Big science, big business, big breakthroughs:
Reach for the skies with the ESA Science Programme
CM25 - BELSPO

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Head of Science Projects / Head of Future Missions / Head of PRODEX
European Space Agency

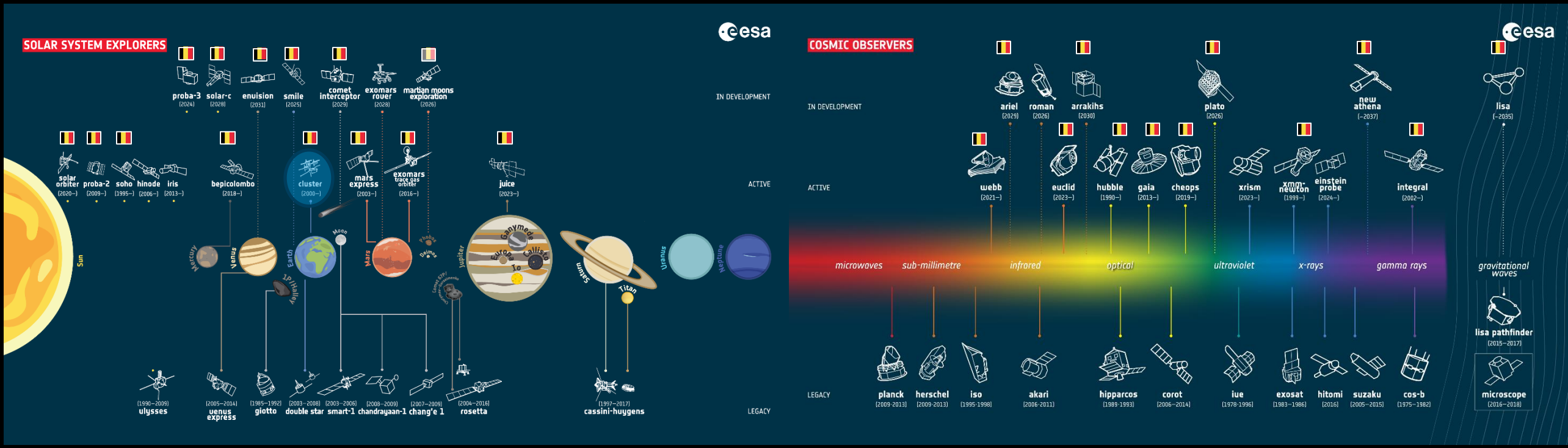
OBJECTIVES

To enable European leadership in frontier breakthrough science and technology

To empower member states to lead in global space science

To advance European competitiveness

ESA's Science Fleet



17 missions in operation; 12 missions in preparation; 25 in legacy archives

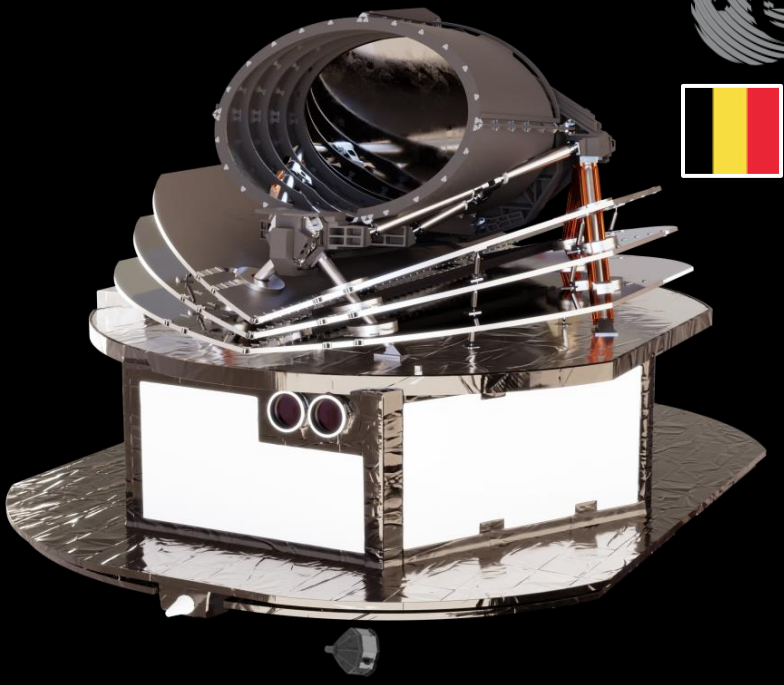
… standing on the shoulders of giants! …

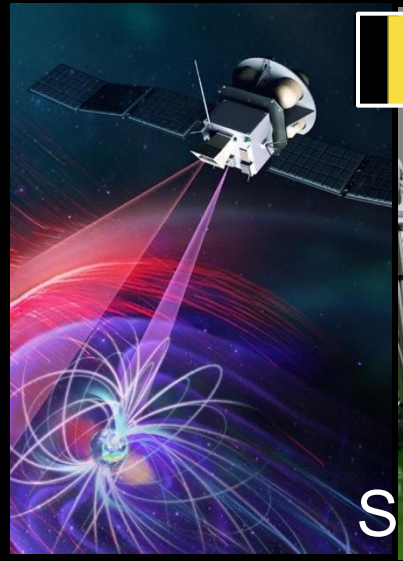
Agency-to-agency international cooperation and scientific collaboration

