# ESA's Science and PRODEX programmes

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# ESA PROGRAMMES

**Mandatory activities: all Member States, pro rata to GNP**

**Optional programmes**

**Mandatory activities:**

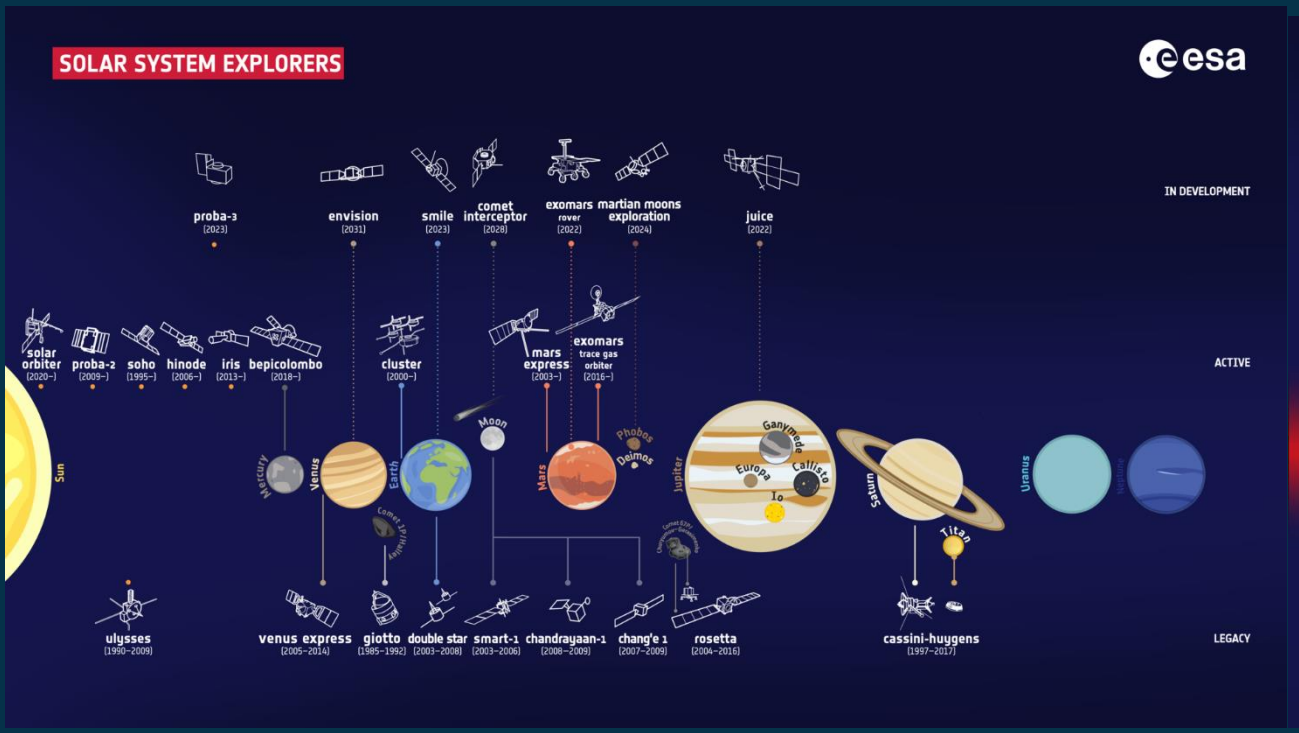
- General Budget
- **Science Programme**

