

# EGS-CC

EUROPEAN  
GROUND SYSTEMS  
COMMON CORE

## The Initiative is Becoming a Reality

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# Motivation of the EGS-CC Initiative

- Within Europe, different monitoring and control systems are used by different organisations
  - 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

# Objectives of the EGS-CC Initiative

- The EGS-CC Initiative aims at developing a common European Monitoring & Control infrastructure. These are the main expected benefits:
  - Increased synergy across all pre- and post-launch mission phases
  - Reduced overall development, sustaining and maintenance costs
  - Enable the modernization of legacy implementations of Electrical Ground Support Equipment (EGSE) and Mission Control Systems (MCS)
  - Facilitate cost and risk reductions when implementing space projects through the provision of a stable common infrastructure
  - Promote the cross-fertilisation and enable the exchange of ancillary implementations across organizations and across missions.

# Stakeholders of the EGS-CC Initiative

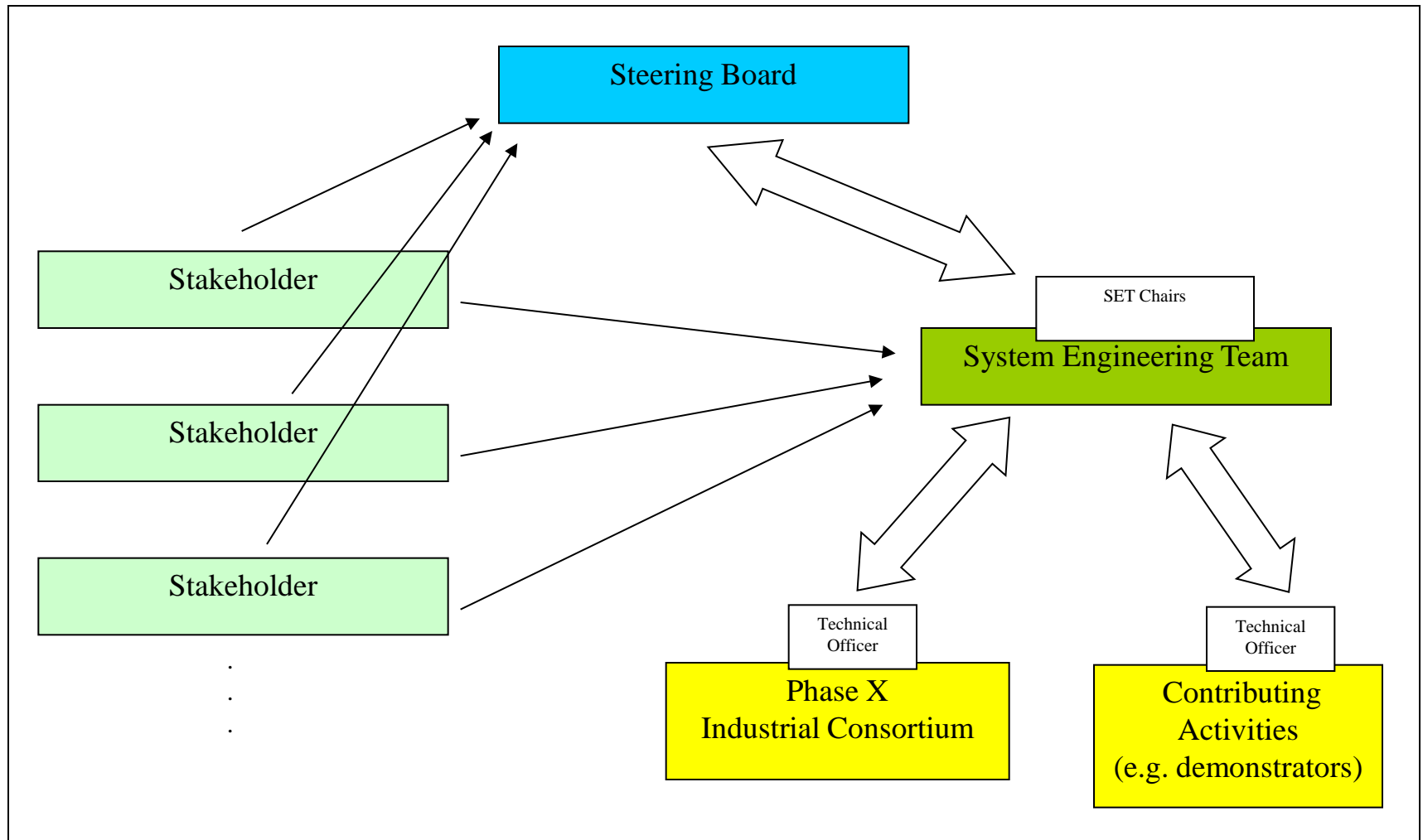
- EGS-CC is a collaboration of large system integrators and space agencies to develop a common core
  - AIRBUS Defence & Space
  - CNES
  - DLR
  - ESA ESOC
  - ESA ESTEC
  - OHB System
  - Thales Alenia France
  - Thales Alenia Italy
  - UKSA

