SESP 2010

Session:	Session: EGSE Building Blocks (12)
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Date:	Wednesday, September 29, 2010
Time:	11:30 - 13:00
Room:	Einstein
Chair:	
Co-chair:	
Remarks:	

Seq	Time	Title	Abs No
1	11:30	Formation Flying EMCS based on the ESTEC EMCS Reference Facility Mazza, M.[1]; Fokou, G.[2] [1]Vitrociset Belgium, NETHERLANDS; [2]Vitrociset Belgium, BELGIUM Scientists have just begun to understand the full potential of space vehicle formation flying. In the last few years, this technology has gone from a space oddity - and a high risk one at that - to a concept fully embraced by earth and space scientists around the world. Simultaneous measurements by multiple formation flying vehicles can provide substantial benefits. Distributed spacecraft technologies enable higher resolution imagery and interferometry, robust and redundant fault-tolerant spacecraft system architectures, and complex networks dispersed over clusters of satellites in space. The Formation Flying support equipment most peculiar requirement is supporting the concept of a "Virtual Spacecraft". This means driving all involved spacecrafts as if they were only one through a set of predefined coordinated operations. The ESTEC EMCS Reference Facility (ERF) is a services oriented client-server suite of applications for EGSE and Mission Control built around three main components: ASE (Automates Schedule Execution, front-end to ECSS-E70-31 and ECSS-E70-32 standards), SCOS 2000 R3.1 EGSE and the EGSE Router. It is a scalable flexible and ECSS-oriented CCS. The VEGA EGSE showed already how this concept can be turned into a real working and highly performing tool with an addition of a suite of support utilities that ease the AIT/AIV procedures definition and execution. This article aims at demonstrating the feasibility of the Formation Flying support capability potentially provided by the actual ERF by means of actualising already existing features and making advantage of reusing proven reliable components. Current developments based on SCOS 2000 4.0 or the latest SCOS 2000 5.0 approach the problem with multiple instantiation of the usual Monitoring and Control tasks in a multi-domain fashion within the same SCOS framework but these solutions have not matured yet enough flight hours to present. What has been instead considered a limitation in the solutions based on SCOS 2000 R3.1 is not having this embedded capability to drive and control multiple domains at a time. Moreover, concerns deriving from having SCOS 2000 R3.1 being supported only by obsolete versions of the Operating System (SuSE 8.2) have been discarded by the porting of this software to SuSE 9.3	

before and 10.3 later (under the contract of the VEGA EGSE).
What was never considered before is the possibility to use the multi-domain support provided by ASE as filling this gap. ASE version developed for VEGA EGSE and the following ASE4 have indeed already embedded and tested a certain multi-domain capability.
With this approach ASE is able to provide a unique interface to multiple instances of SCOS 2000 in operations or multiple SCOS based CCS chains in EGSE applications.
This means that models of more spacecrafts can be mapped onto different branches of the very same Space System Model. This provides the advantage to have all of the involved information and activities available at the same time to the same procedures / schedules / displays. This means getting the capability to stimulate and monitor in a coordinated way all the hardware under test or the combined operations.
Such a Formation Flying capable EMCS would be in the perfect condition to manage all of it in two most probable scenarios like:

- Master - slave formation flying, where the formation is handled by the master S/C being the only one commanded from ground. In this case ASE - SCOS would command the master only and monitor the two at the same time. ASE could manage unforeseen / contingency ground-coordinated formation flying tests / operations.
- Ground driven formation flying, where the formation and the coordination mechanisms are managed by ground. In this case ASE would be in the position to manage the coordination logic. This approach could be used as a validation / backup solution for the first one.

The two scenarios above can be implemented by exploiting the same EMCS in a way instead of another as well supported by the very same architecture, therefore not requiring any further development. ASE based solutions guarantee more scalable architectures and the possibility to deploy the EMCS infrastructure on distributed environments with virtually no efforts when facing demanding performances requirements.

It is worth taking into account that, being MATIS (Mission Automation EGOS tool) a development based on ASE, such multi-domain consolidated approach would be easily migrated as well in the context of the flight operations segment.