Projects in Development

PLATO

Ariel

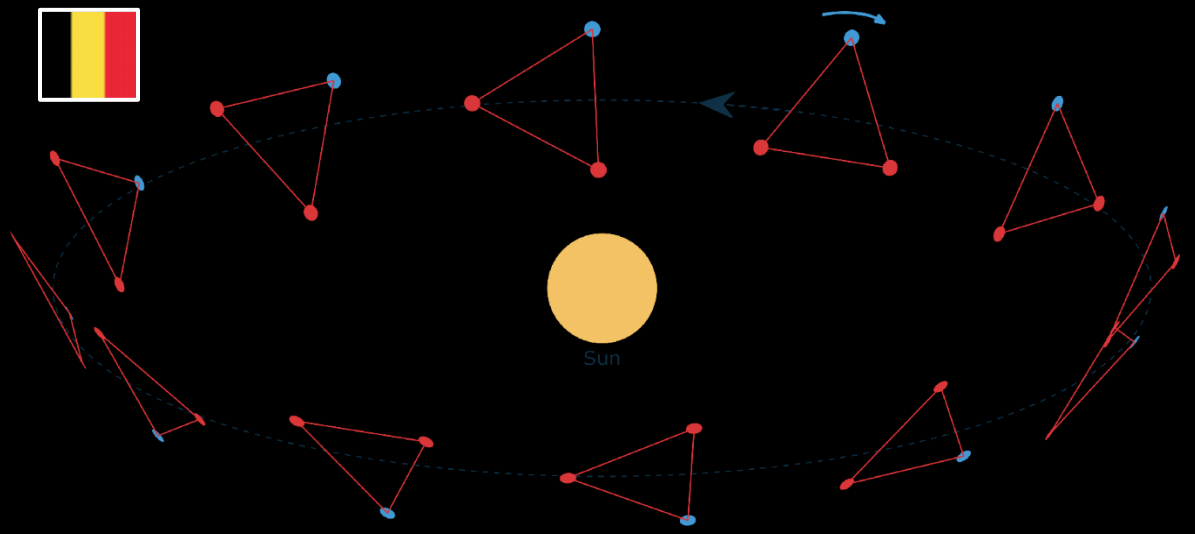


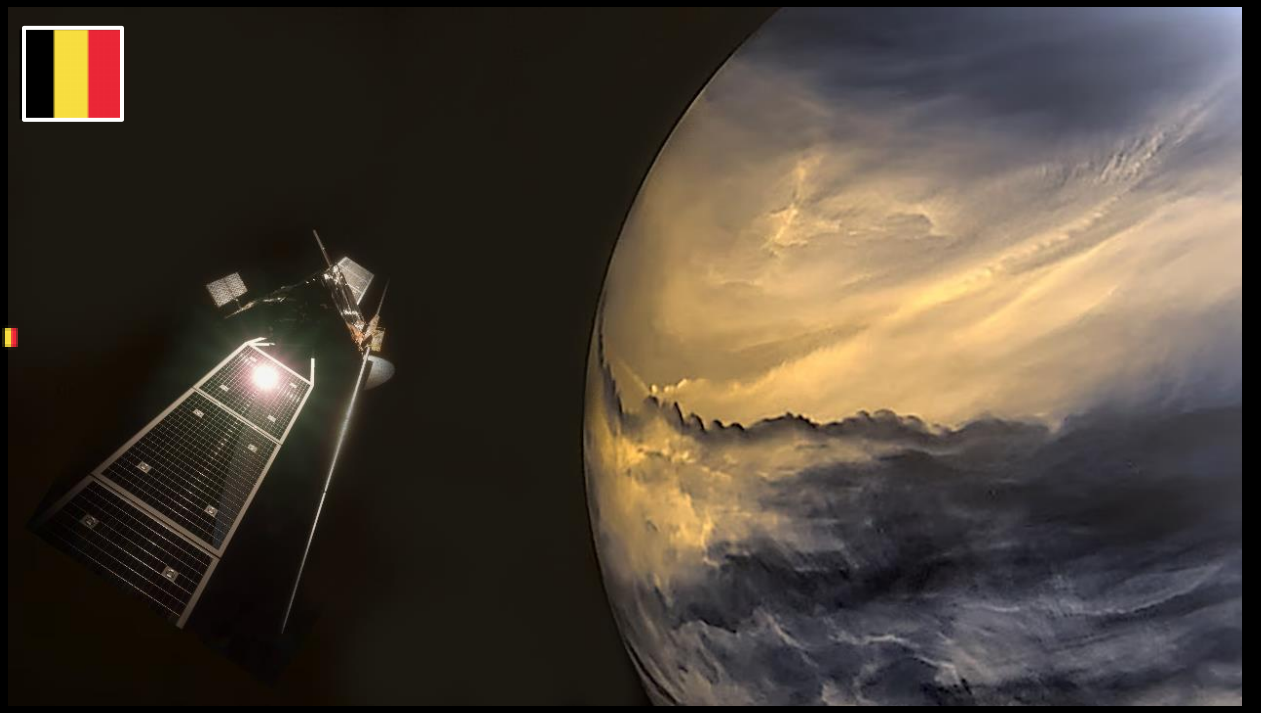


SMILE

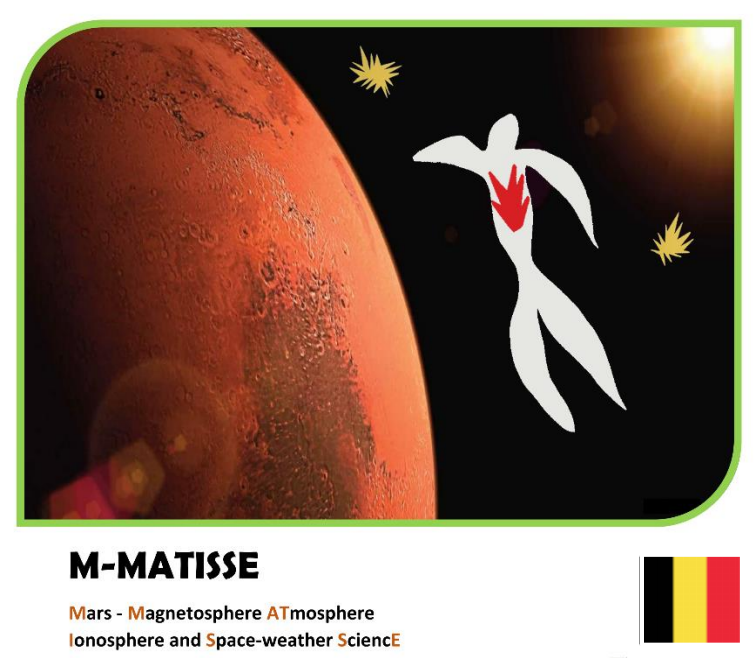
Comet Interceptor

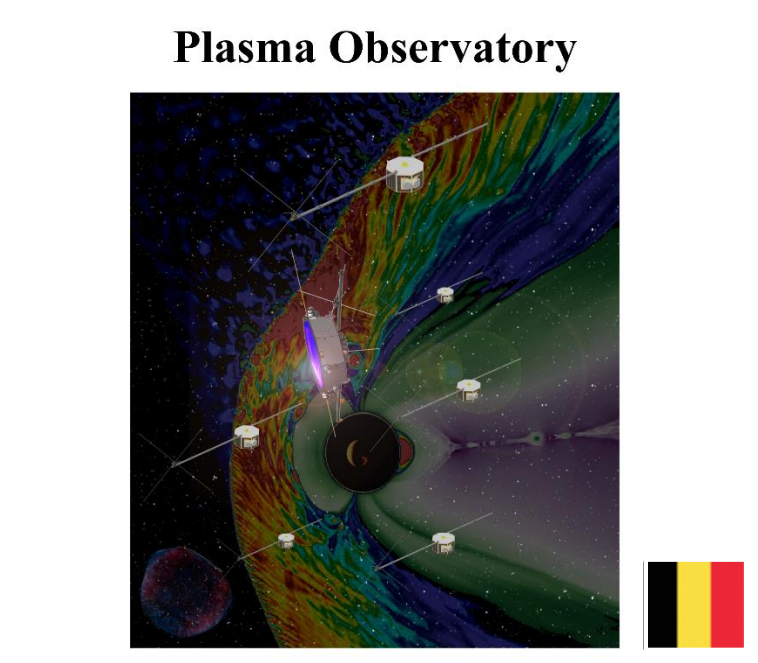
LISA and EnVision

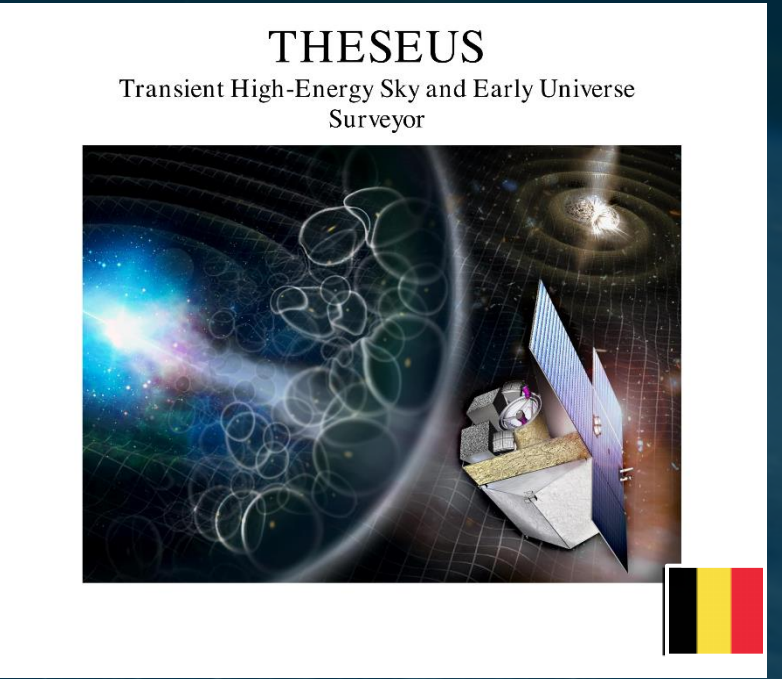




M7 Mission Selected in June 2026







M-Matisse

Tandem of two spacecraft to study Mars Magnetosphere
Launch with Ariane 6
High Elliptic Orbits at Mars

Plasma Observatory

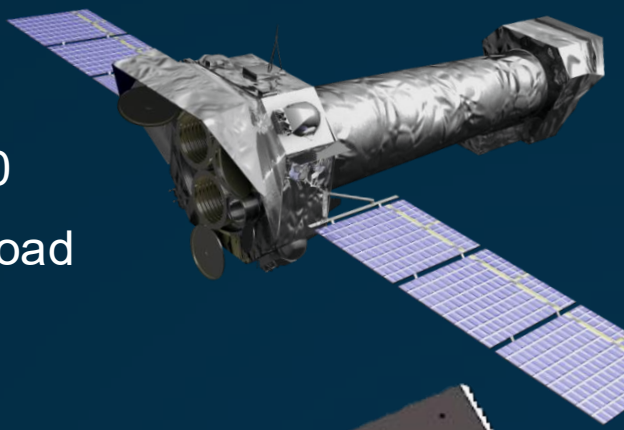
Multi-spacecraft constellation to study Earth Magnetosphere
Launch with Ariane 6
High Elliptic Orbit close to the Ecliptic plane