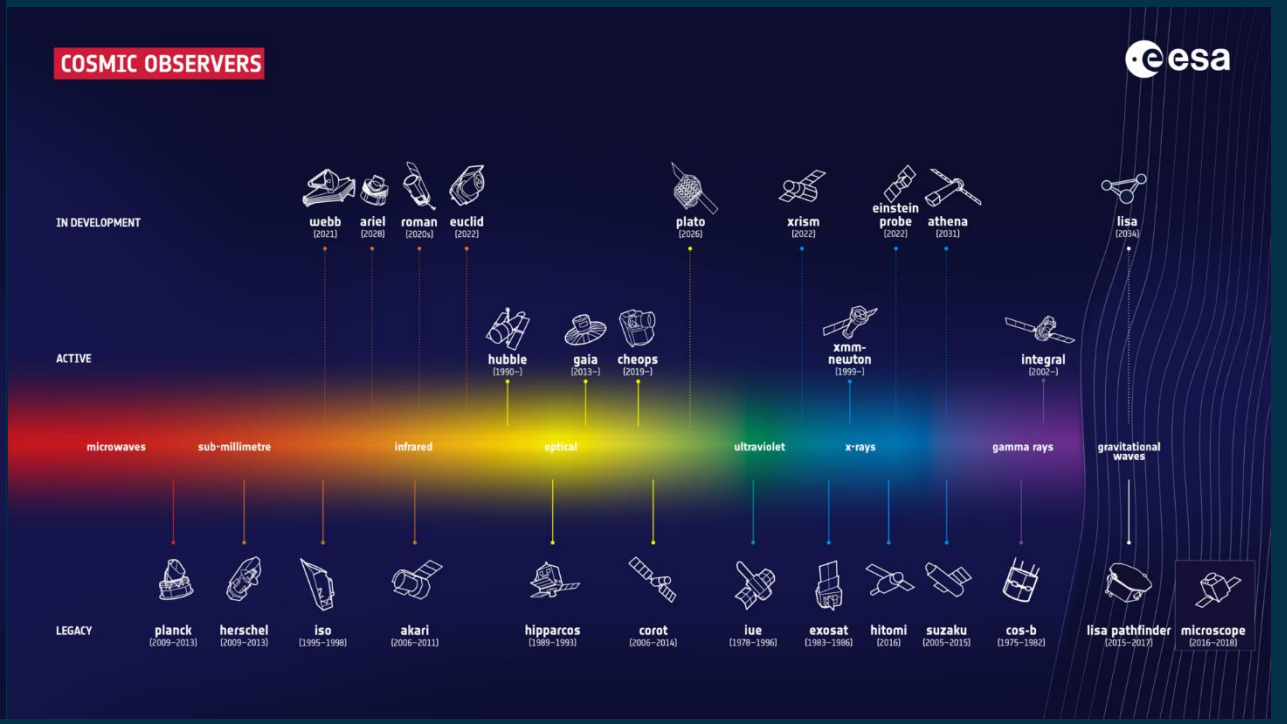
**Optional programmes:**

Human Spaceflight & Robotic Exploration; Telecoms & Integrated Applications; Earth Observation ; Launchers; Navigation; Space Safety and Security, **PRODEX** …

The Directorate of Science manages the Science (mandatory) programme and PRODEX (optional) programme

# ESA Scientific Programme Fleet




14 missions in orbit; 16 missions in preparation; 22 in legacy phase
Large majority of these missions is done in international cooperation

# The Science Programme Elements

Science Programme budget ≈ 560 M€ per year (2022 e.c.)

