GSAW 2024 Towards Ground Segment as a Service (GSaaS)

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GSAW24 27/02/2024

Agenda

- EUMETSAT
- Current and new Ground Segment services
- Ground Segment Governance

Current EUMETSAT satellites

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SENTINEL-3A & -3B (98.7° incl.)

Low Earth, sun-synchronous orbit

Copernicus satellites delivering marine data services from 814km altitude

JASON-3 (63° incl.)

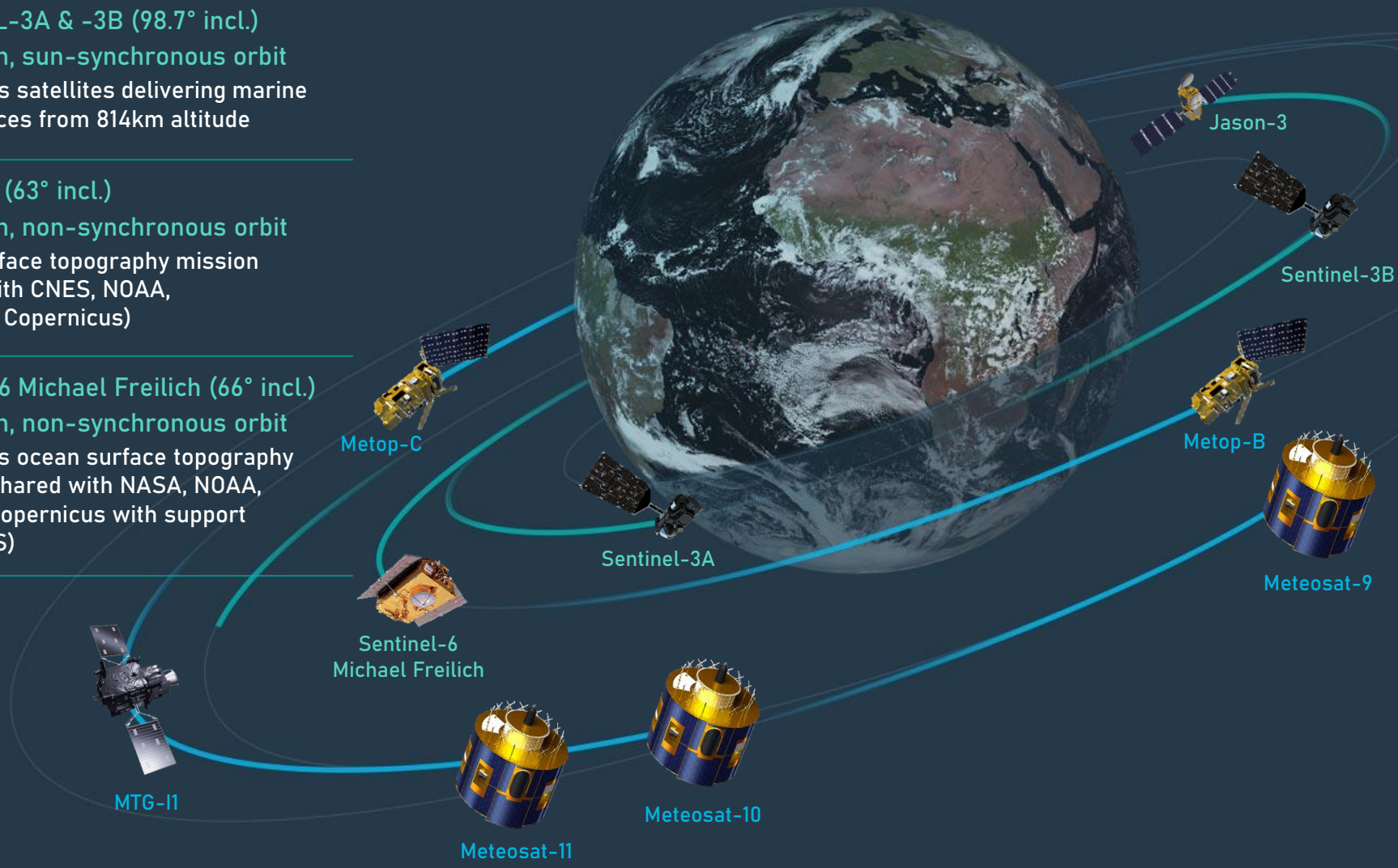
Low Earth, non-synchronous orbit

Ocean surface topography mission (shared with CNES, NOAA, NASA and Copernicus)

Sentinel-6 Michael Freilich (66° incl.)

Low Earth, non-synchronous orbit

Copernicus ocean surface topography mission (shared with NASA, NOAA, ESA and Copernicus with support from CNES)



METEOSAT-10, -11

Geostationary orbit

Meteosat Second Generation

Two-satellite system
Full disc imagery mission (15 mins) (Meteosat-11 (0°))
Rapid scan service over Europe (5 mins) (Meteosat-10 (9.5° E))

METEOSAT-9 (45.5° E)

Geostationary orbit

Meteosat Second Generation providing Indian Ocean data coverage

METOP-B & -C (98.7° incl.)

