26th annual INCOSE international symposium
Edinburgh, UK
July 18 - 21, 2016

The enabling role of **Configuration Management** for the **Systems Engineering** of tomorrow's complex systems and SoS

Adriana D'Souza *(CSEP)*
Airbus Operations Ltd

Dr. Mario Kossmann *(ESEP)*
Airbus Operations Ltd

Stephen Watts *(CMIIP)*
Airbus Operations Ltd

CSEP/ESEP = Certified / Expert Systems Engineering Professional (INCOSE Certification)

CMIIP = CMII Professional (Institute of Configuration Management Certification)

Contents

- ❑ Airbus within Airbus Group
- ❑ Configuration Management (CM)
- ❑ Systems Engineering(SE) and CM today
- ❑ Cross-industry trends
- ❑ Vision for tomorrow – extending the scope of CM
- ❑ What is still missing to make it happen?
- ❑ Conclusions

26th annual INCOSE international symposium
Edinburgh, UK
July 18 - 21, 2016

Our aircraft are a familiar sight around the world

26th annual INCOSE international symposium
Edinburgh, UK
July 18 - 21, 2016

Presence

An Airbus takes off or lands every

2 seconds

16,400+
Aircraft sold

60
Produced monthly

9,700
Delivered

25,000+
Daily flights

Data to end December 2015

The **AIRBUS** Family

26th annual INCOSE international symposium
Edinburgh, UK
July 18 - 21, 2016

A320 Family

The market leader

A330 Family

The right aircraft, right now

A350 XWB

The Xtra that makes a difference

A380

Own the sky

We are part of **Airbus Group**

AIRBUS GROUP

136,000+
Total workforce

€1,006billion
Order book

€64.4billion
Annual revenue

AIRBUS

AIRBUS HELICOPTERS

AIRBUS DEFENCE & SPACE

2014 statistics

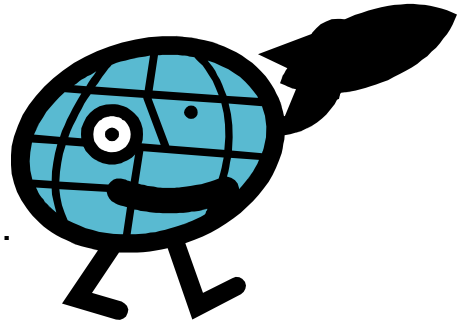
Configuration Management

Successful demonstration ➔ the projectile hit target

Buyer: ‘Build me 100 more’

Industry had the following dilemma:

- The prototype was expended…
- No adequate records
- Technical publications did not reflect built...

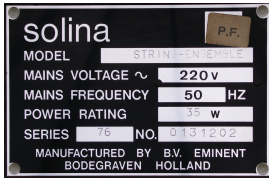


... a second success could not be guaranteed, nor an identical article produced.

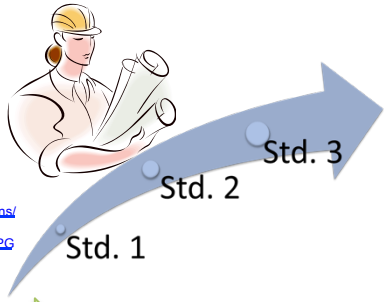
Configuration Management

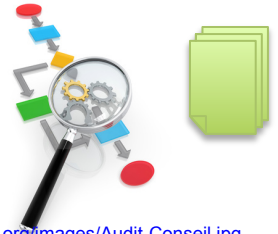
Main activities (ISO 10007):

- Configuration management planning
- Configuration identification
- Change control
- Configuration status accounting
- Configuration audit



https://upload.wikimedia.org/wikipedia/commons/6/6f/Solina_StringEnsemble_identification_plate.JPG



