INTRODUCTION TO ESA AND THE EUROPEAN SPACE INDUSTRY

UNITED SPACE IN EUROPE

18 Sept 2019

ESA facts and figures

- Over 50 years of experience
- 22 Member States
- Eight sites/facilities in Europe, about 2300 staff (approx. 5000 total personnel)
- 5.72 billion Euro budget (2019)
- Over 80 satellites designed, tested and operated in flight

Purpose of ESA

"To provide for and promote, for exclusively peaceful purposes, cooperation among European states in space research and technology and their space applications."

Article 2 of ESA Convention

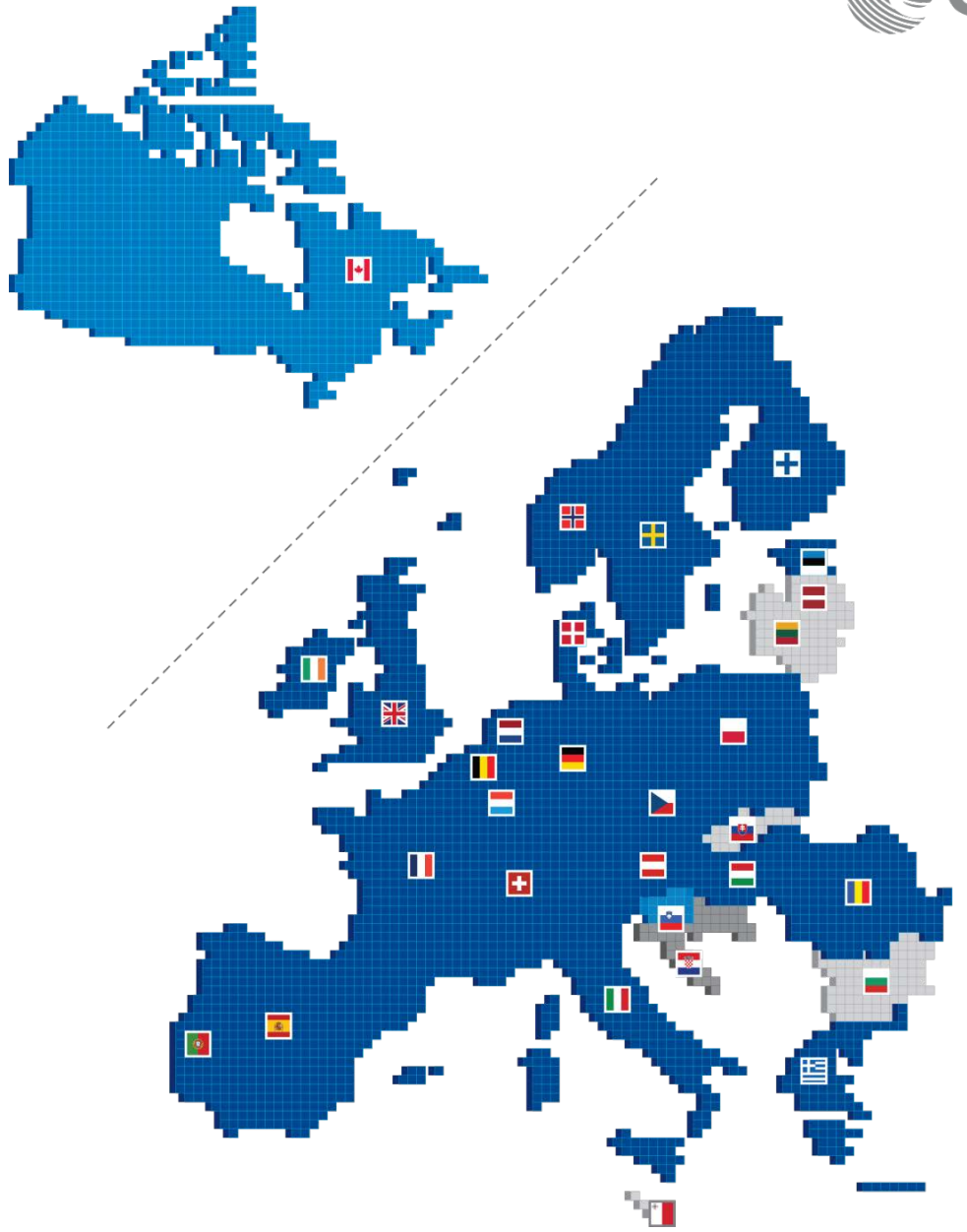
Member States

ESA has 22 Member States: 20 states of the EU (AT, BE, CZ, DE, DK, EE, ES, FI, FR, IT, GR, HU, IE, LU, NL, PT, PL, RO, SE, UK) plus Norway and Switzerland.

7 other EU states have Cooperation Agreements with ESA: Bulgaria, Croatia, Cyprus, Latvia, Lithuania, Malta and Slovakia.

Slovenia is an Associate Member.

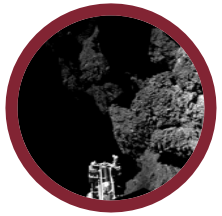
Canada takes part in some programmes under a long-standing Cooperation Agreement.



Activities

ESA is one of the few space agencies in the world to combine responsibility in nearly all areas of space activity.

