

Highlights of the European Ground System – Common Core Initiative

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In the space domain, different monitoring and control systems are used by different organisations within Europe:

- ❑ Poor synergy and cross-fertilisation

Existing implementations have not been designed having the needs of the complete system lifecycle in mind:

- ❑ Even within the same mission or organisation heterogeneous systems are often adopted to support the various phases
- ❑ The process to progressively validate, integrate and operate space systems is resource intensive

Many of the existing systems have reached or are reaching their end of life:

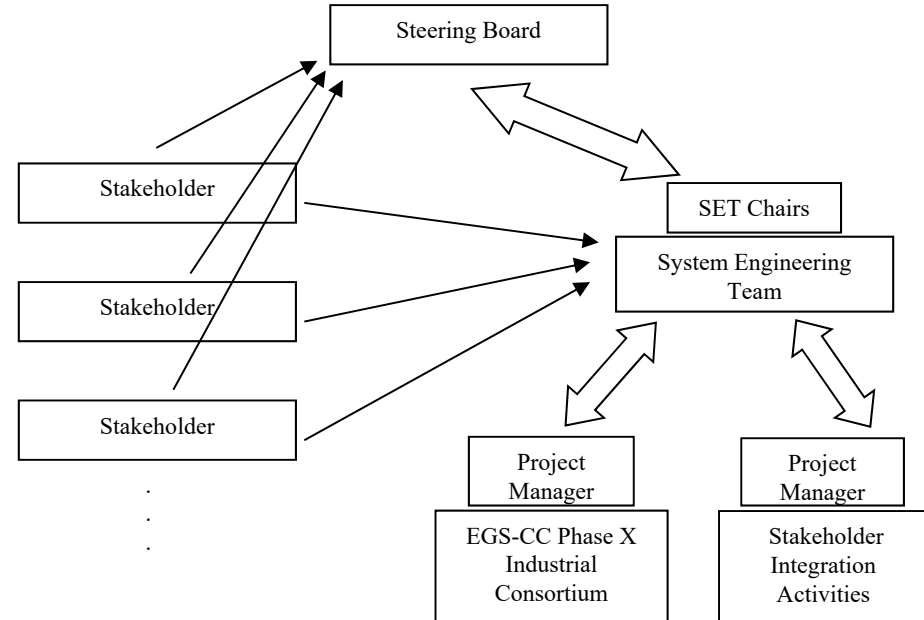
- ❑ Severe maintainability issues are expected to be faced in the medium term future

Stakeholders and governance of the EGS-CC Initiative



The European Ground System – Common Core (EGS-CC) is a collaboration of European Large System Integrators and Space Agencies:

- ❑ Airbus Defence & Space (France & Germany)
- ❑ CNES
- ❑ DLR
- ❑ ESA (ESOC & ESTEC)
- ❑ OHB System
- ❑ Thales Alenia Space (France and Italy)



We share the same problems. Let's develop a shared solution!

- [illegible]

The roles of ESA in the EGS-CC Initiative



ESA plays several roles in the EGS-CC initiative, namely:

- ❑ Leading the initiative at programmatic, steering and engineering level
- ❑ Acting as a stakeholder to ensure that the needs of pre-launch validation (ESTEC) and post-launch operations (ESOC) target applications are adequately considered
- ❑ Contributing to the V&V activities of the EGS-CC project deliverables
- ❑ Acting as 'Integrator' during the development phase, to contribute to the System Level testing of the EGS-CC in target environments
- ❑ Adopting the EGS-CC as the basis for the new generation M&C ground data systems infrastructure

The 'driving' features of Pre-Launch Systems



The EGS-CC based Pre-Launch Systems (aiming at V&V of the space systems) shall exhibit the following main features:

- ❑ High level of user-friendliness and ergonomcy. The Pre-Launch infrastructure is made available to external users who do not necessarily have sufficient resources to devote to familiarisation and training
- ❑ Ability to support, off-the-shelf, specific applications used in the development of space systems, like instrument development systems
- ❑ Ability to repeat the same (automated) test operations in different environments (e.g. different routings, different integration stages of the system under test)
- ❑ Accurate traceability of configuration and tailoring data to test sessions and results
- ❑ Minimal platform requirements (single low-end computers)

The 'driving' features of Mission Control Systems



The EGS-CC based post-launch operations (Mission Control Systems) will also need to support challenging use cases:

- ❑ Support of many dozens of users in parallel, in particular during critical phases
- ❑ Adaptability to various types of missions (short passes/short propagation delays, long passes/short propagation delays, long passes/long propagation delays)
- ❑ Handling of real-time as well as deferred data (high rate) in order to reconstruct the state of the controlled system
- ❑ Ability to provide the operators with a comfortable and reliable environment supporting the execution and end-to-end verification of complex operations
- ❑ Support of 'off-line operations' (ability to automate the execution of mission operations which typically involve a large variety of systems, belonging to both the ground and the space segment)
- ❑ Need to store, manage and disseminate massive amounts of data increasing throughout the mission

Trying to emulate the old systems?



