Managing complexity in automotive development

Brett Hillhouse Global Automotive Leader Al Applications





Business Goals

Improve Vehicle Quality



Increase Reuse



Improve On-time Delivery

Explicitly support process and safety standards including the ASPICE framework

Enable strategic reuse through IBM's unique global configuration capability

Support SAFe for agile development in systems, sw and electrical engineering

Automotive

companies

continue to

complexity

struggle with

the increasing

IBM Approach



ASPICE in a nutshell

Automotive Software Process Improvement and Capability Determination (ASPICE)

Governance

Maintained by Automotive Companies & required by Automotive OEMs

Projects shall follow state of the art system & software engineering practices

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Assessment



Factors that accelerate relevance of ASPICE

Past

<>

Focus on Software development process



ASPICE primarily common among German OEMs 



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ASPICE burden for suppliers of single components





Focus on Systems and Software development

Accepted standard by Automotive OEMs worldwide

OEM's strive for ASPICE on vehicle level (System of Systems)



ASPICE

The ASPICE standard is about assessing process maturity



Management Process Group (MAN)

MAN.3 Project Management

MAN.5 Risk Management

> MAN.6 Measurement

Reuse Process Group (REU)

REU.2 Reuse Program Management

Process Improvement Process Group (PIM)

PIM.3 Process Improvement

Supporting life Cycle Processes

ASPICE defines a plug-in concept for different domains which makes it a good engineering process framework



SYS: System engineering SWE: Software engineering HWE : Hardware (electrical) engineering **MEE:** Mechanical engineering

Traceability is a common issue Automotive Engineering







Automotive development requires adherence to a range of standards

ASPICE	 Process Maturity Model derived from ISO 1550 Maturity in development processes to achieve (Usually, Systems and Software Processes red
ISO-26262	 Automotive functional safety standard based of Safety concept based on Hazardous Analysis, to prohibit danger that originate from system of
Source and the second s	 i) SOTIF term refers to ISO/PAS 21448 norm ➡ Safety in the absence of fault (Functionality that awareness - autonomous systems)
Cybersecurity	 i) ISO/SAE 21434 to satisfy UNECE and EU Reg Security measures to prohibit hacking vulneral
Contraction of the second seco	
IATF-16949:2016	 <i>Quality Management standard is based on EN</i> OEMs who are members of the IATF (Internati Force) require their suppliers to be certified ac

604 (SPICE) high work product quality quire Level 2-3)

on IEC 61508 , Safety Goals operation

at relies on situational

gulations bilities

N ISO 9001

ional Automotive Task cording to IATF 16949 Standards work complementary towards the joint goal: "Absence of unreasonable risks"



Outside World

Functional Safety

Example for a current challenge: Safety for autonomous systems

IEC 61508 Level 4 (ISO 26262 ASIL D) requires achieving *low dangerous system failure rates of < 10-9/hr*

All strategies for producing safe software are vulnerable to

- Mismatch requirement and real world need ×
- Obsolete design (not considering latest requirements) ×
- Inconsistent design (vague / contradictory requirements) ×
- Ensuring that design is using well defined & current requirements is more crucial than ever before



Real World

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Monitoring System monitors defined

"safe" operation

High false positive

Too many crashes



AI in Engineering Example: IBM Requirements Quality Assistant

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Watson Natural Language Understanding







Requirements training data: public data sets + additional client-specific data

Enterprise benefits

- Reduce the cost of defects by 60%
- Reduce cost of manual reviews by 25%
- Retain engineering expertise for junior engineers



IBM Requirements Quality Assistant

In general, Cybersecurity and Functional Safety standards follow similar patterns



Cyber regulations are still evolving, with major milestones in 2020



ASPICE defines Levels

OEMs commonly require and aim for Level 3

ASPICE Levels

5 **Innovating Process Predictable Process** 3 **Established Process** 2 Managed Process Performed Process **Incomplete Process**





The Way to ASPICE Compliance





ASPICE key challenge

Handle dependencies of work products and processes

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Transparency Traceability Consistency

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O 1948 CONTRACTOR OF THE OPERATION OF THE





IBM ELM capabilities work with every methodology





IBM ELM allows for integrated work product management







ASPICE Essential IBM Engineering Domain Model





How to avoid cost explosion when dealing with multiple variants?