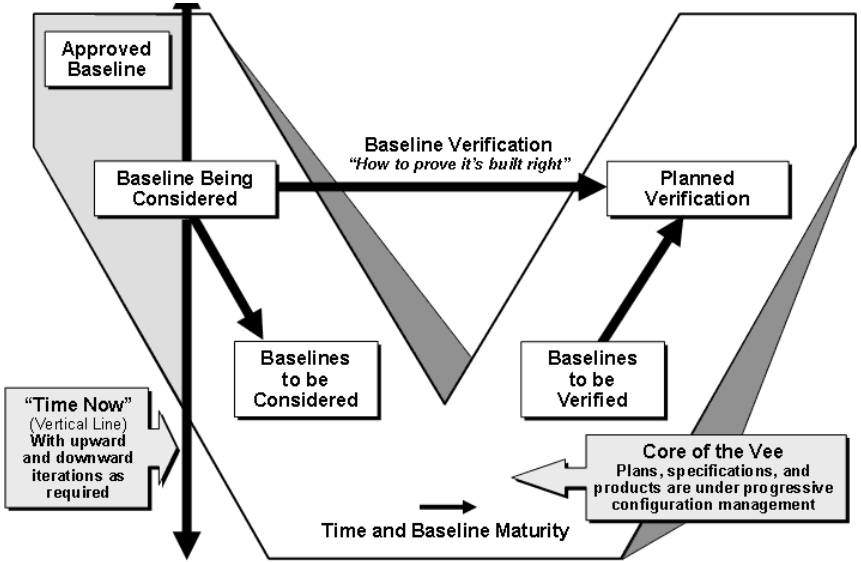


http://tapoueh.org/images/Audit-Conseil.jpg

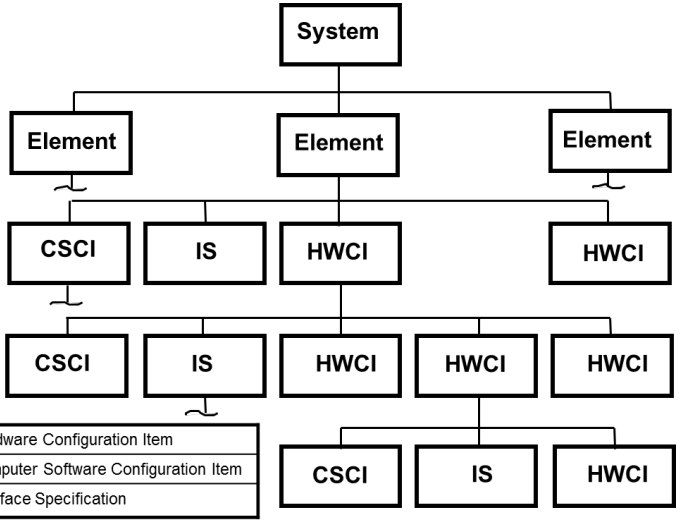
Requirements for CM can be found in the **ISO 10007**, **EIA 649 B**, **EN 9100** standards, the specific domain of activity regulations (e.g. **EASA** and **FAA** regulation for the aerospace industry) and recommended practices (e.g. **ARP4754** for the aerospace industry)

SE and CM today

SE - Baselines



CM – Configuration Items



HWCI	Hardware Configuration Item
CSCI	Computer Software Configuration Item
IS	Interface Specification

Wiley, pub. 2015. *Systems Engineering Handbook: A Guide for System Life Cycle Processes and Activities.* 4th editon. Prepared by INCOSE. Compiled and Edited by D. Walden, G. Roedler, K. Forsberg, R. D. Hamelin and T. Shortell. ISBN: 978-1-118-99940-0. Aug 2015

Cross-Industry trends

- Life cycle span and 

- Evolving and diversified customer expectations
- Evolving market conditions and business cases
- Globalisation
- Technology revolutions (e.g. 3D Printing)

