

A Multi-mission strategy for long-term data preservation at the ESAC Science Data Centre



M. Arévalo¹, J. Cook¹, J. Espinosa¹, Á. Carasa¹, I. León², J. Osinde¹, H. Pérez¹, M. Fernández¹, B. Merín³ and R. Bhatawdekar³

¹Starion for ESA, ²Aurora Technology for ESA, ³ESA

The ESAC Science Data Center (ESDC) is transitioning from supporting primarily active missions to maintaining legacy archives, prompting a need to streamline operations. To address inefficiencies and ensure long-term data preservation, ESDC proposes integrating individual mission archives into a unified system called the ESDC Multi-Mission Data Services (EMDS). EMDS will standardize access and interfaces across disciplines, support new missions, and facilitate the migration of existing archives into a scalable, interoperable infrastructure.

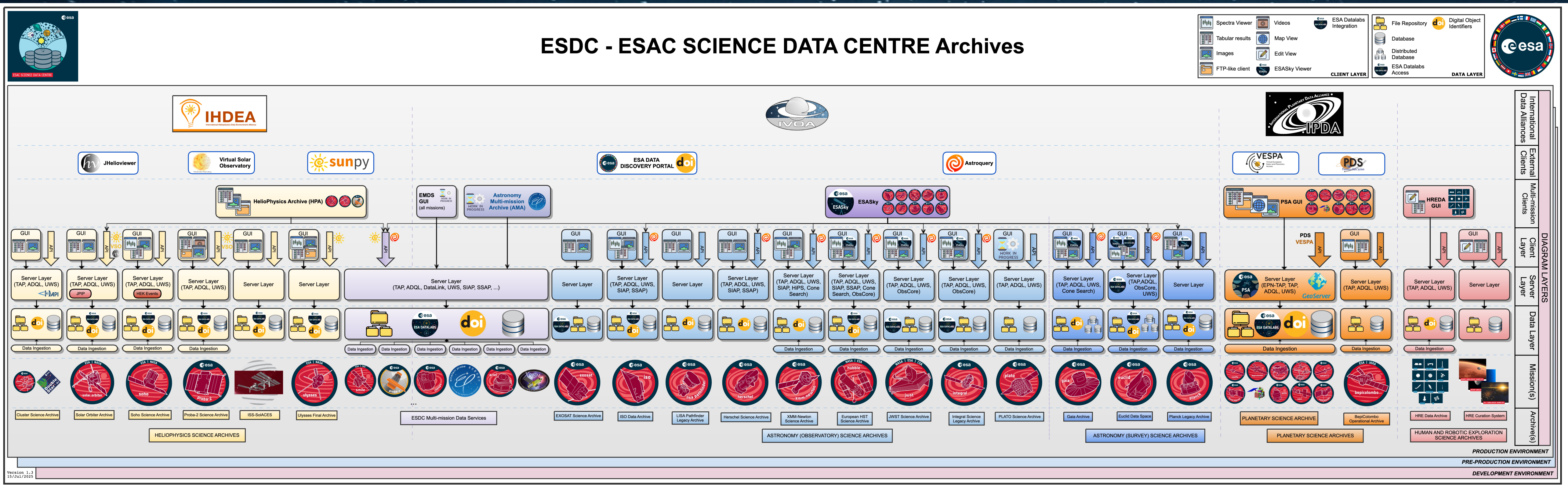
ESAC Science Data Centre

Connecting many mission archives across different disciplines under shared standards, searchable interfaces, and interoperable services