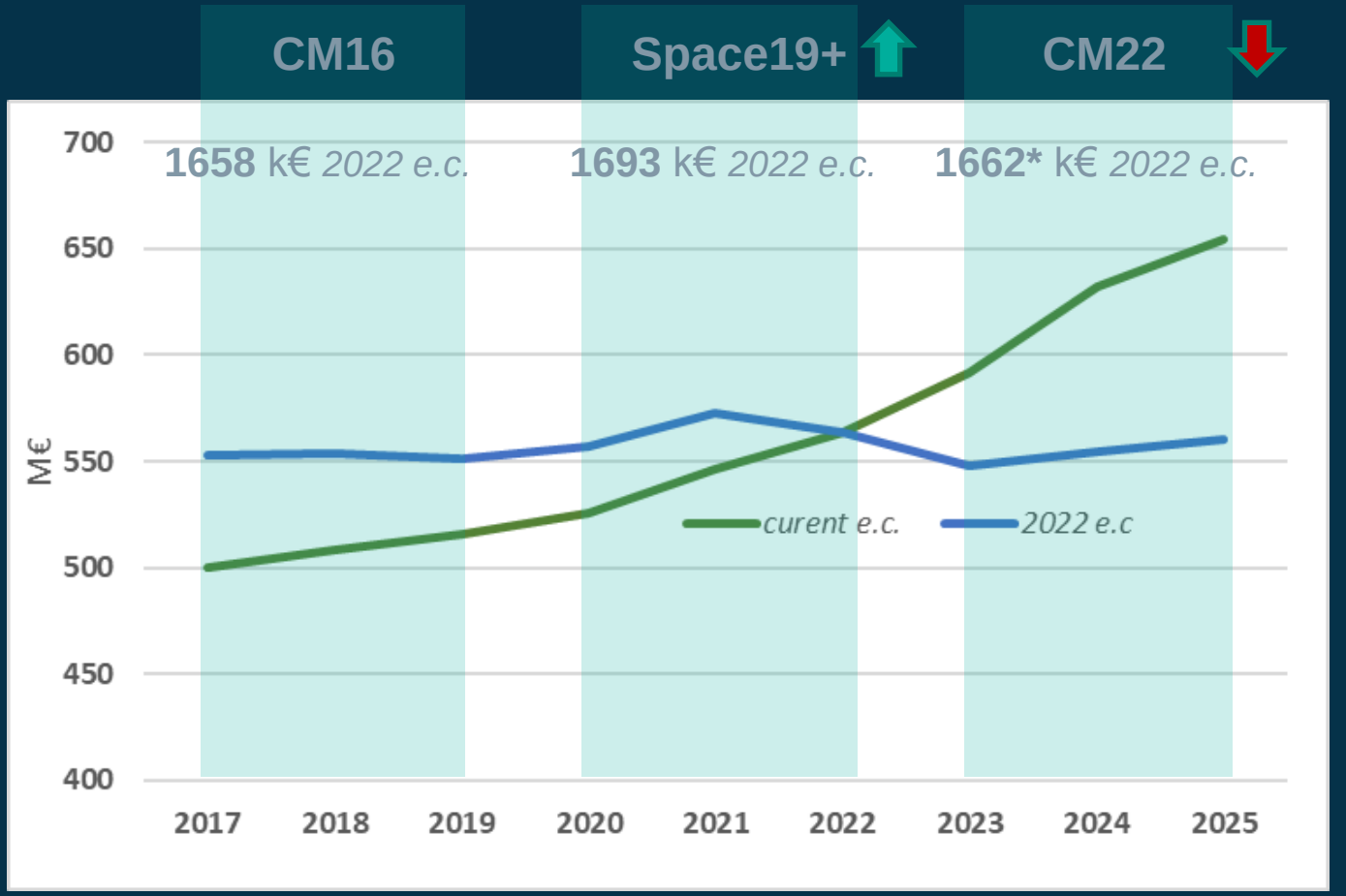
All science missions are in partnership with the Member States

- Nationally provided payload, elements of the science ground segment
- Direct national funding or through ESA PRODEX programme

Four types of missions (building blocks): Large missions, Medium missions, Fast (F-) missions, Missions of Opportunity

More on https://sci.esa.int/

# Science Programme purchasing power




*Future inflation in line with the latest ECB projections i.e. 8.1%, 5.5% and 2.3% for 2022, 2023 and 2024 respectively

