

ISS Columbus Module On-Board Software Maintenance

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All the space you need

Design for Future
Aachen, 1st March 2013



Agenda

- Company Overview
- ISS / Columbus
- Columbus Software System
- Columbus On-Board Software Maintenance
- Summary

Astrium: A Global Company with European Roots



Astrium: Facts & Figures 2011



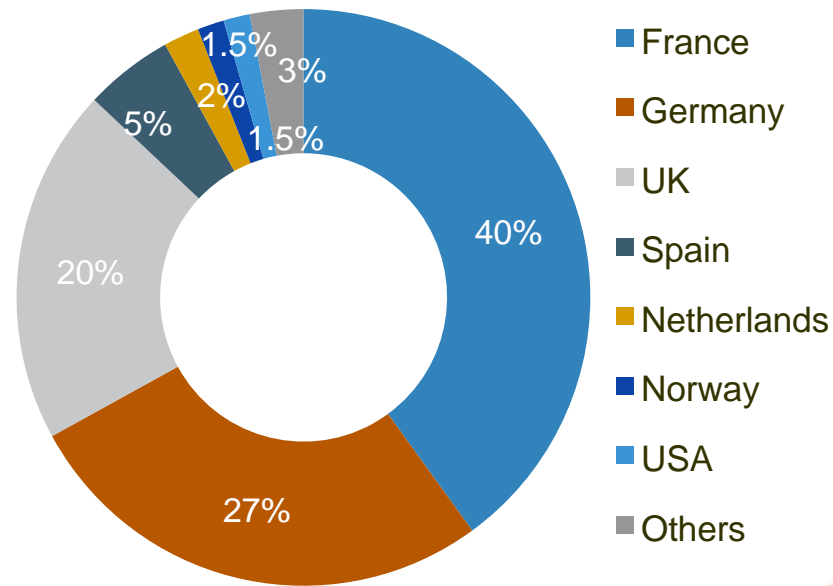
Employees:
18,000

Turnover:
€5 billion

Order backlog:
€14.7 billion

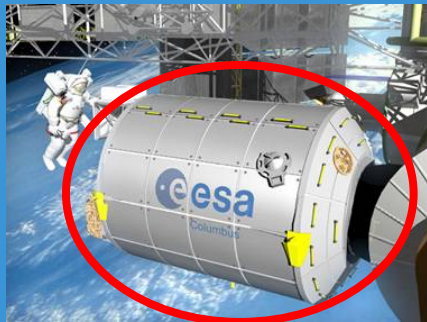
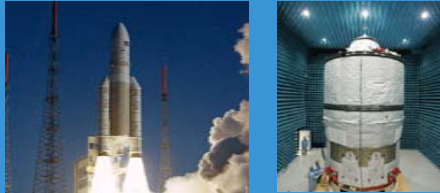
CEO:
François Auque

Employees by country:

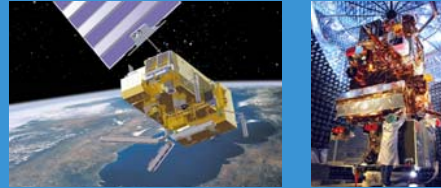


Astrium: Main Activity Areas

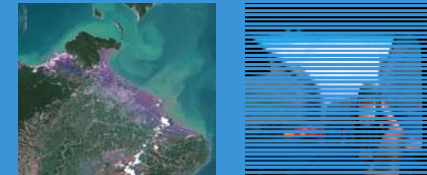
Astrium Space Transportation



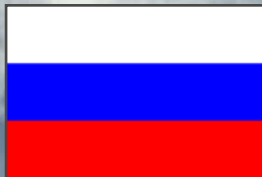
Astrium Satellites



Astrium Services



Columbus Module



10 EU Countries



International Space Station - ISS

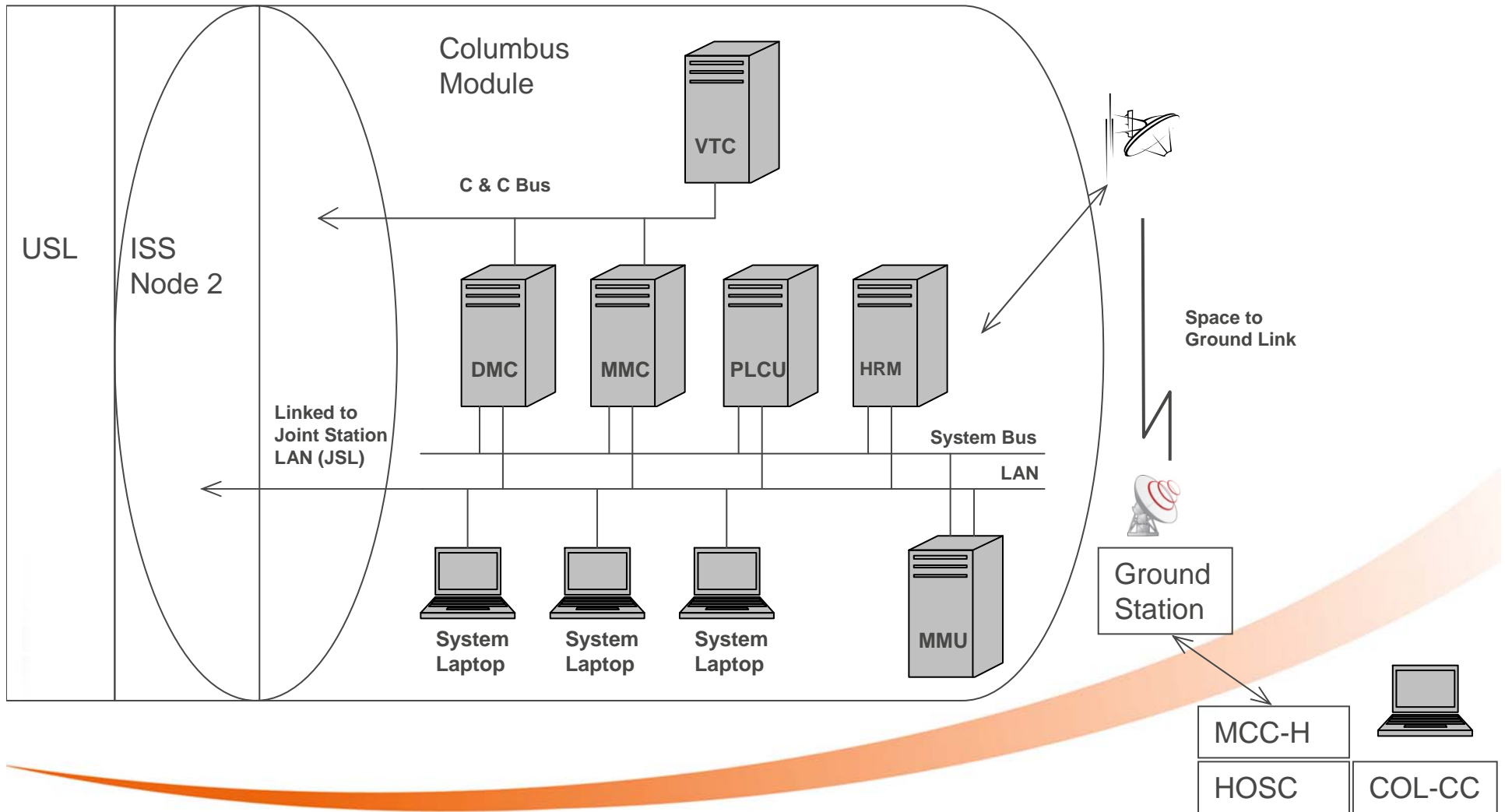
