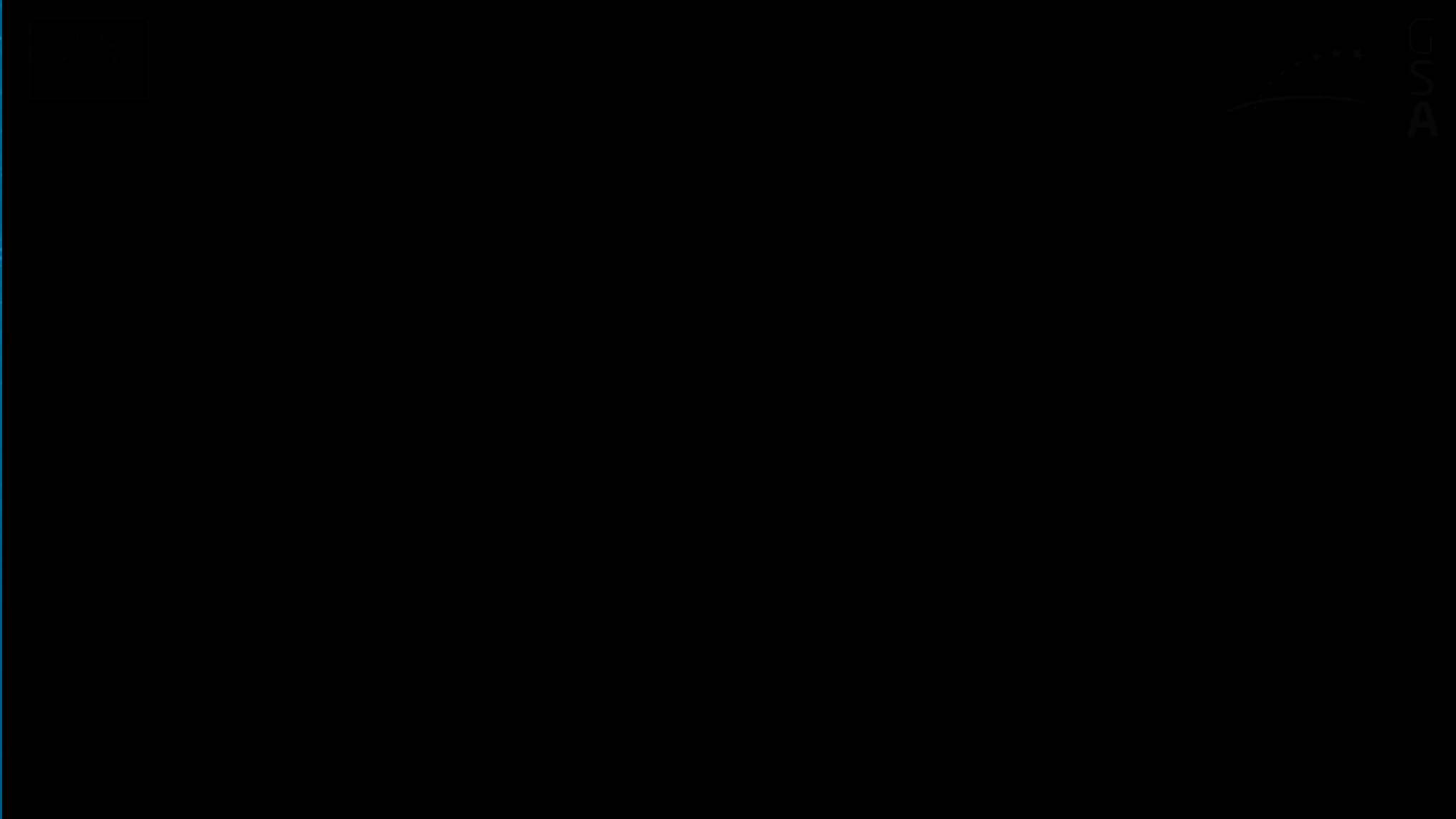# Agenda

➢ **What is EGNOS (European SBAS)**

➢ **EGNOS - Safety Of Life System Architecture**

➢ **Aircraft Certification vs EGNOS Application**

➢ **Mitigating certification risks on EGNOS**

➢ **EGNOS Approval Reviews Process**