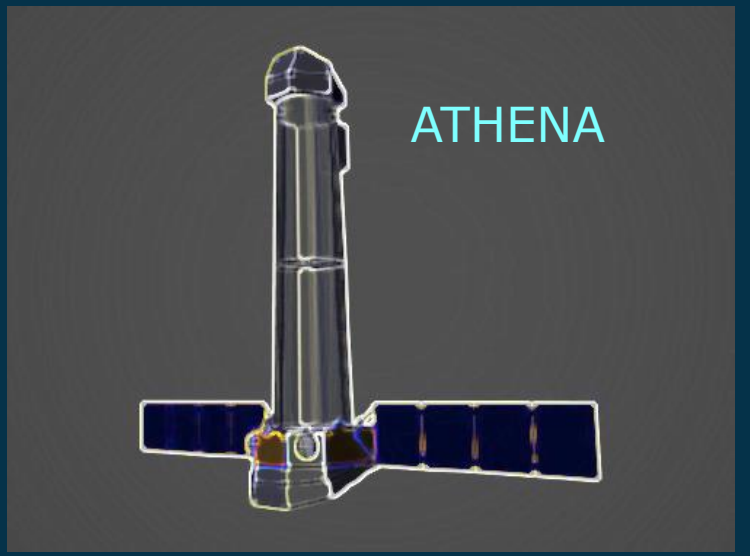
# The Science Programme Elements: L missions

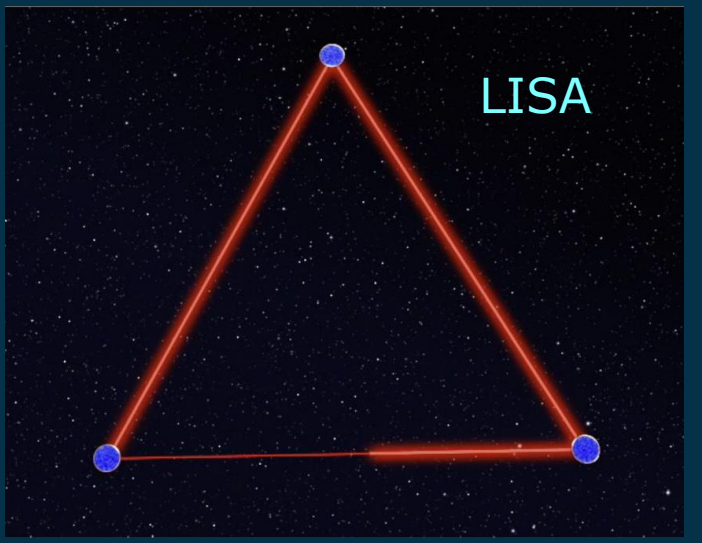
**Large missions:** European-led flagship missions (Cost to ESA ≈ 2 yearly budgets); one mission every 7-8 years.

*L1: JUICE mission to Jovian system (in phase D, launch 2023)*

L2: ATHENA X-ray observatory (being rebooted)

L3: LISA Gravitational Wave Mission (phase B1 starting, *launch ~ 2037*)

# The Science Programme Elements: M missions

**M-missions:** flexible program element, ESA-led or with international collaboration. Cost to ESA ≈ 1 yearly budget, one mission every 3-4 years.

*M1- Solar Orbiter (2020): studying the Sun from close by, in orbit*

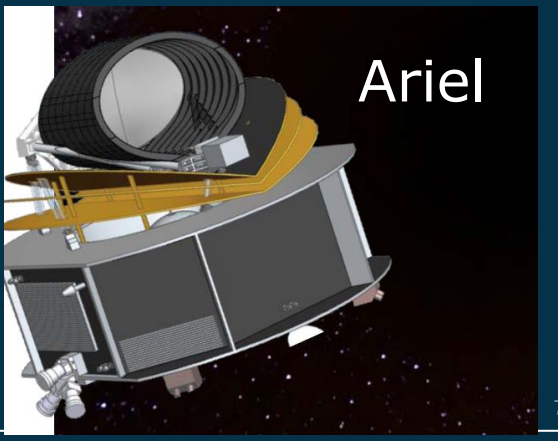
*M2- Euclid (2023): probing Dark Energy, in phase D*