Low Earth, sun-synchronous orbit

EUMETSAT Polar System (EPS)/ Initial Joint Polar System

MTG-I1

Geostationary orbit

Meteosat Third Generation imaging mission, currently in commissioning phase

EUMETSAT mission planning

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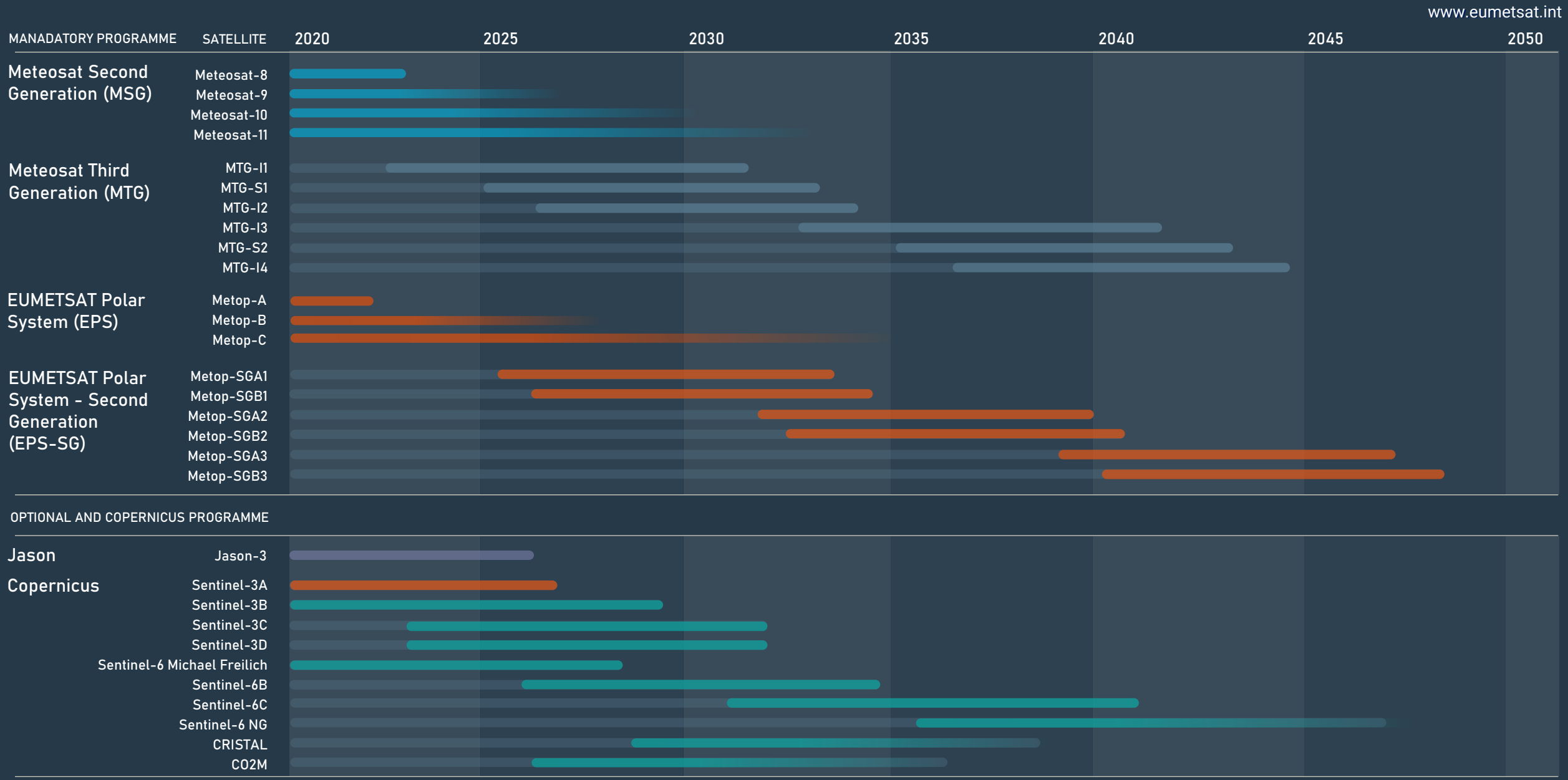

EUMETSAT ground systems across Europe...