* Space science is a Mandatory programme, all Member States contribute to it according to GNP. All other programmes are Optional, funded ‘a la carte’ by Participating States.


space science


human spaceflight


exploration


earth observation


space transportation

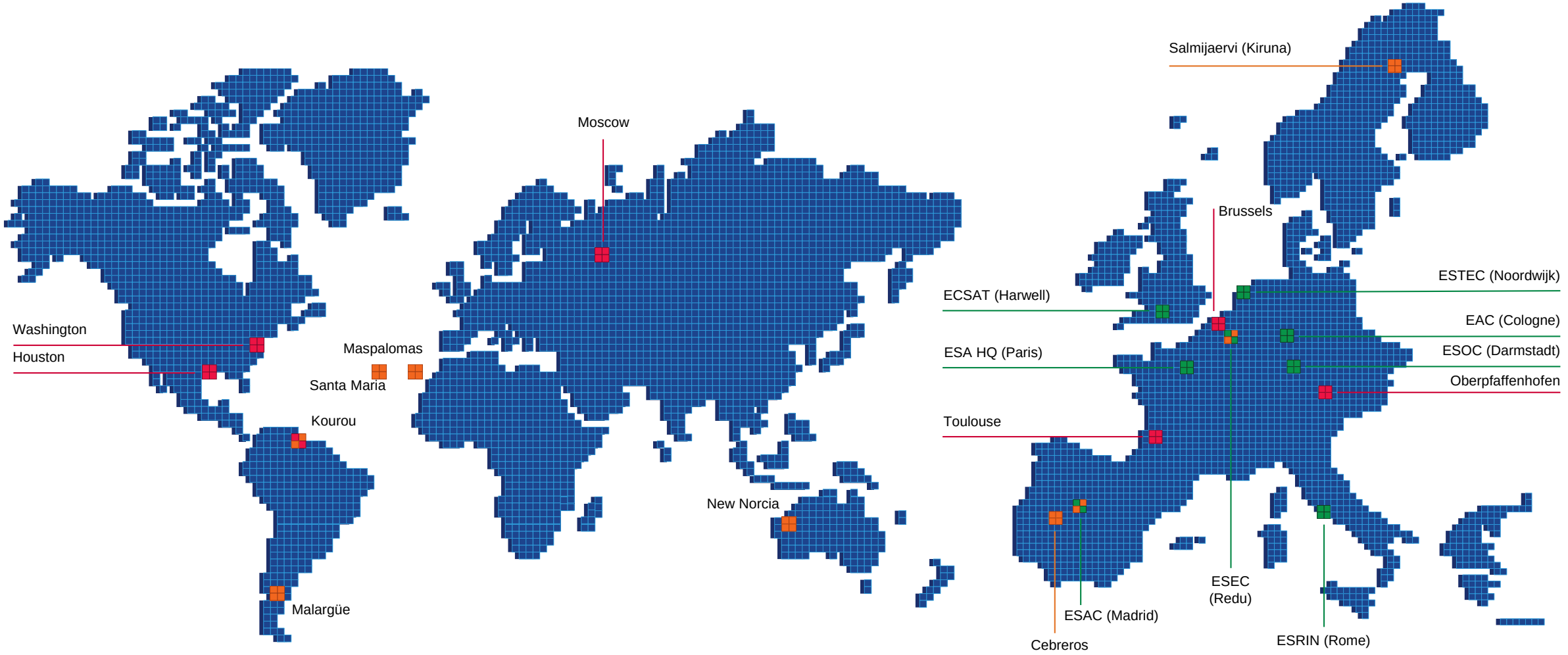

navigation


operations


technology


telecommunications

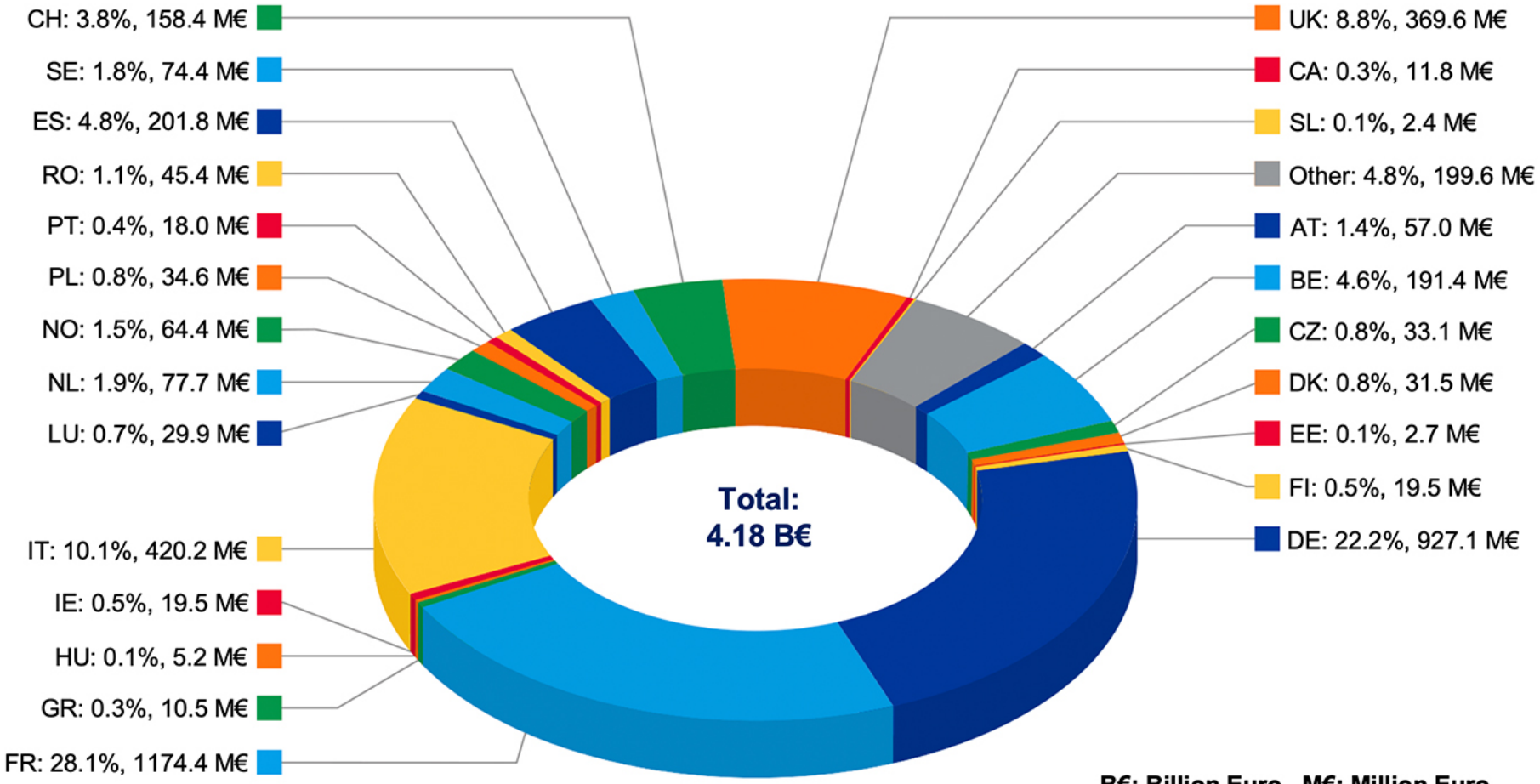
ESA's locations



- ESA sites
- Offices
- ESA Ground Station
- ESA Ground Station + Offices
- ESA sites + ESA Ground Station

