Building the Virtual Plant for PlantPAx

Mart Berutti
MYNAH Technologies

Rockwell Automation
Process Solutions User Group (PSUG)
November 14-15, 2011
Chicago, IL - McCormick Place West
MYNAH - Simulation Leader

Dynamic Simulation Leader
Over MiMiC 1100 Registered Sites
World-class Software Development Team
World-class Simulation Consultants

Rockwell Automation
Encompass Partner for Dynamic Process Simulation

Simulation Software
Exceptional Customer Service (4.3/5)
ISO 9001:2008 Certified
Tough Times for Process Plant Operations

- The Demographic Time Bomb
- The Automation Paradox
- Risks in Automation
- Transferring Operational Knowledge
- Global Competitive Pressure
The Solution is the PlantPAx Virtual Plant

- **Manage Experienced Operator Shortages**
  - Qualify potential board operators
  - Decrease time required to achieve operator competence
- **Plan for Highly Automated Plants**
  - Safely teach operators how to operate
  - Qualify, test, new control and operational strategies
- **Remove Risk, Increase Safety**
  - Knowledge transfer of operations staff
  - Training on infrequent process occurrences
  - Problem solving, risk mitigation tool
The PlantPAx Virtual Plant

- **Virtual Control System** – exact replica of the plant system
  - Training on identical HMI graphics, alarms, controls
  - Testing on identical control strategies

- **Virtual Process** – dynamic simulation
  - Selective application of simulation fidelity
  - Easy-to-use, easy-to-change

- **Integrated approach for testing and training**
  - Integrated to automation project schedule
  - Available as operations resource for control system life cycle
MiMiC - Built for the PlantPAx Virtual Plant

• Built for SAT and OTS
  – Non-intrusive simulation interfaces
  – Protects control system integrity
  – Integrated Operator Training Manager

• Easy to use
  – Designed for use by the end-user or integrator
  – Automatic integration with control system
  – Auto-generation of simulation database

• Flexible, Powerful, Dynamic
  – Scalable from small to large applications
  – Selective application of simulation models
  – Dynamic, accurate modeling functions
• .NET Graphical User Interfaces
• XML data exchange
• MS SQL Server Express Database
• OPC access of modeling and OTM data
• IEC function block simulation objects
• Multiprocessor workstation support
• Windows 7, Server 2008 Support

Dynamic … Accurate … Intuitive
PlantPAx Virtual Plant Delivers Results

- Time to Market - reduce startup time – $100-500K / day
- Product Quality - reduce off-spec product – $50K-$1MM / run
- Operating Cost - reduce unscheduled downtime – $5-50K / hour
- Reduce Risk – reduce failures and incidents – $50K - $1MM / incident
  - Hidden errors in automation application software
  - Insufficient or inappropriate operator actions
  - Incorrect or incomplete operating procedures
Driving Simulated IO to Rockwell PLCs

- **Simulated IO Driver for EtherNet/IP, MM3-2106**
  - SIO Bridge supports asynchronous read/write to IO signals
  - Global Logix Tags, DF1 Table Access
  - 32 Runtime EtherNet/IP Nodes per MiMiC Workstation
Automatic Generation of SIO Definition

- Builds Direct IO to Logix Global Tags Using Logix5000 File
Driving Simulated IO to RSEmulate

- Simulated IO Driver for OPC Servers, MM3-2106
  - Direct Link to RSEmulate for Logix, PLC5
Manage the Dynamic Simulation

- MiMiC Explorer
  - Simulation Models
  - Model Library
  - Simulated IO (SIO)
  - User Views
  - Training Scenarios
  - Process Snapshots
  - Database Control
  - Import / Export to XML
• Simulated IO Definition for Rockwell PLCs
• Simulation Studio – Dynamic Models in IE1131
Effective Process Modeling

- Integrated Steam Tables
- Thermodynamic Properties Blocks
- First Principles Modeling Blocks
- IEC1131 Structured Text Calc Model Block
View the Simulation

- Configurable User Interface - Views
  - Data View – Tabular data of Model, and IO data
  - Data Monitor – Dynamic trends - MiMiC or OPC
  - Component Studio – Dynamic Process Flow Diagrams - MiMiC or OPC
Virtual Process Working with PlantPAx

Automatic Integration with Control System
Advanced Modeling for PlantPAx Systems

• **MiMiC Advanced Modeling Objects**
  – Medium-High to High Fidelity Focus
  – Rigorous First Principles modeling using differential equations
  – Unit Operation IEC1131 objects

• **Advanced, Dynamic Modeling Infrastructure**
  – Dynamic Objects – Real Time Convergence
  – Object to Object links with process Streams
  – Component Sets Property Management
  – Automatic Engineering Unit Handling
  – Automatic Dynamic Flow Solver
Advanced Modeling for PlantPAx Systems

- Thermo / Flash / Stream Property Functions
- Advanced Modeling Core Objects
  - Vessel, Valve, Pump, PRV, HX, DHX, Stream T, Compressor
  - PF Solver
- Energy Management Objects
  - Boiler with Furnace, Steam Header, Desuperheater, Fuel, Turbine
- Distillation / Separation Objects
  - Column, Stripper, Separator, Physical Absorber
- Reactor / BioReactor – coming soon!
  - Mammalian Cell, Fermenter
PlantPAX Training Scenarios

- Training Scenarios
  - Structured sets of malfunctions or process events
  - Scenarios added or changed without changing process models

- MiMiC Operator Training Manager Scenarios
  - Malfunctions can be set in MiMiC or RSEmulate
  - MiMiC Simulation functions have malfunction actions built-in
  - Scoring conditions can be defined for each Malfunctions
  - "Ad-Hoc" Instructor driven scenarios with reporting
  - Training sessions use a Scenario definition
  - Training Session report results in HTML, PDF, or RTF
PlantPAx Instructor Station

- Easy to develop / modify
- Dynamic Process Flow Diagram User View
- Instructor Friendly Model & Boundary Controls
- Simulation of field tasks coordinated with panel tasks
- Training Scenario Start Controls
- Snapshot Restore Controls
Automated Testing of PlantPAx Systems

- **MiMiC Test Bench** - Automated configuration testing
  - Test scripts edited in Excel or MiMiC Test Bench
  - Results saved in MiMiC Test Bench log file
  - Automatic testing with MS Windows Scheduler
Virtual Plant Multi-User Support

- MiMiC Server – Multi-User Support with MS Remote Terminal Services
- MiMiC Access Control Layer
  - Coordinates user access
  - Protects simulation integrity
  - Simplifies multi-user management
  - Provides user status information
Dynamic Simulation Leader

• **MiMiC Simulation Software**
  – Over 1100 Systems Installed Worldwide
  – Exceptional Customer Service

• **Getting More Information** – [www.mynah.com](http://www.mynah.com)
  – MiMiC v3.4 New Release
  – Building the Virtual Plant for PlantPAx White Paper

• **Contact for Questions**
  – Mart Berutti, +1.636.728.2016, Skype mberutti
    [martin.berutti@mynah.com](mailto:martin.berutti@mynah.com)