We share the same problems: let's collaborate to find a common solution

# EGS-CC Partnership

- Collaboration Agreement covering all phases signed by all stakeholders
- The development of the EGS-CC is managed in open competition according to ESA contract conditions and processes
- Adoption of the EGS-CC for institutional missions as well as for commercial missions after successful operational validation in priority (pilot) projects
- Active stakeholders involvement at two levels:
  - Steering Board, owning the responsibility of defining and managing the implementation of policy related aspects (e.g. funding, procurement, evolution, licensing)
  - System Engineering Team, acting as a technical coordination body managing the definition and all technical aspects of the system

# Governance of the EGS-CC Initiative

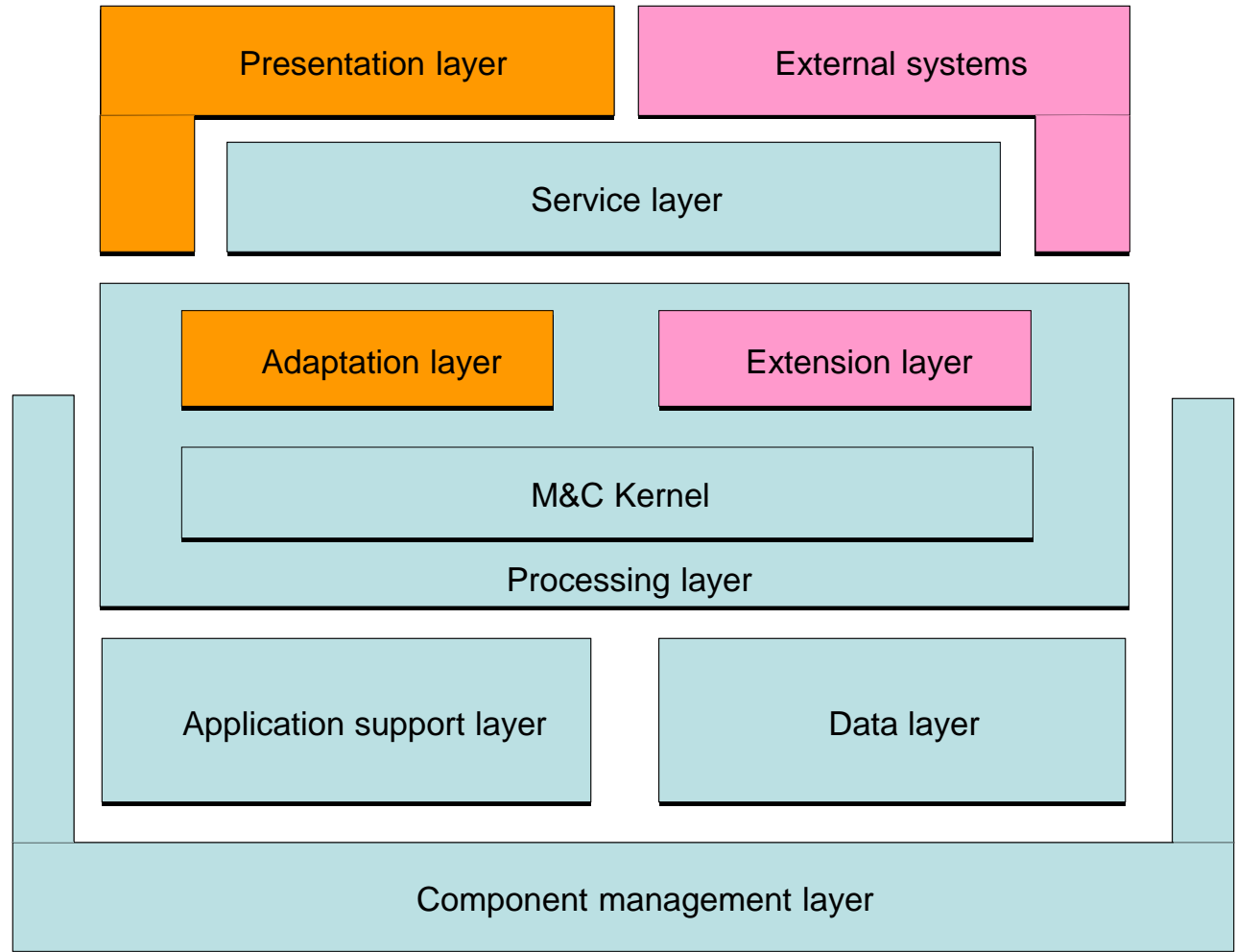


# EGS-CC Wish List...

The objectives of the EGS-CC initiative are very ambitious

- Support of all mission phases
- Support of all mission types
- Support of heterogeneous space systems
- Generic and extensible functionality
- Designed for automation
  
- Component based, service oriented architecture
- Interface based design, strict dependency control
- Clear separation between generic M&C functions (kernel) and specific features of the controlled system (adaptation layer)
- Clear separation between the infrastructure and the application specific implementations
  
- High performance and scalability
- Long term maintainability (technology isolation, adoption of standards, portability, modularity, etc.)

