Managing Large Scale Specification Projects

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Mercedes-Benz
Outline

- Motivation: Role of Requirements in Automotive Business
- Vehicle Development and Specification Process at Mercedes-Benz
- Managing Large-Scale RE-Processes
Motivation: Role of Requirements in Automotive Business

Increasing Relevance of Software in the Automotive Industry

Shift from single to system innovation

Software-driven Innovation

Total no. of functions

No. of devices

1960
1980
2000
2015

Please note: ABS = anti-lock braking system, ESC = electronic stability control, EPS = electronic power steering, APS = adaptive power steering, EMB = electro-mechanical braking, ACC = adaptive cruise control, PSS = predictive safety systems

Source: 2015 Car innovation: A comprehensive study on innovation in the automotive industry, Oliver Wyman, 2007
Motivation: Role of Requirements in Automotive Business

Core Competence Requirements Engineering

Nowadays, requirements engineering is considered to be a core competence of an automotive OEM
Large-Scale Specifications

Motivation: Role of Requirements in Automotive Business

For a new car model, specification document with more than 100,000 pages have to be created

Example:
Automatic Rear Door

Example:
Body Controller Remote Key etc.

Vehicle Specification

System Specification (approx. 100/car model) (approx. 200 pages/spec)

Component Specification (approx. 400/car model, (approx. 250 pages/spec)
After creation of a specification, an extensive validation and approval process starts.
Vehicle Development and Specification Process at Mercedes-Benz

Specification Process Characteristics

- Template-driven specification creation
- Component-Individual time-lines
  - Comp. A
  - Comp. B
  - Comp. C
  - Comp. D
  - Comp. E

→ Challenge for cross-system and cross-domain topics

- High degree of reuse: Often more than 80% reuse
- Many Supplementary Specifications (often with late changes)
Managing Large-Scale RE-Processes: Key Elements

Relevant Aspects

- Synchronization System – Comp.
- Supplementary Specifications
- Specification Template

Necessary Activities
- Definition
- Information
- Check
- Correction

Specification Process
- Creation
- Validation
- Approval
- Contract award process
Managing Supplementary Specifications

Definition

- Information of Sup. Spec. Authors
- Appointing Spec. Authors
- Spec. Start
- Sup. Spec. finalised and available via Doc-Info-System
- Provision of Sup. Spec. List as template to all Spec. Authors
- Sup. Spec. Freeze (Board of Experts)
- Information of Sup. Spec. Authors
- Sup. Spec. Workshop

Information

Check

- Automated Supplementary Specification Check
- Manual cross-check during Specification Validation

Correction

- Findings during Validation: Rework of specification author
- Late-Changes: Inserting via Support
Requirements Controlling while Specification Creation

During Specification Creation, ongoing Monitoring of Specification Maturity

<table>
<thead>
<tr>
<th>Name</th>
<th>Nr.</th>
<th>Template</th>
<th>Language</th>
<th>ISO-View</th>
<th>Rare earth metal</th>
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<tbody>
<tr>
<td>Body Controller</td>
<td>QEV111EA3TV</td>
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<td>6.1</td>
<td>English</td>
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<td>No</td>
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</tbody>
</table>

**Beneficial:**
Specific aspects → Immediate correction activities

**Limited benefit:**
Formal progress data

Change Rate

History - Gesamt
Anzahl der Änderungen im Lastenheft pro Woche
2559
1439
509
740
500
1000
1500
2000
2500
3000
vor KW35
KW35
KW36
KW37

Änderungen pro LH
Synchronization System - Component

“When do I have to finalize my system spec.?”

Essential: Create Awareness
→ Information to System Spec. and Component Spec. authors

Beneficial, but hard to organize: Bring together meetings

<table>
<thead>
<tr>
<th>Time</th>
<th>System</th>
<th>Body Controller</th>
<th>Remote Key</th>
<th>Wiper Motor</th>
<th>...</th>
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<tr>
<td>8:00</td>
<td>Automatic rear door</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>...</td>
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<tr>
<td>8:10</td>
<td>Outside light control</td>
<td>X</td>
<td>-</td>
<td>–</td>
<td>...</td>
</tr>
<tr>
<td>8:20</td>
<td>Wiper system</td>
<td>X</td>
<td>–</td>
<td>X</td>
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</table>
Summary and Outlook

- Necessary: Explicit management of Large-Scale Specification Landscapes
- Essential: Right balance

Guidelines/ Rules | Information (e.g. Kick-Off)
--- | ---
Controlling | Support (e.g. correction)

- Start early

Outlook

- Further automation (controlling)
- Online-Information channel
### Some Facts about Specifications at Daimler Passenger Cars

**Specification Size**

<table>
<thead>
<tr>
<th>Specification Size</th>
<th>Number of pages</th>
<th>Number of DOORS objects</th>
<th>Number of referenced documents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of pages</td>
<td>60</td>
<td>1,000</td>
<td>30</td>
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<td>300</td>
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<tr>
<td>Number of referenced documents</td>
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**Specification Template**

- 17 chapters
- More than 150 pages
- More than 2,000 DOORS objects
- Many standard phrases

**Frequencies**

<table>
<thead>
<tr>
<th>Frequency of specification actions</th>
<th>full-time specification author</th>
<th>one specification within three years</th>
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<tbody>
<tr>
<td>Change rate/intensity</td>
<td>one major release, some minor changes</td>
<td>Ten major releases, many minor changes</td>
</tr>
</tbody>
</table>

**Specification Style**

- Mainly natural language (German, English)
- Where appropriate: Tables, figures, etc.
- Usually no formal specification, except
  - Executable models (Matlab/Simulink)
  - CAD drawings
- Labeling: requirement, information