Welcome from ESA and Introduction:
SciOps 2017: Distributed Science Operations

Martin Kessler, 17 October 2017

ESAC: History and Current Activities

- 1978: Opening of ESA **VIL**lafranca **SPA**in Satellite Tracking Station, VILSPA.
- 1970s, 1980s, 1990s: Support various astronomy missions.
- Early 2000's: Expansion to planetary missions.
- 2005 – Cebreros Deep Space Antenna inaugurated.
- 2008: VILSPA became ESAC, **European Space Astronomy Centre**.

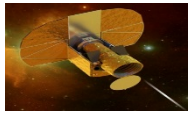
ESAC'S **main activities** now:

- Satellite Tracking,
- Earth Observation:
  - SMOS Spanish National Centre,
- INTA/CSIC Astrobiology Centre (CAB)
- Space Situational Awareness,
- Galileo Science Office,
- ESAC Communication Office,
- **Space science missions:**
  - **Science ops, archives, in-orbit management.**

D/SCI Operations Department

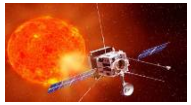
- Science Operations Centres (SOCs) for
  - Astronomy,
  - Heliospheric, and
  - Planetary missions.
- Science Data Archives
  - long-term access to data & information.
- Overall management of ESA's operational space science missions.
- Involved in ~25 missions/studies.
- Nearly 250 scientists and engineers involved at ESAC and at STScI, GSFC, ESTEC, …

Science Missions in Development

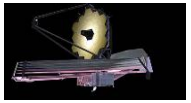


2018 CHEOPS (CHaracterising ExOPlanet Satellite)

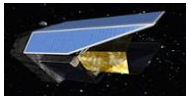
2018 BepiColombo (Closing in on Mercury)



2018 Solar Orbiter (Closest to the Sun)



2019 JWST (Observing the First Light)



2020 Euclid (Mapping the geometry of the Dark Universe)

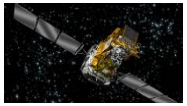
2022 JUICE (JUpiter ICy Moons Explorer)

2026 PLATO (PLAnetary Transits and Oscillations of Stars)

Astronomy & Fundamental Physics Missions in Orbit

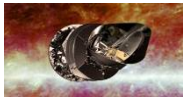
1990 Hubble Space Telescope (UV/Optical/NIR Observatory)

1999 XMM-Newton (X-ray Observatory)



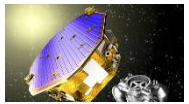
2002 INTEGRAL (Gamma-ray Observatory)

2009 Herschel (FIR Observatory) – now in post ops



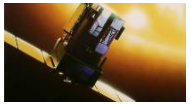
2009 Planck (Mapping microwave background) – now in post ops

2013 Gaia (astrometry – charting a billion stars)

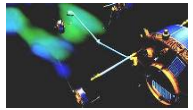


2015 Lisa Pathfinder (gravitational wave technology) – now post ops

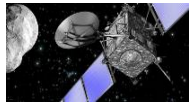
Heliospheric & Planetary Missions in Orbit