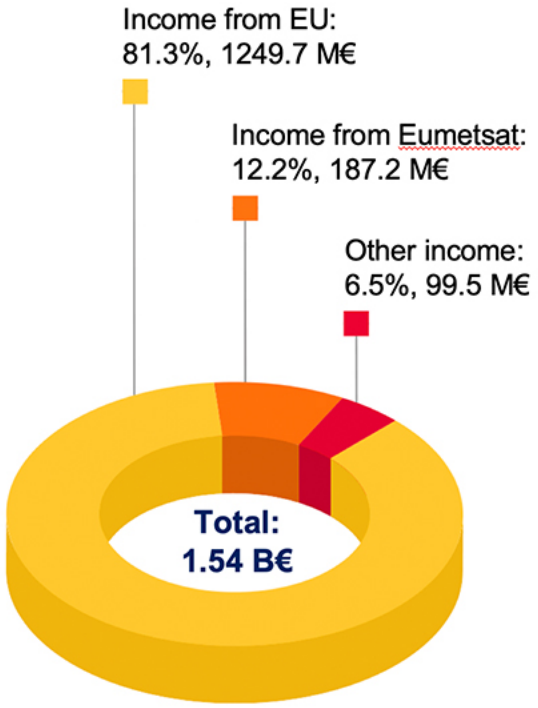
ESA budget for 2019: 5.72 B€

ESA Activities and Programmes

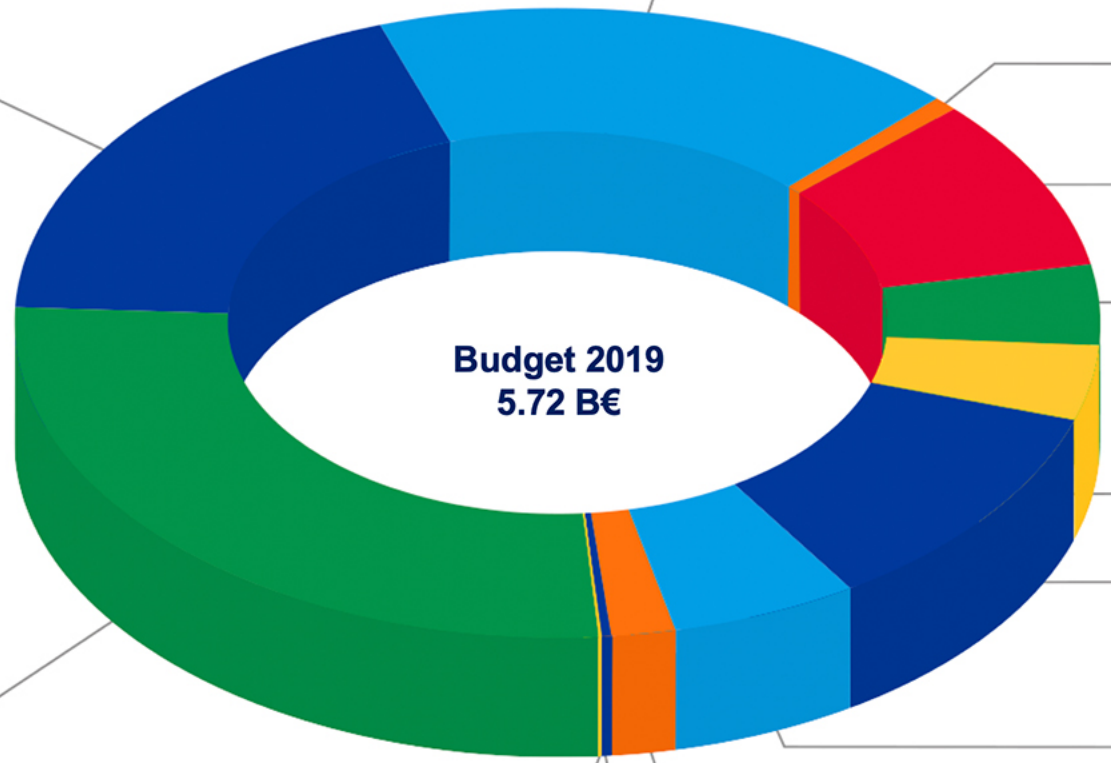


B€: Billion Euro M€: Million Euro

Programmes implemented for other institutional partners



ESA budget by domain for 2019: 5.72 B€



Navigation*
13.1%

Space Transportation*
22.5%

Earth Observation*
24.3%

European Cooperating States Agreements
0.1%

Prodex
1.2%

