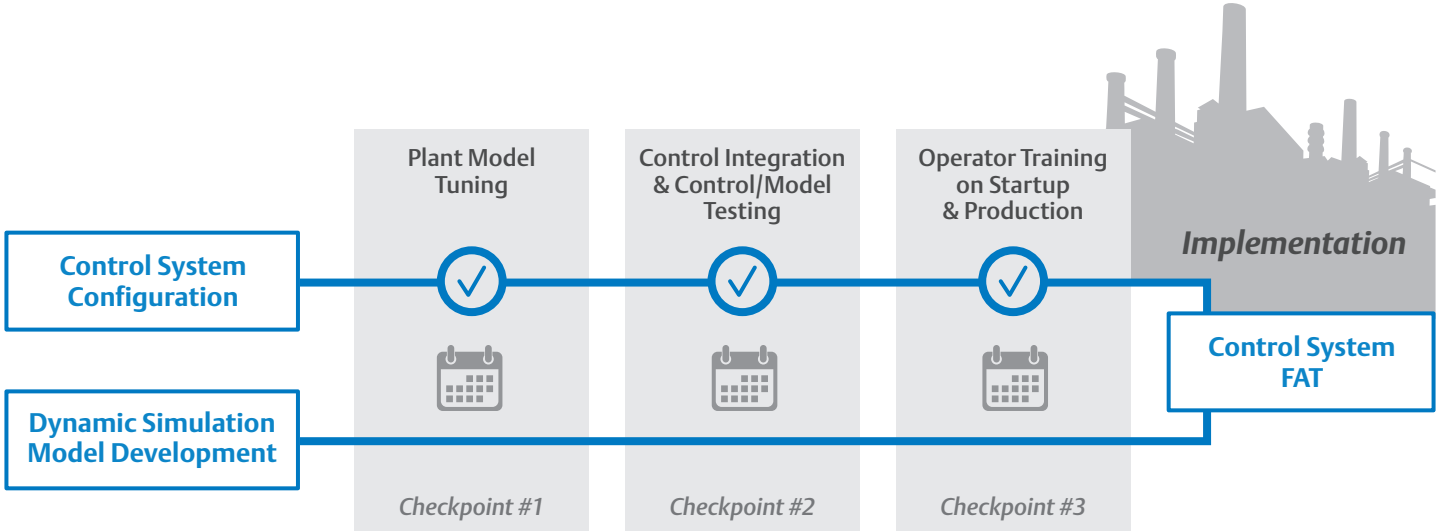
Meet the project schedule and ensure operational readiness

Project schedules often get compressed, leaving you with the challenge of meeting those shortened times while still delivering reliable results.

To accommodate tight project timelines and maximize the available benefits, Mimic supports development of simulation alongside control system configuration. While control logic is developed, simulation models are created to test alarm points, ranges and scales, PID loop control direction, simple and complex interlocks, process sequence control, and HMI configuration. With these items tested at an early stage in the project, factory acceptance tests are completed quickly and successfully. Once tested, the same model can be used to train operators without any additional effort.

Developing process simulation in parallel to the project allows for more validation and training opportunities, keeping the schedule reliable and operations ready.

Control System Configuration

Dynamic Simulation Model Development

Plant Model Tuning

Control Integration & Control/Model Testing

Operator Training on Startup & Production

Implementation

Control System FAT

Checkpoint #1

Checkpoint #2

Checkpoint #3

What if you had a Digital Twin of your control system and your process that gave you to freedom to focus on improving performance and personnel? What if that same Digital Twin could be used to reduce the cost and risk of capital projects?

Simulation software delivers value in any stage of your plant lifecycle

To get the most out of your simulator, leverage all the benefits across the lifecycle of the facility. At the beginning of your project, validate the control system build with parallel simulation development. Use that same simulation to train operators on the new system before it goes live. And continue to test operational changes and improvements in the simulated plant to make sure hidden errors don't cause unplanned shutdowns when changes go live.

Dynamic Simulation Tasks & Deliverables

Capital Project Phase

CONCEPT
- ✔ Set goals for dynamic simulation use
- ✔ Develop vision for business impact

PRE-FEED (Front-End Engineering and Design)
- ✔ Develop project strategy
- ✔ Develop functional requirements
- ✔ Develop execution plan

FEED (Front-End Engineering & Design)
- ✔ Review process design & control philosophy
- ✔ Identify operational & control issues

ENGINEERING
- ✔ Test control system configuration & graphics
- ✔ Advance evaluation of control system design

CONSTRUCTION
- ✔ Test control system for operational readiness
- ✔ Train operators, assess competency

START-UP
- ✔ Test any final changes prior to implementation
- ✔ Review procedures, test operator competency

EARLY OPERATION
- ✔ Finalize operational procedures & documents
- ✔ Test process control improvements

