The Digital Twin: Ensuring Start-up & Stay-up of an Asset

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Emerson Confidential

Presenter

- Ronnie Bains is the Director of Process Simulation for Emerson, where is focussed on value creation for clients through application of the Digital Twin. He has over 15 years experience in the process industries and prior to this he was also responsible for the Process Optimization business within Emerson Europe, including Advanced Process Control & Control Performance Services. Ronnie holds a first degree in Chemical Engineering from Loughborough University in the UK, as well as an Executive MBA from Geneva Business school.

Agenda

- Introduction
- Digital Twin Concept
- Technology
- Case Study
- Summary & Questions

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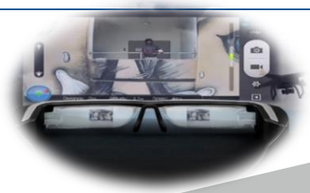
Introduction

- Application of simulation technologies linked to control systems has evolved since 1950's
- In the process industries, the technology was first used for training – hence Operator Training Simulators
- Increasing functionality, scope and general computing power means the use of the simulator now extends far beyond just training – hence Multi-purpose Dynamic Simulators.
- Digital twin refers to a digital replica of physical assets, processes and systems. This is the next step for our Simulators
- MPDS are now a critical element on new green field projects



Future – Worker of the future? Real time support from the Digital Twin?

2010s 3D simulation. Augmented reality for immersive simulation. Cloud solutions

2005 1st Emerson MPDS

2000s Process Simulation used widely for engineering support – Life cycle simulation concept

1990s Initial versions of the high fidelity process simulation software

1973 First Marine vessel simulator

1966 First well drilling simulator by B. Butler

1954 First commercial airline simulator by Curtiss-Wright

The Digital Twin – Building Block for Top Quartile Projects and Operations Certainty

Capital Projects

Plant Operations

Plan and Execute – 1- 5years

Appraise | Pre-FEED / FEED | Execute | Startup

HandOver

Operate and Maintain - 20-40 Years

Maintenance & Repair | Shutdowns, Turnarounds, & Outages | Optimize, Expand & Upgrade

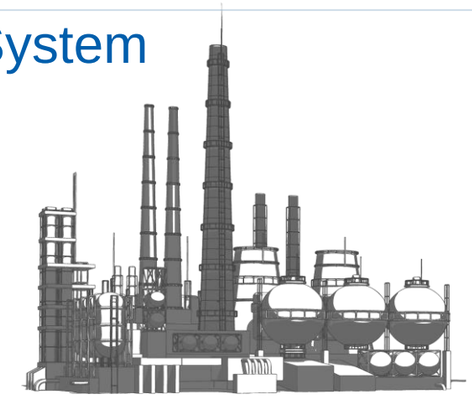
- Reduce Complexity
- Eliminate Risk
- Accomodate Change

- Improve Reliability
- Optimize Production
- Minimize Emissions
- Ensure Safety

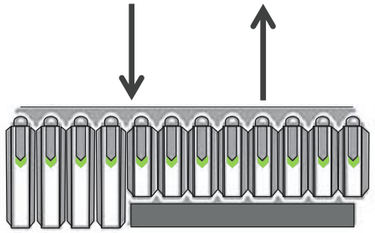
Entry point for Digital Transformation

What is the Digital Twin?

Production System



Physical Site

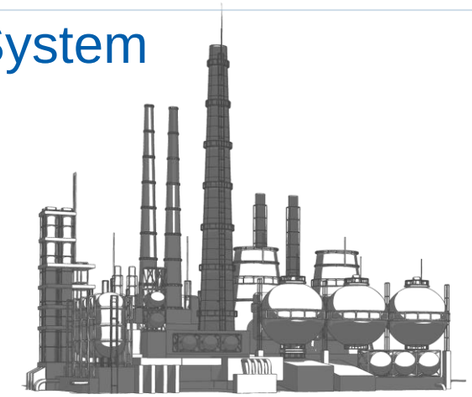


Control System Hardware

Operator Console

What is the Digital Twin?

