# Rheinmetall Group

<table>
<thead>
<tr>
<th>Company</th>
<th>Revenue</th>
<th>Employees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rheinmetall AG</td>
<td>approx. € 4,600 million</td>
<td>approx. 22,000</td>
</tr>
<tr>
<td>Rheinmetall Automotive</td>
<td>€ 2,400 million</td>
<td>12,000</td>
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<tr>
<td>Rheinmetall Defence</td>
<td>€ 2,200 million</td>
<td>10,000</td>
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</tbody>
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**Rheinmetall Automotive**

Leading Supplier of Motor-Components and Systems

**Rheinmetall Defence**

One of the World leading Supplier in Defence and Simulation- and Training Systems
• Initial Situation

• Engineering Test Bed

• Simulation based Verification & Validation Process

• Benefits

• Summary
Initial Situation

- Various Sub-suppliers
- No consistent design database
- Late availability of detailed information
- Interface problems to be resolved during commissioning
- Guaranteed performance of power plant not demonstrated
- Operating procedures not optimized

Typical situation in start-up phase
**Initial Situation**

**Proposed Solution**

- Pre-integration on “Engineering Test Bed”
- Pre-operational test of process-, I&C-, and HMI-Design
- Possibility of early design modifications
- Demonstration of guaranteed performance prior to commissioning in by a dedicated V&V process

V&V is Rheinmetall’s solution to improve the situation
Emulation by Virtual Controller
- Actual control system running on PC's
- HMI's & controls stimulated by models
- True to DCS
- Fully Stimulated
- Uses DCS hardware
- Exact copy of control system
- HMI's & controls stimulated by model
- Hybrid
- Control system translated
- Uses same DCS HMI's
- Emulation by translation
- HMI's & controls translated
- Requires custom DCS translation software

Simulation Approach for V&V Projects
Engineering Test Bed Software

- Windows based Graphical User Interface (GUI)
- Graphical coding of process and I&C systems
- Automated code generation tool and object calibration
- Integrated Configuration Management System and build management
- Integrated on-line test environment
- Standard interfaces via TCP/IP, OPC
- On-line documentation and help facility for tools
Simulation based V&V Process

• Pre-integration of design input data on “Engineering Test Bed”
• Pre-operational test of process-, I&C-, and HMI-Design
• Possibility of early design modifications
• Demonstration of guaranteed performance prior to commissioning by a dedicated V&V process

Engineering Test Bed supports DCS Design
Process Model Characteristics

- Fully dynamic process model based on plant P&ID’s, isometric drawings, system design data and component data
- Full scope in simulated systems and components
- Full scale in simulation depths to achieve the required accuracy and prediction capability (multi node models)
- High fidelity simulation methods for super critical boiler and all other plant systems, e.g. subsequent usage of two-phase methods for all main water/steam systems
- Consideration of metal masses, spatial temperature distributions, thermal transport delays, and component characteristics to achieve a realistic behavior during transients
- Full simulation of the electrical system and the generators for realistic start-up and black start

Full Scope and in-depth Modelling
Dynamic Plant Tests

- Verification of all I&C interlocks, controls, safety systems
- Verification of plant automation (sub-group controls) and Unit Coordinator
- Start-up from cold, warm and hot, shut-down, plant maneuvers, pump transfers, steady state conditions and plant capabilities
- Worst Case scenarios (major damages, … etc.)

Comprehensive pre-operational tests
Plant Procedure Optimization

- Check of normal operating procedures
- Check of emergency operating procedures
- Update of plant procedures
- Optimization of start-up sequence for the entire plant

Optimized procedures available before plant commissioning
Context of simulation based V&V Process

- Embedded in DCS design and development process
- Input data for process after availability of major plant components
- Step by Step pre-test of DCS functional areas in line with the DCS development
- Dynamical overall plant tests before commissioning
- Optimization of controls and plant procedures
- Training prior to start of commissioning of plant

Simulation based V&V is vital part of DCS development
Recent V&V-Simulation Projects

- Datteln Power Station (E.On, ABB, RDE)
- Maasvlakte Power Station (E.On, ABB, RDE)
- RDK8 Power Station (EnBW, Siemens, RDE)
- Medupi Power Station (Eskom, Alstom, RDE)
- Moorburg Power Plant (Vattenfall, Mauell, RDE)

Actual Projects are supported by simulation based V&V
Benefits of Simulation based V&V Process

• Consistent design data base

• Well checked interfaces between all sub-systems, I&C and HMI

• Possibility of early design modifications

• Early availability of training aids for pre-commissioning training of customer

• Potential cost savings, e.g. optimized plant procedures, reduced project risk, time savings during commissioning

• Design and Construction Monitoring

• Planning Support

• Commissioning Support

• Training in advance

• Tool for Life Cycle Support

Improved overall quality
V&V Process Summary

Engineering Simulators are not longer a Back Room Tool

• Designer’s First level of Verification
  - Can verify equipment design changes
  - Can accommodate Control Strategy Modifications
  - Overall Control Design Unification
  - Validates Operating Procedures

• Engineer’s favorite Tool
  - Assists Verifying controls prior to FAT
  - Allows Reviews of permissive and control strategies
  - Allows for comprehensive HFE investigations of the Operator HMI

• Project Manager’s Best Tool
  - Invaluable tool during commissioning
  - Implemental in delivering a project on-time and on-budget
Thank you for your audience!

Lars Mohr, M.Sc.
Manager International Sales
Process Simulation
Maritime and Process Simulation

Rheinmetall Defence Electronics GmbH
Brueggeweg 54
28309 Bremen, Germany

Telephone:  +49 (0) 421 457-2398
Mobile:    +49 (0) 162 2174780
Fax:       +49 (0) 421 457-2930
E-Mail:    lars.mohr@rheinmetall.com