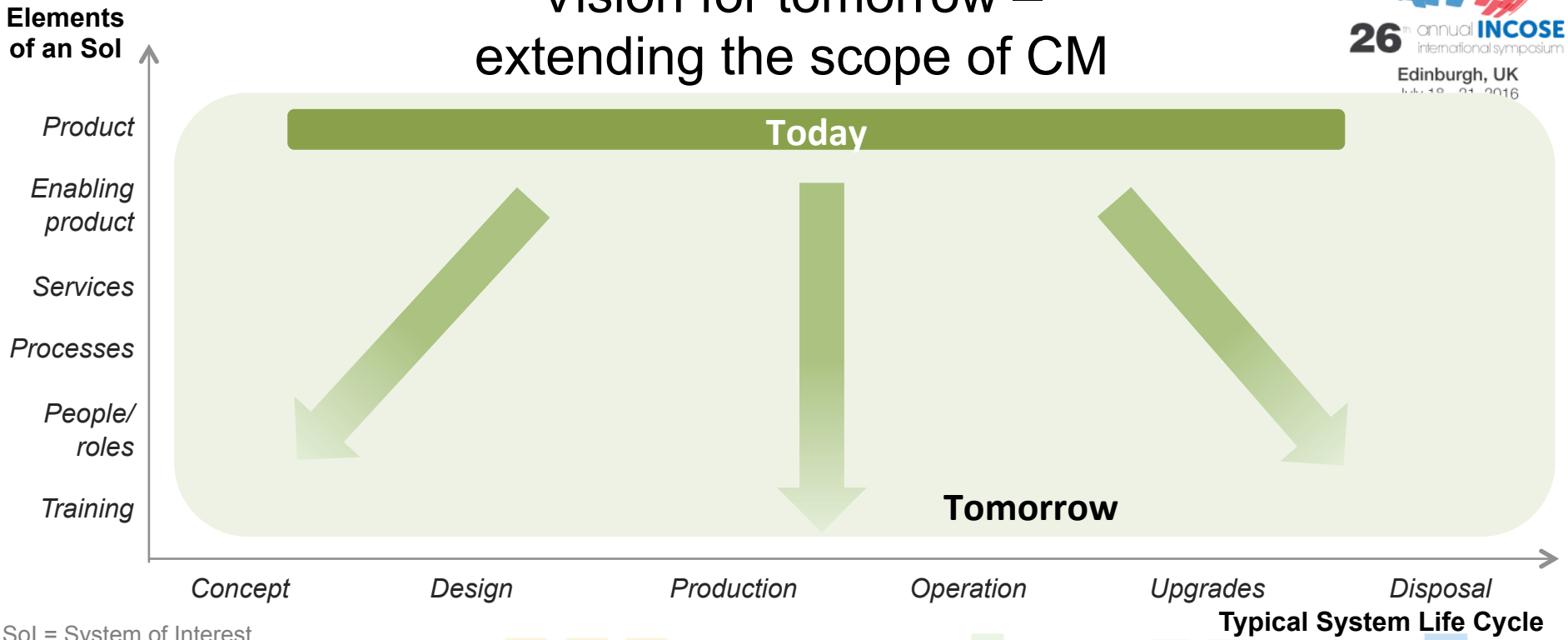
Copyright © Frank Boyle 2000

© Photo Andy Smulders / BTmagazine.nl

http://www.dailymail.co.uk/sciencetech/article-3601146/Airbus-unit-unveils-3D-printed-electric-motorcycle.html