THESEUS

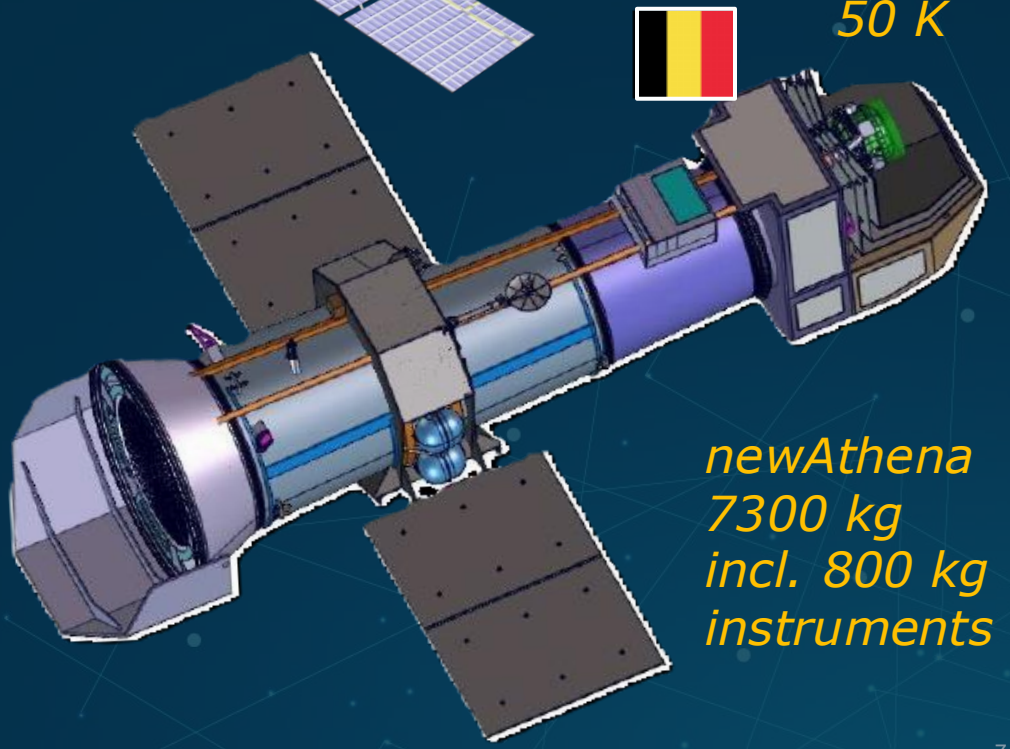
Detection and characterization of Gamma Ray Bursts
Launch with VEGA-E
LEO equatorial orbit, 600 km

newAthena X-ray Observatory

- Will be the largest X-ray observatory ever built
- Mission adoption in early 2027, launch around 2037.
- Most of industrial procurements will occur over 2027-2030
  - Operates @ L1 Lagrangian point with cryogenic payload
  - Service module @ L1
  - Large optics and mirror structure
  - Large structures: Fixed metering structure, mirror sunshield, payload compartment
  - Instrument Switching Mechanism
  - Cryostat @ ~50 K, Heat Pipes and Loop Heat Pipes
  - 2 Instruments XIFU and WFI



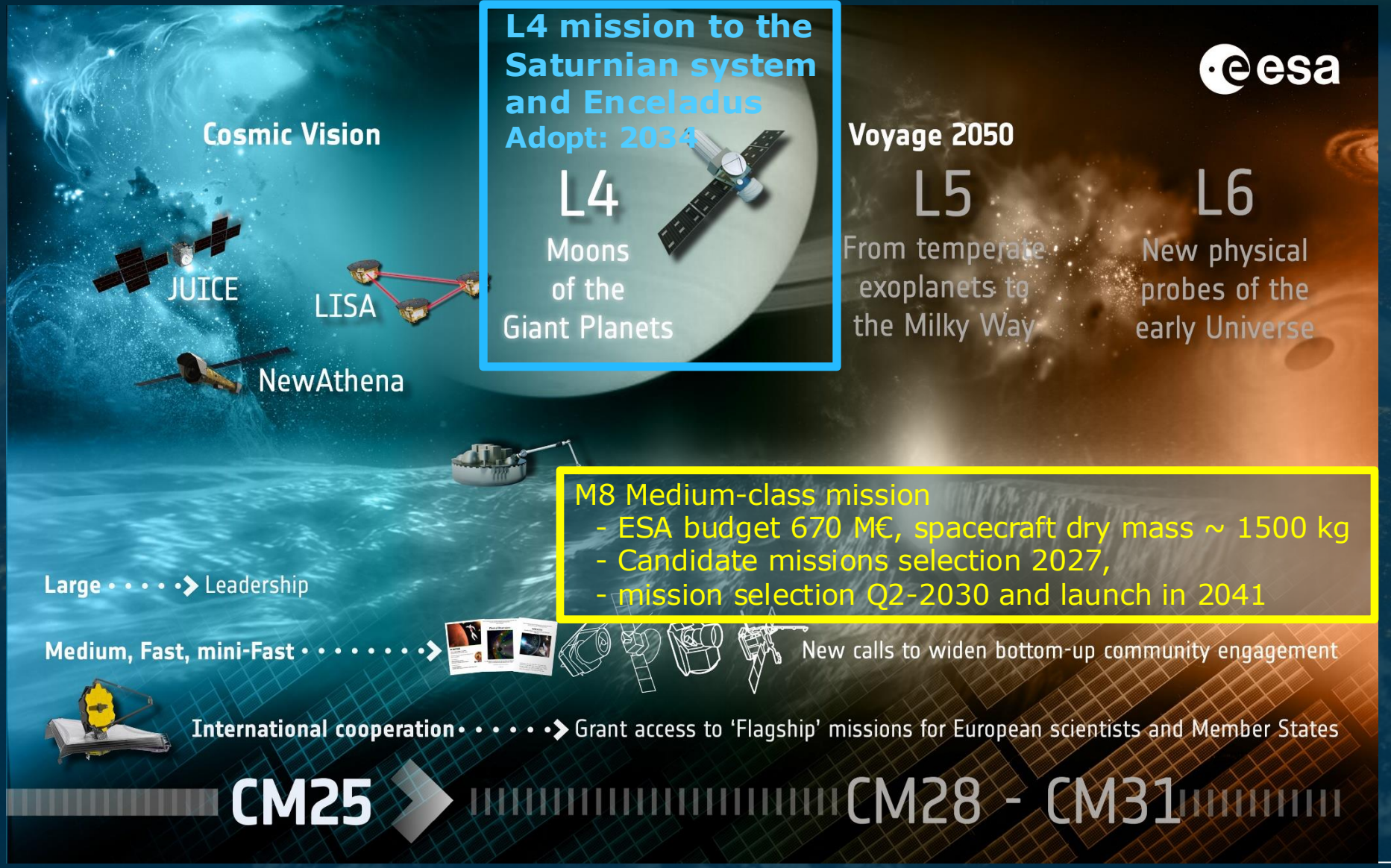
XMM-Newton



50 K

newAthena
7300 kg
incl. 800 kg
instruments

Paving the Future of the Science Programme



F3 Fast-class

- Selection: late 2026
- ESA budget ~ 205 M€
- S/C dry mass ~ 500 kg
- industrial proc. 2027-2030
- launch in 2034

mini-Fast missions

- smaller / faster
- < 5 years from early selection to launch
- Early LEO or further
- Selection possibly in 2026,
- ESA budget ~ 50 M€, spacecraft ~ 100 kg
- First mini-F launch in ~2031

CTP Core Technology Programme

- Timely and effective preparation of ESA future science missions
- develop ***critical enabling technologies*** to required maturity level before mission adoption.