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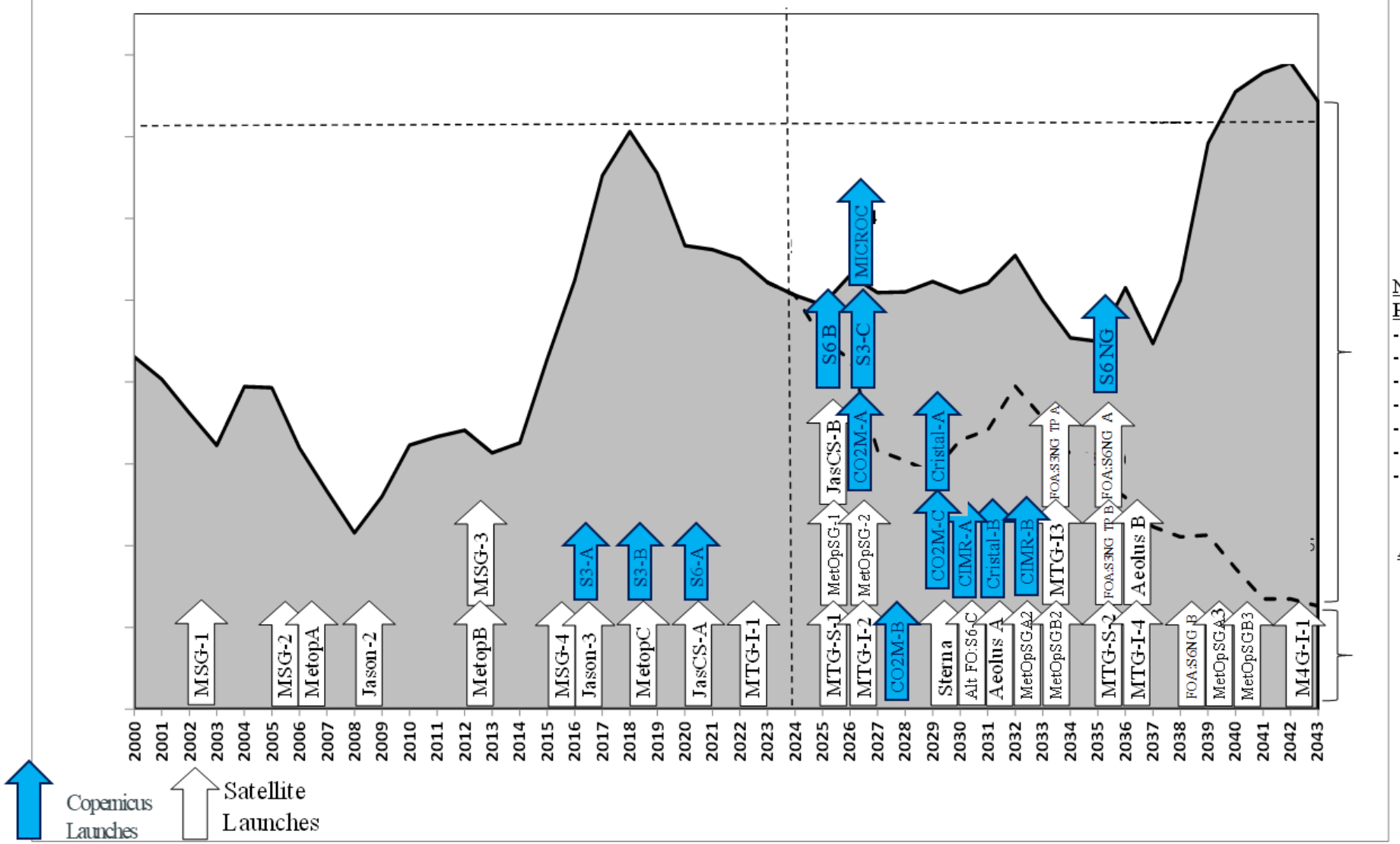
EUMETSAT mission control

Overview, Progs, Launches: tentative planning



Non approved Programmes/Activities:
- EPS Aeolus
- EPS Sterna
- EPS-TG
- M4G
- FO Ocean Altimetry
- SAFs
- CommData

Approved Programmes:
- GB
- MSG
- MTG
- EPS
- EPS-SG
- JASON-CS

Multi-Mission: Challenges and rational for a service approach

- EUMETSAT Challenges
  - Improvement and Obsolescence of existing GS
  - Sustainability / Cost efficiency / time-to-delivery of future GS developments
  - Increased reliability and less anomalies
  - Technological changes (digital move, new bands, etc.)

- EUMETSAT GS transformation:
  - Service approach instead of system approach, enabling design-to-cost vs. design-to-requirements
  - A reliable MME (Multi-Mission Element) approach based on past successes (starting 2000's)
  - Standardisation of requirements and rationalized solutions
  - Maximise re-use: components, documentation, skills