➢ **Major points raised during the Approval Reviews**

➢ **Lessons learned on EGNOS**

➢ **QUESTIONS**

→ THE EUROPEAN SPACE AGENCY

What is EGNOS

European Geostationary Navigation Overlay Service

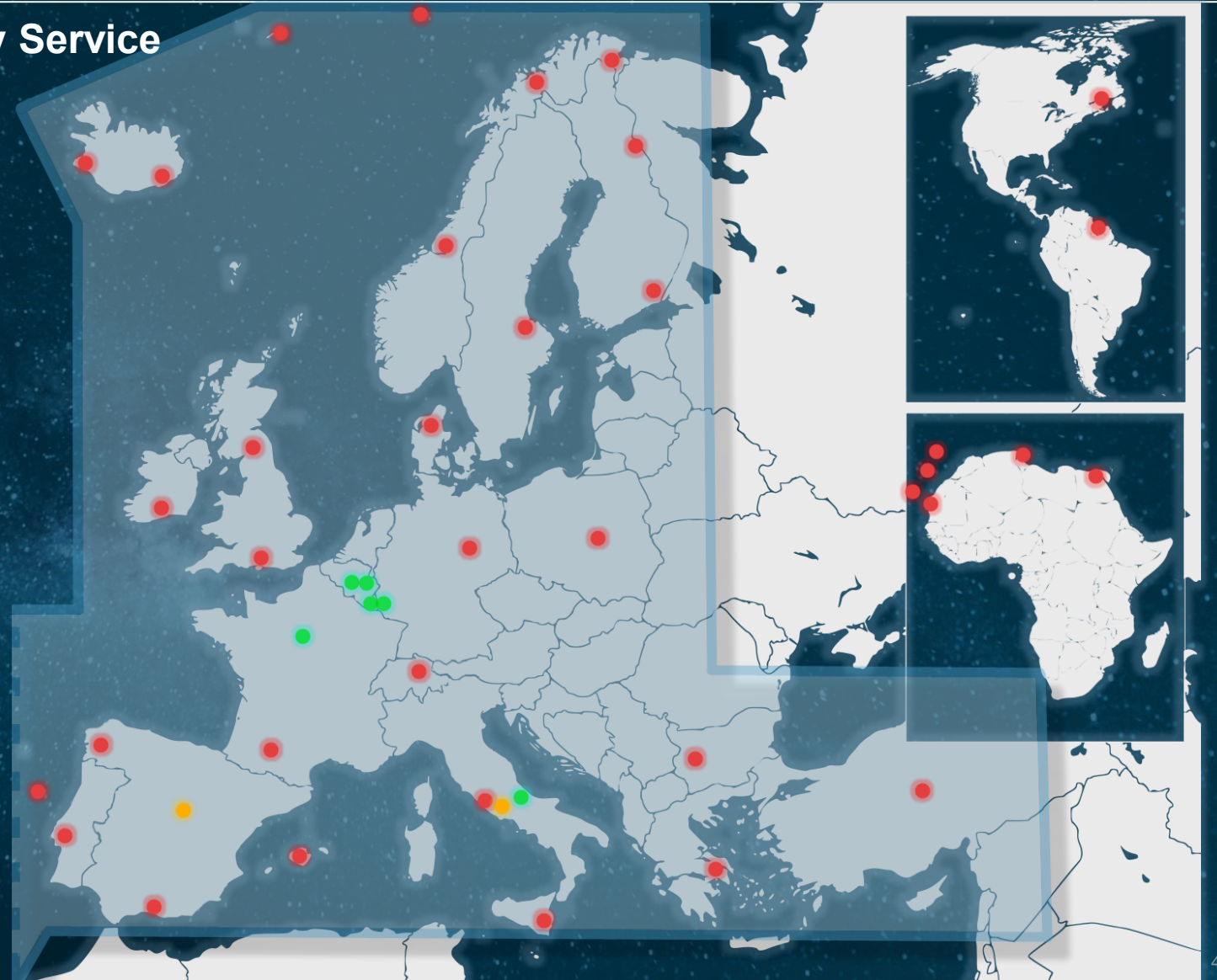Europe's first venture in the world of satellite navigation