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Or rather rethinking it?



The arrogance of success is to think that what you did yesterday will be sufficient for tomorrow

William Pollard

Any change, even a change for a better, is accompanied by drawbacks and discomforts

Arnold Bennett

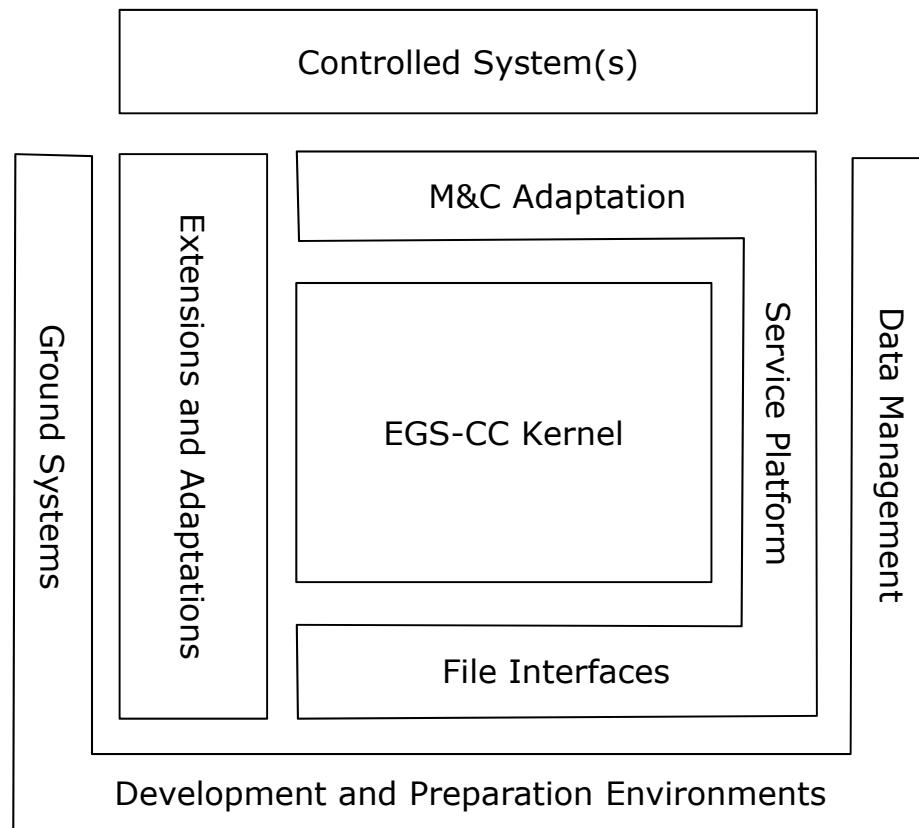
Your life does not get better by chance, it gets better by change