We want to go from a sub-system approach to a fully packaged service approach

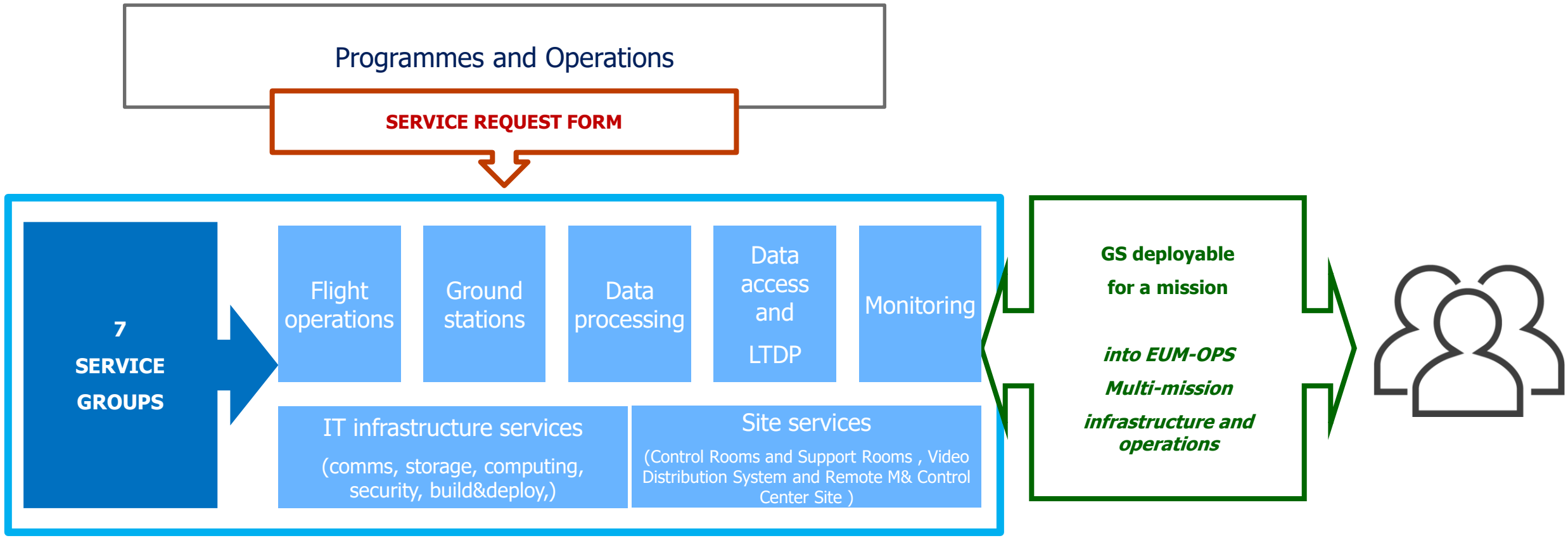
Challenges and rational for a multi-mission service approach

- “Multi-Mission” experience since its introduction in EUMETSAT (referring to “GSAW 2015 - Multi-Mission Elements Key Ground Segment Systems Services for EUMETSAT future programmes) and elaborate on the pragmatic frameworks (integrative architecture and design, supporting plans and processes, team organisation, dedicated lifecycles...) put in place in order to implement the Multi-Mission strategy and its future evolutions before