Main drivers: Accuracy & Integrity

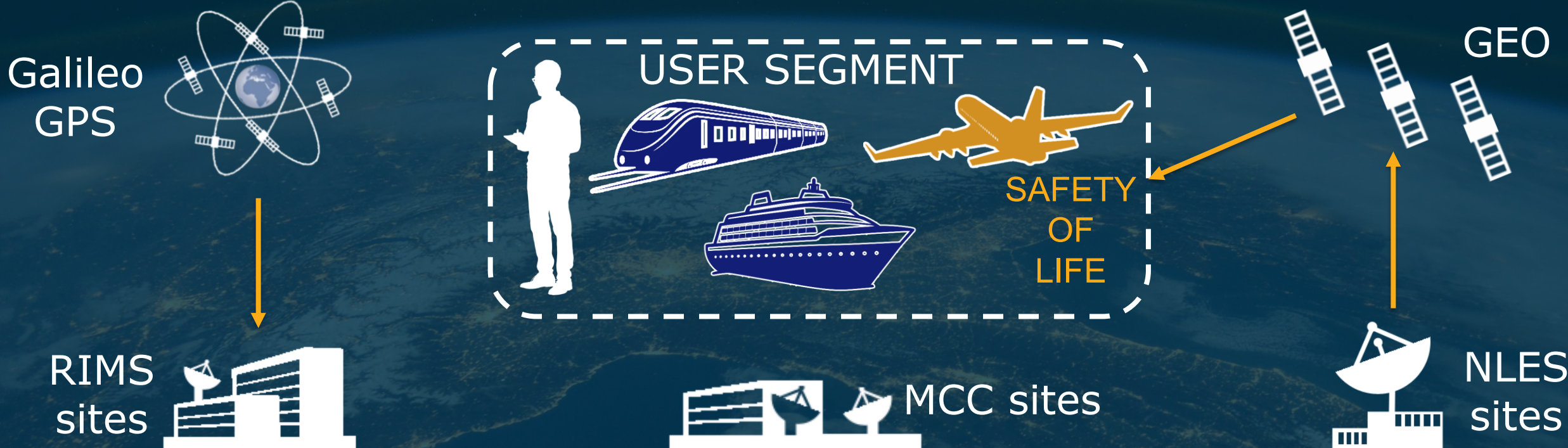**EGNOS primarily covers Europe, including:**

- All EU member states

- Norway, Switzerland, and parts of North Africa

- Parts of Eastern Europe and Western Russia

Based on a large infrastructure:

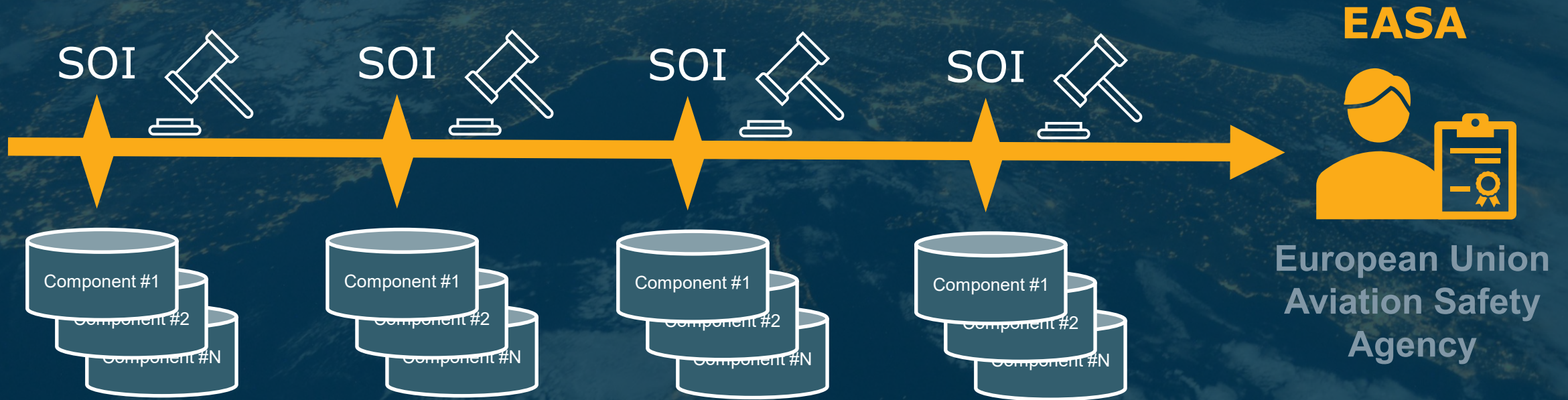- ➢ 2   **MCC** sites

- ➢ 6   **NLES** sites

- ➢ 40   **RIMS** sites

Aircraft Certification vs EGNOS Application

Aircrafts and Aircraft equipment (E-TSO*) are certified by the Authority (EASA in EU):