Potential NASA Withdrawal – consequences

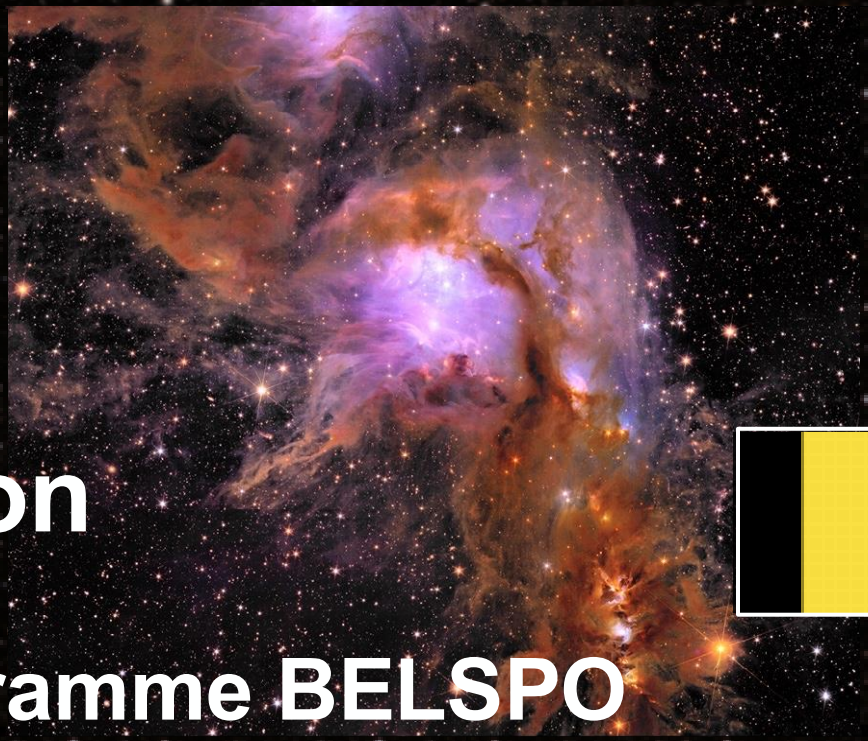
- ESA SCI Programme: sustained & fruitful international collaborations, favors collaborations while developing European leadership
- NASA responded to Presidential proposed budget cut (-24% overall; -47% for science) by announcing cancellation of its participation to around 40 projects
  - LISA, EnVision (both with Prime contractors under contract) and NewAthena (not yet adopted) significantly impacted as NASA planned to make hardware contributions to these projects
- NASA budget: Complex decision-making process, involving the President, Congress and NASA – finalization announced by end September, likely over-run by months
  - Congress pushing for higher NASA budget and more to Science
- ESA-SCI takes action to anticipate NASA withdrawal (very short term or longer term)
  - European alternatives for LISA (lasers, telescopes, charge management devices), EnVision (S-band SAR) and NewAthena (cryocooler, detectors)
  - Technology available in Europe but development costs plus project delay has **impact of around 1B€**
  - Discussions on-going related to Programme and/or National funding solutions
- Impact of the Programme will be assessed by SPC in December and will depend on extent of NASA withdrawal, outcome of CM25 and availability of ***complementary national funding***

In Summary

- The Science Programme is world-leading
- Diversity of science, technology, scale, industrial reach and return – something for everyone!
- Very strong project performance, reliable delivery schedule, cost and quality
- Large ambition/competition from science community and industry for frontier work
- *Correct level of resources must be secured at CM25* to secure near-term and future sustainability and excellence of the programme: turning–point criticality
- Potential NASA withdrawal is a **technology opportunity for Europe** but *needs to be sufficiently funded (preferably nationally)*
- Member States must support requested level of funding to ensure a strong Science Programme and long-term stable industry investment; cooperations welcomed and highly favored; *should NASA withdraw, European solutions exists that can replace its contributions*

SCIENCE Programme - Thank you!

PRODEX Programme



CM25 preparation

ESA PRODEX Programme BELSPO

Securing Belgium's Industry and University Leadership in ESA scientific programmes through PRODEX

Michel Lazerges, ESA PRODEX Office

In this deck

PRODEX programme overview (4 slides)

Selection of scientific Space Hardware Developed through PRODEX (1 slide)

Why PRODEX for Belgium (1 slide)

Successful BE Projects Funded by PRODEX (2 slides)

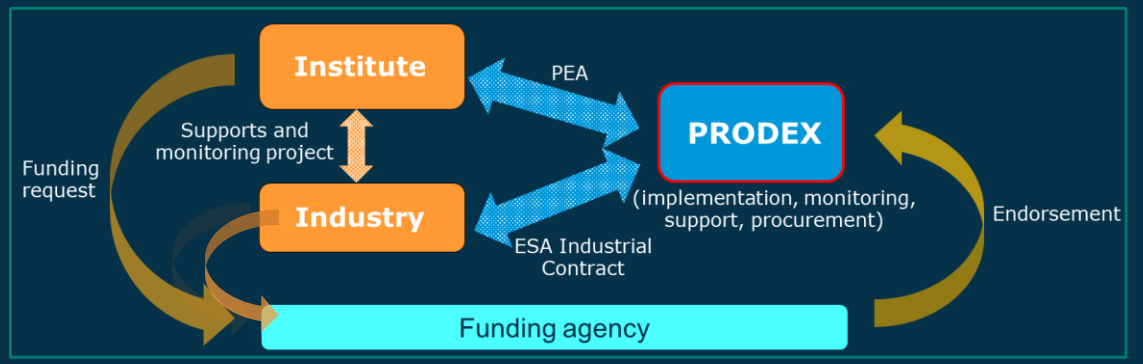
BE PRODEX – Why covering the 70-95 Mio envelope matters (2 slides)

Takeaways (1 slide)

What is PRODEX

PROgramme for the **D**evelopment of scientific **EX**periments

- Optional programme with Guaranteed return
- Participating States contribute as desired
- Implements Participating States contributions to ESA Programmes, with ESA management & technical support
  - e.g. Payload HW developments with national institutes/industry,
- Can also be used for non-ESA Programmes (e.g. with NASA, JAXA)
- As a rule, ~ 50% return through industrial activities



Switzerland (1986)
The Netherlands (2012)
Ireland (1987)
Poland (2012)
Belgium (1988)
Romania (2012)
Norway (1989)
Portugal (2016)
Austria (1991)
Slovenia (2016)
Denmark (1994)
Spain (2016)
Czech Republic (2008)
Hungary (2017)
Greece (2008)
Finland (2019)
Estonia (2021)

17 Participating States (Nov. 2024)

PRODEX specifics

❖ Flexible programme, for institutes (universities) and industry

PRODEX activity proposed by **Institute / University** (or by industry, N/A for BE)

- Activity may include Institute / University - contracted via “PRODEX Experiment Arrangement” - and/or an Industry - contracted via ESA Industrial procurement
- Institute in general participates in activity definition and management, and in instrumentation development and integration

❖ The PRODEX Office Implements activities ***endorsed*** by the Participating States

=> Each participating State ***decides*** which activities to invest on

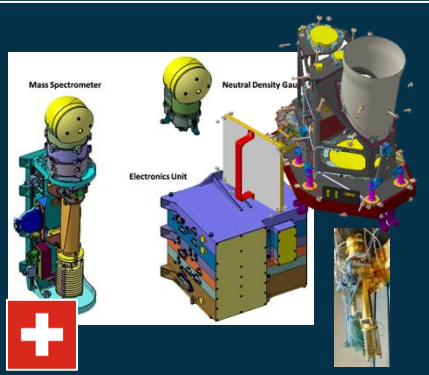
- PRODEX supports participating States in activities pre-endorsement review (technical, risks)
- Activities for ESA or non-ESA missions, as approved by Participating State

PRODEX scale & efficiency

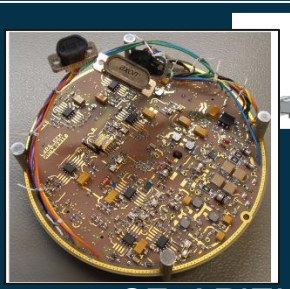
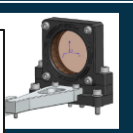
- > 70 M€ annual contractual volume
- > 300 running activities/year (≈220 instrumentation development contracts, 65% of yearly budget)
- ≤ 10% administrative costs
- Proven delivery - support to implemented activities through PRODEX technical officer and management, ESA technical expertise and infrastructure
- Delivers Scientific Space H/W for *all ESA Scientific and Exploration missions*, contributions to S2P
- Supports *operations for most ESA Scientific missions*
- Supports Data processing for Microgravity, Earth Observation, Science and S2P

Recent flight H/W developments in PRODEX


AT: CI DFP Fluxgate magnetometer (EM)
SMILE SXI Ebox

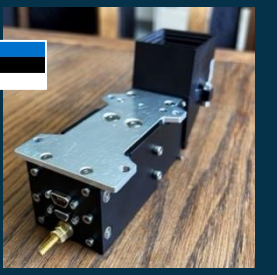


CH: CI MaNIAC - CoCa

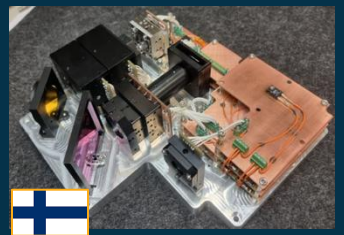
CZ: ARIEL common optic
CI LEES LVPS

DK: ARIEL bipods
LISA PCM -PCU

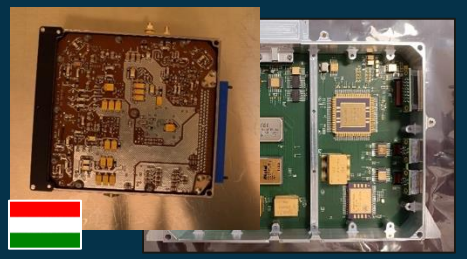


EE: OPIC instrument
EFM, Comet Interceptor

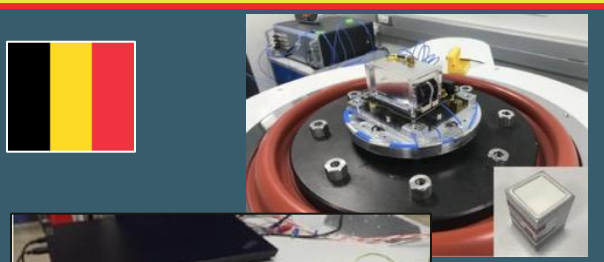
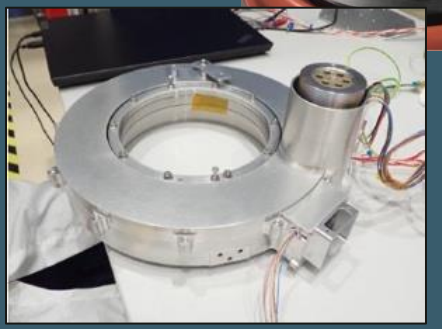
ES: PLATO cameras – Focal Plane Assembly Structure