26th annual INCOSE international symposium
Edinburgh, UK
July 18 - 21, 2016

Vision for tomorrow – extending the scope of CM



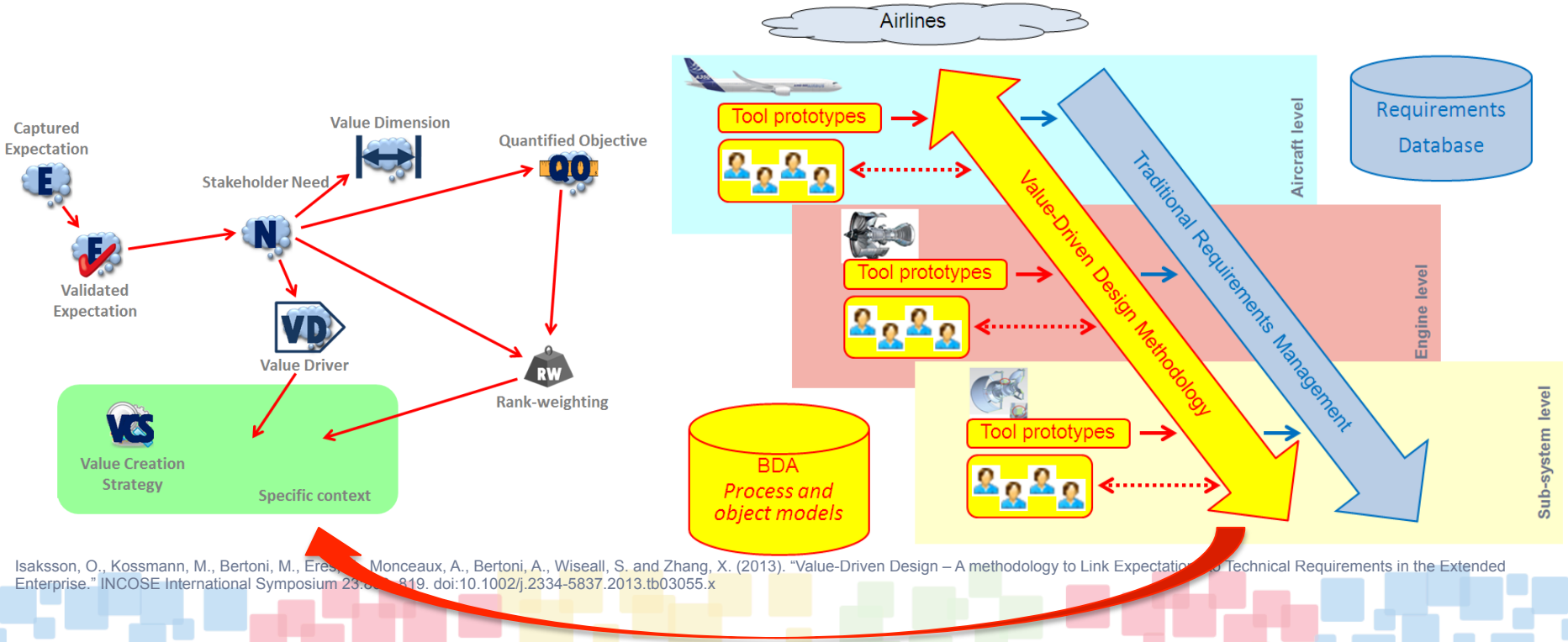
SoI = System of Interest

Vision for tomorrow

- The extension of CM & SE along the full lifecycle
- The extension of CM across all elements of the SoI
- Tailoring and automation of CM
- Traceability and reusability across multiple programs