Production System



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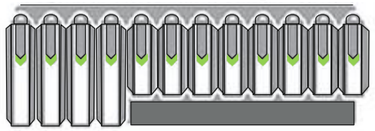

Control System Hardware

Operator Console

Digital Twin

DeltaV Simulate
ICSS

aspentech

aspentech

DATADA
TDATAD
ATADAT
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Operator Console

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Where can it help?

“I need to get back to nameplate capacity faster, how can I reduce my project schedule?”

“My workforce will be retiring soon, how do I capture their knowledge?”

“How can I ensure the cut-over of my process will be smooth?”

“I need to validate my STO plan?“

“How can we practice operating my plant before the revamp is complete?”

“I need to get online quicker and reduce commissioning time”

“This process has not been shut down before. How do I validate my start-up prior to the shutdown?”

Digital Twin Lifecycle

Concept Definition

Process Design

ICSS Development

Commission& Start-up

Operations Support & Maintenance

Plant Optimization

Preliminary Design

FEED Studies

Detailed Design

HAZOP

Test Start-up & Shut down Procedures

Pre-tune Control Loops

Test Integrated Controls

Virtual Commissioning

Develop/Test Advanced Process Control

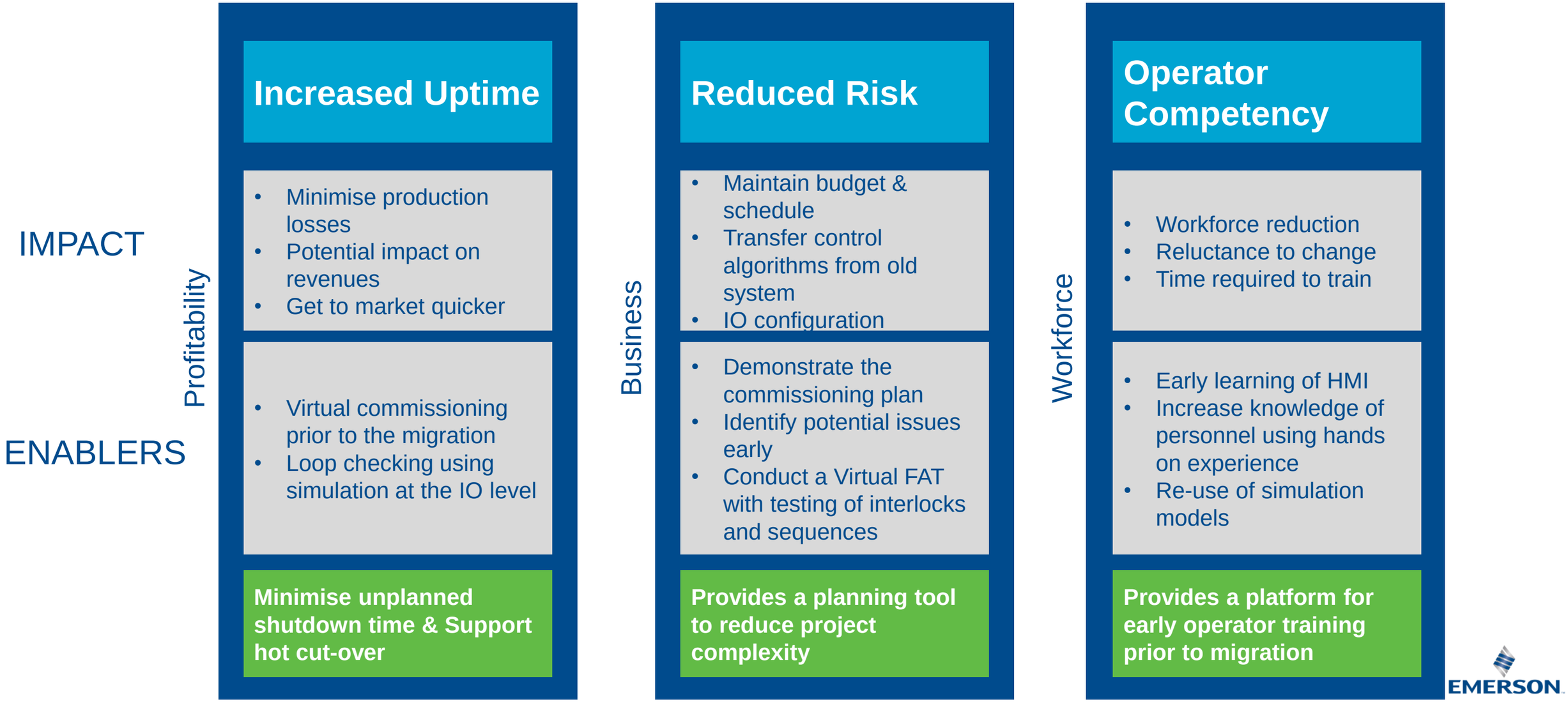
Verify Operating Procedures

Training & Competency Assessment

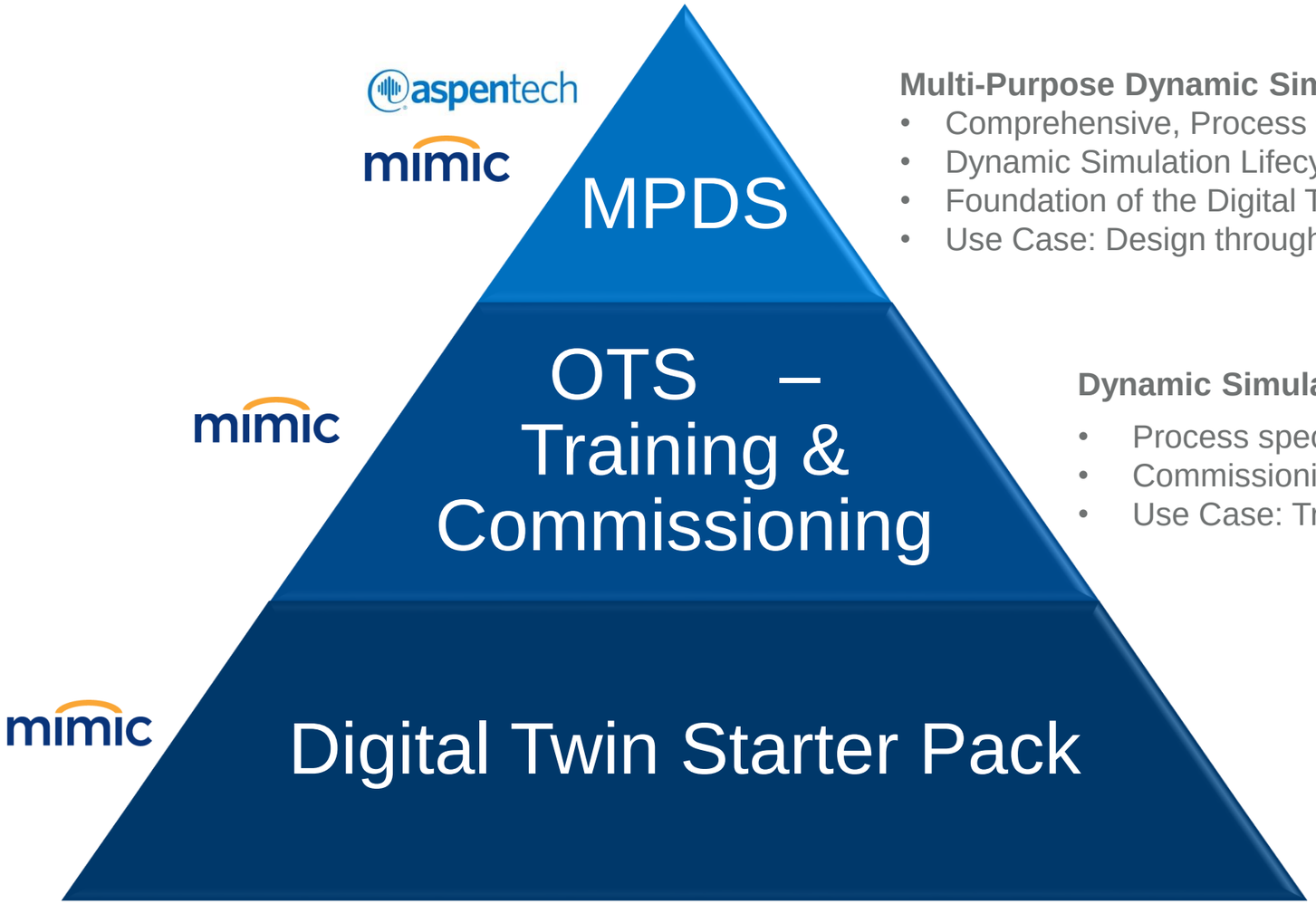
Optimization & De-bottlenecking