Current Multi-Mission Services

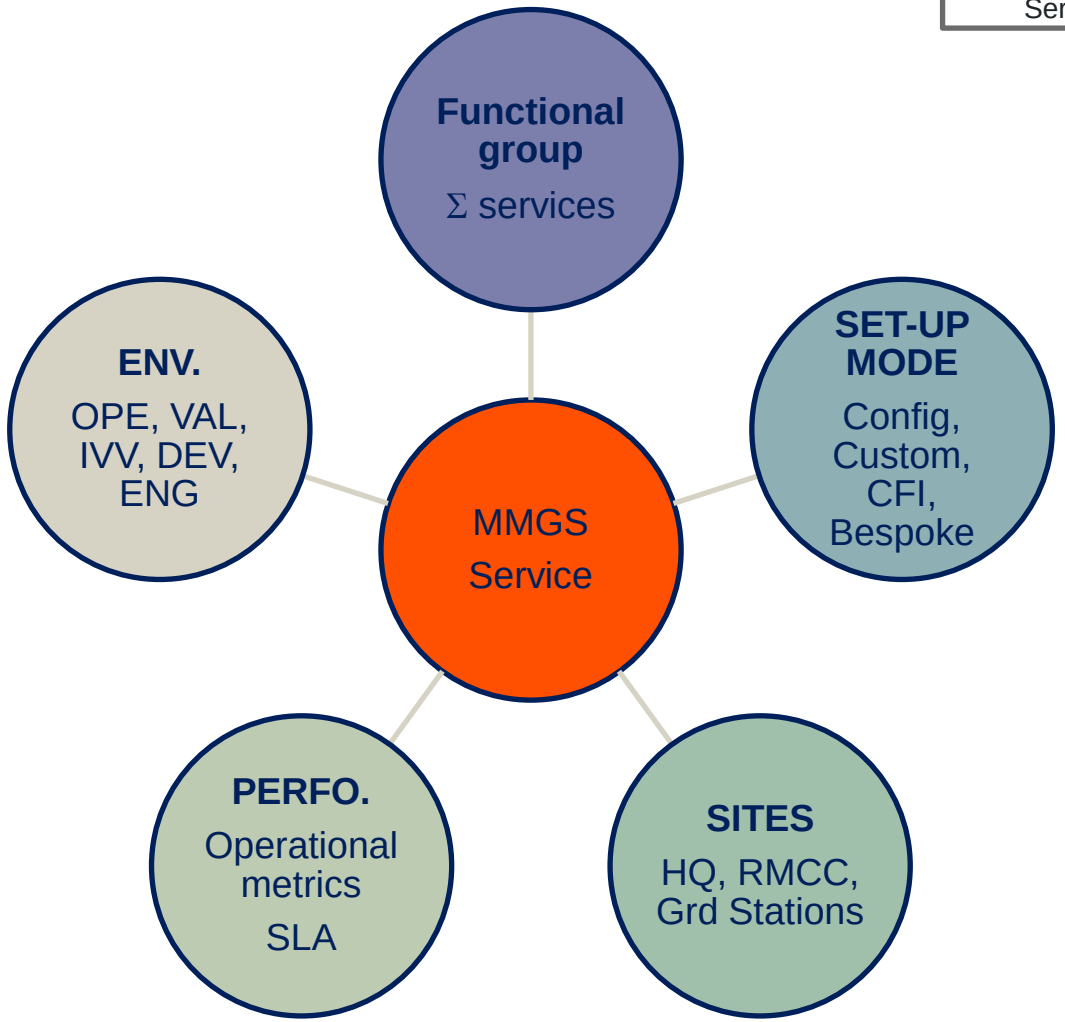
- EUMETSAT has established and is maintaining a baseline of Multi-Mission Elements (MMEs) which were gathered in, initial, 4 and now 5 functional groups:
  - MME Data Access for dissemination of data to end users and ingestion of data from external parties plus long term archiving and access/retrieval of mission data and user support services, including service registration;
  - MME Monitoring for System Monitoring for centralized monitoring capabilities for the ground segments, end-to-end production, service status, hardware, remote spacecraft telemetry;
  - MME Processing for Reprocessing, Offline Analysis & Reporting, Science Data Quality Analysis & Reporting, Calibration & Validation and Data Collection Platform Services;
  - MME IT Infrastructure for computing, storage, networks for connectivity to/from the MMEs and inter-buildings, Internet, external connectivity as well as for security and data protection services;
  - MME Site Infrastructure for Control Rooms and Support Rooms services, Video Distribution System and Remote Monitoring and Control Center Site Service.