Inside Columbus Module



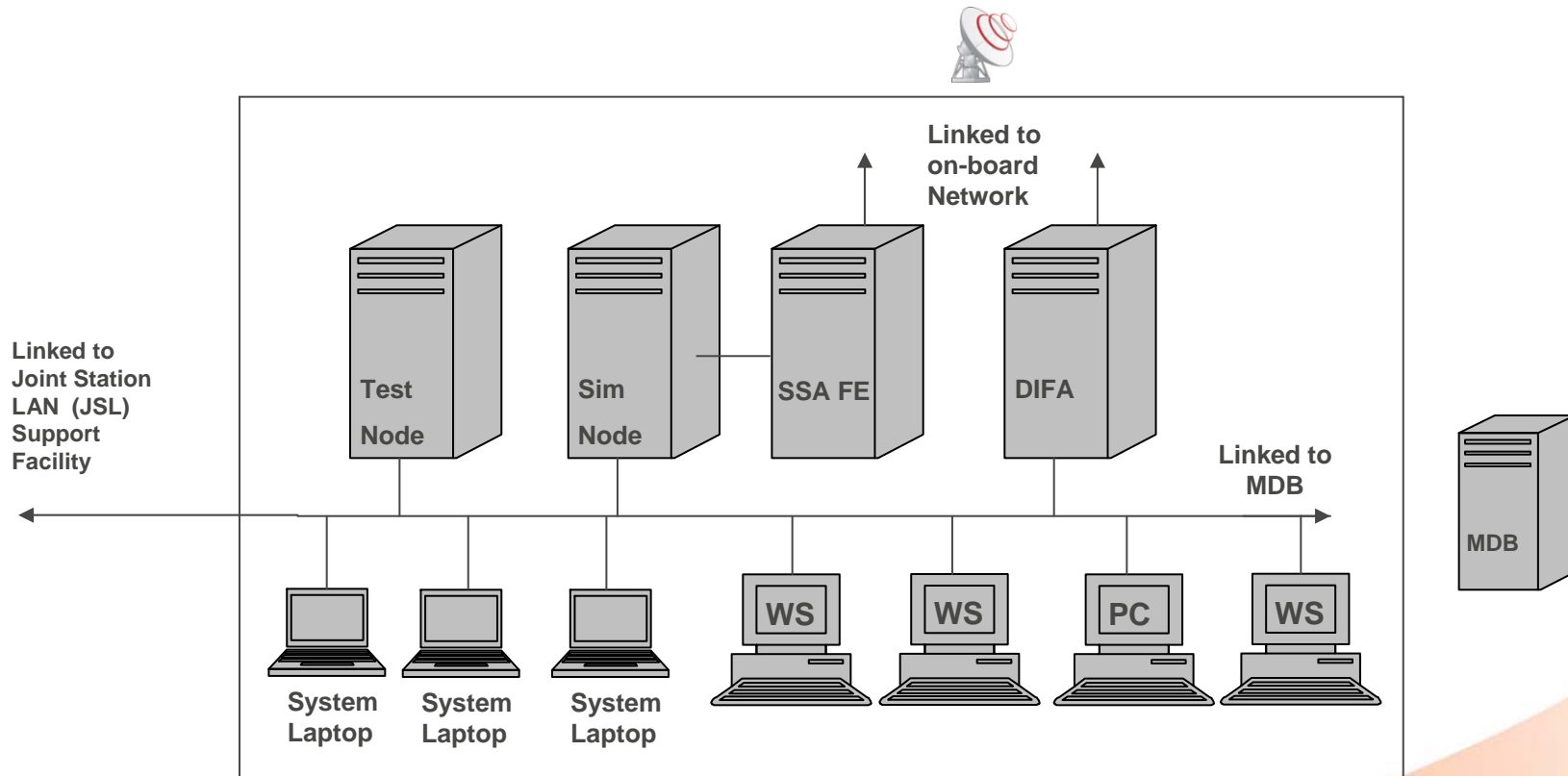
Columbus Software System

- Embedded Software & Avionics
- Operating Systems
 - VxWorks
 - Linux
 - Unix
 - Windows
- Software Applications developed in
 - ADA
 - C/C++
 - Java
- Different Database System
- Network Communication
 - LAN (TCP/IP, HTTP...)
 - MIL Bus (C&C, Vital ...)
- ...