➤ Aircraft equipment suppliers, and Aircraft integrators are in relation with Certification Authorities

➤ Several SOI (Stage Of Involvement) performed by EASA during the development depending on the LOI (Level Of Involvement)

➤ Equipment and processes are progressively assessed

SOI SOI SOI SOI

EASA

Component #1
Component #2
Component #N

European Union Aviation Safety Agency

(*) E-TSO = European Technical Standard Order

Aircraft Certification vs EGNOS Application

Currently only EGNOS services are certified
No Progressive verification by EASA

Rework

OR

Authorisation for operation

QR

EGNOS DEVELOPMENT

OPERATIONS PREPARATION

Certification Authority

SAFETY CASES

EGNOS IN OPERATION
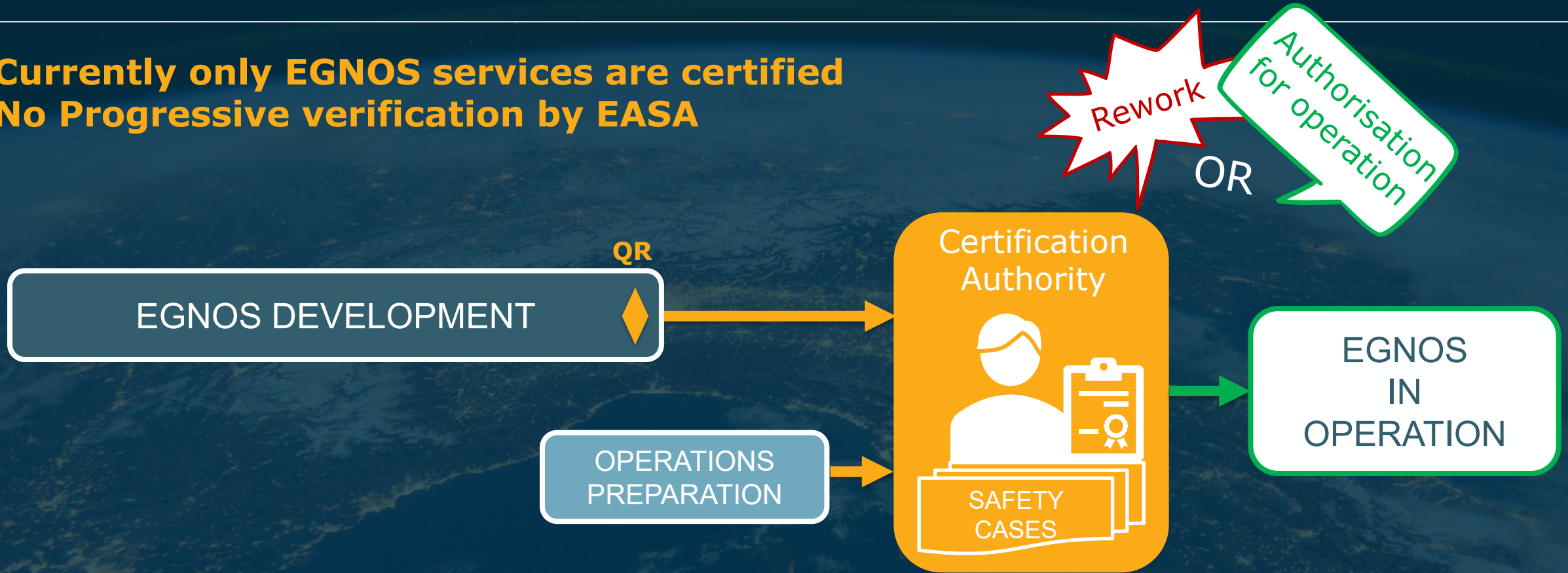
EGNOS Safety dossier will be evaluated by EASA at the end, additional information may be requested

➢ **ESA-EGNOS objective is to mitigate the certification risk**

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Mitigating certification risks on EGNOS

Means of Compliance (MoC)

- **Use of RTCA/EUROCAE standard which is approved by EASA for software:** ED-109A / **DO-278A**
- Plus ESA additional adoption for hardware: ED-80 / **DO-254**
- Plus ESA ECSS referential

Selection of mature solutions & reliable technologies on Safety critical parts

- Avoid too recent technologies or non-deterministic solutions (VM, Multicore, Machine Learning…) on safety-critical applications
- While it can be used on non-safety critical components, e.g. monitoring functions

Approval Reviews (ApR)

