Functional Safety, Automotive SPICE® and Agile Methodology
Automotive SPIN Italia
8th Automotive Software Workshop
17. February 2011

Markus Müller

KUGLER MAAG CIE GmbH
Leibnizstr. 11, 70806 Kornwestheim near Stuttgart
Tel / Fax +49 (0) 7154 1796 – 100 / +49 173 678 7338
Markus.mueller@kuglermaag.com, www.kuglermaag.com
Agenda

- Kugler Maag Cie company profile
- Introductory considerations regarding “Agile” methods
  - Why use agile methods? – motivation
  - Our understanding of Agile methods
  - Challenges in automotive regarding the use of Agile methods
  - Disclaimer

- Best Practices – our experience in automotive
  - Using best practices to apply “Agile” principles and ASPICE and functional safety requirements
  - Some examples from the field
  - Potential analysis to estimate cost and benefit

- Summary
About the author: Markus Mueller

- Married with 2 children
- Director Operations at Kugler Maag Cie
- Over 15 years of experience in industry and research projects
- Assisting medium-size companies as well as international corporations, primarily in the automotive industry
- PMI Project Management Professional
- Very experienced trainer, moderator, and management coach
- Speaker at conferences and co-author of books

Qualification & Experience
- intacs™-certified Principal Assessor and trainer, intacs™ Advisory Board member, who
  - conducted more than 40 assessments, many of them for OEMs
  - trained more than 150 ISO/IEC 15504 provisional assessors from leading car manufactures (OEMs) and suppliers
  - advised OEM representatives on the development of Automotive SPICE®
- Project leader of several change and improvement projects based on ISO/IEC 15504 and CMM/CMMI®
- Providing consultancy, coaching, and active support in several ECU development projects in automotive
- E.g. project leader for the implementation of a project control office (PCO) in the electronics development of a major car manufacturer, which today controls more than 100 ECU development projects
KUGLER MAAG CIE is a service company with recognized expertise in process improvement

Facts

- Founded in 2004, today a team of more than 50 recognized experts
- Specialized on process improvement
- Expertise in CMMI®, ISO 15504/SPICE, Automotive SPICE®, IEC 61508/functional safety, project/quality/requirements management, change management, ...

Industries

- Automotive industry,
- Financial services, ICT,
- Health, telecommunications, and transportation

Customers

- Global players, culturally diverse, operating in
  - Europe incl. Italy
  - North America and
  - Asia

Partners & Networks
Introductory considerations regarding “agile“ methods
Why use agile methods? – Motivation

- **Customer requirements are often changing** during the development cycle of a project – or, even more common, customers don’t know their requirements at the start of development, as they are frequently developed in the course of the project.

- Companies often complain that the **development cycle is too slow and not flexible enough** - they need innovative products with functionality within weeks.

- The development process requires several **“non value added”** process steps and work products (from the perspective of the development team).

- Agile methods are focused on handling these challenges by
  - adapting the development process to continuously changing requirements
  - stabilizing the development process to be able to develop software under these conditions
  - introducing the high productivity of small teams with extensive expertise
    - being quick and economical
    - focusing on added value (i.e. developing only what is required by internal and external customers)
The seven “agile“ principles

1. Eliminate waste:
   • Waste is everything that does not add value to a product, value as perceived by the customer.

2. Amplify learning:
   • Development is an exercise in discovery, while production is an exercise in reducing variations. For this reason a lean approach to development results in practices that are quite different from lean production practices.

3. Decide as late as possible:
   • Development practices that provide for late decision making are effective in domains that involve uncertainty.

4. Deliver as fast as possible:
   • In development the discovery cycle is critical for learning: Design, implement, feedback, improve. The shorter these cycles are, the more can be learned.
The seven “agile“ principles

5. Empower the team:
   • Because decisions are made late and execution is fast, it is not possible for a central authority to orchestrate the activities of the workers.

6. Build in integrity:
   • Software with integrity has a coherent architecture, scores high on usability and fitness for purpose, and is maintainable, adaptable and extensible.

7. See the whole:
   • The common good suffers, if people attend first to their own specialized interests. When individuals or organizations are measured by their specialized contribution rather than overall performance, sub-optimization is likely the result.
Our understanding of agile methods

• We at Kugler Maag Cie understand “Agile methods“ as a generic term for different software development models such as Scrum, extreme programming, etc

• We are noticing that the term is increasingly used for a new way of thinking about project management as opposed to traditional, forward-planning project management.

• “Agile“ means that the management and control of projects is performed in a flexible and dynamic way. “Agile” emphasises on the positive aspects of less hierarchical leadership.

• An essential attribute of agile methods are highly networked, self-reliant, interdisciplinary teams. Also a change from defined to adaptive development processes.