Incident Analysis

Digital Twin Value Proposition for STO



Emerson Digital Twin Offerings



Multi-Purpose Dynamic Simulation

- Comprehensive, Process specific, High fidelity process model
- Dynamic Simulation Lifecycle
- Foundation of the Digital Twin
- Use Case: Design through to Optimization

Dynamic Simulation – OTS, Training & Commissioning

- Process specific, Training focused
- Commissioning support tool, Legacy Migration Simulator
- Use Case: Training, Commissioning, Modernizations

Digital Twin Starter Pack

- Low fidelity tieback simulation
- Provides infrastructure for future simulation solutions
- Use Case: Development & Testing

HYSYS + Mimic = Best in Class Hi-Fidelity MPDS

Emerson-AspenTech Alliance

AspenTech Press Release – 12 Feb 2018

Emerson and AspenTech Form Alliance to Deliver Digital Technologies

February 12, 2018

Alliance brings two leading companies together to help customers tackle complex problems, optimize operations, and achieve Top Quartile performance

AUSTIN, TX and BEDFORD, MASS., Feb. 12, 2018 – Emerson (NYSE: EMR) and AspenTech (NASDAQ: AZPN) announced today they have teamed up to deliver asset optimization software solutions along with global automation technologies and operational consulting services. Together, the two industry leaders will help customers optimize production and drive operational excellence.

AspenTech's broad suite of asset optimization software creates value across all phases of the asset lifecycle – design, operate and maintain – in capital intensive and complex projects and operations, supporting Emerson's Project Certainty and Operational Certainty initiatives. Emerson's global footprint, automation engineering services and software, extensive large-scale project execution and consulting capabilities complement AspenTech's technology footprint. Collectively, these capabilities can be deployed as solutions in both conventional and cloud-based architectures.

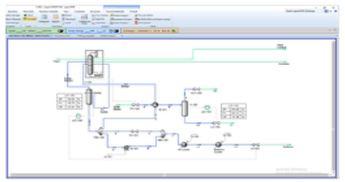
"Emerson and AspenTech are both highly focused on digital technologies and services that deliver measurable improvements and value to our customers' bottom line," says Dave Farr, chairman & CEO of Emerson. "Together, we are well positioned to help our customers navigate the best path in this era of digital transformation and achieve Top Quartile performance." Top Quartile is defined as achieving operations and capital performance in the top 25 percent of peer companies.

The alliance will initially focus on three key areas: engineering software, including high-fidelity simulation to help validate project design and train operators before start-up; manufacturing and supply chain software, including advanced process control software designed for highly complex operations; and asset performance management software to improve plant reliability.