FI: Comet Interceptor MIRMIS NIR-MIR channels (STM)



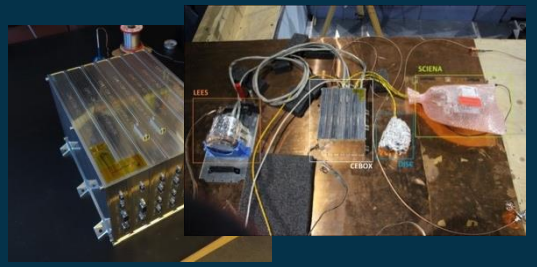
HU: CI CoCa DPU + S/W

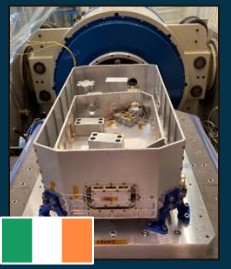
BE: Comet Interceptor CoCa pointing mirror- VenSpec-H instrument lead

NL: SPEX-one Earth atmosphere Polarimeter

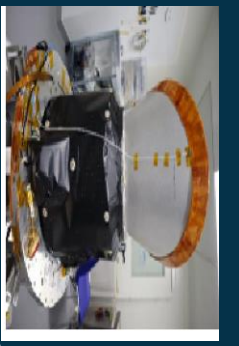

NO: SMILE radiation shutter



PL: Comet Interceptor DFP : EM EMC test and CEBOX



IE: EIRSAT-1
3 experiments

PT: PLATO OGSE & MLI

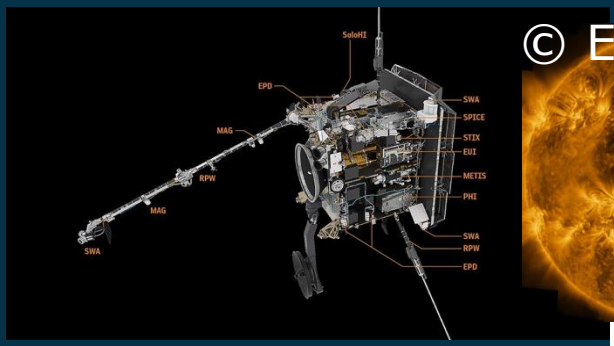
RO – LISA Low-latency pipelines.

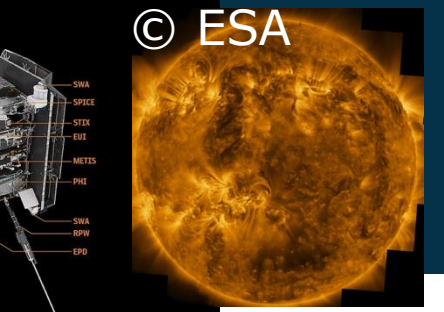
Why PRODEX for BELGIUM

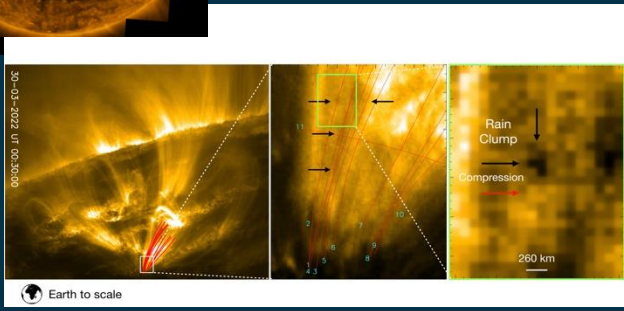
- **Assured national return while leveraging ESA expertise/infrastructure**
- **Accelerates BE industry & labs, builds know-how essential to industry and universities:**
  - Optics, detection, onboard/data processing electronics and S/W…
  - Phases A-B-C-D of technologically advanced instrumentation (LISA QPR, ENVISION VensPec-H, VIGIL ...)
  - *Essential for dual-use activities e.g. low -noise -power -emission electronics, robustness, detection*
- **Pipeline for education & talent : university–industry teaming on flight hardware**
- **Develops BE Influence: stronger BE voice in Missions, consortia, & partnerships**
- **BE entities benefit from the Agency *infrastructure and expertise* for activities pre-endorsement assessment, implementation and monitoring**

Examples of BE PRODEX success stories

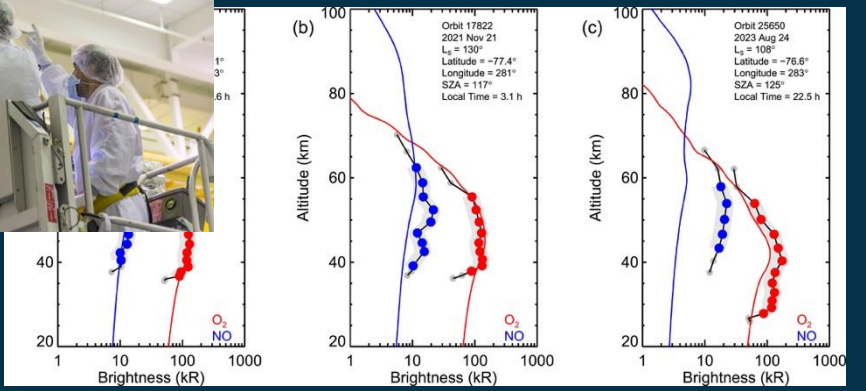
- **Solar Orbiter-EUI (BE-CH+DE-FR-UK)**
  CSL, ROB, DELTATEC, CMOSIS, AMOS, PMOD, APCO + MPS, IAS - IA, MSSL
  - High-resolution images of solar atmosphere and poles (UV) ; key to understanding solar magnetism and space weather.
  - >100 peer-reviewed publications so far







- **Exomars 2016 Nomad (BE, ES, UK)**
  BIRA, CSL,OIP, ETCA
  - High-resolution spectrometer onboard ExoMars TGO
  - > 100 peer-reviewed publications so far
  - Key findings: methane detection, water vapor dynamics, dust storms on Mars.