Scientific Programme
9.2%

Basic Activities
4.2%

Associated with General Budget
4.1%

Human Spaceflight, Micro. & Exploration
12.0%

Telecom & Integrated Applications*
6.8%

Technology Support*
2.1%

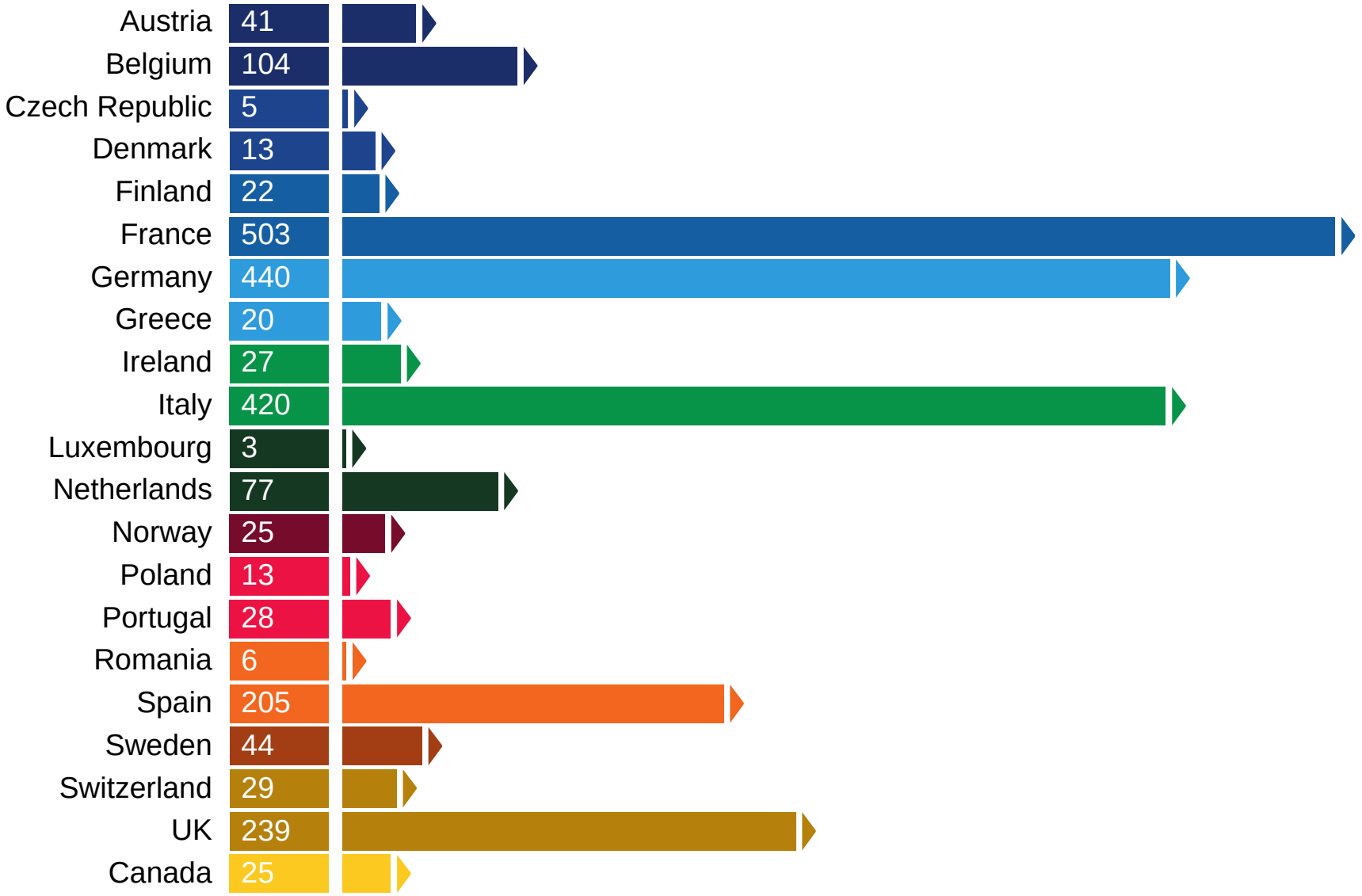
Space Situational Awareness
0.5%

B€: Billion Euro

M€: Million Euro

***includes programmes implemented for other institutional partners**

Staff by nationality (2016 figures)