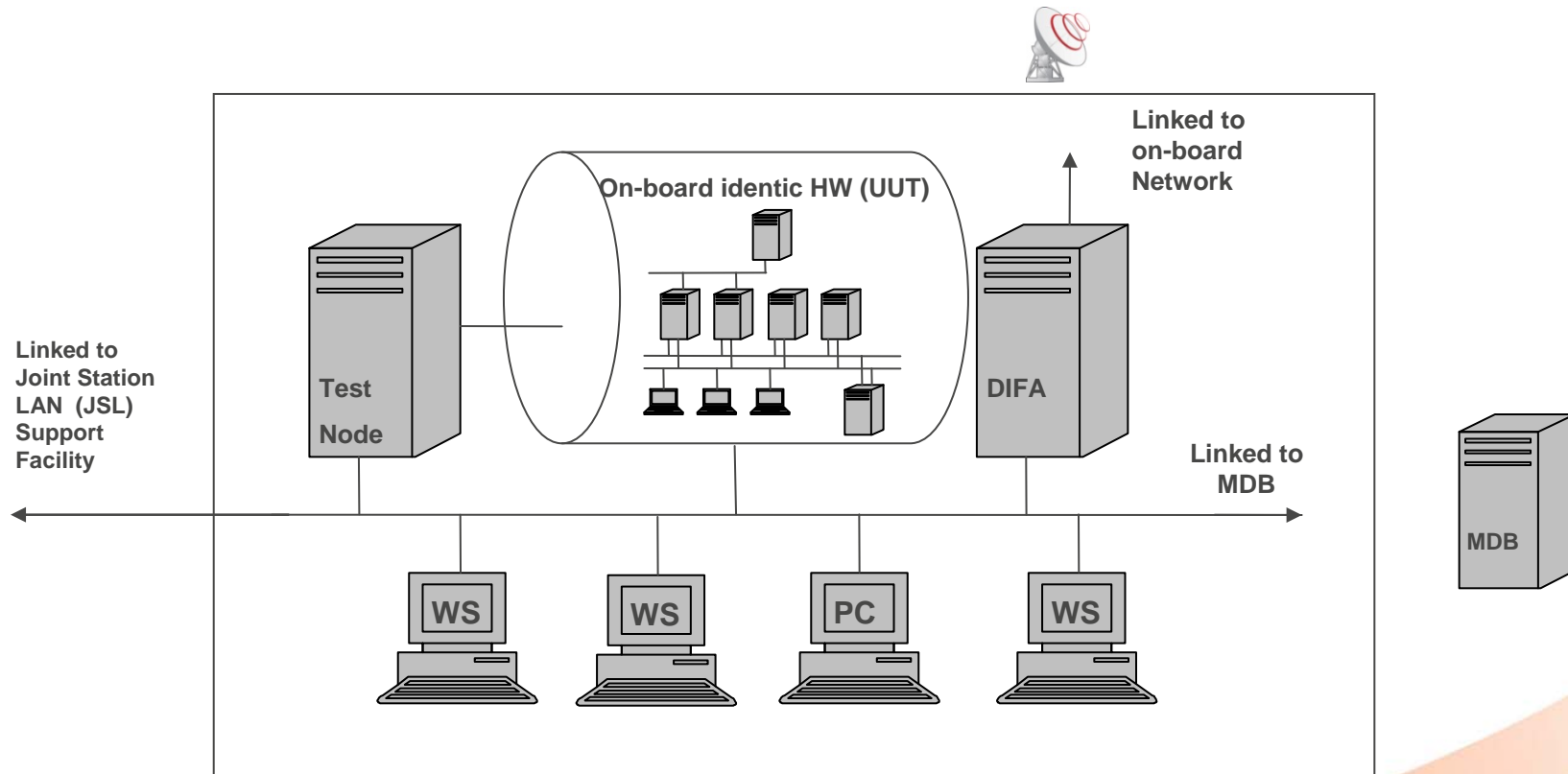
Columbus On-Board Software System