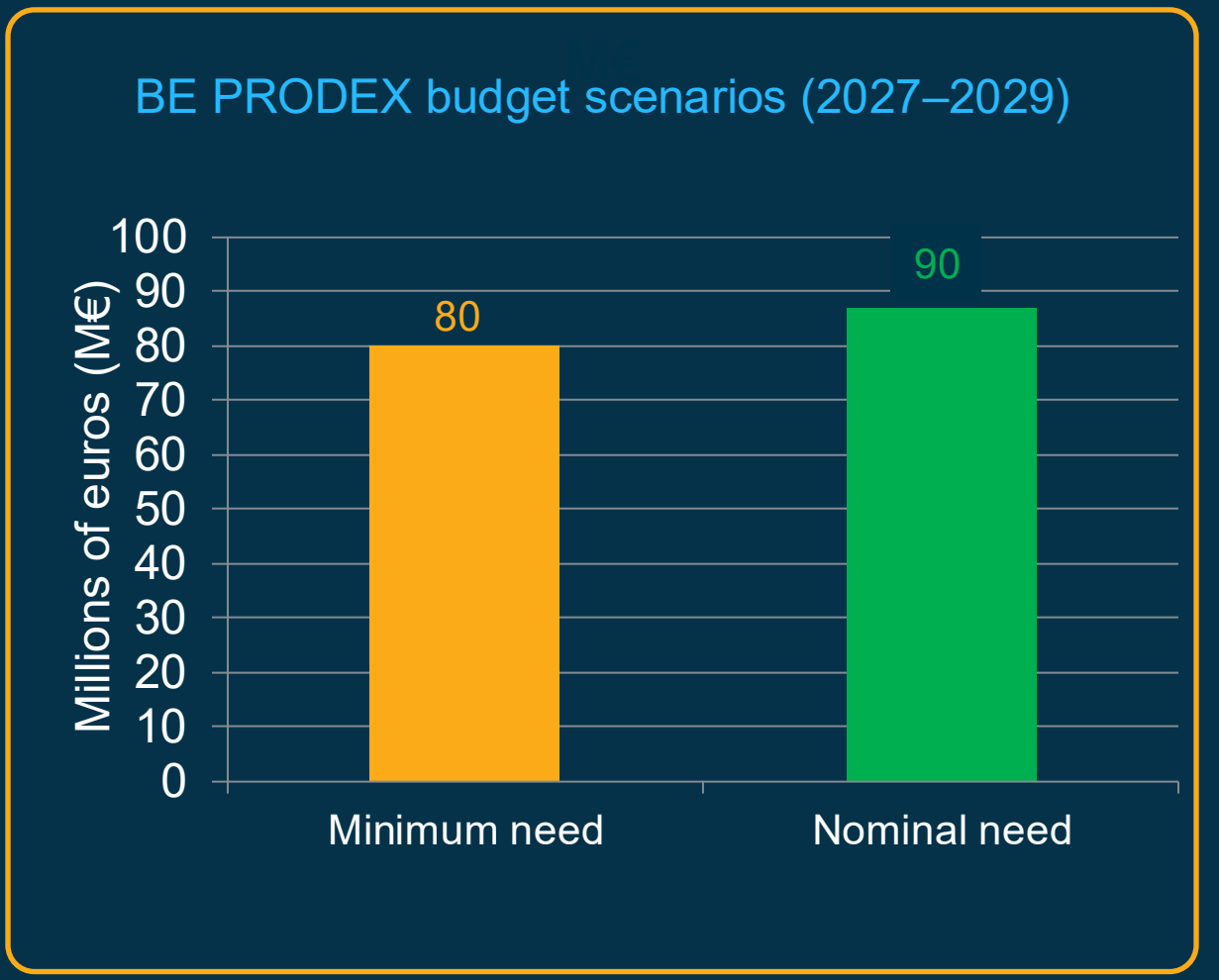
Belgium's Impact in PRODEX: Track Record of Excellence

- **BE active in 15+ ESA and int'l missions including H/W provisions to:**
  - Exomars NOMAD, Solar Orbiter EUI , Euclid, SMILE, PLATO, ARIEL, ARRAKIHS, Comet Interceptor, LISA, Envision, Solar-C, ViGIL, GENESIS, involved in ARRAKIHS, NewAthena, M7
- **BE leadership in Payload Development, strong University-Industry Partnerships**
  - Belgian institutes and industry at the **forefront** of instrument design, integration, mission op's
  - University / industry partnership ensures innovation and talent development
  - Experiment (H/W) development to support R Liegeois' flight
- **BE Broad Scientific Reach**
  - Planetary science, astrophysics, S2P, Earth observation, microgravity / exploration
- **BE Sustained Output**
  - Hundreds of peer-reviewed publications and major scientific discoveries
  - Leading edge payloads, positioning BE industry as key players

BE PRODEX budget scenarios CM25

Why covering the CM25 PRODEX envelope matters

- **Keep** BE commitments as per MLAs and NPMC
- **Keep** BE reliability reputation & strong international presence
- **Preserve** BE leadership and competitiveness in payload development, operations, science and data exploitation
- **Retain and develop** know-how



If BE CM 25 PRODEX contribution is below thresholds

❖ Below-nominal funding

⇒ **Reduced data exploitation & scientific activities**

⇒ # FTE loss (function of budget reduction)

- ✵ Contract terminations fees => ***unfunded liabilities***
- ✵ Talent loss: re-entry into community ***long, difficult, and costly***
- ✵ **Pipeline** to post CM25 activities *reduced* / ***stopped***

What's at stake

- BE lead in key ESA and international missions
- BE influence in the European / International Space sector

- **Loss** of Belgian leadership in key ESA and international missions
- **Broken commitments** to payload and operations
- **Termination of contracts** and loss of jobs in institutes and industry
- **Recovery time (10+ years)**
- **Reputation and influence**

❖ *Below minimum* funding

⇒ **Belgium's withdrawal from MLA-NPMC payload and operations**, would ***severely*** damage its top-tier reliability reputation

⇒ ***Talent drain: Loss of industrial and university competence, contractual terminations***

e.g. 35% nominal budget reduction ~ 65 FTE lost / Year >> 7 Mio Euro contracts termination fees

Re-entry into community long, extremely difficult, and costly (>> 10 years)

BE PRODEX @ CM25 - takeaways

- **Impossible to decrease budgets by x-folds from one CM to the next**
  - **Breached commitments - *loss of BE excellent reliability reputation***
  - **Serious and long-term loss of institute and industrial skills – long, hard and costly to recover**

- **Target 90 M€ to maintain and develop BE leadership and secure participation in future developments (incl.: M8, F & mini-F, PRODEX Call for ideas 2025)**
  - Frame activities as ‘protect ongoing + seed next-generation’ across 2027–2029
  - Maintain BE Institutes and Industry leadership on leading edge Space activities
  - SCI increased LoR shall be matched by National contribution to benefit from its returns – including Georeturns – benefits

- **PRODEX H/W development budget = investment**
  - Sustains competitiveness, contributes building GeoReturn statistics in other programmes
  - High-performance scientific payloads and technologies
  - **Bridges to *dual-use* technologies**

Thanks and Q&A

❖ Thank You to the Belgian Delegation

- ➢ For your continued support and commitment to Belgium's leadership in European space science

❖ BE investment enables

- ➢ World-class research and innovation
- ➢ Growth of Belgian industry and talent – preservation of BE GeoR
- ➢ BE scientific and high-tech International recognition and influence
- ➢ Strengthened competencies bridging with dual-use tech

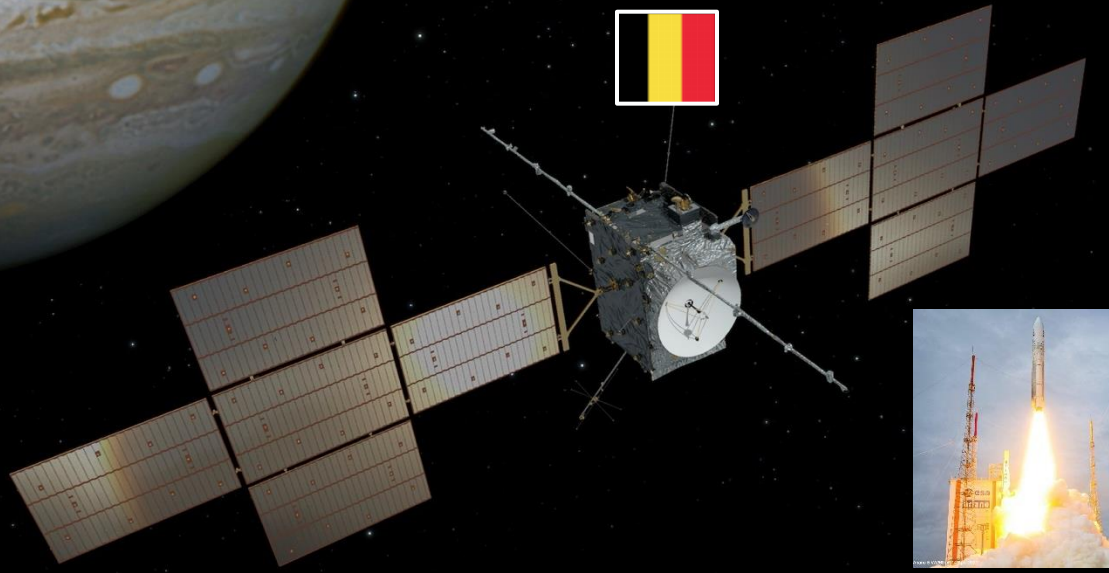
❖ Questions & Discussion

- ➢ *Working together to secure Belgium's future in space*

Reserve slides – Science Programme

Jupiter Icy Moons Explorer

- Studying Jupiter & its icy, ocean-bearing moons
- 4 planetary flybys, 35 Galilean moon flybys, 10 in situ + remote instruments
- ESA-led with NASA, JAXA, ISA participation
- Launched 14 April 2023 on Ariane 5, Jupiter arrival 2031, Ganymede orbit in 2034



Euclid Delivers First Images with Sparkling Cosmic Views

L4 mission to the Saturnian system and Enceladus

Technology developments and studies will ramp-up in 2026 to de-risk critical subsystems and start the spacecraft development in 2035

