MODELLING OF COMPLEX DISTRIBUTED TEST SCENARIOS
Presented by Dr. Karl Ambrus & Andreas Weitl
CONTENT

- Introduction
- Objectives
- Virtual Integration Platform
- Use Cases & Test Scenarios
- Model Based Test Generation
- Conclusion & Outlook
AIRBUS DEFENCE & SPACE

Europe’s number No.1 defence and space company

Employees
33,500

2015 Revenues
€13.0 bn

2015 Order Book
€42.9 bn

2015 Major Orders
14 A330 MRTTs, 6 telecommunications satellites, WorldDEM

2015 Highlights
- Delivery of 11 A400Ms to 5 customers
- C295 best selling aircraft in its category
- Agreement with OneWeb for constellation of 900 small telecommunications satellites

Manching

User Conference on
Advanced Automated Testing
Introduction: Integration of Aircraft Systems

Integration of A/C Systems
- Aircraft are long living products (40 years)
- A lot of upgrade programs, enhancements & national adaptations during their lifetime
- Growth of functionality & complexity of the aircraft subsystems
- Increase and diversification of A/C variants during lifetimes
- New agile development methods

Integration Environment
- Complex, rare and expensive test facilities & aircraft components
- Compatibility of the integration environment for all integration levels & methods
- Reuse of test procedures during system lifetime (regression testing)
- Create synergies between different programs & testing methods
- Long Term Obsolescence handling for complex
  - Test environments
  - Test procedures
Introduction: Test Levels and Test Strategies

Levels of system integration testing:
• System specification & design model testing
• S/W and unit testing
• Component & subsystem testing
• System testing
• Virtual system integration
• System integration
• System qualification & certification

Test & Integration strategies:
• Test & analysis of system models (design, specification, S/W)
• Development tests using special development tools (agile development)
• Functional tests to ensure system operation under all use case conditions
• Formal qualification tests for requirement verification
• Automated regression tests to ensure system functionality
Introduction: AIDASS® Test System Family
for all steps of the Product Life Cycle

- Customer Requirements
- System Concept
- System Design
- Detailed Design
- Development & Implementation
- Component Testing
- Sub-System Testing
- System Testing
- Qualification & Certification
- Flight Test
- Production
- Automatic Test Procedures
- AGE

Based on common AIDASS GUI and AIDASS Front End Systems for all implementations

User Conference on Advanced Automated Testing
Introduction: TORNADO System Integration Rig
Introduction: Eurofighter System Integration Facility
Objectives for System Test & Integration

Reduce overall project cost for system development, system integration and system operation by improving product quality.

It is not the primary goal to reduce the cost for system integration & test, but to increase test coverage and quality of testing to find more problems in early integration phases.
Objectives for System Test & Integration

- Increase availability and reduce cost of test environments
- Offline (desktop) test preparation & test execution
- Agile automatic development testing
- Distributed System Integration
  - Remote operation of Test Benches & Test Tools
  - Distributed real-time testing of real and virtual systems
  - Standards for interoperability & communication (Commands, Data, Time, Files, OSLC …)
- Virtual System Integration
  - Integrate virtual equipment on virtual integration facilities
  - Portability of test procedures between real and virtual test environment
  - Service Based Testing on distributed hybrid computing infrastructure
- Model Based System Integration
  - Test variant management
  - Modelling of Test Scenarios
  - Automatic Test Case generation
  - Tracing of requirements
STEVE “Virtual Integration Platform – Next Generation”
Modular Distributed Test Environment & Communication Layer

STEVE “System-Technik und Virtuelle Erprobung”
VIP-NG “Virtual Integration Platform – Next Generation”

- Virtual & Hybrid Integration Benches
- Distributed System Integration
- Portability of Test Procedures
- Enhance availability of Test Environments
- Replacement of obsolete Modules

Distributed Test Environment

STEVE VIP-NG Modular Concept

STEVE VIP-NG Communication Layer Definition
Airbus D&S - Virtual Integration Platform

Service based system Architecture

- Modules & Objects (Services)
  - Desktop, Virtual & Target
  - Test Environment (AIDASS)
  - Simulation Environment (SIRIUS)
  - Test Tools

- Communication
  - Local, LAN, WAN

- Computing Host (H/W, OS)
  - Desktop PC (Windows) & Servers
  - Test PC (Linux, Windows)
  - I/O Front Ends
  - Test Bench Modules
  - Desktop, Virtual, Target & hybrid configurations