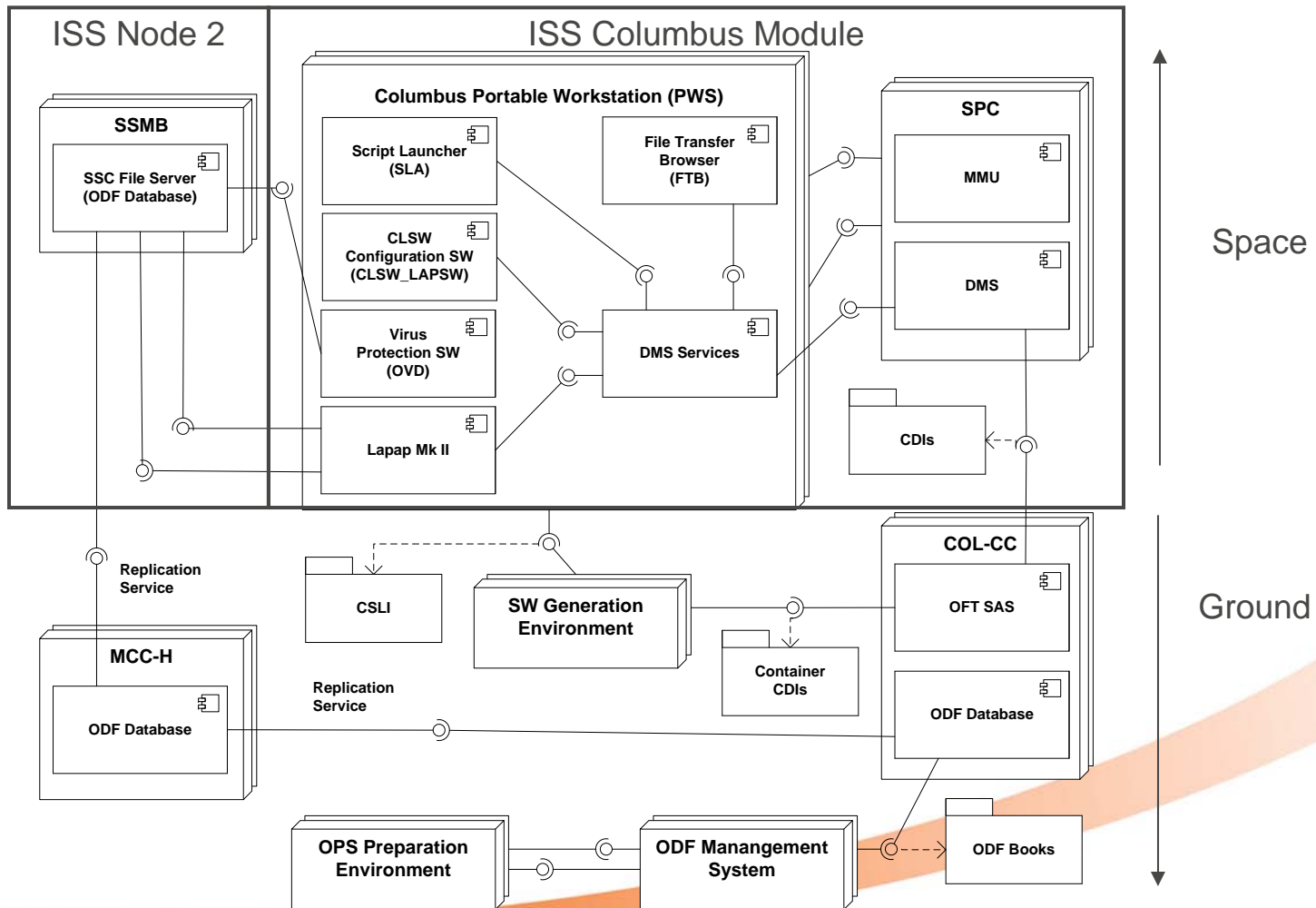
Software Integration and Test Equipment - SITE



