ISS Columbus Module
On-Board Software Maintenance

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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
Astrium: Main Activity Areas

Astrium Space Transportation

Astrium Satellites

Astrium Services
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 …)
- …
Software Integration and Test Equipment - SITE
Electrical Ground Support Equipment - EGSE

Linked to Joint Station LAN (JSL) Support Facility

Test Node

On-board identic HW (UUT)

Linked to on-board Network

DIFA

Linked to MDB

MDB

WS

WS

PC

WS
Columbus System Laptop End-to-End Architecture

ISS Node 2
- SSMB
  - SSC File Server (ODF Database)
- Replication Service
- MCC-H
  - ODF Database
- OPS Preparation Environment

ISS Columbus Module
- Columbus Portable Workstation (PWS)
  - Script Launcher (SLA)
  - CLSW Configuration SW (CLSW_LAPSW)
  - Virus Protection SW (OVD)
  - Lapap Mk II
- DMS Services
- File Transfer Browser (FTB)
- DMS
- SPC
  - MMU
  - DMS
  - CDIs

COL-CC
- OFT SAS
- ODF Database
- ODF Books
- Container CDIs
- Replication Environment
- SW Generation Environment

Ground

Space
Process Model for the Software Cycle Process
(Uwe Westerholt)

Phase 1
Phase 2
Phase 3
Phase 4

Cycle N - 1
Cycle N
Cycle N + 1

Adaptations

Utilization Phase

(Uwe Westerholt)
ISS Columbus Module On-Board Software Maintenance

Dr.-Ing. J. Matevska

ISS / Columbus

The Company

SW System

SW Maintenance

Requirements Definition

Specification and Design of Change

Implementation of Change

Software System Integration and Generation

System Test and Qualification

System Delivery and Deployment

Software Transition

Cycle Kick-off

SRR

Software Product Development and Integration

Test with old cycle

Initial Software Provision

System Generation

Product Release

Software System Releases

Software System Documentation

TRR

Pre-Qualification

Qualification

Stage Tests

Transition Tests

QR

ADP Preparation

CoFR Preparation

Manifesting Preparation

Cycle Utilization
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
- [OPS13] Columbus Operational Documentation, ESA/DLR/Astrium Space Transportation Internal Documentation, 1998-2013