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SIMULATION TECHNOLOGY, APPLIED TO INTEGRATION AND VALIDATION OF A MAJOR SPACE SYSTEM.

Abstract

A new simulation based Assembly, Integration and Verification Platform (AIVP) has been developed for Europe's Galileo Global Navigation Satellite System., to support integration of the navigation signal processing ground segment (the Galileo 'Mission' Segment – or GMS). The GMS AIV platform is a real-time simulation tool suite, designed to accurately reproduce the interface behaviour of the GMS sub-systems. During early GMS integration the system has been used to independently validate sub-system interfaces. In later stages, it has been used to represent those parts of the system which are not or cannot yet be deployed (including the Space segment). In future phases of Galileo, it will be used for continuing logistical support in the domains of technical staff training, system design evolution, and system re-qualification.

The GMS AIVP approach provides a wide range of technical and commercial benefits for Prime Contractors and Systems (or System-of-Systems) Integrators. It can be applied to a broad range of aerospace programme types. Benefits include (but are not limited to): improved risk management; reduced interdependency between sub-development schedules; increased access to system level expertise; validation of system level behaviour significantly in advance of full deployment; natural extension to through-life support activities.

A major advantage of the approach is demonstrated to be the ability to prove system behaviour in advance of space segment deployment. For programmes with high technical risk, or for nations with newly developing Space programmes, this allows launch and operations costs to be deferred until confidence is gained in the behaviour of the system as a whole (Ground and Space segments).

The general design of the GMS AIVP is described at architectural level. Novel features are presented, supporting flexible simultaneous real-time simulation of a large number of complex system elements, in a scaleable and distributed manner. Actual use of the system in the context of the Galileo Mission Segment is described, as well as lessons learned for future AIV systems. Key benefits are identified and discussed in relation to phases of Space system integration.

Applicability of the approach to systems of varying scale and technical heritage is discussed, concluding that the GMS AIVP approach is broadly applicable, but with particular emphasis on larger real-time ground segments (considering the Space domain), or those with a significant degree of new sub-system development.