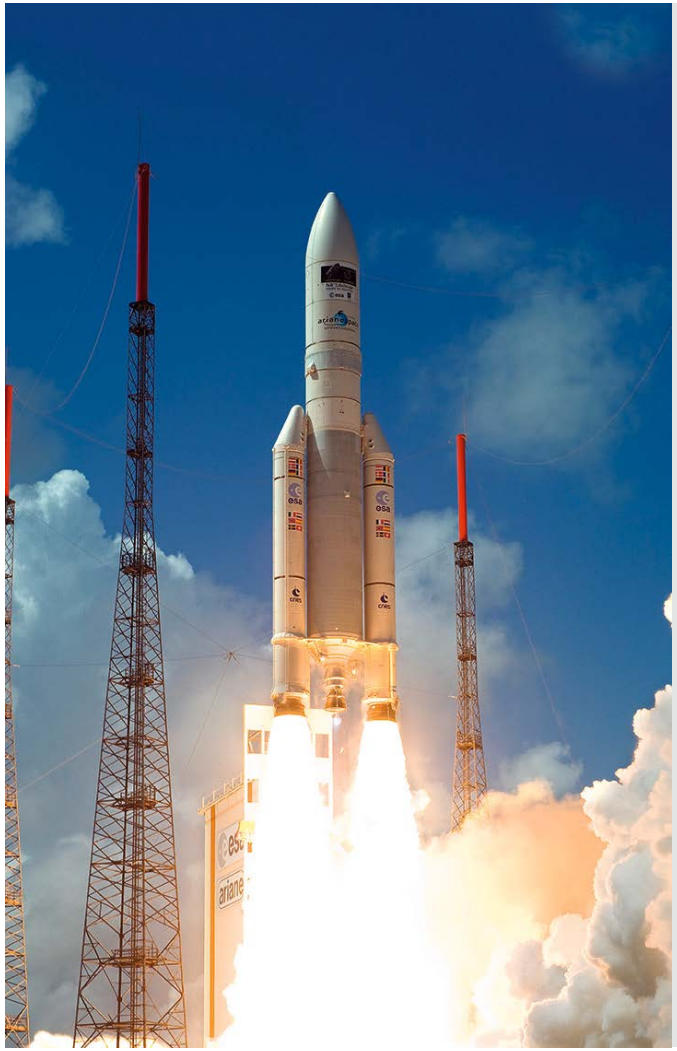


Total international staff: 2289

ESA and the European space sector 1/3

ESA Member States finance 50% of the total public space spending in Europe. Because of the cooperation between ESA, EC and the national space agencies:

- The European space industry sustains around 35 000 jobs;
- Europe is successful in the commercial arena, with a market share of telecom and launch services higher than the fraction of Europe's public spending worldwide;
- European scientific communities are world-class and attract international cooperation;
- Research and innovation centres are recognised worldwide;
- European space operators (Arianespace, Eumetsat, Eutelsat, SES Global, etc.) are the most successful in the world.