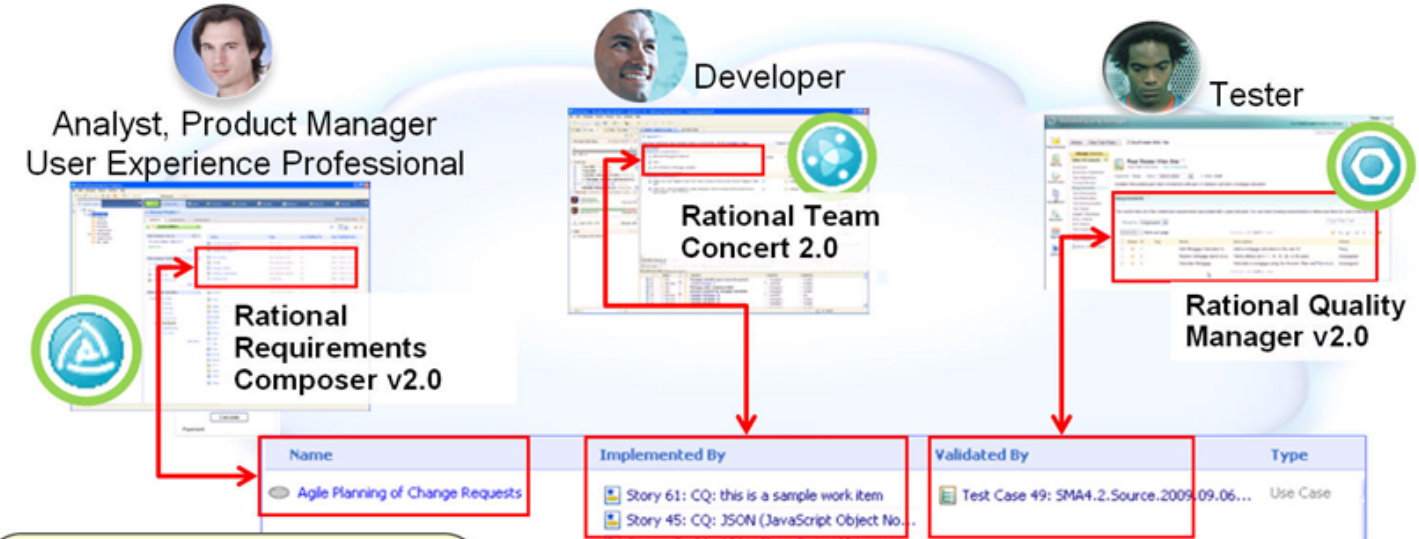
SoI = System of Interest

Vision for tomorrow (examples)



Isaksson, O., Kossmann, M., Bertoni, M., Ere[illegible], Monceaux, A., Bertoni, A., Wiseall, S. and Zhang, X. (2013). "Value-Driven Design – A methodology to Link Expectation to Technical Requirements in the Extended Enterprise." INCOSE International Symposium 23:8[illegible]819. doi:10.1002/j.2334-5837.2013.tb03055.x

Vision for tomorrow (examples)

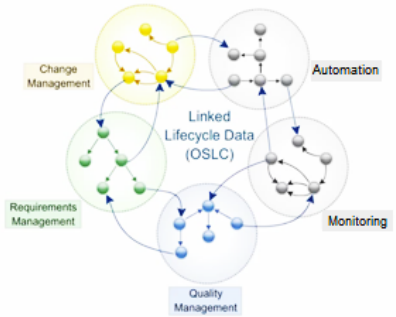


Analysts define and validate scenarios; analyze and organize requirements

User Experience Professionals elaborate work items in storyboards and other artifacts

Developers create, prioritize and track work items according to business value

Testers create test plans, and report test results against requirements



http://open-services.net/resources/whitepapers/oslc-one-page-flyer

http://www.mypmhome.com/requirement-management-software-rational-requirements-composer/

Vision for tomorrow (examples)

‘Thor’ (Airbus):

- First fully 3D printed UAV
- Tested during a 40km test flight from Hamburg to Stade

Production of spare parts and components by 3D printing becomes reality…

https://3dprint.com/137389/airbus-thor-3d-printed-plane/

UAV = Unmanned Aerial Vehicle

What is still **missing** to make it happen?


Further research in specific areas


Strategic collaboration frameworks


Legal frameworks


Culture of sharing


Further standardization

Conclusions

- Cross-industry trends will force us to further **advance** and **automate** the way we conduct **CM** and how we **integrate it with SE** approaches for tomorrow's complex systems and SoS.
- An **extension** of the **scope of CM** is needed; while at the same time making CM much more **agile and flexible**.
- Two key obstacles to the needed changes are the **lack of early collaborative environments** within the extended enterprise (including appropriate **legal frameworks**); as well as further **standardization**.

SoS = Systems of Systems

Thank you

AIRBUS