Jim Rohn

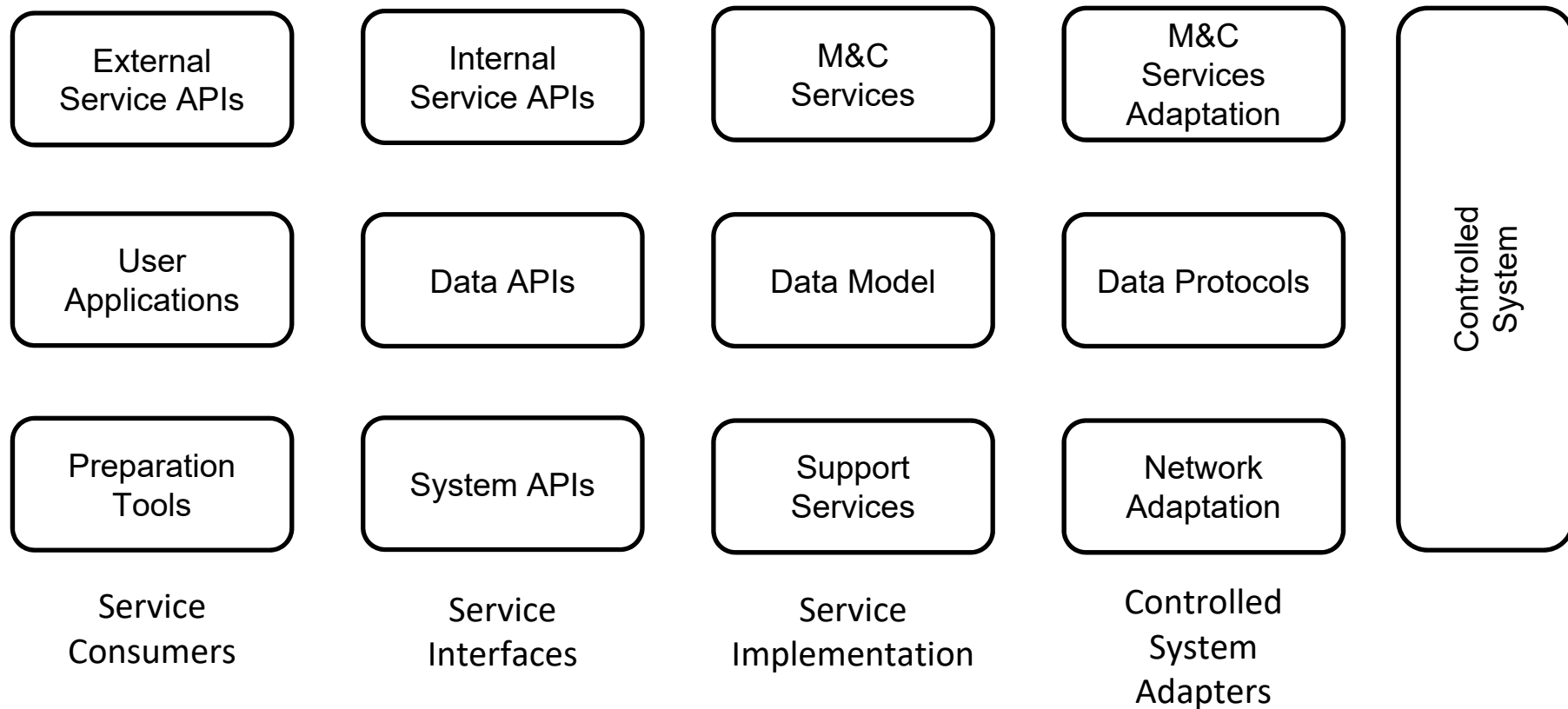
The main features of the EGS-CC Product



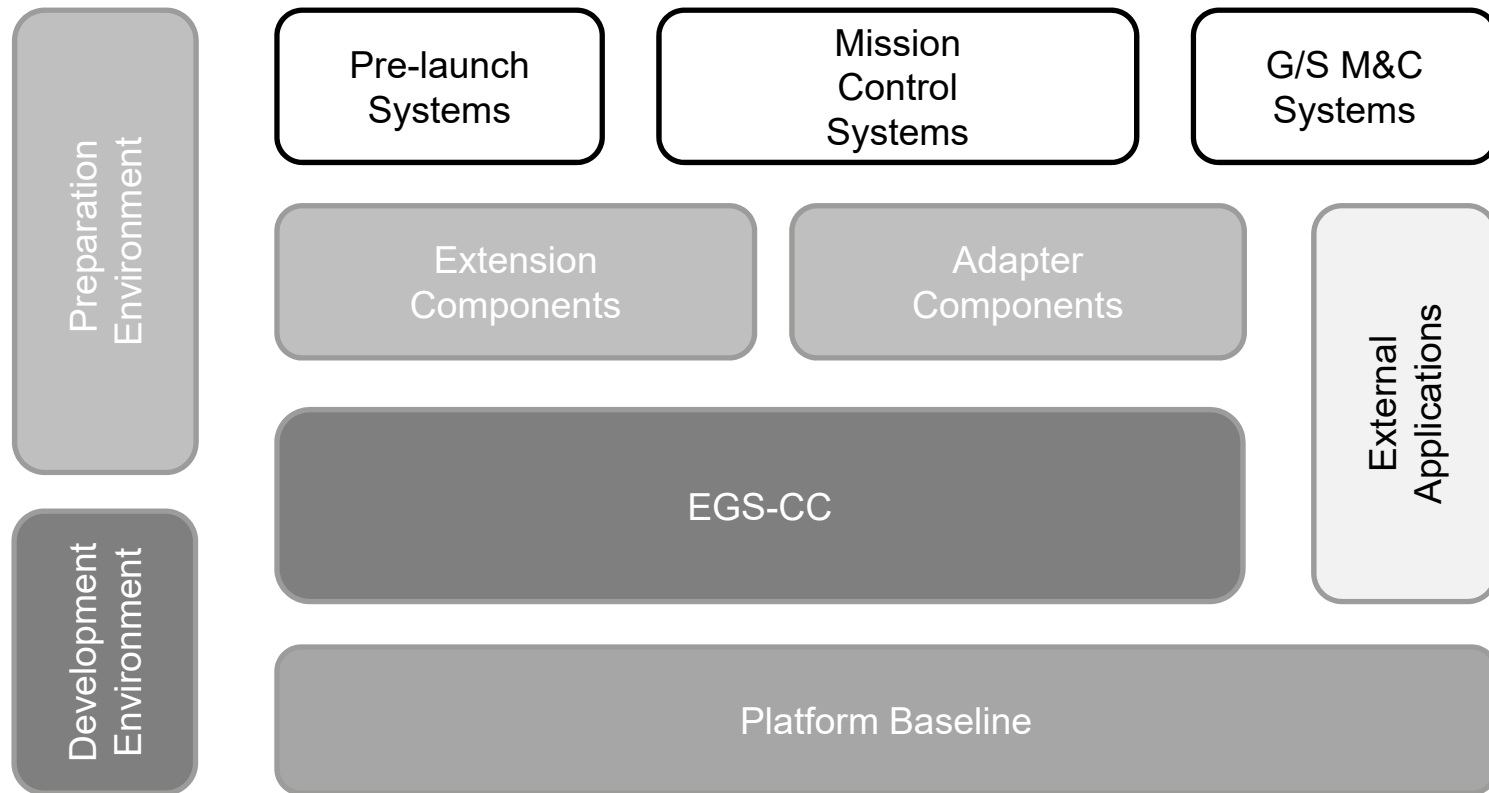
- ❑ Providing support to the full lifecycle (development, integration, preparation and operation) of M&C target applications
- ❑ Designed to support all mission phases (pre- and post-launch)
- ❑ Truly adaptable to any type of space system
- ❑ Consisting of self-standing components collaborating through service interfaces
- ❑ Based on modern and widely used technologies
- ❑ Formalised data model shared with Industry
- ❑ 'Conceptually centralised architecture' (one service provider, many service consumers)



Conceptual overview of the EGS-CC product



Top-level overview of EGS-CC based systems



The expected impact of the EGS-CC adoption



The EGS-CC adoption at the stakeholders organisations will be 'disruptive' in many respects:

- ☐ Terminology
- ☐ Engineering culture
- ☐ Engineering support tools and associated processes (e.g. model based engineering, white-box testing, automated validation)
- ☐ Technology stack (e.g. Java, OSGi)
- ☐ Data model
- ☐ M&C Data definitions preparation and lifecycle
- ☐ Approach to tests/operations (higher level of abstraction, native automation support)
- ☐ Development and maintenance approach of M&C systems (EGS-CC as a 3rd party product)
- ☐ External interfaces (with other ground systems)

Status of the EGS-CC Initiative



- ❑ Phase A (Definition of System concepts and Requirements baseline) carried out in collaboration by the various stakeholders and concluded at the end of year 2012
- ❑ Phase B (Architectural design and Technology baseline definition) carried out with the support of two industrial consortia. It was completed in June 2014
- ❑ Phase C/D (Development) carried out by a single industrial consortium consisting of about 20 European companies. It started in June 2015 and is expected to deliver the final product by the end of 2019. It is based on an incremental implementation, validation, integration and delivery approach
- ❑ Integration and adoption: carried out independently by each stakeholder organisation in parallel with the actual EGS-CC development. At ESOC a large Project has been put in place, aiming at developing the Mission Control System for the Juice mission (around Jupiter) to be launched in 2022

Conclusions



- ❑ The EGS-CC initiative is an absolute first in the space domain in many respects
- ❑ The EGS-CC is materialising (third 'Integration Release' due in one month from now)
- ❑ The EGS-CC represents an excellent opportunity to modernise the European M&C infrastructure and produce a new generation of products
- ❑ The EGS-CC based M&C infrastructure products will be disruptive in many respects compared to the current ones
- ❑ The most critical challenge will be to overcome the natural reluctance of projects and of users communities to embark on new concepts/systems
- ❑ Commitment by all parties is needed 'end-to-end'

Thanks for your attention

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We would like to acknowledge the excellent work of all the other
EGS-CC Team members in all stakeholder organisations