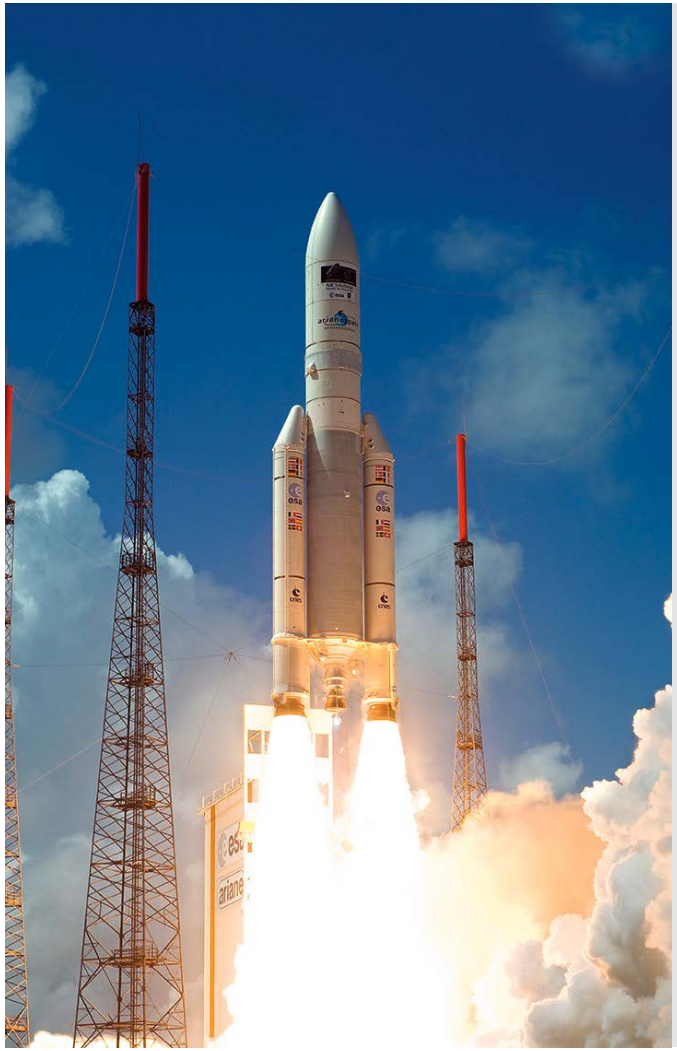
ESA and the European space sector 2/3

There are a number of large national space agencies:
- CNES
- DLR
- ASI

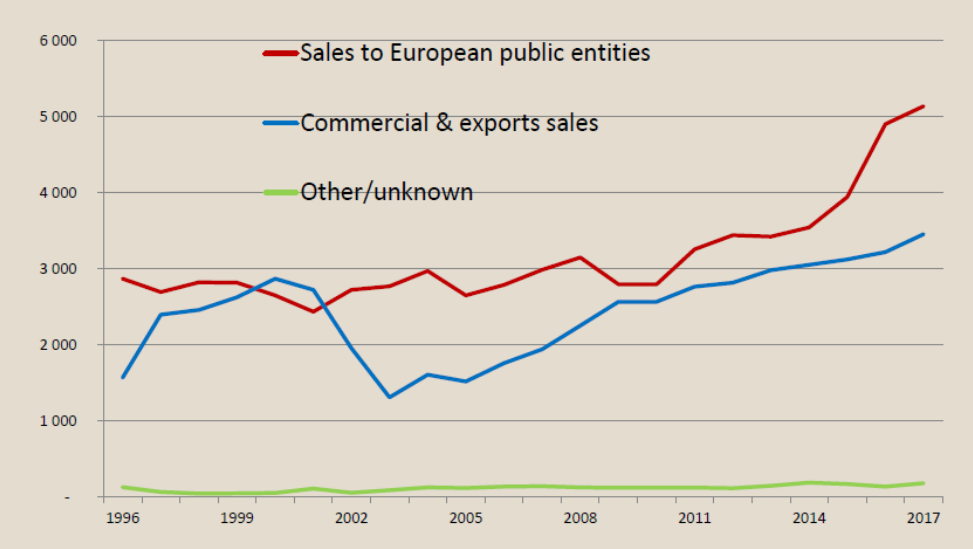
Satellite and Launcher production dominated by the Large System Integrators:
- Thales Alenia Space
- Airbus
- OHB
- Ariane Group

Significant, trans-European, SME supply chain for all aspects of space sector – approximately 13% of space employment in Europe*

**source: Eurospace*

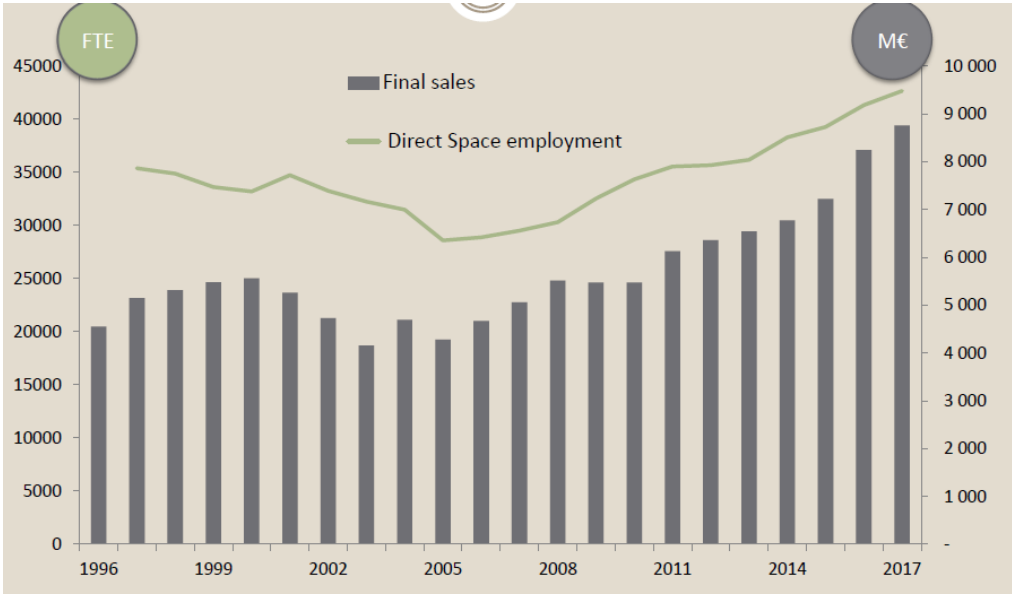


ESA and the European space sector 3/3



Space sector sales approximately 60% to public entities, of which ESA is approximately half

Both total sales and the employment in the space sector are growing in Europe



Source: Eurospace 2018

ESA’s industrial policy

About 85% of ESA’s budget is spent on contracts with European industry.

ESA’s industrial policy:

- Ensures that Member States get a fair return on their investment;
- Improves competitiveness of European industry;
- Maintains and develops space technology;
- Exploits the advantages of free competitive bidding, except where incompatible with objectives of the industrial policy.