Operations Phase

SAFETY
- ✔ HAZOP and process safety review
- ✔ Interlock verification & training
- ✔ Risk analysis

TRAINING
- ✔ Safe operator experimentation
- ✔ Unit start-up, shutdown, trip recovery
- ✔ Infrequent process occurrences

KNOWLEDGE TRANSFER
- ✔ Capture experienced operator lessons
- ✔ Accelerate new operator experience
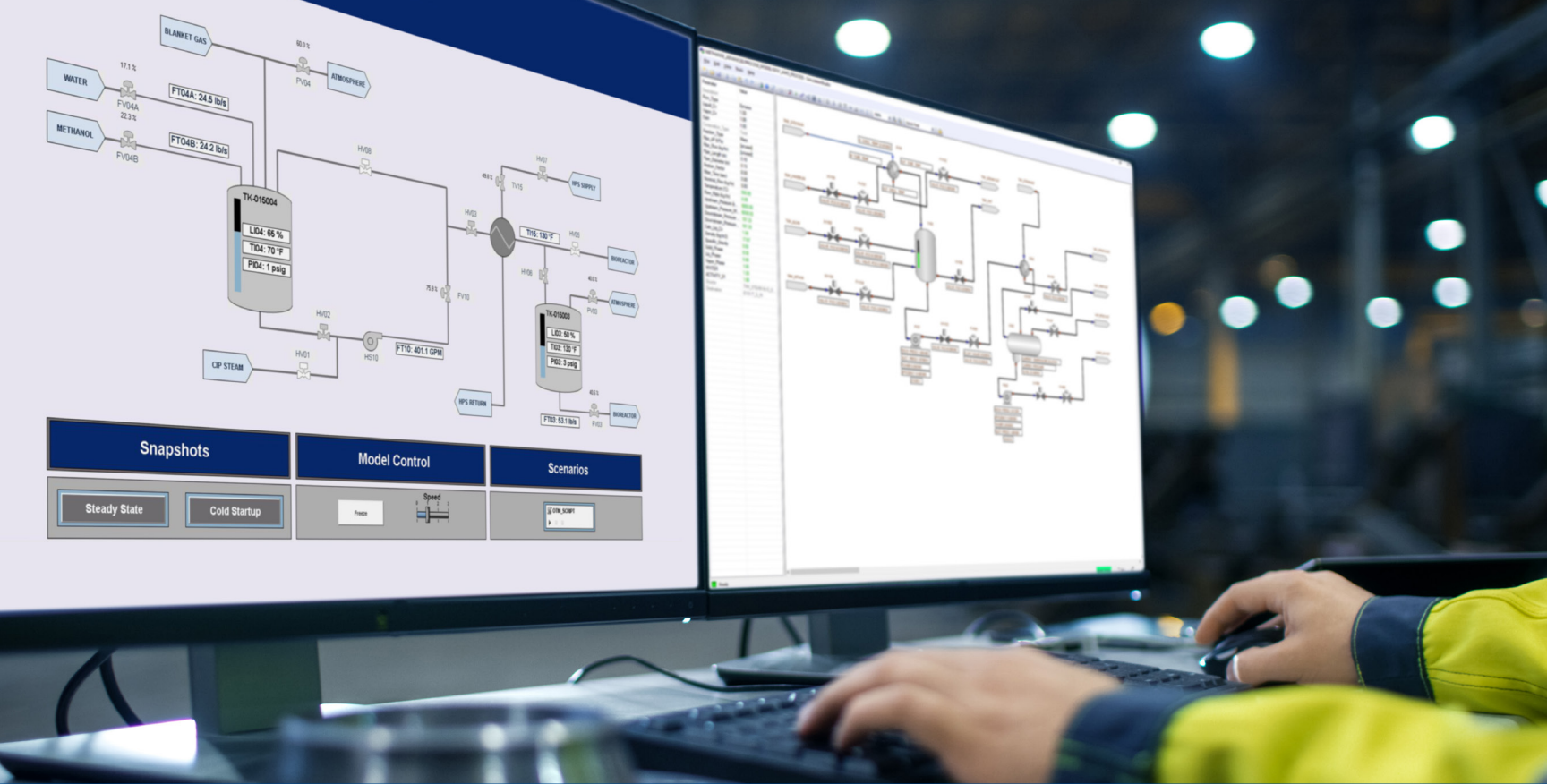- ✔ Efficient experiential training

ENVIRONMENTAL
- ✔ Identify process risks
- ✔ Determine control issues
- ✔ Analyze process event parameters

REGULATORY
- ✔ Operator procedure validation
- ✔ OSHA, FDA preparation
- ✔ Training record development

OPTIMIZATION
- ✔ Process improvement studies
- ✔ Loop tuning & optimization

Improve productivity, quality, and safety with Emerson's Mimic Simulation Software.

Learn more about Emerson's Mimic Simulation Software at **www.emerson.com/mimic**.

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