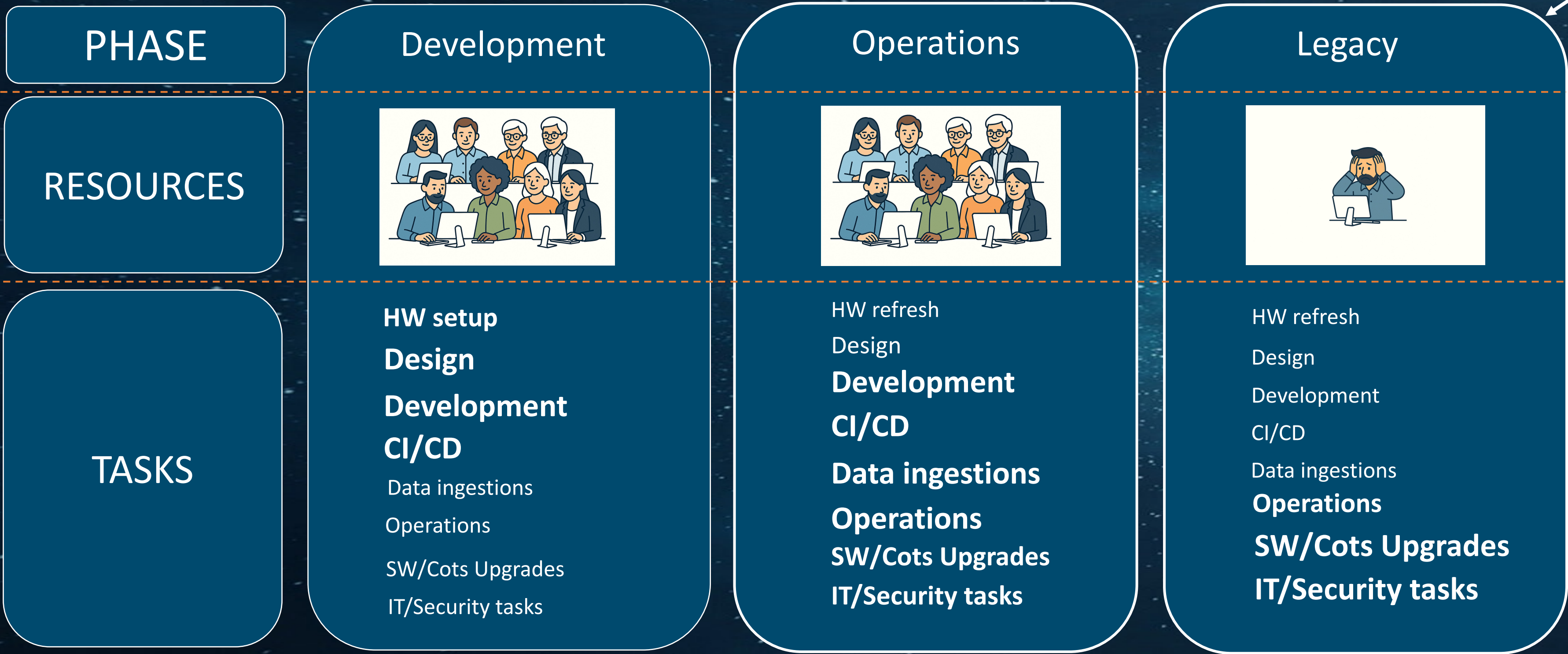
The ESAC Science Data Centre in Madrid hosts all the space missions and experiments of the scientific domains: heliophysics, astronomy, planetary and Human and Robotics Exploration.

Three key points in our strategy

- Enable the **maximum scientific exploitation** of ESA space science data sets
- Enable **efficient long-term preservation** of data, software and knowledge, using modern technology
- Enable **cost-effective archive production** by integration in and across projects