Emerson Press Release – 2 Oct 2018

New Alliance Offering Creates Seamless, Scalable Digital Twin to Bridge Plant Design to Plant Operations

Connected Emerson, AspenTech simulation software increases digital investment value by enabling more capital-efficient digital twin technology for use across operations lifecycle



New integration makes it possible for process engineering designs in Aspen HYSYS (pictured above) to be leveraged for real-time process optimization and operator training in Emerson's Mimic simulation software. High resolution image

AUSTIN, TEXAS (Oct. 2, 2018) – Emerson today announced the first offering to come from the 2018 alliance between Emerson and AspenTech -- a new integration technology that will make it more practical and efficient for organizations to create digital twins for use across an entire plant's lifecycle. With the new capabilities and expertise achieved through this joint development, process industry organizations can now use data from the standard digital twin created during plant design engineering to easily create a real-time digital twin for training operators and optimizing production. This development lowers two of the most significant barriers to digital twin utilization: total cost of ownership and maintainability.

Emerson is natively integrating its Mimic™ simulation software with Aspen HYSYS® Simulation Software, widely used in project engineering. Combining with Mimic adds real-time process optimization and training and makes building and maintaining an operations digital twin much easier for thousands of organizations already using AspenTech's HYSYS software.

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Emerson Digital Twin

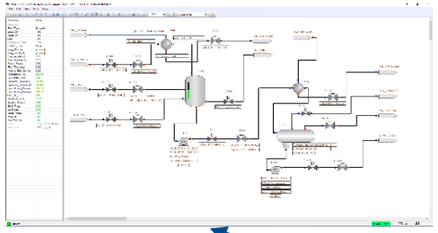
Technical Platform Leadership

Scalable Process Modeling

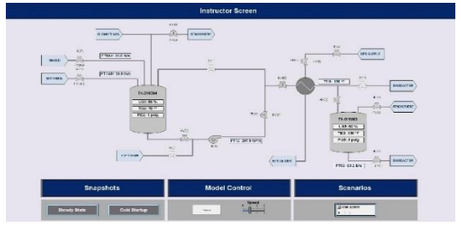
Total Cost Ownership

Seamless Integration

Engineering Station



Instructor Station



Operator Station

2018 READERS' CONTROL CHOICE AWARDS

aspentech

Plant 1 Process Design by EPC

Aspen HYSYS Engineering Suite

HYSYS Dynamics Process Model