New Catalogue of Multi-Mission Ground Segment services



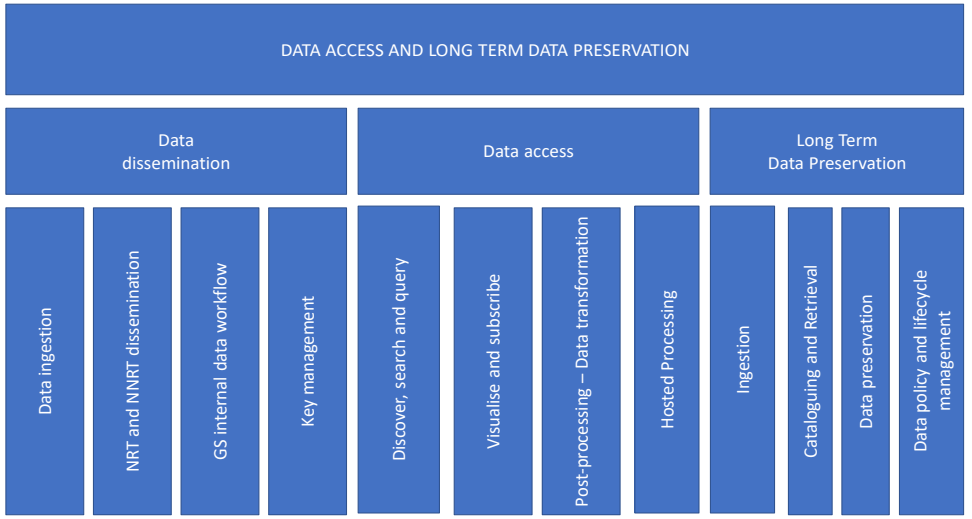
* LTDP: Long Term Data Preservation

Multi-Mission Ground Segment (MMGS) service description



Service group

Functions mapping



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Service description

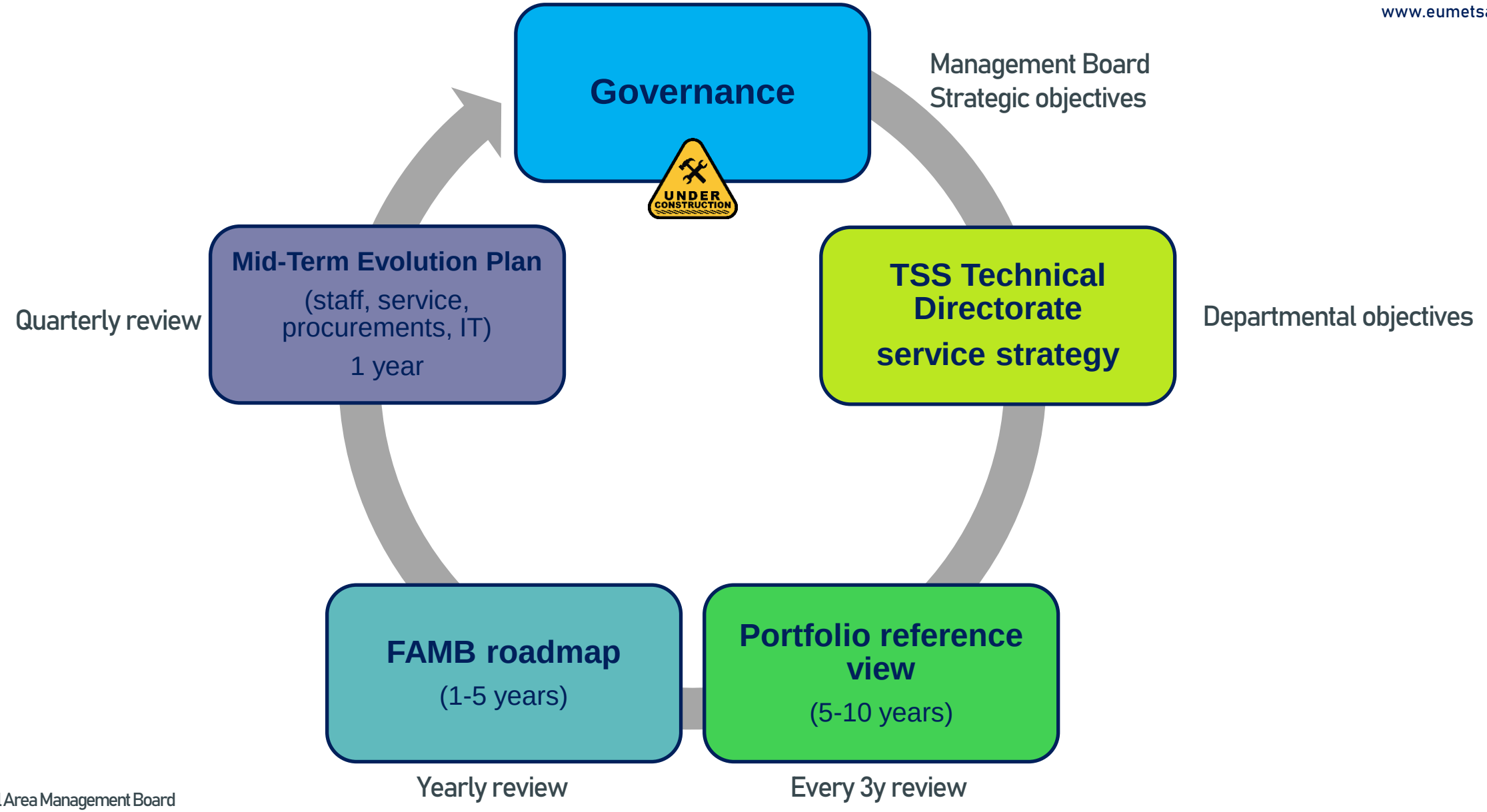
Service SLA

Service Description:	
What is included •	
How to request/implement: • Set-up mode: CAPA, CONF • Sites offered: HQ. • Deployable on: OPE, VAL, IVV	Tutorial/use case • Template service request
Standards, Protocols and credentials •	Reference documentation • Service declaration • ICDs
Operational Metrics: • Archive overall capacity. • NRT Ingestion availability • NRT Ingestion timeliness • NRT Ingestion volume • Bulk ingestion availability • Bulk retrieval availability • Bulk ingestion volume • Bulk retrieval volume	Service Level Performances • Measured and reported on calendar months.

Service declaration

ICDs

Overall Programmatic



* FAMB: Functional Area Management Board

Planning

1. **Governance and multi-year planning**

2. **Finalisation of the service catalogue**

3. **Development of the 3 last service groups with existing assets**

4. **Opportunity for demonstration of the MMGS approach**
   - Legacy programmes
   - Aeolus-2, Sterna
   - Copernicus

* MMGS : Multi-Mission Ground Segment

How to Implement, deploy and operate ?