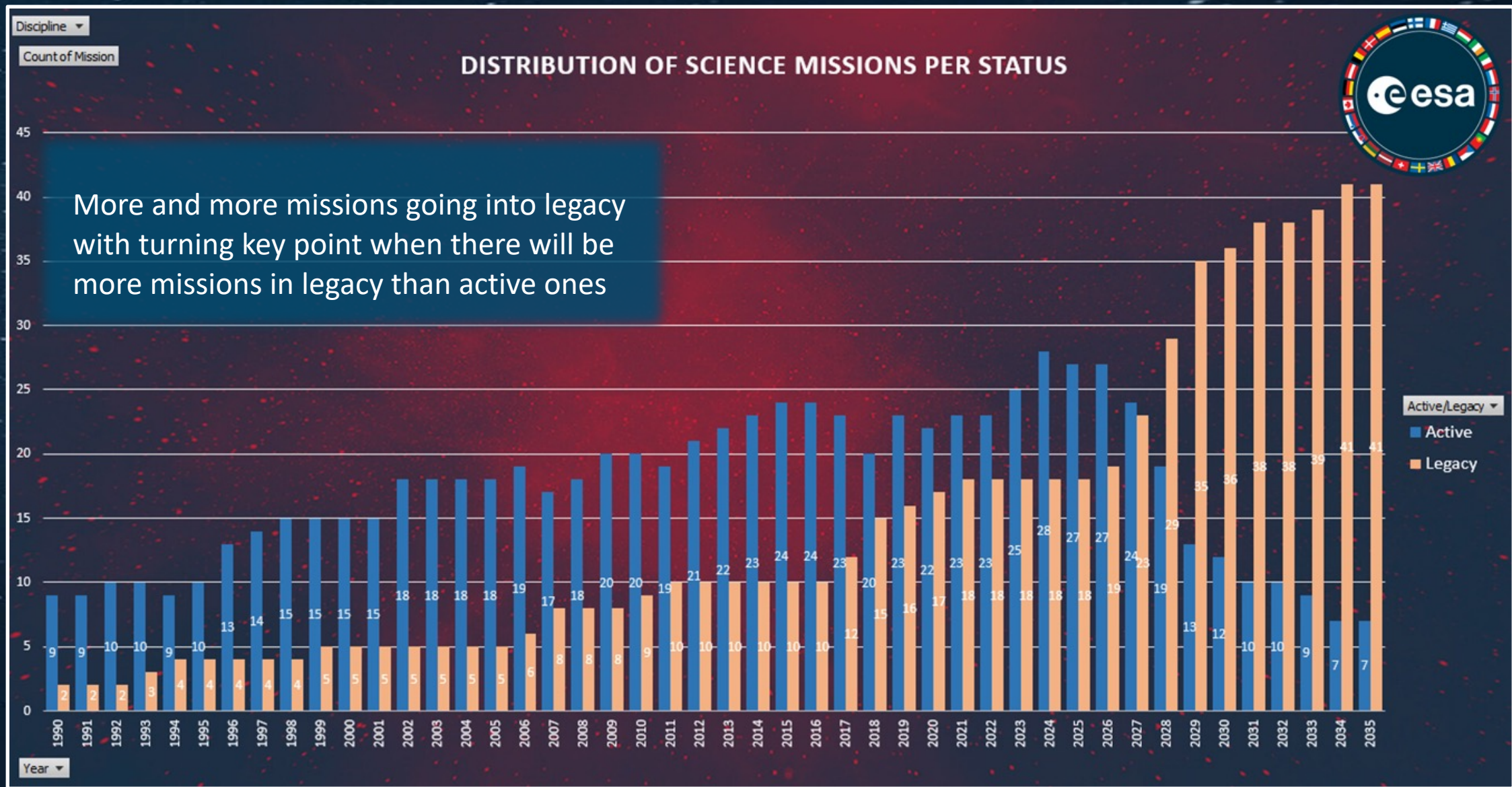
Long term data preservation evolution and challenges



Challenges in legacy phase

- Huge impact of SW Obsolescence
- Lack of homogenization
- Lack of interoperability
- Loss of archive knowledge
- Periods of loss of data access