# EGS-CC Architectural Layers



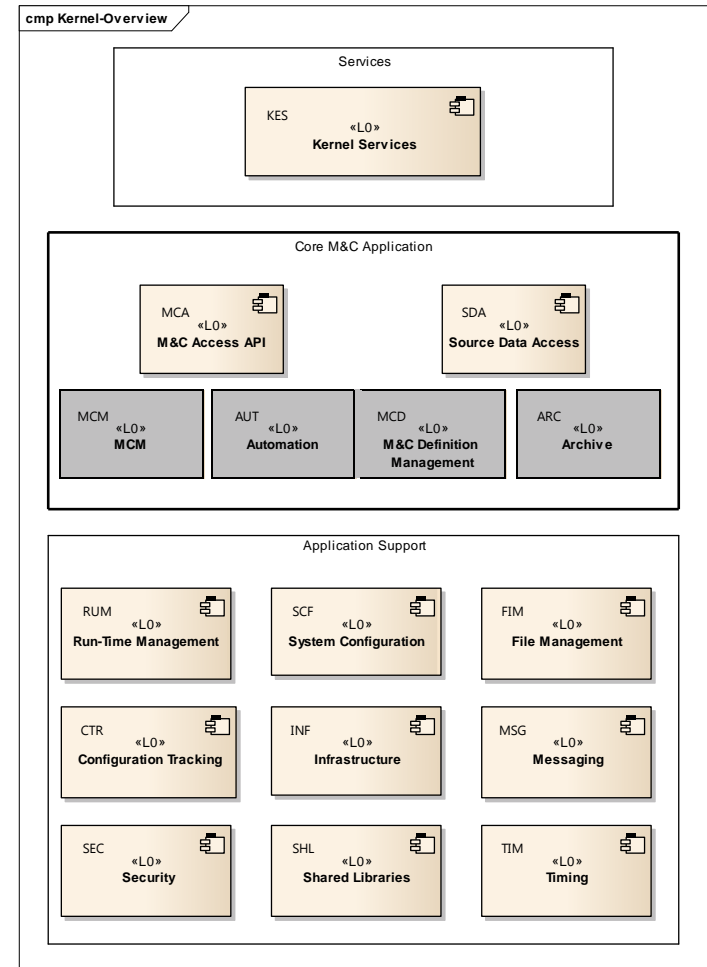
## Legenda

- Reference Test Facility
- Reference Implementation
- Kernel



# EGS-CC Architecture

- Hierarchical decomposition:
  - Subsystems
    - Level 0 components
      - Level 1 components
  - » ...
- Level 0 components provide the formal interfaces (contract) of the EGS-CC
- Level 0 are developed (almost always) as single entities by a single team. They are the validation unit
- The Component Test Framework is specifically intended to validate L0 components in isolation



# EGS-CC licensing

- EGS-CC products will be licensed as open source (similar to LGPL) within the ESA member territories:
  - Source code is available to users and can be modified by them
  - Users can sub-license the software
- EGS-CC may be licensed outside the ESA member territories under ESA Technology Transfer rules
- ESA will hold the IPR for EGS-CC products on behalf of the stakeholders
- Users may contribute to the EGS-CC baseline: bug corrections, improvements, etc.

# EGS-CC Products

- EGS-CC products will continue to be developed by a collaborative community after completion of Phase C/D