HYSYS End Point Server

Other Control System Simulator

mimic

OTM

Test Bench

Process Models

HYSYS Link

IO / Equipment Models

Other SIO Bridges

DeltaV SIO Bridge

DELTAV™

DeltaV Operate

Control Modules

DeltaV DST

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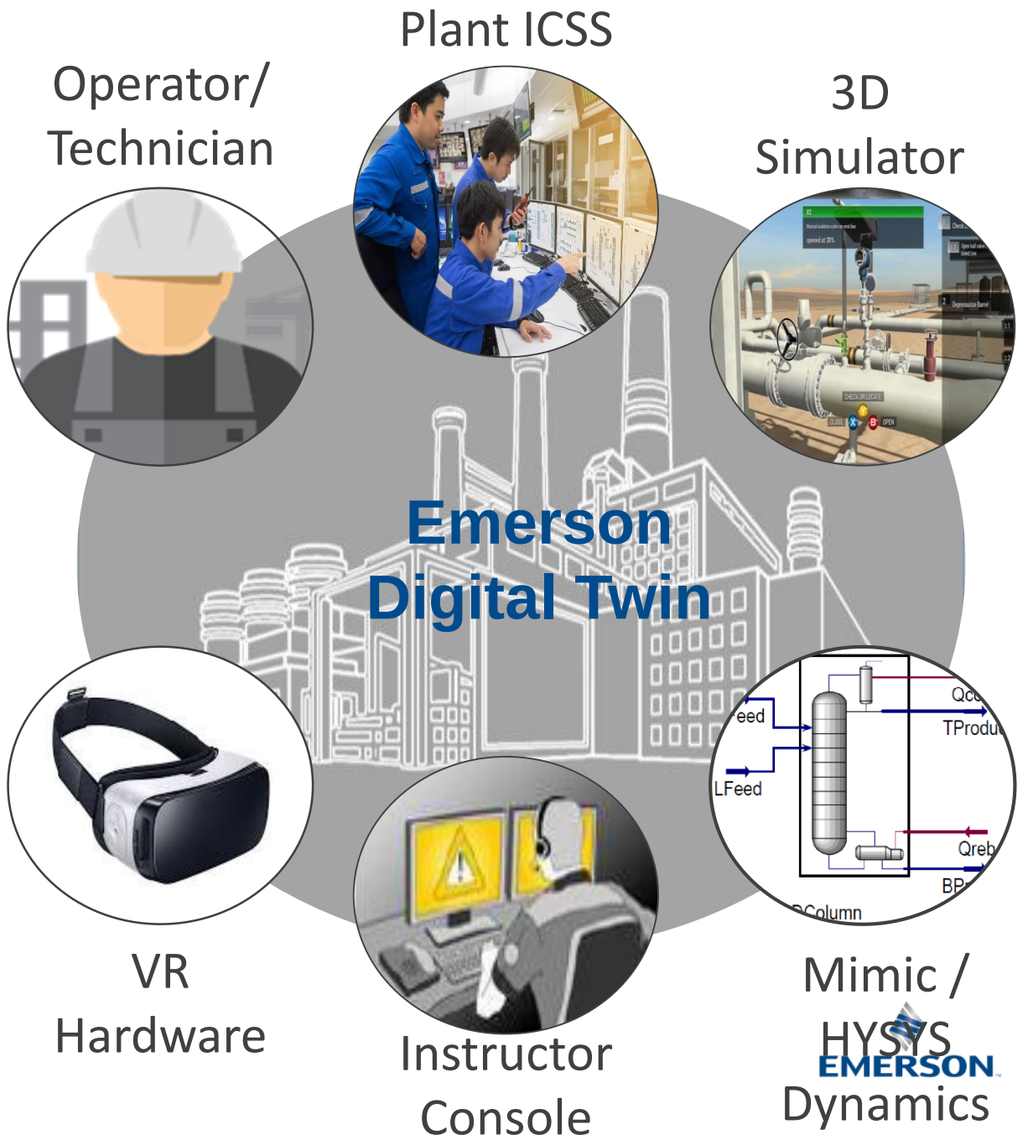
VR Immersive Simulator – Building on the Digital Twin

- **Customer Value**
  - Standard Operator/Maintenance Onboarding
  - Crisis management training
  - Commissioning support
  - Shutdowns/Turnarounds/Outages (STO) support
  - Mitigate risks through real-life scenarios

- **Powered by the Emerson Digital Twin**
  - Mimic foundation for all solutions
  - Hydrocarbon, power, mining, and life sciences



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Digital Twin Reference - Global Chemical Manufacturer

Challenge/Critical Business Issue

- Migration project – needed engineering verification tool to support the ICSS migration & reduce shutdown time
- Complex project - logic and sequences needed to be thoroughly tested prior to commissioning.
- Operator competence – needed a safe environment on which to carry out process learning, familiarization with the operating procedures, and testing of abnormal situations in order to build the confidence of the operators

Solution

- DCS: DeltaV
- ESD system: Triconex
- Simulation SW: Mimic
- Deliverables:
  - Hardware – DeltaV
  - Software – DeltaV Simulate & Mimic
  - Engineering Services – by Emerson
  - Training – by Emerson

Results

- A number of configuration issues were identified and corrected prior to the commissioning of the plant, on the integrated OTS system
- Training objectives were met – all operators were trained and confident prior to the plant commissioning
- Saved £2M million pounds in rework, testing of sequences and potential damage to equipment

North East UK

Summary

Faster Commissioning & Start-up

Decision Support & Competency

Risk Mitigation & Planning

Get to Market Faster

Development & Optimization

Optimizing production and driving operational excellence with the Digital Twin

EMERSON™