Electrical Ground Support Equipment - EGSE

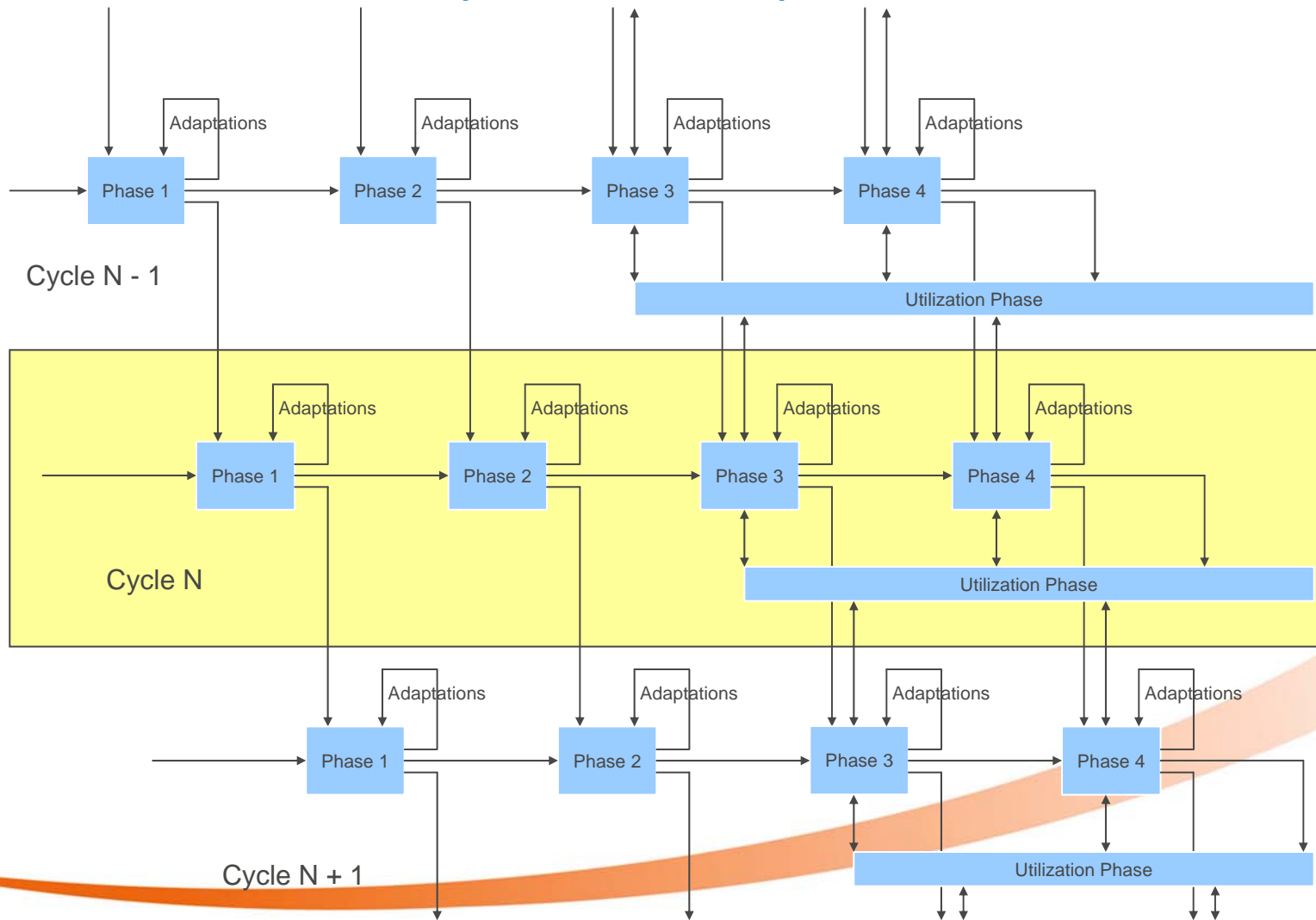


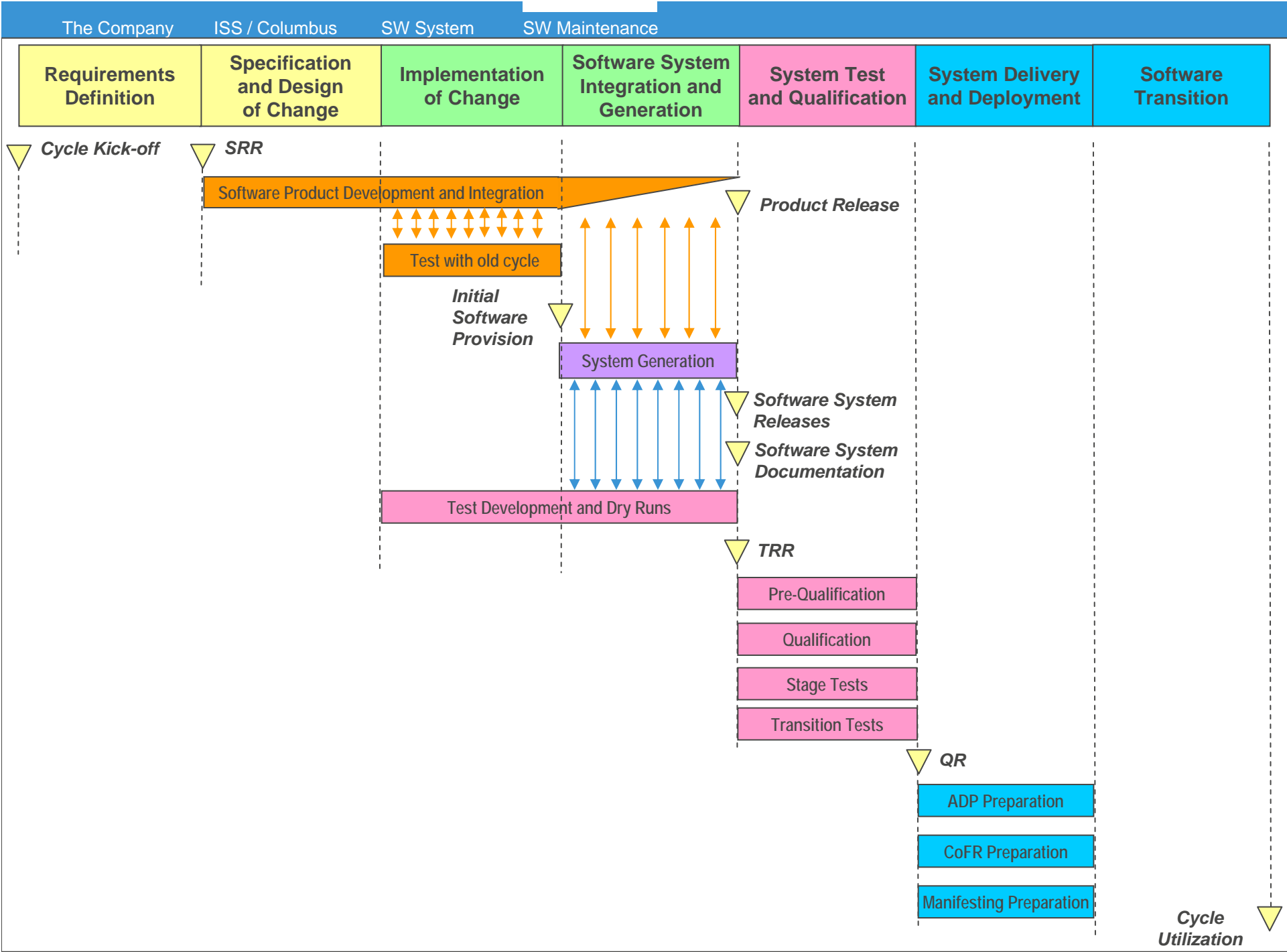
Columbus System Laptop End-to-End Architecture



Process Model for the Software Cycle Process

(Uwe Westerholt)





Summary

- ISS Columbus Module is a complex and heterogeneous space system
- Columbus is successfully utilized since February 2008
- Efficient and high quality work of various teams
 - On-board ISS
 - Ground Engineering Centers
 - Ground Control Centers
- Successful Cycle Approach for Software Maintenance

References

- **Fotos and Information Sources: Arianespace, DLR, ESA, NASA & Astrium**
- **[ADD12] Columbus On-board Software Architectural Design Documentation, Astrium Space Transportation Internal Documentation, 1998-2012**
- **[ICD12] Columbus On-board Software Interface Control Documentation, Astrium Space Transportation Internal Documentation, 1998-2012**
- **[PRD12] Columbus On-board Software Maintenance Process Documentation, Astrium Space Transportation Internal Documentation, 1998-2012**
- **[MSP13] Columbus On-board Software Maintenance Specification, Astrium Space Transportation Internal Documentation, 2013**
- **[VCD13] Columbus On-board Software Verification Control Document, Astrium Space Transportation Internal Documentation, 1998-2013**
- **[TED13] Columbus On-board Software Test Documentation, Astrium Space Transportation Internal Documentation, 1998-2013**
- **[SPR13] Columbus System Problem Report Database Documentation, Astrium Space Transportation Internal Documentation, 1998-2013**
- **[OPS13] Columbus Operational Documentation, ESA/DLR/Astrium Space Transportation Internal Documentation, 1998-2013**
- **[ISS12] NASA International Space Station Documentation, NASA/ESA Internal Documentation, 1998-2012**
- **[GEN13] Columbus Software Generation Documentation, ESA/DLR/Astrium Space Transportation Internal Documentation, 1998-2013**
- **[IWB10] Ignatova, T.; Westerholt, U.; Brandt, M.: Advanced Software Maintenance Approach for the Complex Columbus Flight Software System. Proc. of Data systems in Aerospace (DASIA) 2010, Budapest, Hungary, 2010; P. 289-292.**
- **[ECSS12] ECSS Standards, European Cooperation for Space Standardization, 1993-2012**