- Products are not limited to the EGS-CC operational software. They also include:
  - Software validation infrastructure: Component Test Framework and Reference Test Facility
  - Software Development Environment
  - Collaboration and distribution platform, CSDE hosted by ESA
  - Procedures and rules for software delivery and maintenance

# EGS-CC Phases – A and B

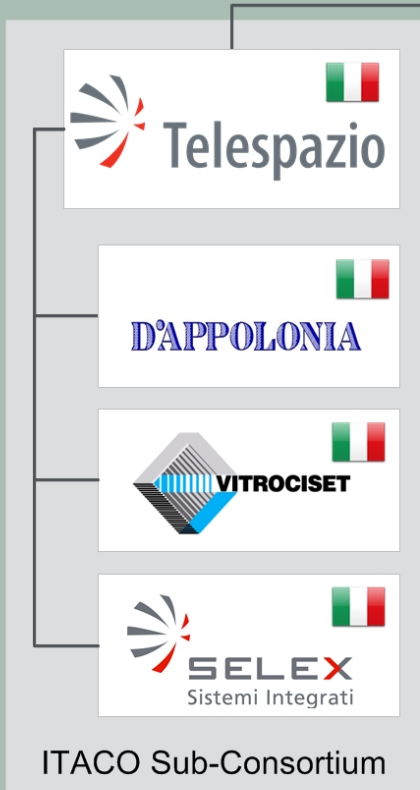
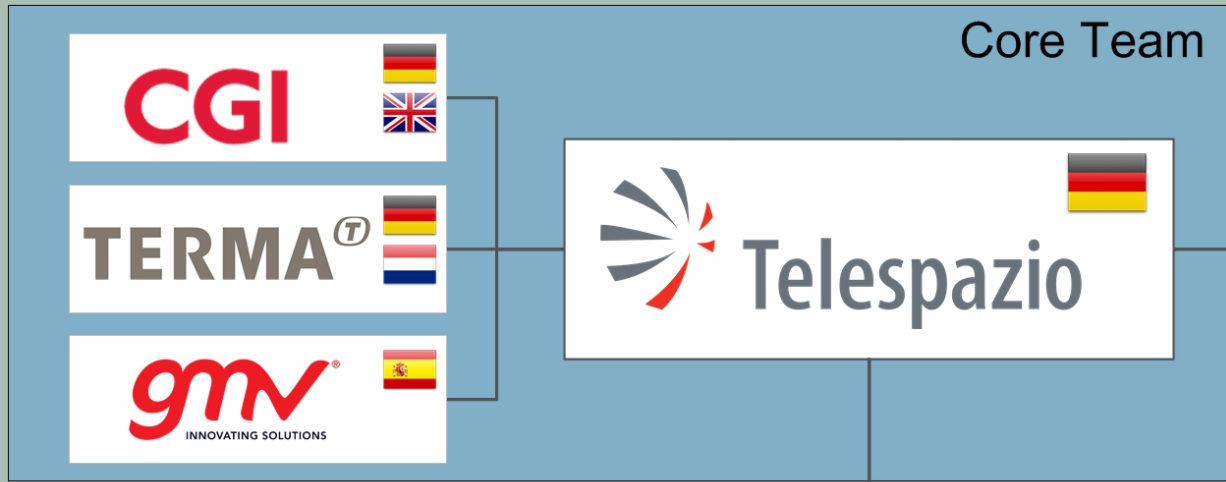
- Phase A carried out by the Systems Engineering Team and concluded at the end of year 2012. Main outputs were:
  - System concept
  - Requirements Baseline (use cases, functional and non-functional requirements, including Reference Test Facility Requirements)
  - Conceptual Data Model
  - Glossary of terms
- Phase B carried out by two industrial consortia concluded in 2014. Main outputs were:
  - Software Requirements and Architectural Design (Phase B contract), producing the Technical Specification
  - Technology Evaluation (PoC contract), defining the Technology Baseline (third party products and technologies)