- Same process will apply for all critical SW
- Verify availability & adequacy of artefacts/evidences during development
- Dedicated milestones to prevent deviations

EGNOS Approval Reviews Process

EGNOS Progress

Planning Approval Review — Align with standards and organisation

Implementation Approval Review — Focused on product traceability and implementation
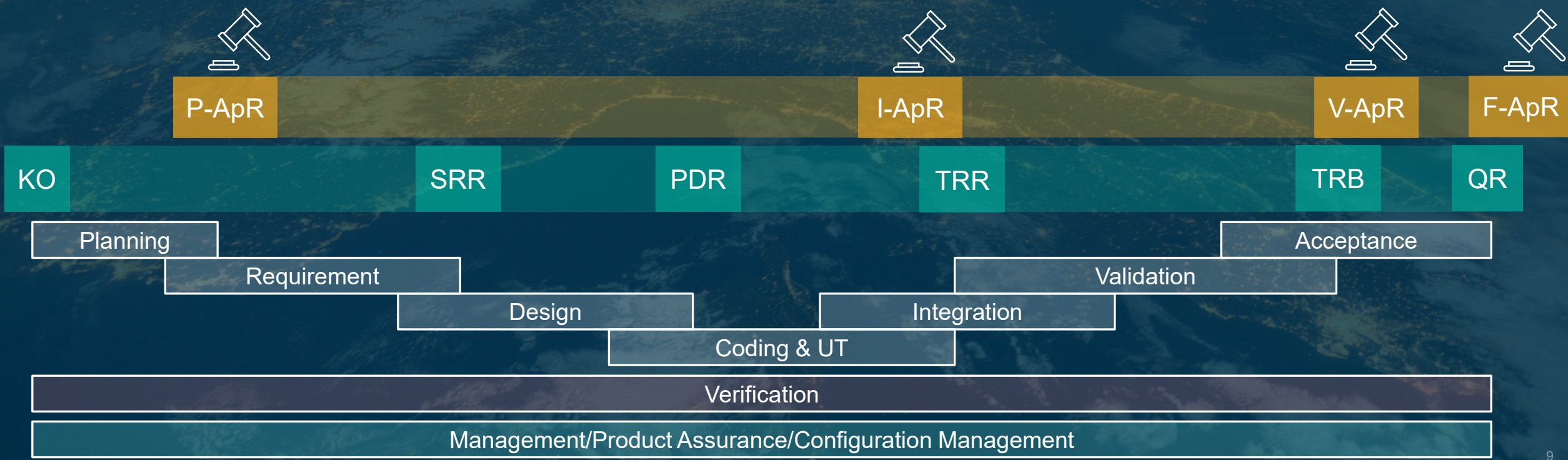
Verification Approval Review — Focused on verification & testing

Final Approval Review — Resolve discrepancies and finalize approval

P-ApR | I-ApR | V-ApR | F-ApR

KO | SRR | PDR | TRR | TRB | QR

Planning
Requirement
Design
Coding & UT
Integration
Validation
Acceptance

Verification

Management/Product Assurance/Configuration Management

Major points raised during the Approval Reviews

❑ **Planning Approval Reviews**

  ➢ Some processes are not fully described

  ➢ Some life cycle data requested by the standards are not fully identified

❑ **Implementation Approval Reviews**

  ➢ Completeness & Consistency of requirements

  ➢ Compatibility of SW architecture with HLR (high-level requirements)

  ➢ Traceability between HLR and LLR (Low-level requirements)

  ➢ Management of derived requirements

  ➢ Reviews with the associated checklists

❑ **Verification Approval Reviews**

  ➢ Configuration Management and Data Control Category (CC1 & CC2)

  ➢ Completeness of Verification and Validation activities

Completeness of organisational aspects

Completeness and consistency of requirements & traceability

Reviews & associated checklists

Test completeness

Lessons learned on EGNOS

❏ **Expertise on certification processes is essential**

➢ **Some subcontractor teams struggle to understand the process**

➢ **ESA in support**

❏ **Management awareness of safety processes**

➢ **E.g. Approval Reviews & normal lifecycle shall run in parallel (and not a posteriori)**

❏ **Preparation is important**

➢ **E.g. Monitoring Reviews proposed by industry**

❏ **Recurrent or structural problems (transversal to several components)**

➢ **To be addressed asap (e.g. dedicated workshops with the relevant parties)**

❏ **New EU Safety Regulation in place since 2023 – still to be applied to EGNOS**

QUESTIONS?