1995 SOHO (Solar and Heliospheric Observatory)


1997 Cassini-Huygens (Saturn and probe to Titan) – post ops


2000 Cluster (Sun-Earth Environment)


2003 Mars Express


2004 Rosetta (Comet exploration) – now in post ops

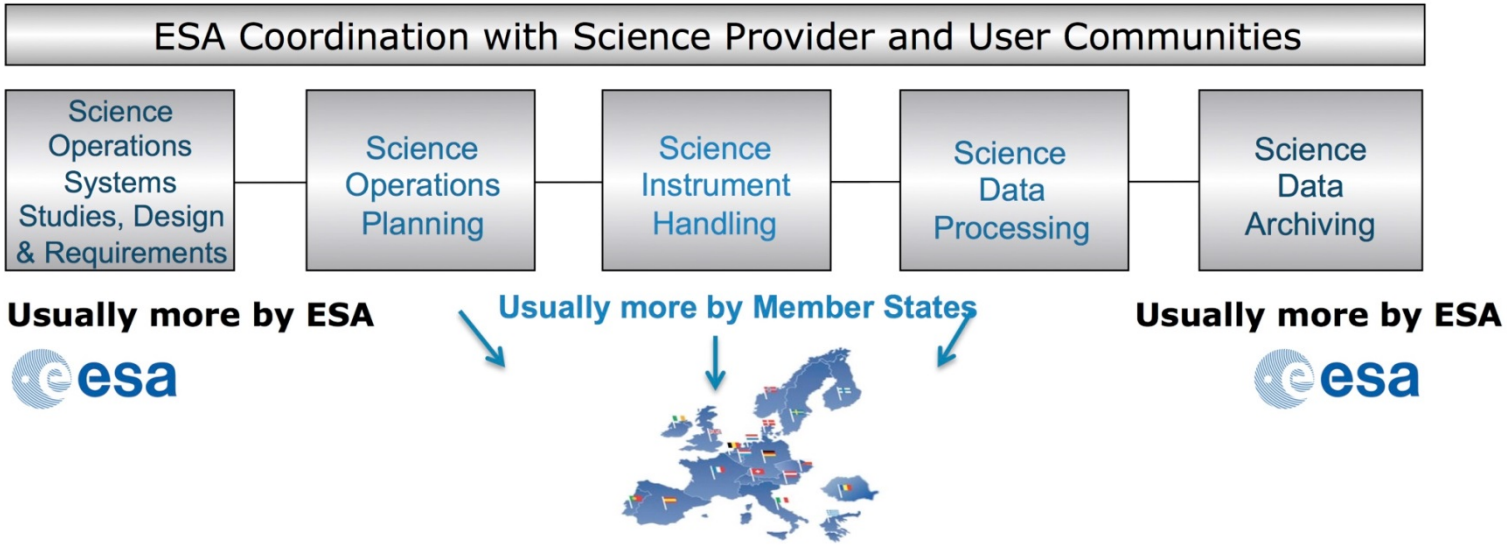

2005 Venus Express – now in post ops


2009 PROBA-2 (technology and solar observations)

Collaborations with Member States (1)