# EGS-CC Phases – C/D

- Phase C/D kicked off in November 2014:
  - Split in two steps, C/D-1 and C/D-2
  - Large contract (>15 M€) and consortium (20 companies)
  - One main contract for development
  - One separate contract for definition and integration of the Software Development Environment
- Phase C/D-1 (ends May 2015):
  - Software re-use analysis
  - EGS-CC – ISIS convergence analysis
  - Definition of guidelines and rules (coding rules, UI development guidelines, automation procedures programmer's guide)
  - Initial development of key components with significant lead time: UI, archive and component test framework
- Phase C/D-2 (ends December 2017): development and delivery of a significant number of incremental releases
- Decision point between steps 1 and 2 for the contributing countries

# Consortium

## Core Team



# Interaction with Integrators

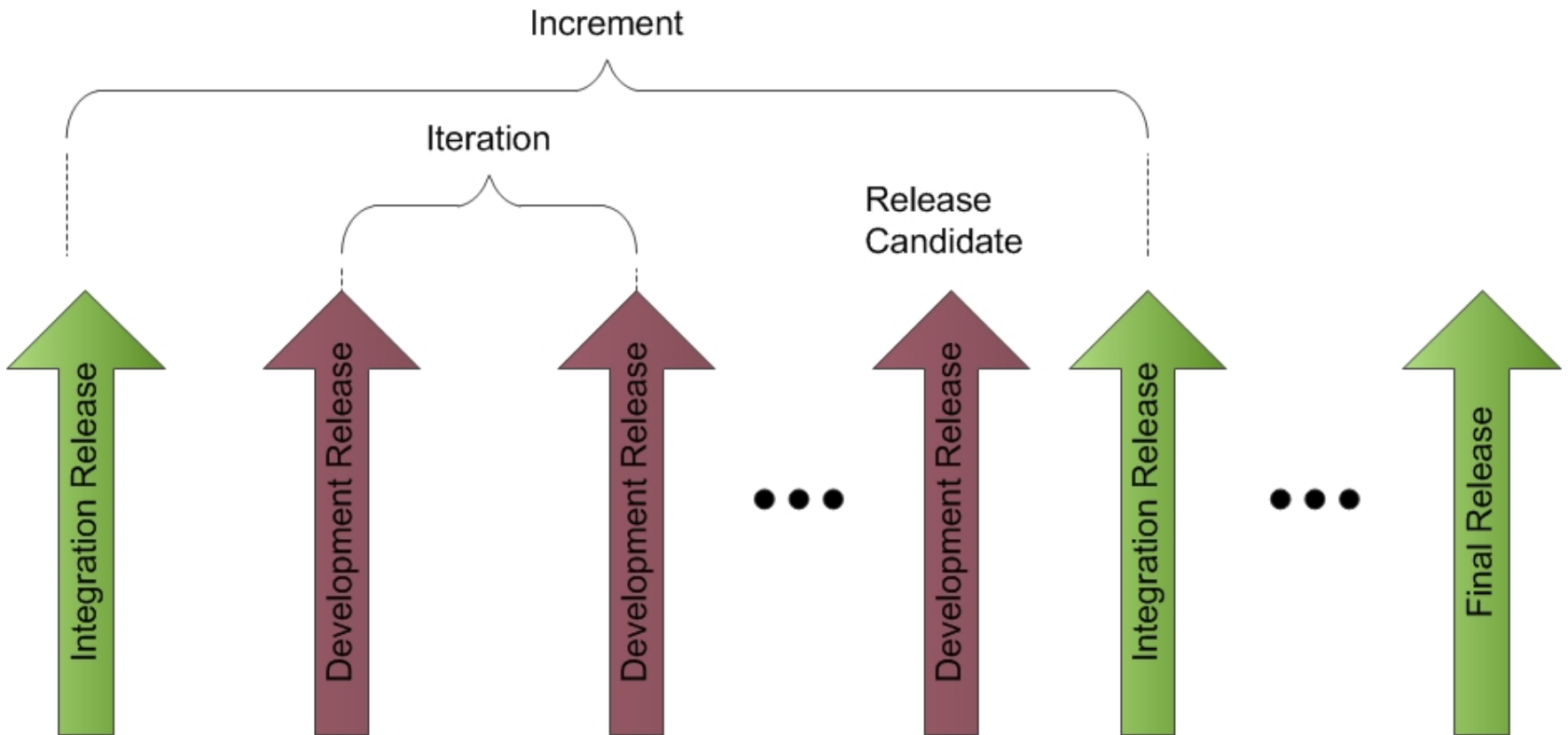
- EGS-CC integration into stakeholders' infrastructure requires time and needs to be planned carefully
- During Phase C/D releases are made available to EGS-CC stakeholders (only)
- The collaboration platform, CSDE, is the channel for all interactions regarding releases:
  - Between Phase C/D Team and ESA
  - Between ESA and Integrators
- Integrators provide feedback according to specific rules and through the CSDE (JIRA)
- Specific scheme for management of bugs and bug correction

# Development Lifecycle

- Innovative development cycle:
  - Supported critically by SDE and collaboration platform (CSDE)
  - Large number of players (developers, customer, users) and many interactions among them
- Incremental at two levels (integration and development releases)
- Starting from a complete and stable technical specification produced in Phase B
- Implements some agile features at the lowest levels of the development organisations
- Compliant with ECSS standards