Birth of commercial operators

ESA's 'catalyst' role

ESA is responsible for R&D of space projects. On completion of qualification, they are handed to outside entities for production and exploitation. Most of these entities emanated from ESA.

Meteorology: Eumetsat

Launch services: Arianespace

Telecoms: Eutelsat and Inmarsat

Space 4.0: a new era of space

Space 4.0 represents the evolution of the space sector into a new era:

- From being the preserve of the governments of a few spacefaring nations, to an increased number of diverse space actors around the world;
- With the emergence of private companies, participation with academia, industry and citizens, digitalisation and global interaction;
- Analogous to, and is intertwined with, Industry 4.0, which is considered as the unfolding fourth industrial revolution of manufacturing and services.

Mark your calendar: Industry Space Days

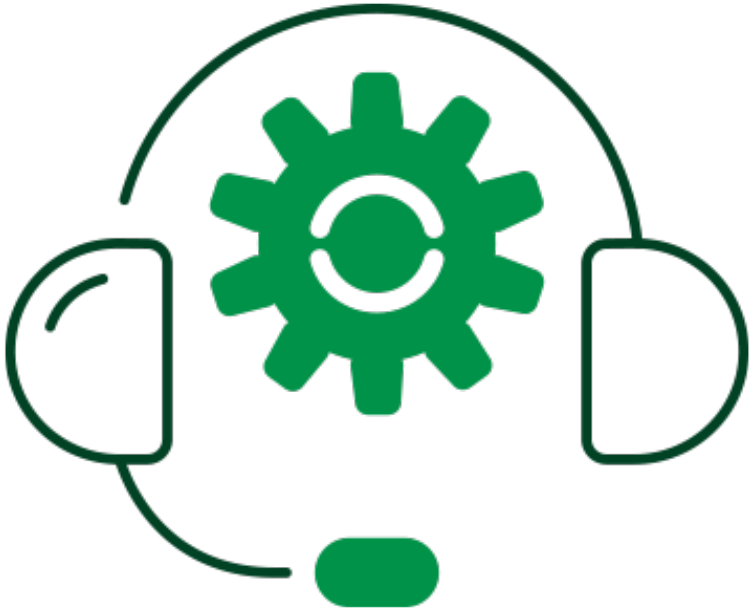
B2B meetings

Conference presentations

Exhibition

- The ISD is a **B2B event** organised by the SME Office to facilitate business among space companies with a special emphasis on increasing the involvement of SMEs in space activities
- The 8th edition of the ISD will take place on **16 – 17 September 2020** at ESA/ESTEC

SME Support: Communication & Training



- The SME Office organises and supports various training courses for SMEs
- SME **Portal** www.esa.int/sme
- SME Office **Helpdesk** sme-office@esa.int
- SME **Newsletter** https://bit.ly/2TzBL0q
- http://www.esa.int/About_Us/Business_with_ESA

10–11 September	ECOS 5.3 (second session)	ESA/ESTEC
14 October	ECSS - Q-10 Q-20 PA/QA	Livestream, 13:30 –17:00
15 October	ECSS - Q-40 Safety	Livestream, 9:00 –12:30
15 October	ECSS - Q-60 EEE Components	Livestream, 13:30 –17:00
16 October	ECSS - Q-70 Materials, Mechanical Parts and Processes	Livestream, 9:00 –12:30
16 October	ECSS - Q-70 Materials, Mechanical Parts and Processes	Livestream, 13:30 –17:00
29–30 October	Product Assurance in ESA projects	ESA/ESTEC
31 October	Rate Calculation Training course	ESA/ESTEC
5–7 November	R&D proposal writing course	ESA/ESTEC
4 December	EEE components procurement: different cost areas and their relevance	ESA/ESTEC
Q4 2019 (tbd)	Intellectual Property Rights	ESA/ESTEC

https://ideas.esa.int

	Title	Status	Ideas	Published
	System Studies - Lunar Caves	Idea Submission	6	Aug 21
	Space Technology Transfer to ESA sites and building sector - Call for ideas	Idea Submission	24	Apr 29
	Digital Design-to-Produce	Evaluation	27	Apr 18
	Cyber-Safety/-Security	Evaluation	37	Apr 18
	Artificial Intelligence for Space	Evaluation	100	Apr 18
	Operations Innovation - Call for ideas 2019	Evaluation	107	Apr 15
	Remote Sensing of Plastic Marine Litter	Evaluation	59	Apr 12
	Enabling Harbour to Harbour Autonomous Shipping	Evaluation	20	Apr 12