- Overall space segment architecture in two spacecraft
- Rendezvous in-orbit and docking
- Cryogenic payload and mechanism for surface operations
- Payload miniaturization
- Autonomous navigation
- Surface reconnaissance and autonomous landing on Enceladus
- Power management and low-power operations power consumption and heat dissipation drastic reductions
- Data compression and transfer

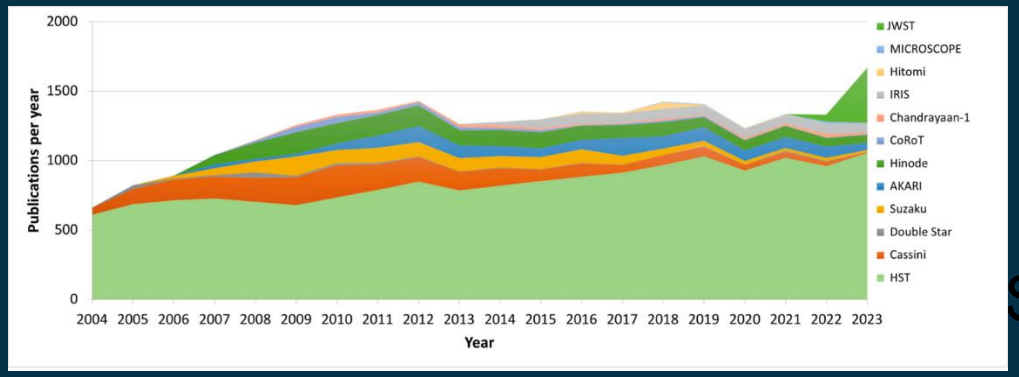
Future Missions: M8, F3 and mini-Fast

- **Our missions are highly competitive, aiming at scientific and technical excellence**
- Call for M8 and F3 mission proposals issued in March soliciting the scientific community
- M8 Medium-class mission
  - Early selection of candidate missions planned in 2027, mission selection in Q2-2030 and launch in 2041
  - ESA budget 670 M€, spacecraft dry mass ~ 1500 kg
- F3 Fast-class mission
  - Selection planned in late 2026, industrial procurements in 2027-2030 and launch in 2034
  - ESA budget 205 M€, spacecraft dry mass ~ 500 kg
- Call for mini-Fast mission proposals also issued in March
  - Explore the possibility of a new line of smaller/faster missions, < 5 years from early selection to launch
  - ESA budget ~ 50 M€, spacecraft mass ~ 100 kg
  - Use of shared launch to access LEO. Farther destinations if passenger to some other mission
  - Early selection possibly in 2026, and first mini-F launch in ~2031

ESA Missions: Refereed Publications

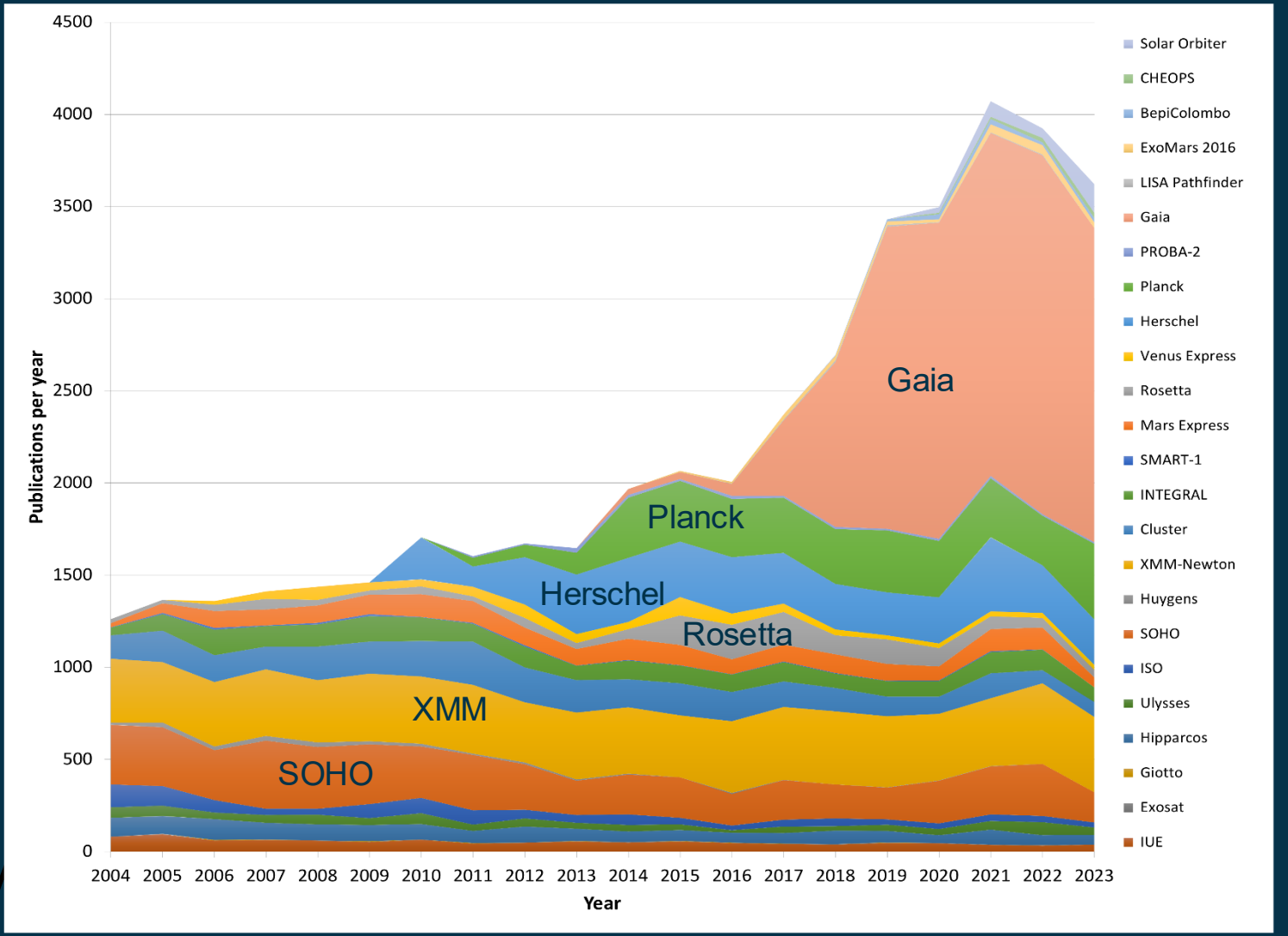
Performance in 2023

- Total number of refereed papers is 4743
- 11% of all refereed astrophysics, planetary sciences, and solar physics papers worldwide are based on data from ESA-led Science Programme missions