- System under Test
  - Real & simulated equipment

User Conference on Advanced Automated Testing
Airbus D&S - Virtual Integration Platform
VIP Demonstrator: AIDASS Environments & Computing Clusters

Desktop Integration Environment shall run on any Windows - PC

Virtual Integration Environment

Target Integration Environment

VIP Network Clusters

User Conference on Advanced Automated Testing
Airbus D&S - Virtual Integration Platform
VIP Demonstrator: Modules & Objects

Distributed Test Services (Network Cluster, Modules, Objects, H/W)
Airbus D&S - Virtual Integration Platform
VIP Demonstrator: AIDASS Module Controller

AIDASS Module Controller
Gateway for Commands & States

Unique commands & states for VIP Modules & Objects

Local Status Monitor
Use Cases & Test Scenarios
Show portability of Test Procedures

• Automated Generation of Test Scenarios
  ➢ Automated model based generation Test Cases & Test Scripts
  ➢ EA, MBTsuite, AIDASS Desktop

• Functional I/O Test:
  ➢ Test I/O interfaces and Test Rig functions
  ➢ AIDASS (Desktop, Virtual, Target & Hybrid)
  ➢ Test Rig (Desktop & Target)

• Command Test
  ➢ Test of XML-RPC Command interfaces
  ➢ Local & remote operation

• Quality of Service Test
  ➢ Commands (XML-RPC) & Data (DDS)

• VIP Demonstration Test
  ➢ Show operation of VIP Test Environments
  ➢ Virtual Flight Test (AC simulation & Displays)
  ➢ Real & virtual data I/O
  ➢ Distributed test environment (Computing Clusters)
  ➢ Image recording (VSS) & automated offline analysis (ADEO)
Model Based Test Generation
Design Test Scenarios (Test Model)

Define Test Variation Parameters

Define Test Variants

Modelling of Test Scenarios

Define Test Variant Rules
Model Based Test Generation
Design Test Scenarios (Test Actions)

Modelling of Test Actions

Action Libraries for Test Model Development

Test Model - Action Library Element

AIDASS - Action Library Test Script

Generated AIDASS Test Script

User Conference on
Advanced Automated Testing

26-28/10/2016
© All rights reserved
Model Based Test Generation
Test Case & Test Script Generation (MBTsuite)

```c
// main function, calling all testcases

function main()
begin

BeginTestLog()

DisplayPanel_IMAGE()
DisplayPanel_IMAGE_ERROR()
DisplayPanel_IMAGE_ERROR_002()
DisplayPanel_IMAGE_ERROR_003()
DisplayPanel_BSTOCHASTIC()
DisplayPanel_MANUALLY_ERROR()
DisplayPanel_MANUALLY()
DisplayPanel_AUTOMATIC()
DisplayPanel_AUTOMATIC_002()
DisplayPanel_AUTOMATIC_003()
DisplayPanel_AUTOMATIC_004()
DisplayPanel_AUTOMATIC_005()
DisplayPanel_AUTOMATIC_006()
DisplayPanel_AUTOMATIC_007()
DisplayPanel_AUTOMATIC_008()

********
DisplayPanel_AUTOMATIC_035()
DisplayPanel_AUTOMATIC_036()
DisplayPanel_AUTOMATIC_037()
DisplayPanel_AUTOMATIC_038()
DisplayPanel_AUTOMATIC_039()
DisplayPanel_AUTOMATIC_040()
DisplayPanel_AUTOMATIC_041()
DisplayPanel_AUTOMATIC_042()
DisplayPanel_AUTOMATIC_043()

RequirementCoverageTable()

EndTestLog()

end
```
Conclusion & Outlook

• Integration of Modules, AIDASS Environments & Network Clusters
  - Desktop, Virtual, Target & Hybrid Environments
  - Configuration & Setup of Service based Network Clusters
  - Health monitoring
  - ICD handling

• Use Cases and Test Variation Model for Airbus D&S - VIP Demonstrator

• Generation of Test Cases and Demonstrator Test Procedures
  - Portability of Test Procedures on Desktop, Virtual and Target Environments
  - Distribution of Modules & Objects (Test Tasks) in different Network Clusters

• Communication Layer API & Protocols
  - XML-RPC (remote application control)
  - DDS (real-time data exchange)
  - Configuration & File handling protocols (http)
  - System Time synchronisation (NTP, PTP, virtual Clock, target Clock)
  - VISTAS – EUROCAE WG 97 Avionic Bus Interfaces for Simulation Environments
  - Benchmarks for distributed test applications