

# Agile Software Development for Mercedes-Benz Electric and Hybrid Vehicles

Dr. Siegfried Saenger Zetina Mercedes-Benz Research and Development @ Polarion Live! EMEA User Conference 2015 13.10.2015 Stuttgart



#### Agenda

- 1. The Standard V/A Powertrain Software Development Cycle
- 2. The Agile Powertrain Software Development Cycle
- 3. One Example: B-Class Electric Drive Powertrain Software
- 4. Lesson's Learnt and Next-Steps



# The Standard Powertrain Software Development Cycle



The Standard Powertrain Software Development Cycle

#### Vehicle Development Cycle

- 3 main hardware phases
- Standardized project development in 4 years
- At least 2 full summer and winter phases for prototype C development needed
- Microcontroller architecture fixed at the beginning of product
- Communication between vehicle microcontrollers can be changed every 3 or 6 month
- Every 6 months one powertrain software release bundle



#### Development Guidelines

 The vehicles shall be developed after the Mercedes-Benz Development-Standard (MDS)

In addition to all the other standards, the vehicles shall be developed after the ISO-26262.

- Quality Assurance processes must be followed.
- An automotive SPICE assessment can be performed for the powertrain software project.

The Standard Powertrain Software Development Cycle

#### The V/A Software Development Cycle

New Communication Matrix

Drivability, Fuel Economy, OBD, New Features Calibration

**New Features Test-Cases** 

	Microcontrollers Update		Safety Tests and Release Tests
Requirements and Feature Definition	Build-Integration	Issue verification	Industrialization
		Communication and Regression Tests	
	Pre-Build <sup>-</sup> Module Fe	Tests ature Requirements-Tests	
System Requirements Definition Modelling-Phase	Static Code-Analysis Code-Coverage Regression-Unit-Tests		



# The Agile Powertrain Software Development Cycle



The Agile Software Development Cvcle

### **Motivation**

- The customers are spoiled with faster "appupdates" and "over the air updates" in smartphones and tablets.
- Nowadays, a vehicle or powertrain software update is valued. "It enables new features with current hardware."
- Competitors never sleep



🖉 Follow

Tesla P85D 0 to 60mph acceleration will improve by ~0.1 sec soon via over-the-air software update to inverter algorithm

9:33 PM - 29 Jan 2015



Al Errico I can't wait to see/drive all the new options. I am spoiled with my driving experience in the LEAF and other EVs are going to have to match that experience. For example keyless entry/start. From what I can see you still need the key for the MB. Mod ... See More August 20 at 3:42pm · Like

Can Hatipoglu May 10 · White, WA, United States

I found a 2014 model without range package. And decided to pass on the car since i really wanted range package. Question for you all: can range package be activated with a SW update?

31 Comments



#### Rana Jee July 26 at 5:38am

Where can i check wich software my car have? I live in Norway my dealer told me that a new software is coming soon, with many upgrade.

We dont have any web app support and the range is not stable soo all this fix was coming in new software soon.

I thought to make list of wich software new owners have in their car when they get the car here in Norway.

The Agile Manifesto

- Individuals and interactions over processes and tools
- Working software over comprehensive documentation
- Customer collaboration over contract negotiation
- Responding to change over following a plan

New Communication Matrix

Drivability, Fuel Economy, OBD Calibration **New Features Test-Cases** 

Safety Tests and Release Tests

Let's get rid of the V-

Cvcle

Industrialization

Requirements and Feature Definition

**Build-Integration** 

Update

Microcontrollers

Issue verification

Communication and Regression Tests

Pre-Build Tests Module Feature Requirements-Tests

System Requirements Definition Modelling-Phase

Static Code-Analysis Code-Coverage Regression-Unit-Tests

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#### Mercedes-Benz

New Communication Matrix

**New Communication Matrix** 

Drivability, Fuel Economy,

**OBD** Calibration

Let's use all communication matrices every 3 months

New Features Test-Cases

Safety Tests and Release Tests

Industrialization

Update Requirements and Feature Definition

**Build-Integration** 

Microcontrollers

Communication and Regression Tests Pre-Build Tests

Issue verification

System Requirements Definition Modelling-Phase

Module Feature Requirements-Static Code-Analysis Code-Coverage Regression-Unit-Tests

Instead of one big flash party every 6 months, one every 3 months with less changes





# One Example: B-Class Electric Drive Powertrain Software



#### Picking the Application Lifecycle Management Tool

Instead of using dedicated tools for requirements or issues, the project decided to use a tool with full traceability along the development cycle: the Application Lifecycle Management Tool: Polarion.

Requirement engineers, test engineers software developers and managers could coexist under one roof.

Two ALM-Tool projects were created.

- One for supplier parts and the other for internal powertrain software development.
- The division of projects enabled different microcontroller domain work while providing full supplier access the contracted project only.

#### **Developing Code of Ethics**

**Main Characters** 





**Requirements:** Every new feature needs proper requirements.





Tasks for implementation work in software. Per approved requirement or issue-fix a task is used.



Test-Cases for everything you would like to test. Feature, Requirement or Software.



Calibration for a set of application parameters. A Dataset file changing the behavior of the software.

**Supporting roles** 



**Information:** Not every text-line is a requirement!



Code Integration Task: For Deployment of Sprints

#### **Workitem Statistics**



#### Project Statistics: Requirements 🗊



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# Project Statistics: Issues per Month S Compared to Requirements



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#### Project Statistics: Issues Fixed in Weeks



#### Project Statistics: Tasks Fixed in Weeks



#### The Hard Facts of Powertrain Software

For a **Series Release** half of the development time is consumed by processes with factories, suppliers, and safety and regression testing.

Of the time, when the software can be changed, 1/4 is lost due to integration and supplier hand-off.





## Lessons Learned and Next-Steps



#### Lessons Learned

- "Out-the-Shelf-Agile" cannot be simply applied to automotive programs, due to hardware's and factories' timeframes, weather testing, etc...
- Tailoring and **cherry-picking of Agile** is very important for first-phase assimilation and application.
- ALM-Tool helped the **people's transition mindset** from standard Waterfall to Agile.
- A **full supplier integration** with clear contract processes and rules in the ALM-Tool is needed
- Tool-users in project 98

Agile and ALM: the development of the software for the B-Class Electric Drive Powertrain was achieved in only **60%** of a standard powertrain project time

- **Current hybrid** powertrain software projects develop with **agile processes**, with tendency of more.
- Current electric powertrain software projects develop with Scrum (light) processes with tendency of more.

## Next Steps

- The **next hybrid powertrain** project consisting of new **hardware and software components** is currently being developed **with agile processes**.
- Use of ALM-tool within hybrid and electric powertrain projects > 200 and growing
- Since **an ALM is not the official tool** for requirements or issue tracking within the company, **intelligent synchronization tools** are **needed**.
- Further spread and acceptance of additional ALM-Tools within the company is needed.



# Thank you for your attention

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