Space Software Product Assurance Research and Development

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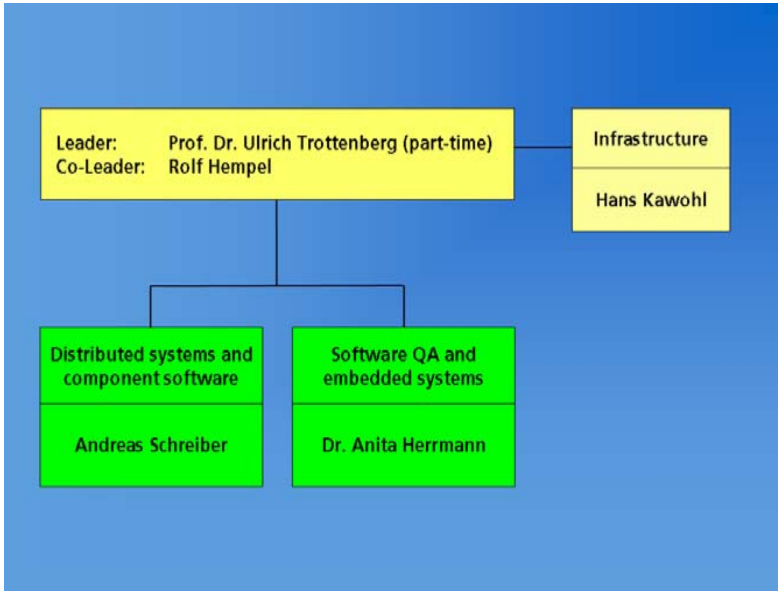
German Aerospace Center (DLR)

Simulation and Software Technology (SISTEC)

www.dlr.de/sc/

Simulation and Software Technology (SISTEC)

- Founded 1999
- Central DLR facility for
  - Information Technology
  - Software Product Assurance (standards, assessment, project support)
- Long-term SPA support in space projects (i.e. TerraSAR, Corot, Rosetta) based on ECSS, ESA-PSS
- Own software development experience as basis for professional SPA work. Focus: critical embedded real-time systems, i.e. BIRD satellite ACS)



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Infrastructure
Hans Kawohl

Distributed systems and component software
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Software QA and embedded systems
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Current projects and directions of research

- „DLR Software Basis Standards“: DLR intranet application for
  - SPA and SE requirements tailoring (ECSS-E-40, ECSS-Q-80, and other standards IEEE, RTCA/DO 178B, EN 61508)
  - Knowledge base (project documents, links, definitions, publications ...)

- SiLEST: Software in the Loop for Embedded Software Test:
  - Test and safety/dependability analysis of critical embedded real-time software
  - Surrounding system/hardware environment simulated by software
  - Applications: space software (ACS) and automotive control software

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Current projects and directions of research (cont.)

- **DataFinder**: **Data management in a scientific environment**
  - **Structured organization of long-term data (from simulation/experiments)**
  - **Client / Server tool, based on open standards**
  - **Roll-out at DLR under way**
- **Grid Computing:**
  - **New paradigm for distributed systems**
  - **Grown from research applications**
  - **Great potential for space applications (e.g. mission operation)**
  - **Important research topic: Security in virtual organisations**

Required Development of ECSS-E-40/ECSS-Q-80

- An E40/Q80 requirements tailoring system, based on the specific project characteristics / project context
- Elimination of overlap between ECSS-E-40 and ECSS-Q-80 requirements
- A reference between SPICE for Space (S4S) assessment capability levels (ISO 15504) and ECSS-Q-80 requirements

SPA R&D: Cost Reduction in Space Software Projects

- **Software Reuse**
  - **Effective (tool-supported) engineering and SPA processes**
  - **OO architectural frames / generic architectures for specific technical domains (i.e. ground systems)**
  - **design evaluation criteria / metrics for software reuseability**

- **Formal Code Analysis Methods and Tools**
  - **Determination of Worst Case Execution Time (WCET) of real-time software based on the source code only (symbolic code analysis)**
  - **Automatic code analysis to verify the match of execution pathes with the OO software model**

SPA R&D: Safety/Security of Space Systems

- Use of System Simulation (SiL, HiL) to support SPA for critical embedded real-time software
  - Software requirements analysis (in particular software-related safety/dependability)
  - Software verification and test
  - Robustness analysis with respect to
    - hardware / environment failure
    - hardware aging

SPA R&D: Safety/Security of Space Systems (cont.)

- Analysis of the relation between
  - software-affected system safety and
  - security

  in critical distributed, internet-based or grid-based systems

- Development of
  - Architectural guidelines for software / system security
  - Test and evaluation approaches for software / system security (systematic penetration tests)