MOIS ? The Manufacturing and Operations Information System

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Technology abstract

MOIS is a suite of software tools for spacecraft and ground segment testing, operations preparation and automation. It was developed by RHEA and supports space missions procedure preparation, validation and execution. MOIS has supported more than 80 spacecraft. It interfaces with many control systems, third party procedures and databases and supports a wide range of programming languages.

ESA Broker Germany

The software is widely used at ESA and with ESA contractors. Its value for developing and maintaining the operations of critical space infrastructures is proven.

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Technology Description

The spacecraft life cycle is complex and affected by many important factors. Major issues governing its optimisation include, for example, the need to develop operational flight procedures as early as possible on

the ground, during the manufacturing phase and for subsequent use during system integration and test, commissioning and operations. It is also an advantage to use a centralised spacecraft telemetry and telecommand (TM/TC) database that can be used and edited at the various locations where activities are taking place. Moreover, spacecraft on-board autonomy is becoming more important through the use of On-Board Control Procedures. Clearly, the use of a mission software platform that will enable and support such major issues as these will prove time and cost saving. The Manufacturing and Operations Information System (MOIS) is the industry-leading suite of tools for spacecraft mission preparation and execution. Developed in close collaboration with operations and Assembly, Integration and Testing/Validation (AIT/AIV) engineers as well as ground and space segment developers, MOIS addresses the real issues that are key to successful mission preparation and operation.

A key feature of MOIS is its independence from individual mission control infrastructure and operations languages. As a result, MOIS has become the pre-eminent procedure development, execution and automation software platform for spacecraft mission preparation and automation in Europe. MOIS is used worldwide throughout the space industry, by spacecraft operators controlling live missions, as well as by payload/instrument developers and satellite manufacturers to support operations preparation or AIT activities. MOIS is used as a standard by the European Space Agency (ESA), and to date has been used to manage procedures for over 80 spacecraft covering all types of missions.

Outside the space domain, any critical infrastructure, where a command execution is critical and failure due to faulty commands and/or faulty telemetry interpretation as well as due to faulty scheduling of events would be fatal to the mission, could benefit from MOIS. Examples are the (nuclear) energy sector as well as the offshore domain, in particular the operation of submersibles. During the preparatory phase and/or operation of such critical infrastructures, MOIS could support the ingestion and editing of procedures and data, the handling of contingency and routine operations as well as maintaining configuration control over all procedures, documents, databases and schedules.

Innovations & Advantages

The MOIS software solutions are user-oriented systems, providing users with the benefit of safe, cost-effective, high-quality implementations of test and operation procedure management processes. Using MOIS the risk of human error is considerably decreased given the embedded consistency checks with databases and procedure logic. The time spent by the user for operation preparation is drastically reduced by using MOIS, taking advantage of the possibility to exploit commonalities among different procedures and the very short training time since the user does not need to know any programming or operations language. It is possible to export MOIS procedures in any required operations language for further processing.

The user-friendly procedure development, maintenance and execution environment provides for a high Return On Investment (ROI) while simultaneously increasing the quality and safety of testing and operations. MOIS supports all stakeholders from developers, manufacturers, commercial organisations and operators to managers, engineers and administrators.

Further Information

MOIS consist of the following software components:

- Library - Provides seamless, fully-integrated configuration management for mission data, including procedures, schedules, operational databases and documents, across the full suite of MOIS tools.
- Writer - Enables the creation and development of procedures or timelines that may be viewed and worked on both in linearised form, showing steps and associated statements, and as a flow chart graphical display of the step structure (via Flowcharter).
- Flowcharter - Enables the creation, editing and display of procedure structures through a graphical flow chart.
- DB - Controls the creation, import or editing of the MOIS operational system (TC/TM) database.
- Function Editor - Provides a user-friendly interface to create and maintain functions and directives for use in procedure writing.
- Supervisor - Manages the MOIS run-time environment for procedure execution when using Validator.
- Validator - Controls validation testing of a procedure and stores the results.
- Test Harness - Emulates a control system/simulator when using with Validator to test a procedure.
- Scheduler - Enables mission planning for satellite operations and station scheduling.
- Big Board - Displays live events from a MOIS timeline for use with pre- and post-launch phases.
- Publisher - Makes the hard copy production of procedures and timelines as painless as possible by automating the printing of up to thousands of documents under configuration control.
- Reporter - Logs the definition, analysis and solution of problems as they arise, and also performs consistency checking and analysis of sets of procedures.

Current and Potential Domains of Application

MOIS allows satellite manufactures and satellite operators to work on the same operations knowledge to better build, validate and operate a satellite mission. Examples of past, present and future missions using MOIS are: Envisat, Meteosat Second Generation (MSG), Metop-A and ? B, CryoSat-1 and -2, ADM-Aeolus, COSMO-SkyMed, TerraSAR-X, Hershel, Planck, ATV series, Cluster-II, Exomars, Venus Express, Mars Express, GOCE, XMM-Newton, GAIA, PAZ, SICRAL 1 and 2, Swarm, Rosetta, Copernicus and Galileo.

Outside the space domain, any critical infrastructures, where a failure would be fatal to the mission, could benefit from MOIS. Examples are the (nuclear) energy sector, industrial plants operations and automation as well as the offshore domain, there in particular the operation of submersibles. During operations of such critical infrastructures, MOIS supports the ingestion and editing of procedures and data, the handling of contingency and routine operations as well as maintaining configuration control over all procedures, documents, databases and schedules.