# Incremental Development Structure



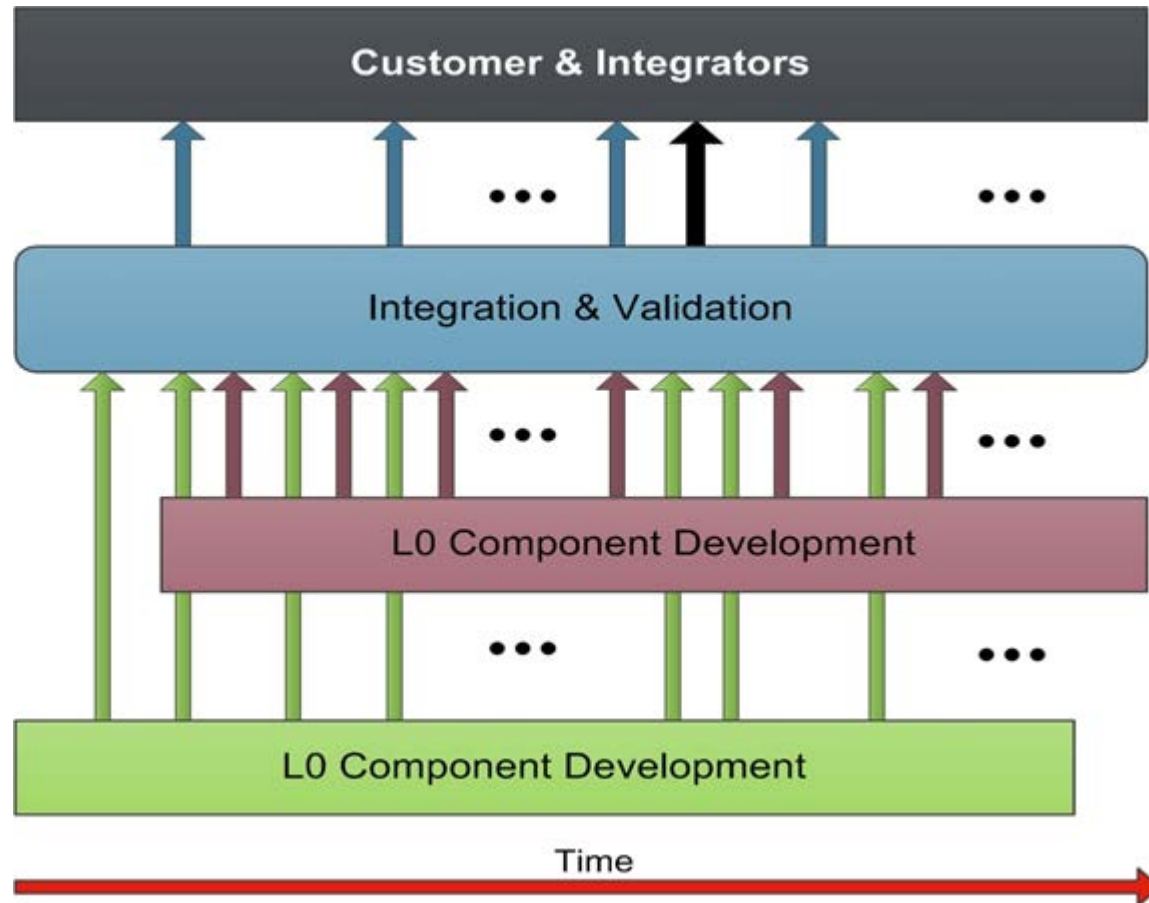
# Integration Releases

- Functional scope defined in the Statement of Work and proposal:
  - IR1: preparation of functional verification
  - IR2: functional verification
  - IR3: AIV
  - IR4: geo satellite operations
  - IR5: full functionality
  - Final release
  - End of warranty release

# Development Releases

- Intermediate steps towards the next integration release
- Functional scope proposed by Phase C/D Team and discussed and agreed with EGS-CC stakeholders
- Full validation is an objective but not a requirement: verification control provides full up to date validation status
- Last development release before an integration release is a “release candidate”: functionally equivalent to the following integration release but may not be fully validated
- Cycle of development releases is 6-10 weeks

# Integration and Release Strategy



# Software Development Environment

- SDE defined and integrated through a separate contract (CS-SI, France) as the users are not only the Phase C/D Team but also:
  - ESA as contract customer
  - Integrators
  - End users
  - Maintenance organisation
- Built on top of public third party tools
- All third party tools are free except for the design and modelling tool (MagicDraw) and the collaboration platform (Atlassian) hosted by ESA

# Development Process Automation

- Such a high rate of iterations can only be achieved if development processes are automated to the highest extent possible:
  - Automate all levels of testing to the highest extent possible
  - Automate generation of artefacts: documentation, code, verification information, test management
  - Up to date information available at all times to Integrators: verification control, metrics, bug reporting
  - Minimise the effort to build and deliver a release

# Conclusions

- The EGS-CC initiative is moving forward
- Continuous and effective collaboration between stakeholders: significant effort to reach consensus from all sides has delivered results
- Pending the decision point at the end of Phase C/D-1, Phase C/D is moving ahead and well on track
- Very large development with many stakeholders and in a very short time is only possible through a well adapted development lifecycle, supporting development environment
- **And a good collaboration spirit from all parties**