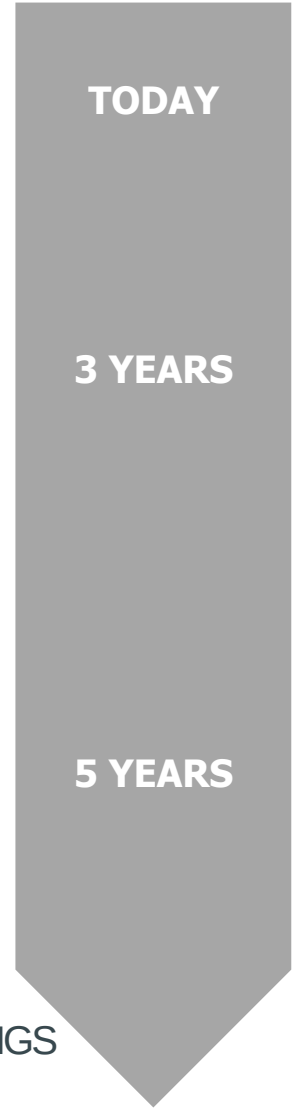
- **Option 1 : most of the functions of a GS are provided as Multi-Mission Elements (MMEs)**
  - Standard and ready to use – adaptable or pluggable
  - Pre-integrated between themselves only
  - The ground system architecture remains fully specific with partly reused components

- **Option 2 : multi-mission component as-a-service based on MMGS reference architecture**
  - Available standardised MMGS reference architecture, all-integrated
    - MMEs are black boxes and are described by their interfaces and performances
    - The MMGS is standard, and ready for delivery
  - Future programmes specify the mission specifics
  - Specifics are implemented on top of the MMGS reference architecture
  - Delivers to OPS a final "stand-alone' GS with standardised operations

- Option 3: **Multi-Mission Ground Segment is as-a-service**

1. **The Multi-Mission Ground Segment is already in operations**
2. **MMGS reference ground system drives the programme design through standardisation, reuse, multi-mission**
3. **Ground segment standard architecture drives the Space ICDs definition**

  - Mission specific functions implemented as part of the **release management** and evolutive maintenance of the Operational MMGS
  - The new mission is added to operational procedures when launched