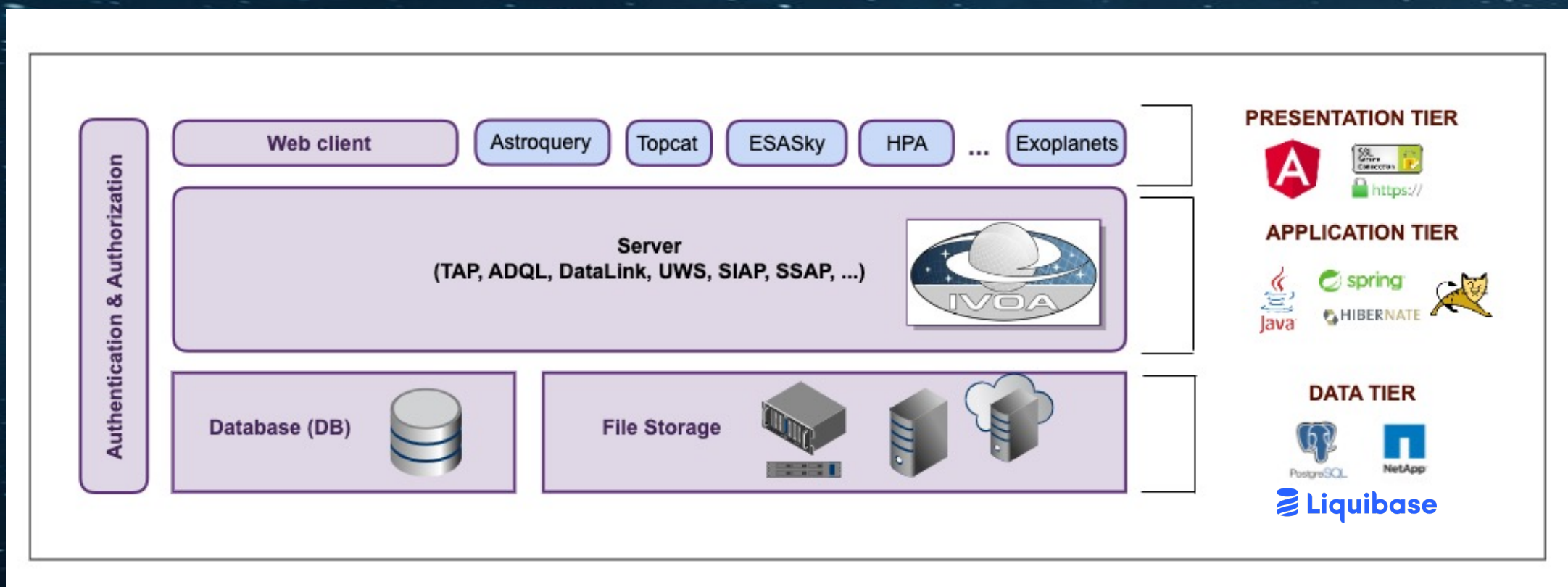
Archives are not being used
The maintenance cost is high



Concept evolution: from legacy missions to Multi-mission

Decided not to limit to legacy:

- Less cost for the archive mission if integrated since the beginning
- Avoids issues for legacy phase
- Unified data access through common services and protocols
- Single, cohesive and scalable system
- Defacto standard for some new missions
- Existing archives will be migrated to EMDS starting with oldest legacy archives