*M3- PLATO (2027) : hunting for rocky exo-planets, in phase C*

*M4- ARIEL (2029): studying the atmospheres of exoplanets, in phase B2*

M5- EnVision (2031): mission to Venus, launch early 2030s, in phase B1



# The Science Programme Elements: S/F missions

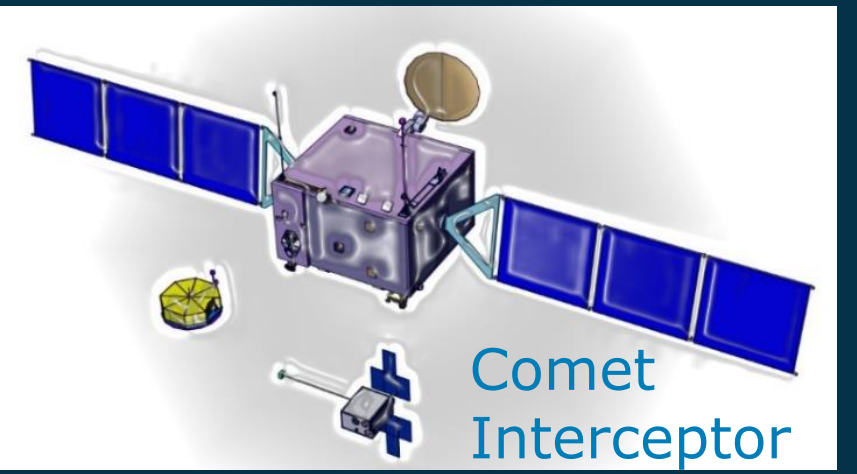
**Smaller mission elements:** faster, smaller missions, built in 4-6 yrs, cost to ESA ≈ 175 M€. Can allow national agencies to play a leading role.

*CHEOPS (2019) Exoplanet mission, in orbit*

*SMILE (2025), magnetospheric mission in cooperation with China, phase C*

Comet Interceptor (2029, dual launch with Ariel), in phase B





# Science Missions Characteristics

**Science Excellence:** European leadership in the chosen area

**Technical Excellence:** Non-recurring spacecraft & high technology content

European industry developing technology often with significant commercial impact (e.g. SiC for science missions -> commercial missions)

Heritage naturally taken into account in the space segment development

- Chose the best company – satisfy geographical return

**Science technology programme** to develop technology maturity (TRL 6)

Science Core Technology Programme (CTP): ~ 20 M€/year

Basic Activities (TDE): ~ 6 M€/year for science missions, address low TRLs (3-4)

# PRODEX programme

## PRODEX implements Member States contributions to space science missions through ESA

- 17 participating States in 2021
- Addresses all space science fields: Science missions, Earth Observation, Exploration, ISS
- For ESA missions and national contributions to international partners (NASA, JAXA, CAS, etc)
- Payload HW developments with national institutes/industry, with ESA management & technical support

# Future science missions and opportunities

| Mission | Definition status | Planned adoption | Flight Model industrial opportunities(*) |
|---|---|---|---|
| | | | |
| *Comet Interceptor (F1)* | *Phase B* | *2022 (done)* | *Pending IPC approval* |
| EnVision (M5) | Phase A | 2024 | 2024-2026 |
| ATHENA (L2) | Being reformulated | TBD | TBD |
| LISA (L3) | Phase B1 (starting) | 2023 | 2025-2028 |
| VOYAGE 2050 (**) first missions | F-Call issued | 2026 | 2026-2027 |
| | M-Call issued | 2029 | 2030-2032 |

(*) Approximate period over which most of the industrial team will be defined

(**) New science programme planning, https://www.cosmos.esa.int/web/voyage-2050

# Belgian excellence in Science

- Large investment in Prodex (PLATO, Ariel, Comet Interceptor, EnVision)

- Large and productive scientific community
  - Belgian scientists have published close to 900 first-author papers based on data from almost all ESA- and partner-led missions (with Soho, Hipparcos, XMM, Herschel, GAIA and Hubble being used the most)
- Effective and competitive industry
  - E.g., communication subsystem for JUICE
  - E.g. cryo-vacuum test for Euclid
  - Etc.

# The end