2 12:00 The EGSE for ESA VEGA Launcher: A New Approach to Combine Versatility and Performances

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The EGSE (Electrical Ground Support Equipment) always plays a primary role in Assembly, Integration and Test activities; this role becomes crucial when the Unit Under Test is a new family of launch vehicles. The EGSE suite for a launcher presents a set of challenges beyond standard developments. Requirements for performance and redundancies for spacecraft and human safety are widely stricter than usual due to the potential hazard implicit in testing on the ground partially developed launcher stages.
This paper describes a quite innovative approach adopted by Vitrociset to develop the EGSE for VEGA launcher, a system capable to admirably combine the versatility of ESA Ground Segment SW infrastructure like SCOS-2000 (S2K) and ASE with the challenging real time performance required by the launch vehicle. The ESTEC EMCS Reference Facility (ERF) has been selected for this purpose as the baseline to develop this demanding EGSE due to its full dedication to ECSS implementation. The VEGA-EGSE shows how this concept can be turned into a real working

and highly performing tool with an addition of a suite of support utilities that ease the AIT/AIV procedures definition and execution with an eye on quality. An overview of the high level system architecture is given, with an outlook inside the main characteristics and features of the TES (Test Execution System), which can be considered the core of the system; a benchmark on the performance currently achieved by the EGSE is also provided.
The TES is the section aimed at executing test session, with capabilities of performing immediate data analysis and real time parameters monitoring. The TES is composed of two main elements: the CCS (Central Checkout System), also known as HLCS (High Level Control System), and LLCS (Low Level Control System).
The VEGA CCS bases its architecture on the ERF, a services oriented client-server suite of applications built around three main components: ASE (Automated Schedule Execution, front-end to ECSS-E70-31 and E70-32), S2K 3.1 EGSE and the EGSE Router. It proposes itself as a scalable flexible and ECSS-oriented CCS. The usual client-server setup of SCOS2000 has been modified splitting the server instance on two separate hosts, separating TM archiving, decommutation and data routing services from calibration and monitoring activity on parameters. It has demonstrated a significant increase of performances. S2K client instance and a customised version of ASE3 have been hosted in three instances providing multi-client featured stations. Concerns based on the requirements of S2K-3.1 being supported only by older versions of the Operating System have been discarded by the porting of this software to SuSE-10.3.
The added value of this approach is provided by the TPE (Test Preparation and Execution) component. This is the VEGA EGSE version of the more common ASE3. Its peculiarity among all other similar applications is the implementation of two ECSS standards: the Space System Model (SSM, E70-31) and the Procedure Language for Users in Test and Operations (PLUTO, E70-32). This application provides the proper level of abstraction for accessing all needed information of the complete system by embedding a Space System Model browsing interface. At the same time it gives homogeneity to all what is data or information under the "Reporting Data" concept and all what is commanding and directives under the "Activities" hat.
The LLCS is composed of a set of Special Checkout Equipments (SCOE) in charge of monitoring and commanding the UUT, reacting in real-time to both nominal and anomalous events and ensuring safety conditions during the test execution, also in absence of connection with the HLCS. The performance and safety requirements make the SCOEs to be intelligent equipments remotely configured and driven by the operator from a distance of up to 4 KM and to be able to autonomously manage in safe way all critical functions of the UUT, operating in strict real-time. This significantly enhances safe test condition and consequently leads to a lower risk both for operators and equipments, being it able to take appropriate actions and put the launcher in safe state.
The reacting capabilities are key features of VEGA-EGSE. Different reaction loop mechanisms (i.e. the loop from parameters acquisition, elaboration and action sending within a specified time) have been developed to make VEGA-EGSE able to meet the challenging performance requirements and maintain a high level of configurability. The fastest loop is closed at low level, where the SCOEs can be configured to autonomously react in real time within 120 ms according to predefined actions. If higher configurability is needed, it is possible to involve TPE in the loop: by means of dedicated interfaces, TPE is able to evaluate events for from SCOE and initiating procedures as reaction. The widest access to data is achieved involving S2K in the reaction, with very interesting results.

3 12:30 Fast Engineering Archives a New Future for Mission Intelligence
James, S
Logica, GERMANY

Mission analysts and principal investigators thrive on data. Typically many agencies extract and reprocess telemetry packets. This requires costly reprocessing associated with long delays depending on the volume of data. Having processed engineering data generated by the spacecraft, EGSE or ground equipment at your finger tips can open up new possibilities for mission intelligence. Logica has developed for ESA/ESOC a high performance engineering archive (DARC) that could pave the way for a new breed of mission intelligence applications. The archives ability to handle large volumes of data including statistics opens up the possibility for analysts to perform complex queries quickly at any time.