Global Configuration Management

provides sophisticated *reuse* capabilities



Engineering Lifecycle Management Autospice Views

Features Selection	E Feature 488	E Feature 445	E Feature 416	E Feature 424	E Feature 384	E Feature 399	E Feature 401
	DIAG-FUN-REQ-1640	DAB Slide Show	AMFM-FUN-REQ-023	Rear-view Camera (R	V8-FUN-REQ-025235	AMFM/2-FUN-REQ-0	VOLv2-REQ-014817/
Feature 370	Feature 371	Feature 372	Feature 381	Feature 383	Feature 390	Feature 368	Feature 389
AMFMv2-FUN-REQ-0	VOL-8R-REQ-014824	AUDSET-FUN-REQ-0	AMFM-FUN-REQ-023	V8-FUN-REQ-025341	AMFM-FUN-REQ-023	V8-FUN-REQ-025218	AMFM-FUN-REQ-023
Feature 293	Feature 285	Feature 294	Feature 298	Feature 297	Feature 288	Feature 299	Feature 329
DAB-FUN-REQ-1329	AMFM-FUN-REQ-023	AMFM-FUN-REQ-023	AMFM-FUN-REQ-023	AMFM-FUN-REQ-023	AMFM-FUN-REQ-023	AUDSET-FUN-REQ-0	AMFM-FUN-REQ-023
Feature 283	Feature 288	Feature 289	Feature 212	Feature 231	K Feature 199	Feature 233	Feature 234
AMFM-FUN-REQ-023	VOL-FUR-REQ-0148	AUDSET-FUN-REQ-0	AMFM-FUN-REQ-023	V8-FUN-REQ-025213	VOL-FUR-REQ-0882	AMFM-FUN-REQ-023	VOLv2-FUR-REQ-026
E Feature 200	Feature 184	E Feature 143	E Feature 149	E Feature 131	E Feature 132	E Feature 109	E Feature 110
V8-FUN-REQ-025206	VOL-FUN-REQ-0148	AMFM-FUN-REQ-023	VOL-SR-REQ-014825	DIAG-UC-REQ-01645	DIAG-FUN-REQ-0164	DIAG-SR-REQ-10365	DIAG-FUN-REQ-0164
E Feature 72 DIAG-FUN-REQ-1157	E Feature 28 DIAG-FUN-REQ-0164						

Doors Next Generation

Rational Team Concert

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Rational QualityManager



Rational Design Manager



Impact Assessment

Engineering Lifecycle Management Autospice Views





IBM ELM offers an end-to-end portfolio to support ASPICE



Legend

Main Application Support Application **3rd Party Application**

SYS.5 System Qualification Test

ETM EWM **HiL Applications**

ETM EWM

HiL Applications

ETM EWM SiL Applications



IBM ELM collaborates with industry experts to create a reference solution



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Six different kinds of deployable assets to tailor ELM for the Automotive Industry



ETM Assets

*121: Deceleration Control - The ACC system decelerates the vehicle by lowering the target spe sent to the Engine Control Module and sending a brake deceleration command to the Brak Control Module.
Int Case Sectors Bayelments The Case Sectors The The The Sectors of the I duriton Institutes to group your test cases along related terms or logical groupings. Weight is on test From our of the O Hone.

Reports (JRS, PUB, ENI)

M) Dashboards >			
Program Details	Current Program Increment (PI) Progress	Quality	Risks and Ir
alysis Reports			
alvsis Reports			
alysis Reports			

Process & User Guidance

Requirements Eng				
System Requireme	Ready for review / svs2 Requirements analysis / ASPICE / SYS 2 System requirements analysis			
Pre-PI Planning M	/ SYS2.8P2: Studure system requirements.			
Work products	Task: SYS.2.BP2: Structure system requirements.			
Guidance				
PICE	Structure the system requirements in the system requirements specification by e.g.			
5YS.2 System req	- grouping to project relevant custers,			
SYS 2.1 A defined	- categorizing based on relevant criteria for the project,			
SYS 2.2 System rt	 prioritizing according to stakeholder needs. 			
SYS 2.3 The impa-				
SYS 2.4 Prioritizati	Relationships			
5YS 2.5 The syste	Outputs SYS 2.2 System requirements are categorized and analyzed for correctness and verifiability			
5Y5 2.6 Consisten	 SYS 2.4 Prioritization for implementing the system requirements is defined 			
SYS 2.7 The syste	Defined process			
SYS 2.8 The syste	Mapping • System Requirements Analysis			
15-01 Analysis rep				
17-12 System req.	Of Type			
13-21 Change con	work zem type • Educe macade type			
13-16 Change req.	Key Considerations			
13-04 Communicar				
17-08 Interface rec	NOTE 3: Prioritizing typically includes the assignment of functional content to planned releases. Refer to SPL 2 8P1.			
13-19 Review recc				

Refence discussion

IBM Engineering Lifecycle Management in Automotive



Industry leaders among 3,000+ IBM Engineering clients

"The number of customer functions are exploding. We need systems engineering. IBM is a close partner."

"The next phase is to lift text-based requirements engineering to model-based systems engineering. This is a game-changer. We are doing this in close cooperation with IBM."



9 of the top 10 largest auto companies



13 of the 15 largest Tier 1 auto suppliers

"Continental will apply the full portfolio of IBM ELM. We are doing it with IBM ELM. We are convinced this will lead to implementation of our strategy."

> Dr. Bernhard Rieger, Head of Processes, Methods, Tools Division Chassis & Safety, Continental AG



Dr. Siegmar Haasis, CIO R&D, Mercedes-Benz





The Transformative Power of IBM Jazz Dr. Bernhard Rieger

June 18, 2019



SensePlanAct

... But Autonomous Mobility Requires Approaches That Go Beyond

- Growing importance of industry standards.
- 2. Growing quantity and complexity of requirements.
- 3. Growing structure and size of architectures.
- Growing number and depth of tests. 4.
- 5. "Exponentially" growing lines of code.





Chassis &Safety Holistic Engineering Platform Public

18 June 2019 Bernhard Rieger, © Continental AG



A Strong and Well-executed Strategy is Game Changing



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... And Vital for Our Future Success



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Rational Quality Manager

Quality Manager

IBM Jazz Key Concepts have Transformative Power

- Promote collaboration on a large scale.
- 2. Orchestrate processes at multiple speeds.
- З. Enable strategic reuse.
- 4. Maintain a single source of truth.
- 5. Automate transparency and traceability.
- 6. Support compliance with safety critical standards.
- Provide scalability.

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Chassis &Safety Holistic Engineering Platform Public

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