→ Long term maintenance ensured

SCIENTIFIC ADVANTAGES

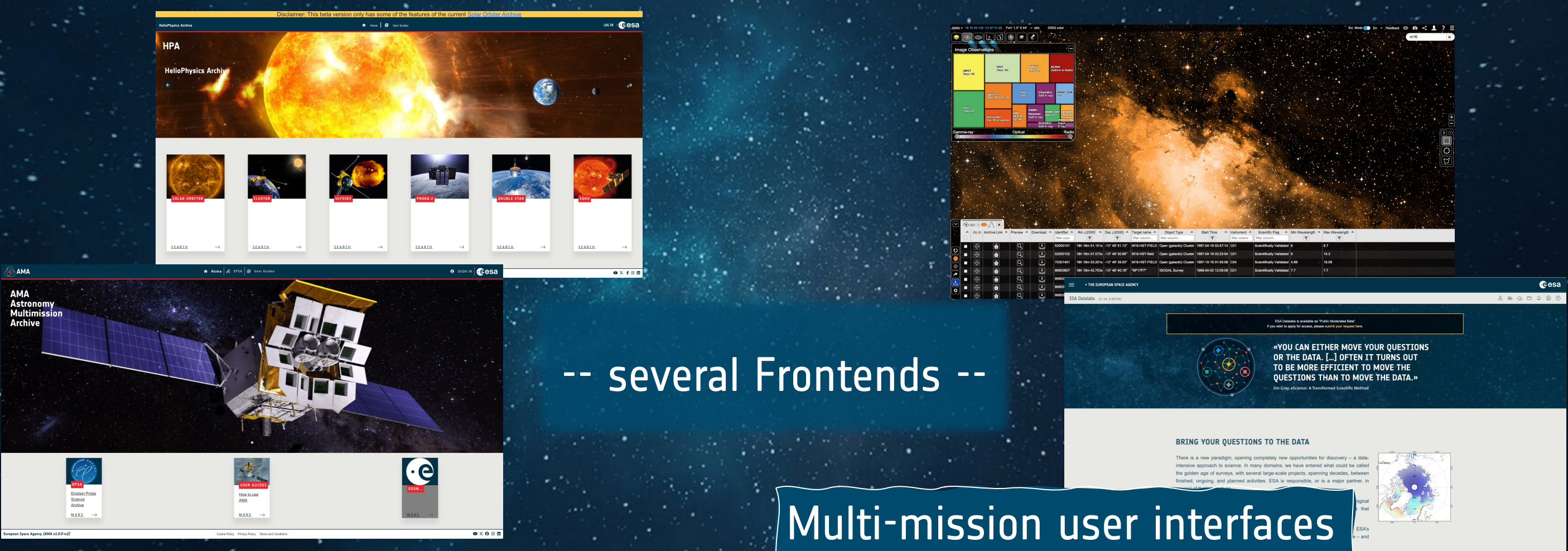
- Unified access**
Access multi-mission, multidisciplinary datasets through a single platform
- Cross-mission analysis**
Enable meaningful data cross-matches where scientifically relevant
- Domain standards support**
Astronomy: IVOA protocols
Heliophysics: TAP, HAPI, JPIP, HEK, SPASE
Planetary Science: EPN-TAP

TECHNICAL ADVANTAGES

- Scalability**
Infrastructure grows easily with new archives, legacy or in development
- Maintainability**
Lower maintenance costs compared to isolated archives
- Usability & Interoperability**
Enhances openness and accessibility of scientific data
- Flexibility**
Robust server-side platform supports diverse clients: mission-specific, domain-specific, and legacy systems

ESDC Multi-mission Data Services

-- one Backend --



-- several Frontends --

Multi-mission user interfaces

Unified access to same data domains:
Heliophysics, Astronomy, ...



Programmatic access

Multi-mission implementation and challenges

Core Principles

- Maximize shared services (authentication, logging, monitoring) across missions
- Mission-specific features implemented as modular extensions or plugins
- No single unified data model; adopt common metadata standards instead
- Coordinate release cycles to accommodate different mission readiness levels
- Some functionalities may require phased deployment before operational rollout
- Define a clear migration strategy for legacy archives (full or partial)

Collaboration Challenges

- Achieving consensus across all missions on the proposed approach
- Organizational coordination for updates, priorities, and schedules across diverse science domains

EMDS 1.0.0 released in April 2025

Access to metadata through ADQL in a TAP based server
Data download (SMILE)
CAS login available

Archives to join the Multi-mission

EINSTEIN-PROBE, CHEOPS, ISO, EXOSAT,
ULYSSES, PROBA3, LISA PATHFINDER,
ARIEL

REFERENCES

<https://emds.esac.esa.int/service/tap>

CONTACT INFO

ESAC Science Data Centre
<https://www.cosmos.esa.int/web/esdc>



European Space Astronomy Centre (ESAC)
Camino Bajo del Castillo s/n
28692 Villanueva de la Cañada, Madrid, Spain

María Arévalo Sánchez
María.Arevalo@ext.esa.int