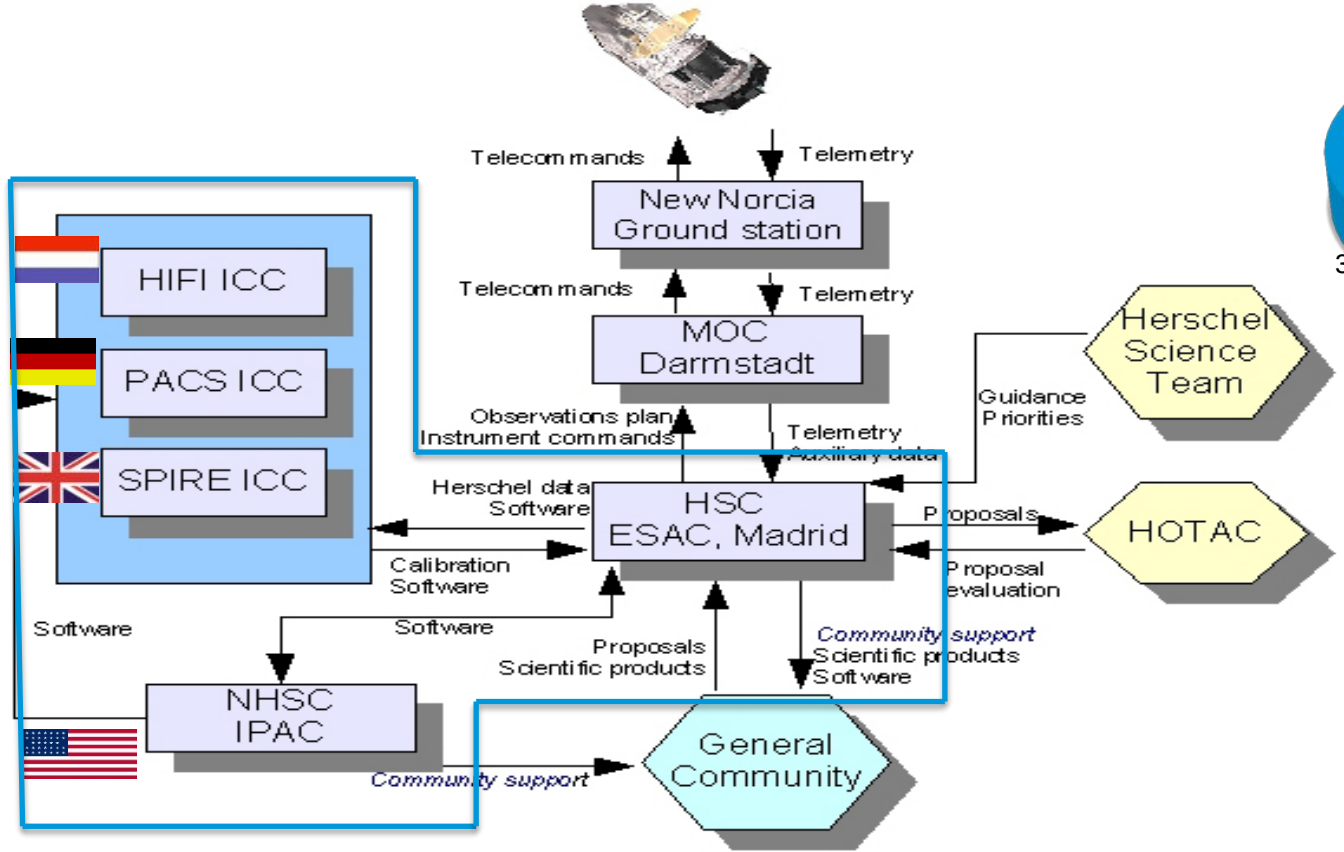
- ESA science ground segments are usually a collaborative development multiple Member State entities.
- ESA-provided elements usually “embedded” in a larger system.
- Task distribution between ESA and Member States is mission specific.
- Member States usually contribute bulk of resources.
- ESA provides overall coordination (rather than direct management).
- ESA has overall responsibility for scientific outputs of the mission.

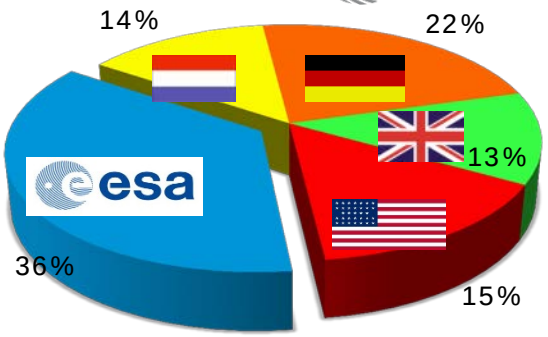
Collaborations with Member States (2)



- Approach, naturally, leads to distributed ground segments
  - Many past, present and future examples:
    - Herschel, Cluster, Gaia, BepiColombo, Solar Orbiter, Euclid, …