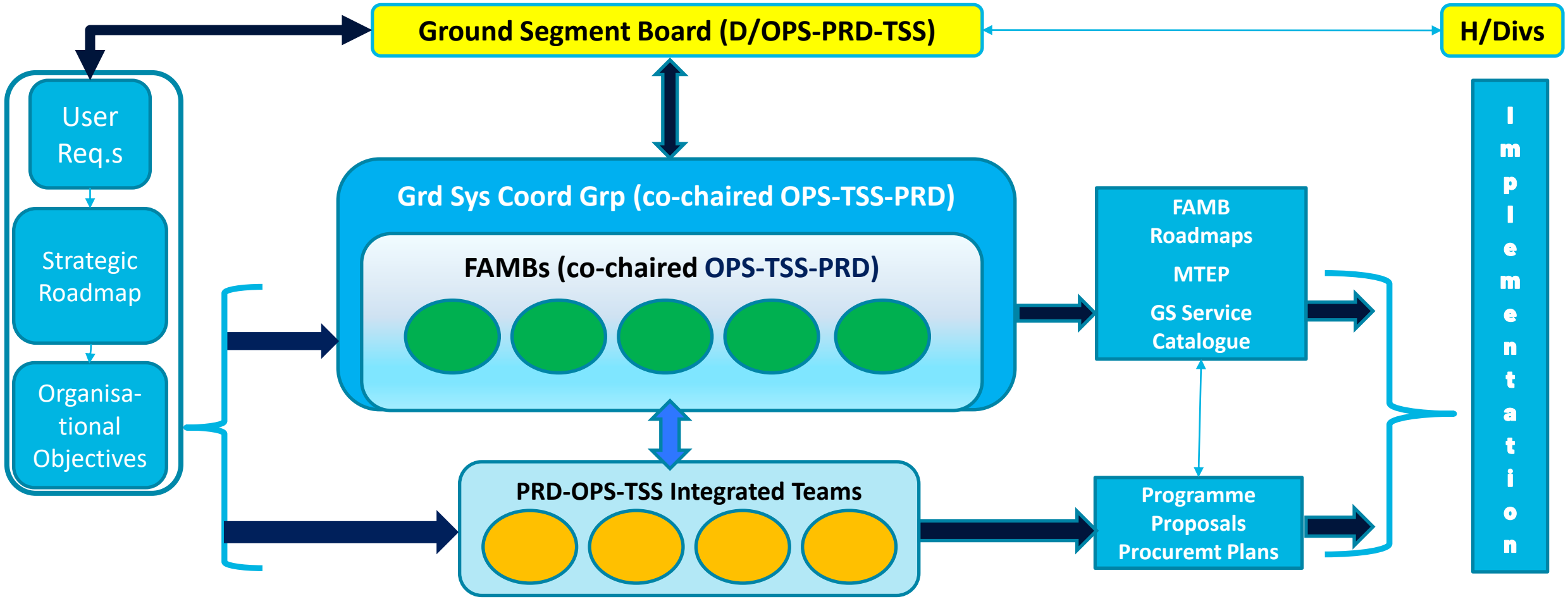


Concept of EUM *Ground Segment-As-A-Service – GSAAS*

- The MMGS Services are described in a Service Catalogue, with associated SLAs and KPIs, defined in coordination between PRD/OPS/TSS
- 3-levels management/(governance) scheme, interacting and not overlapping:
  1. Ground Segment Board (GSB) Level
     - Ensures consistency/coherency between and endorse: GS Strategic Roadmap, FAMB Roadmaps and MMGS evolutions, GS Service Catalogue
     - Changes of strategic nature (e.g. adoption of cloud for some GS functions) are discussed and agreed at Ground Segment Board level
     - Changes requiring major investment and involving policy changes
  2. Ground System Coordination Group (GSCG) Level
     - Overall coordination of FAMBs activities
     - **MTEP** book-captain
     - GS Service Catalogue book-captain
     - **Ground Segment System Engineering**
  3. FAMBs Level
     - Responsible for maintaining Services to be provided by the relevant functions
     - Enrichment/adaptations of the Services to respond to the new needs coming from the operational missions or from new Programmes in development
     - Maintain Work Plan for the Functional Area
     - Day-by-day activities in support to Operations: ARBs, CCBs, etc…

Governance – Skills-oriented and decision-making groups

OO2.11: "Propose a strategy and implementation approach for reducing complexity of IT and Ground Segments based on a multi-mission approach in order to reduce management and technical burden on organisation."



Governance structure: GSB-GSCG-FAMBs - Responsibilities and Interactions

EUMETSAT Management Board

Proposals

- HL dashboard on SLA/KPIs
- Long term MMGS strategy
- Lessons learnt
- Regular briefings

- Long term EUM organizational strategic roadmap (covering Satellite systems and Ground systems)
- Yearly Org Objectives
- Priorities

Ground Segment Board

- Define (with MB) and implement the Ground Segment Strategy
- Approve road-maps and MTEP
- Approve Multi-Mission GS Service Catalogue and GS Enterprise Architecture

- Ensures GS Evolutions are coordinated across all technical departments, are coherent and cost-effective
- Ensure consistency implementing ground systems strategy with Satellite systems strategy

- Proposed GS Service Catalogue (1st release and subsequent modifications)
- Maintained Common Ground Segment Enterprise Architecture including standard GS sys engineering methodologies and tools

- GS Strategy
- Endorsed GS Service Catalogue

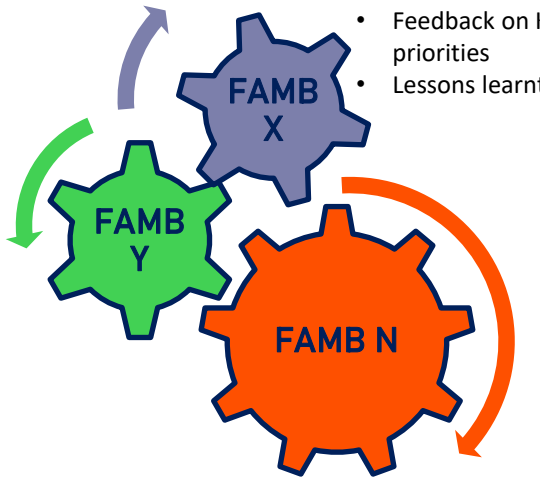
Ground System Coordination Group

- Define and maintain GS Service Catalogue
- Maintained Ground Segment Enterprise Architecture including standard GS sys engineering methodologies and tools
- Ensure timely generation of FAMBs road-maps and MTEP (covering ground segment systems and services) and submit after review to GSB for approval

- Maintain the mapping between ground segment Services and GS Enterprise Architecture
- Coordination, focused on consistency between all Functional Areas roadmaps and with Ground Segment system evolution roadmap
- Coordinate priority for releases taking into account constraints: programmatic and operational

- Reports on FAMB SLAs/KPIs
- Mid and Long term FAMB road-maps
- MTEP

- Coordination/Consistency across FAMBs
- Endorsed FAMB road-map and MTEP
- Feedback on KPIs, SLAs and priorities
- Lessons learnt



EUMETSAT Return of experience to now

- EUMETSAT feedback:
  - Constraints to the implementation of the Vision
    - Define the scope of a Multi-Mission Ground Segment
    - Technological foresight difficult (reality versus Hype cycle)
    - Lack of precise requirements in terms of multi-mission operating changes (what to improve, automatise, …)
  - Resistance to change (technical, organisational)
    - Theoretical approach challenged by existing team ownership
    - Mistrust in commercial solutions or “service procurement / externalisation”
    - Difficulty to plan more than 2 years
  - Management
    - Need of urgency unbalanced
    - Overall risk assessment on new missions, Impact assessment on existing missions
    - Costs benefits

Thank you!

Questions are welcome.