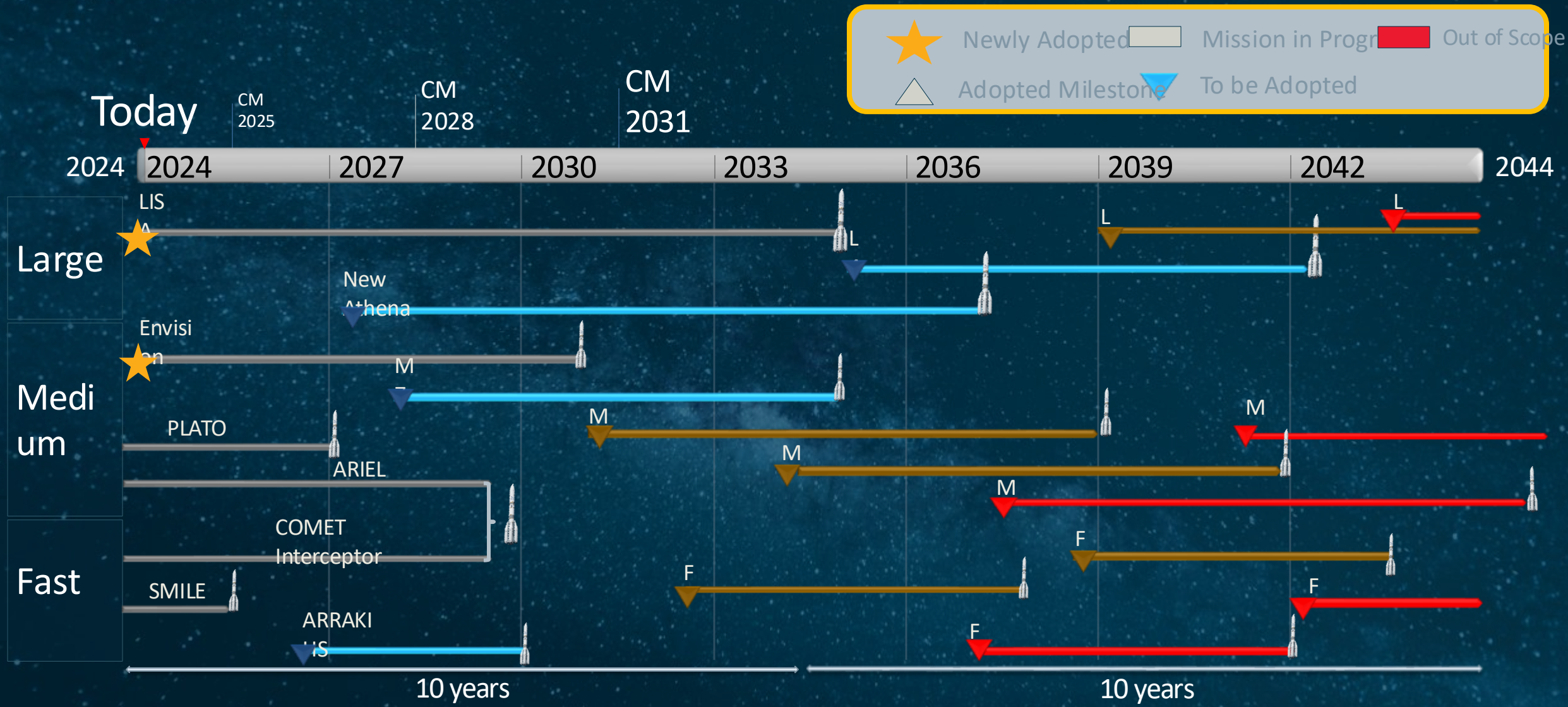


Evolution of the partner-led mission publication numbers with time

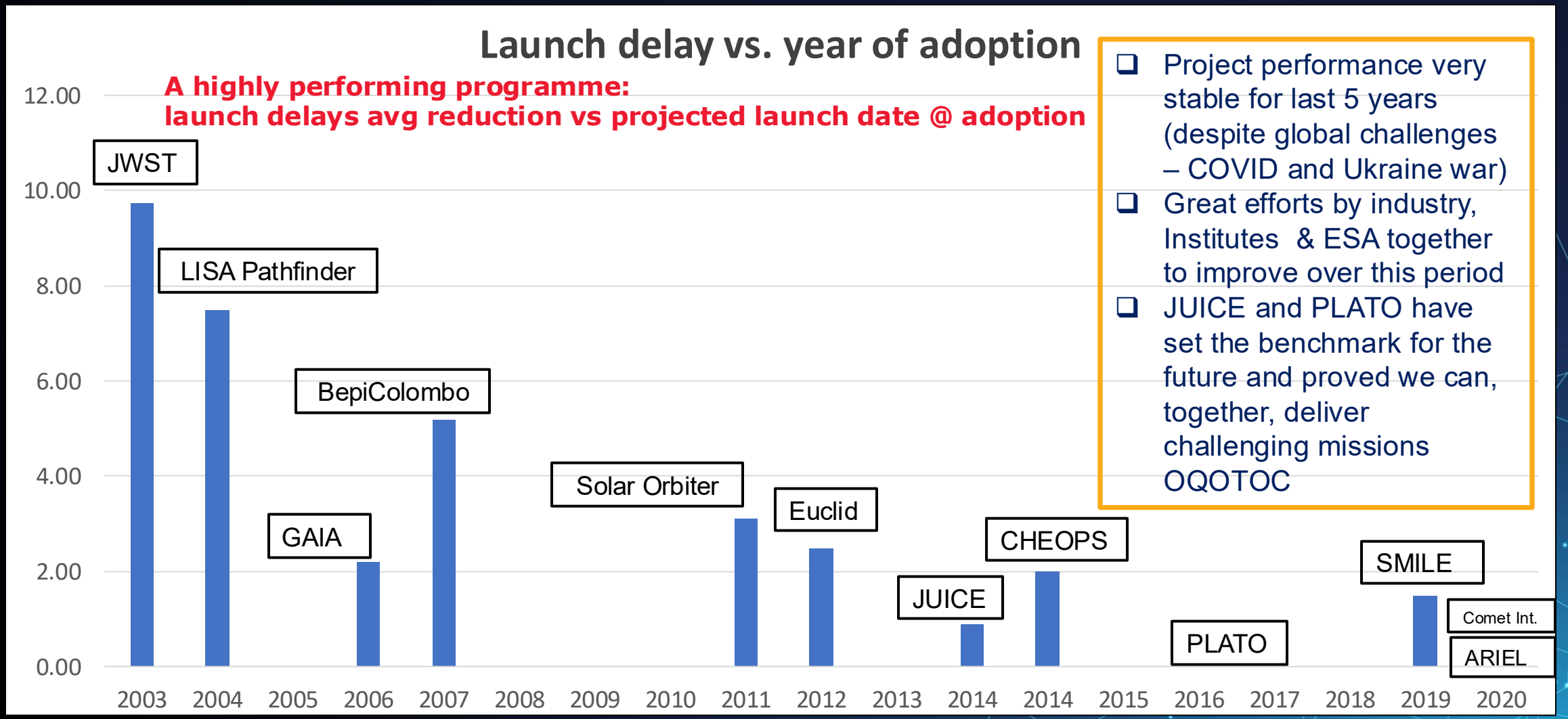
Evolution of the ESA-led mission publication numbers as a function of time



LTIP - Balanced and Reduced Scenario Comparison



Science Project Performance



- Project performance very stable for last 5 years (despite global challenges – COVID and Ukraine war)
- Great efforts by industry, Institutes & ESA together to improve over this period
- JUICE and PLATO have set the benchmark for the future and proved we can, together, deliver challenging missions OQOTOC

RESERVE SLIDES – PRODEX Programme

Main BE contributions – PRODEX

BE contributions to Payloads (Phases A-B-C-D 22 running activities)

Mission	BE contribution	Teams (Uni)
ARIEL	ARIEL Telescope Assembly & ground segment	KU Leuven / CSL
HERA	GRASS Gravimeter	ROB
PLATO	CAM AIT – follow-up	CSL
-	FOCAL7	CSL + ind.
NewATHENA	X-IFU DEA Development	CSL
ARRAKHIS	Baffle and cover	CSL + ind.
Comet Int.	RMA	CSL
Comet Interceptor	DFP COMPLIMENT Langmuir Probes	BISA
ENVISION	VenSpec-H Instrument	BISA+ Ind.
GENESIS	GENESIS VLBI antenna	UCL
LISA	qPR development	KULeuven + UCLouvain + Ind.
M7	Present in the 3 missions	Various
SOLAR-C	SoSpIM Detector and Filter	ROB
VIGIL	JEDI	CSL/ROB
Prep. R. Liegeois flight	3 experiments	Various

BE contributions to missions op's (26 running activities)

Mission	BE contribution	Teams
BEPI Colombo	PETRO-BepiColombo	ULiege, KU Leuven
EXOMARS	NOMAD Mars Science - Vandaele	BISA
GAIA	GAIA - Blomme	ROB, KU Leuven, ULiege, ULB
	SPACE.BE	BISA
JWST	JWST / MIRI Commissioning and Operations	KU Leuven Uliege U Gent
SIDEX	SIDEX	Various
SOLO	EUI	ROB
N/A	Planet Interior data exploitation -Van Hoolst	ROB, U Namur
PROBA-3	ASPIICS - Support to Operations	ROB

BE contributions in science and data exploit.

Support to Science/Earth Observation / Microgravity research and data exploitation (80 activities)	
Earth Observation	14 running activities
Microgravity	30 running activities
Science	34 running activities

PRODEX activities

Number of running contracts and H/W development per domain and per Participating State Snapshot 01-09-2025

	HRE		EOP		SCI		Total	
	Act.	H/W	Act.	H/W	Act.	H/W	Act.	H/W
AT-Austria					8	9	8	9
BE-Belgium	33	2	14		60	22	107	24
CH-Switzerland	7	1			38	26	45	27
CZ-Czech republic					18	17	18	17
DK-Denmark	1		1		9	6	11	6
EE-Estonia					1	1	1	1
ES-Spain	7	4			18	17	25	21
FI-Finland					2	2	2	2
GR-Greece	1				1		2	
HU-Hungary	7	2	1		13	6	21	8
IE-Ireland	2				6	2	8	2
NL-Netherlands			1	1	1		2	1
NO-Norway	8	1	13		15	11	36	12
PL-Poland					10	8	10	8
PT-Portugal	3	1			11	5	14	6
RO-Romania	1				6	4	7	4
SI-Slovenia					6		6	
Total	**70**	**11**	**30**	**1**	**223**	**136**	**323**	**148**