ProSTEP iViP Symposium 2009

VIRTUAL TEST-BED-INSTALLATION ("TEST-BED-DMU")

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AVL COVERS ALL CUSTOMER SEGMENTS

- Passenger Cars
- 2-Wheelers
- Racing
- Construction
- Agriculture
- Commercial Vehicle
- Locomotive
- Marine
- Power Plants

Engineering
Simulation
Testing
Content

AVL’s Development Challenges
Virtual Test-Bed-Installation
Development Process Improvement Project
Benefits and Project Results
Summary and Conclusion
AVL’s Development Challenges

Broad variety of projects – virtual and physical
AVL’s Development Challenges

Increasing number of projects in short time
Content

AVL’s Development Challenges

Virtual Test-Bed-Installation

- Optimization Approach
- “Technical” Results of the Test-Bed-DMU

Development Process Improvement Project

Benefits and Project Results

Summary and Conclusion
Engine Test Process

- 14 Test Tasks
- Description of Results for each task
- Optimisation for all engine development projects
Improve AVL’s Frontloading by Virtual Test Bed Installation

First engine enabling fully relevant performance, emission and also durability targets

Frontloading

Development time

Effort

Start of production

Preproduction development

Prototype development

Virtual Powertrain

Concept study
Virtual Test-Bed-Installation

Optimization Approach
Virtual Test-Bed-Installation

Activities to make an optimization come true

→ Define concept
→ Design all sensors, weldingrings, adapter, …
→ Adapt / convert existing test rigs
→ Create a library for component administration
→ Consider different CAD-Systems
→ Allow automatic adjusting of fixtures
→ Define collision free mounting
→ Define Standard ETS
→ Adapt files to make available with PARTSolution
Virtual Test-Bed-Installation

„Technical“ Results
Content

AVL’s Development Challenges

Virtual Test-Bed-Installation

Development Process Improvement Project

- Challenges and Gains
- The General Model
- Analysis of Processes Affected
- Process Improvement Tools Applied
- Project Results

Benefits and Project Results

Summary and Conclusion
Design Process Improvement Project

Process Challenges and Gains with Development Process Redesign

Challenges

- Surgery on the „Living Body“
- Workflow and Interface Changes
- Data Structures in Complex Environments have to be Changed Carefully
- Impact on the Organisation and the People within
- Quantification of the Improvement (Costs, Time)

Gains

- Process Costs: Reduction around 20% for the Processes Improved
- Development Time: Benchmark with Competition shows 30% shorter Time
- Secondary additional Effects: Quality
Design Process Improvement Project
The General Model

Personnel Layer

Organization Layer

Process Layer
Design Process Improvement Project

Analysis of Processes affected
Design Process Improvement Project
Analysis of Processes affected
### Design Process Improvement Project

#### Process Improvement Tools Applied

<table>
<thead>
<tr>
<th>Method</th>
<th>Target of Method Applied</th>
</tr>
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<tbody>
<tr>
<td>Maturity Models</td>
<td>Customers readiness is an <strong>indicator</strong> for volume and scope of the resulting project.</td>
</tr>
<tr>
<td>Process Map</td>
<td><strong>Overview</strong> of relevant business processes, their relations and implementation in the complete R&amp;D resp. test field process.</td>
</tr>
<tr>
<td>SIPOC</td>
<td>Process model with respect to: <strong>Supplier Input Prozess Output Customer.</strong> This is a first <strong>rough picture</strong> of the <strong>value-chain process</strong>, helping to identify all parties involved.</td>
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<tr>
<td>PCAT for Development</td>
<td><strong>Process Cost Analysis Tool</strong> is a prerequisite to give a quantitative picture of possible process improvements in the development process.</td>
</tr>
<tr>
<td>IAM</td>
<td>The interface-analysis-matrix shows to which extend the organization is <strong>living the processes</strong> resp. has a process understanding. Furthermore <strong>starting points for improvements</strong> will be detected.</td>
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</tbody>
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Content

AVL’s Development Challenges
Virtual Test-Bed-Installation
Design Process Improvement Project

Benefits and Project Results

- Direct Benefits in Time and Costs
- Indirect and Following Benefits

Summary and Conclusion
Benefits

Direct Benefits in Time and Costs

Hours for each Project

- Virtual Time
- fix h/Engine
- Project h

P1: 40 hours (Virtual Time: 30, fix h/Engine: 10, Project h: 0)
P2: 70 hours (Virtual Time: 40, fix h/Engine: 20, Project h: 10)
P3: 60 hours (Virtual Time: 40, fix h/Engine: 20, Project h: 0)
P4: 50 hours (Virtual Time: 40, fix h/Engine: 10, Project h: 10)
P7: 50 hours (Virtual Time: 40, fix h/Engine: 10, Project h: 10)
P14: 40 hours (Virtual Time: 30, fix h/Engine: 10, Project h: 0)
P26: 30 hours (Virtual Time: 30, fix h/Engine: 0, Project h: 10)
Benefits
Direct Benefits in Time and Costs

Hours per project with/without Quality Processes (QP)

Break Even
Benefits

Indirect Benefits in Time

Quality and Reproducability

Test Equipment Planning (TFMS)

Standardization of Tests

Prototype Oriented Purchasing

Common Understanding in the Design and Mechanic Department
Content

AVL’s Development Challenges
Virtual Test-Bed-Installation
Design Process Improvement Project
Benefits and Project Results

Summary and Conclusion
Summary / Conclusion / Next Steps

Implementation Project
- In Budget
- On Time

Technical Aspects
- Time for DMU Effort is becoming shorter
- Enlarge Library with Tools, etc.
- Availability for all designers via PARTSolutions
- Derive 3D sensor mounting model from ETS circuit

Process Aspects
- Process implemented and accepted
- 3-Layer Model was vital for the success of the quick implementation
- Future process optimizations along the EDP will be established acc. to this approach
Thank you to the audience

Combustion Engine

Transmission

Battery System

Electric Engine

Control Strategy
Abstract

Virtueller Motorenversuchsaufbau – Der „PrüfstandsDMU“

Als qualitätsunterstützendes Entwicklungswerkzeug zur Komponentenfreigabe sowie für Abstands- und Einbauuntersuchungen im Fahrzeug sind die Nutzung des DMU (Digital Mock Up) und die entsprechenden Softwarepakete etabliert und prozessgestützt in Verwendung.


Dieser Prozess wurde im Sinne eines konsequenten Frontloading in die virtuelle Welt übergeführt und in den Freigabeprozess aufgenommen.

Der Vortrag beleuchtet die Vorteile und Hindernisse sowie die Wirtschaftlichkeit dieses zukünftig als Standard eingesetzten Optimierungsschrittes.