• We are mainly working with Scrum, but also with KANBAN.
Challenges in automotive regarding the use of agile methods

ECU development in automotive

- requires mature products of high quality, with a long lifetime and a guarantee
- requires fulfilment of “traditional” development standards like ISO 26262, Automotive SPICE, ISO/TS 16949, OEM-specific standards, ...
- requires a high degree of product documentation
- must consider that the development team of an ECU is part of a huge intercompany team that is developing a car (hundreds of companies, thousands of engineers)

Agile methods (e.g. SCRUM) do usually not support

- architectural design
- integration and test on a system level
  - SCRUM is focusing on software development
  - No/only few statements regarding hardware-software integration or system test
  - No/only few statements regarding planning of required infrastructure like HIL, etc.
- an independent quality assurance role
- a complete product documentation
  - Product documentation is perceived as non value added
Disclaimer - before we continue

- Our recommendations are based on our practical experience in automotive
  - We have to consider the existing standards and requirements
  - We do not recommend a purely Agile approach, but to integrate Agile elements into existing and proven development cycles, and to take advantage of both worlds
- Some Agile elements have already proved their worth in automotive for years
  - Incremental development in general
    - Delivery of increments/samples and validation of these at the supplier and the customer side; incorporating the return flow of results into the next increment
  - Rough overall release planning, detailed planning only for the next increment
  - Requirements are not fixed at the start, but developed and clarified during development
- “Agile” fans will say that this is a boring approach, not considering the pure “Agile” principles ... - and they will be right ... - But we do have to consider the automotive conditions ...!
Best Practices – our experience in automotive
Using best practices to apply “Sgile“ principles and ASPICE and Functional Safety requirements

- Project organisation above the sprint teams
- Integrate sprints into the car development cycle
- Define the architecture before the sprints in such a way, that the sprint backlogs can be derived
- Standards for processes, methods, guidelines, tools, and documentation
- Independent integration and system tests (outside the sprints)
- Additional “best practices“, e.g.
  - High degree of automation, e.g. automated testing and continuous builds
  - Attend and guide the cultural change of the organisation from a “classical“ forward planning organisation to a more agile organisation

Customer references:
- Nero, Daimler TSS, Landis & Gyr, GENTEX, AWTCE, Magna

© Copyright 2011 KUGLER MAAG CIE
Page 16 - M.Müller - Version A
Practical example

Integrate agile methods into the development cycle

• Integration of scrum-based process steps into the SW development process
Practical example

Definition of Deliverables

- Refining customer deliverables into atomic issues for sprints
Kugler Maag Cie project experience
- Agile E/E PEP (Electrical / Electronic Product Engineering Process)

The PEP with its typical activities

Elements of the E/E PEP which were not changed (e.g. homologation and purchasing components with long lead times)

Log handling and agile sprints for increasing functionality and component / system maturity
Kugler Maag Cie project experience
- A.SPICE level 3 and Agile

Organization: Automotive Supplier

- **Goal:**
  - To support the customer in implementing A.SPICE requirements in an agile development environment

- **Approach:**
  - Principles for implementing A.SPICE
    - A “compelling reason” to change
    - Do less, but do it well from the start
    - Core Process Improvement Group with the authority to:
      - design and implement the process
      - invest in tools
      - set expectations for staff
      - communicate to management

- **Results:**
  - Target A.SPICE capability levels achieved
  - A.SPICE implemented in a useful way
  - High degree of automation
Project Planning & Management

- V-model combined with SCRUM & Sprints
- Project Planning & Scheduling
  - MS Project Gantt in Server for Macro
  - Detailed planning in issue tracking tool using parent/children relationships
- Burn down charts for progress to plan

Source: Presentation „Agile, SPICE, and corporate values: A case study in effectively merging the best of each to improve software quality at Gentex; Walstra E., Gentex Corporation, USA International SPICE Days 2010, Stuttgart, June 21-23rd, 2010
Potential analysis to estimate cost and benefit

- To align and balance Agile and traditional forward planning we propose a **Quick Check Agile Development**.

- This cost and benefit analysis (duration approx. 2 days) to introduce Agile methods into the existing development organisations identifies:
  - what the potential and the risks are
  - what the consequences are for management, organisation and processes
  - what needs to be changed

- Result is a detailed analysis with concrete improvement suggestions to integrate Agile methods into the development organisation

Analyse risks and opportunities in the following dimensions:

1. **Employees** - Know-how and experience, ...
2. **Dynamics and complexity** - of your products, stability, and requirement change rates, ...
3. Organisation and **project culture**
   - team motivation, degree of freedom re. solutions, team stability, ...
4. **Project size** - team size, duration, project and product types, ...
5. Product functionality and **criticality**
   - Stability of design, security and safety of products, ...

![Diagram showing potential and risk analysis dimensions]

© Copyright 2011 KUGLER MAAG CIE
Page 22 - M.Müller - Version A
Summary

- Agile methods help to handle the development of innovative products involving
  - frequent customer requirement changes during the development cycle
  - high-productivity small teams with extensive expertise focusing on added value
- Agile methods like SCRUM usually do not support some essentials, which are required in the automotive context.
- We therefore do not recommend a pure Agile approach, but to integrate Agile elements in the existing and proven development cycles and to take advantage of both worlds.
- We propose a Quick Check Agile Development to identify cost, benefits and risks of introducing Agile methods into existing development organisations.
- Any questions?
- If yes – please don’t hesitate to contact us! www.kuglermaag.com
  - Markus.mueller@kuglermaag.com, +49 173 678 7338
  - Fabio.Bella@kuglermaag.com, +39 345 7019271 (intacs representative Italy)