Past: Herschel Science Ground Segment





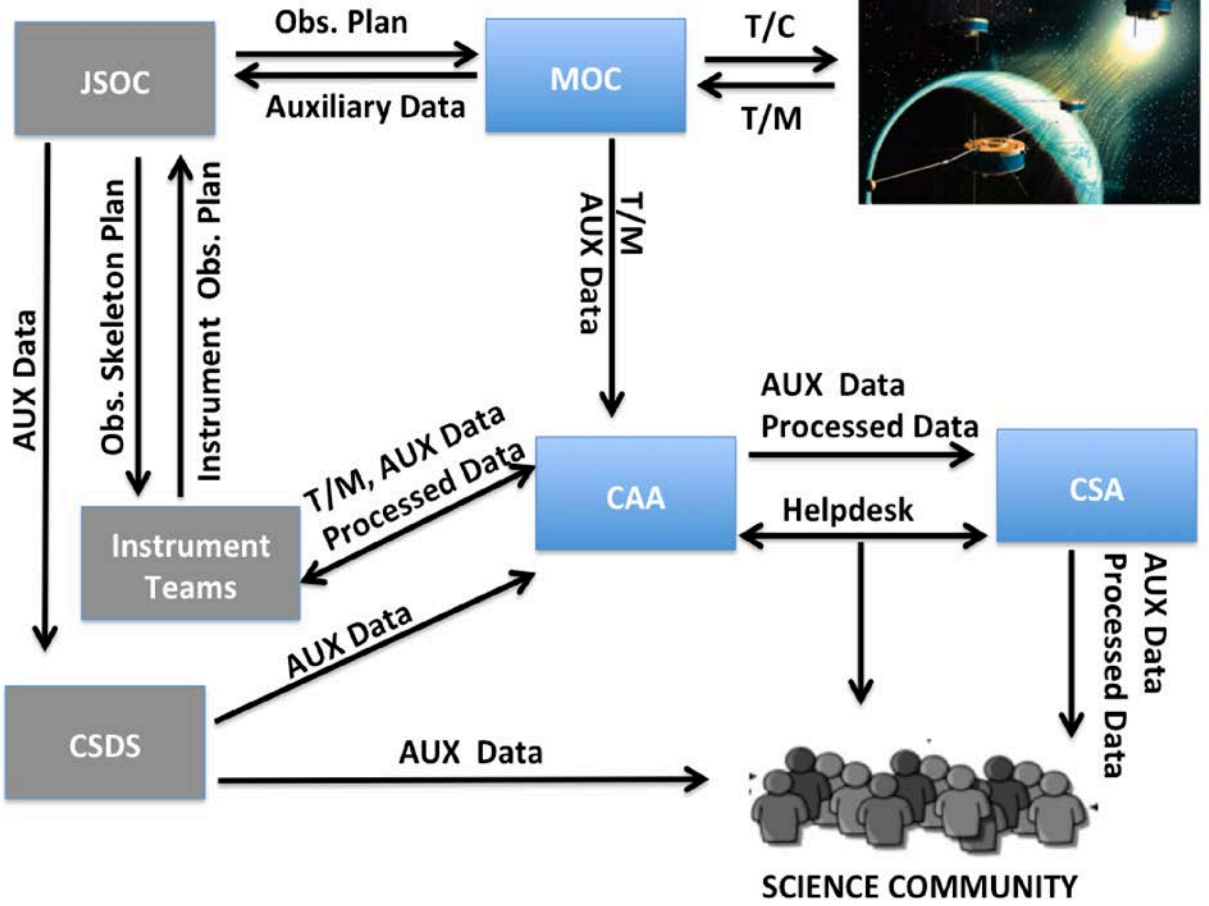
Distributed system.

200 active developers world-wide (mostly Europe, USA, Canada, China.

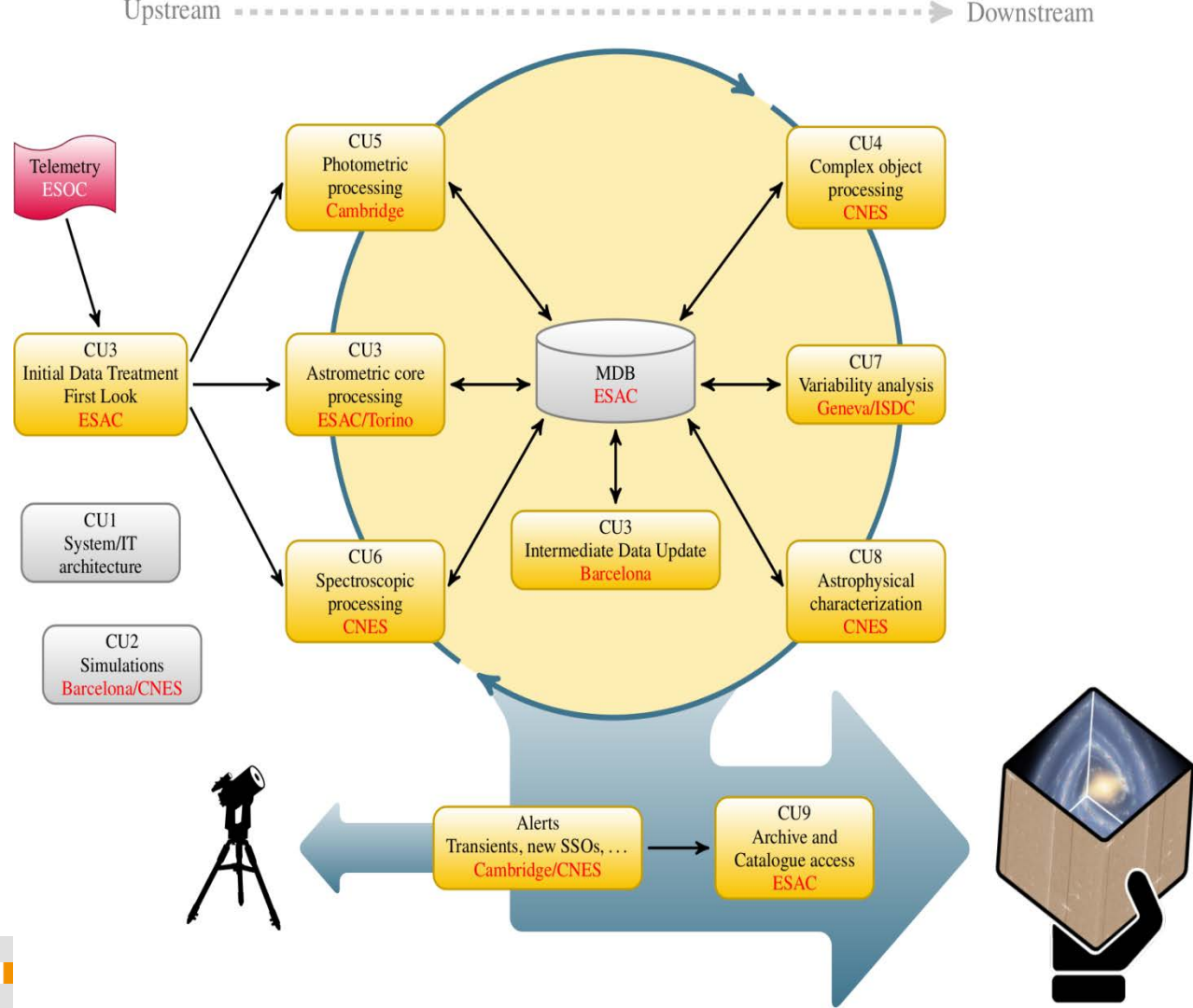
~3 million lines Java code

~15-20 year lifetime

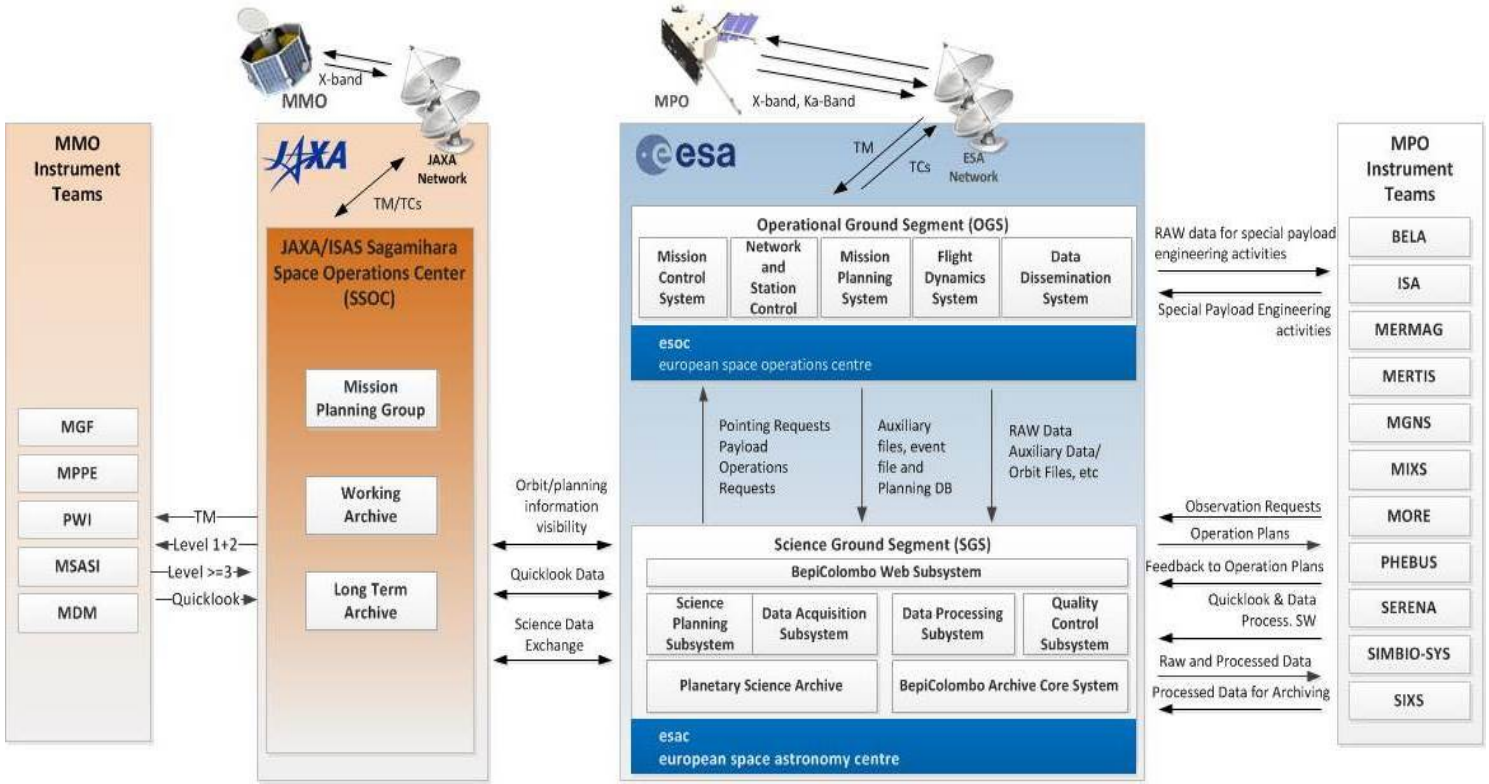
Present: Cluster



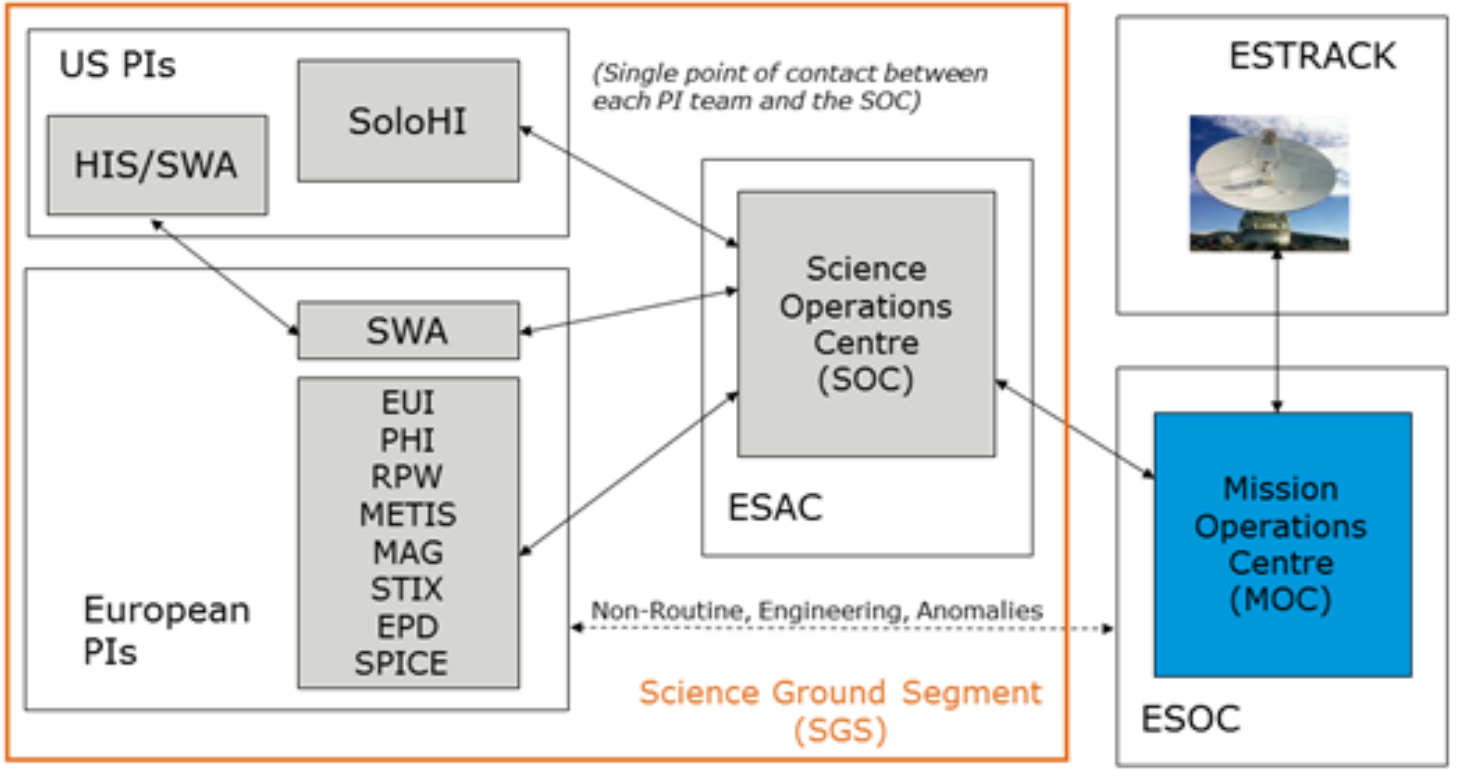
Present: Gaia-DPAC



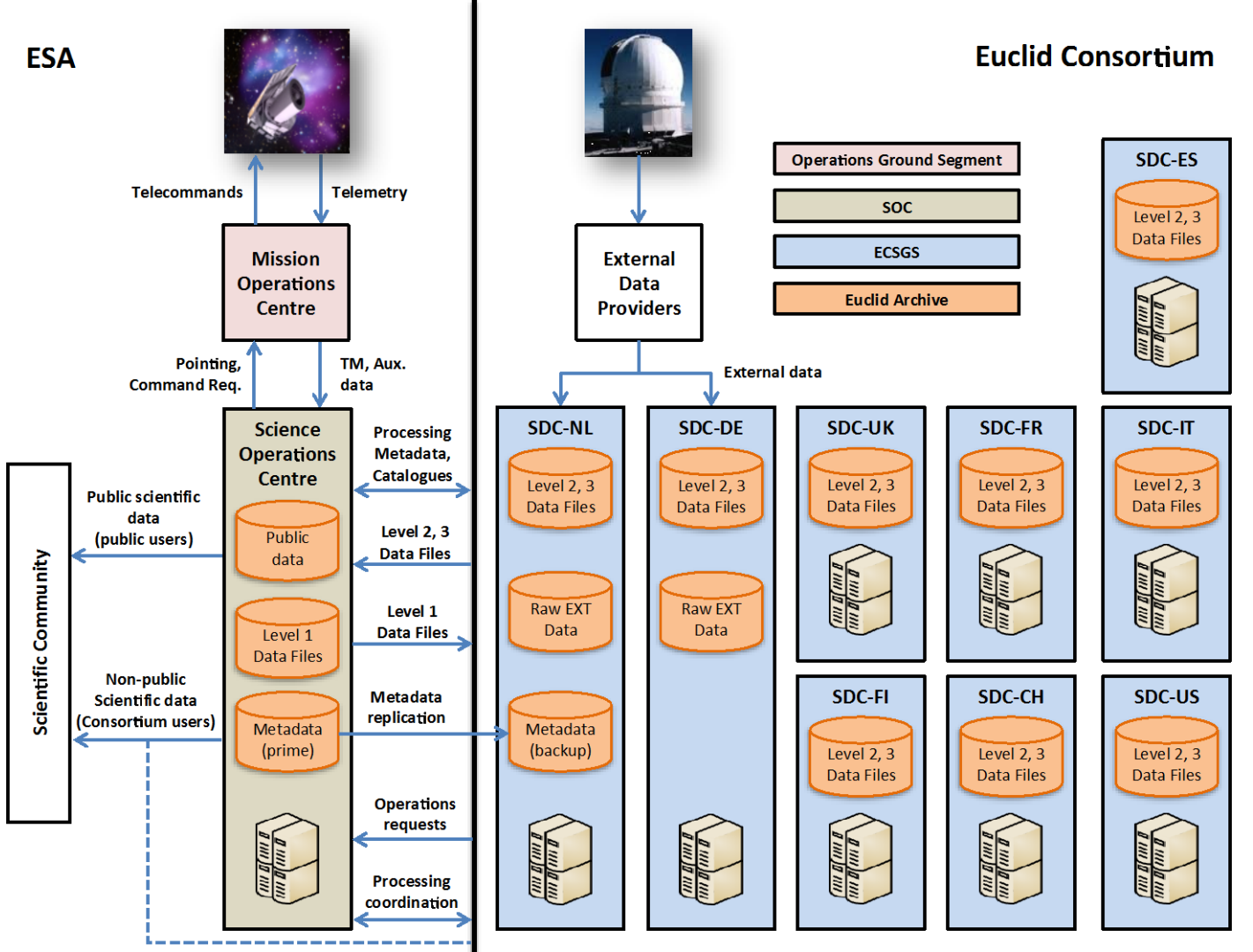
Future: BepiColombo (at Mercury)



Future: Solar Orbiter



Future: Euclid



Collaborations with Member States (3)

- Collaborative approach, naturally, leads to distributed ground segments
  - Many past, present and future examples:
    - Herschel, Cluster, Gaia, BepiColombo, Solar Orbiter, Euclid, …
  - Challenges are scientific, technical, managerial, financial, ….
    - Looking forward to this conference to discuss them!!

Distributed Science Operations

- 3rd ESA-ESO collaborative workshop.
- **Aims**:
  - Focus on challenges that distributed science operations present to space and ground based projects,
  - Promote the interchange of ideas and information between ESA, ESO and the broader community.

Distributed Science Operations

- 3rd ESA-ESO collaborative workshop.
- **Approach**:
  - Review experience gained from past projects (e.g. Herschel/Planck), and discuss experiences of ongoing projects (e.g. Gaia and the ESO Public Surveys),
  - Look forward to challenges presented by more complex future projects, e.g. Euclid and 4MOST, especially relevant to space/ground coordination.

Distributed Science Operations

- 3rd ESA-ESO collaborative workshop.
- **Discussion areas will include**:
  - Experience gained from space missions: past and present,
  - Experience gained from ground-based projects: past and present,
  - Strategic coordination issues between space and ground-based projects,
  - What can we learn from planetary missions, etc.,
  - Challenges of future projects.

Let’s go further!