esa

CTRL ... bringing space closer

GOSPACE

SPACE::LAB

STU FCHPT SLOVAK UNIVERSITY OF TECHNOLOGY IN BRATISLAVA FACULTY OF CHEMICAL AND FOOD TECHNOLOGY

needronix

ORBISYS

ÚEF SAV

IEP SAS SPACE PHYSICS

STU MTF SLOVAK UNIVERSITY OF TECHNOLOGY IN BRATISLAVA FACULTY OF MATERIALS SCIENCE AND TECHNOLOGY IN TRNAVA

STU FEI

ATRI Advanced Technologies Research Institute

MINISTERSTVO ŠKOLSTVA, VEDY, VÝSKUMU A ŠPORTU SLOVENSKEJ REPUBLIKY

International Laser Centre

TILA

AIUB

ÖAW

PECS SLOVAKIA SUCCESS STORIES

ÚJFI ÚSTAV JADROVÉHO A FYZIKÁLNEHO INŽINIERSTVA

touch4IT

YMS

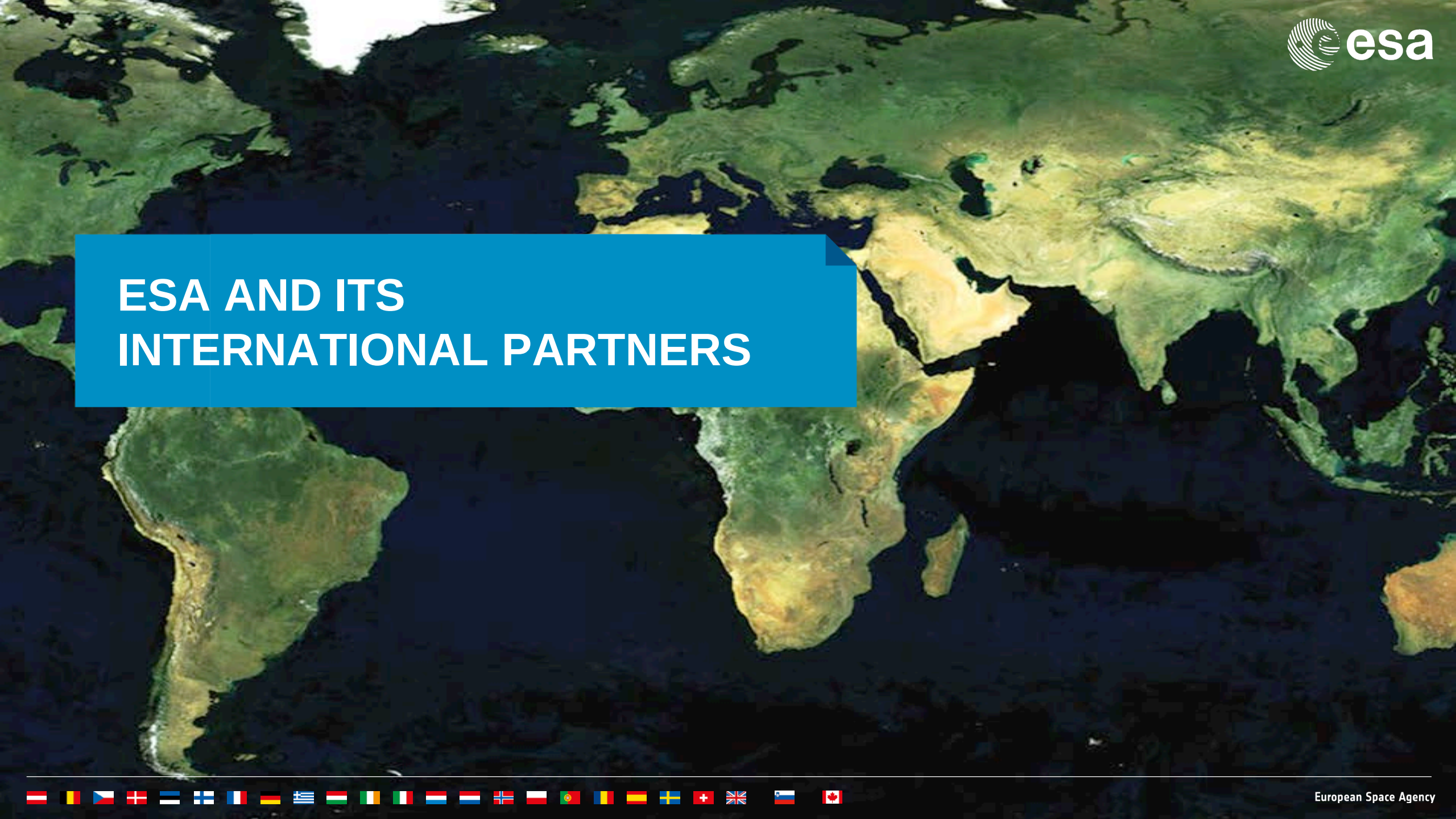
institute of materials & machine mechanics slovak academy of sciences

ABmerit NUCLEAR SCIENCE AND SOFTWARE

BioX technologies

ÚSTAV GEOGRAFIE Prírodovedecká fakulta UPJŠ v Košiciach

European Space Agency



ESA AND ITS INTERNATIONAL PARTNERS

United space in Europe – ESA and the EU

As confirmed in the ‘Joint Statement on Shared Vision and Goals for the Future of European Space’, signed by the ESA Director General and the European Commission in October 2016, ESA and the EU share three core goals for the future:

- To maximise the integration of space into European society and economy;
- To foster a globally competitive European space sector;
- To ensure European autonomy in accessing and using space in a safe and secure environment.

Cooperation between ESA and the EU

Policy coordination:

- Since 2004 the ESA/EU Framework Agreement has been the basis for cooperation between ESA and the EU (extended in 2016 until 2020).
- Article 189 of the Lisbon Treaty of 2009 gave mandate to the EU to develop a ‘European’ space policy, providing that it should establish appropriate relations with ESA.
- ESA/EU ministerial-level meetings and related resolutions provide directions and guidelines for policy development.

EU/ESA space programmes and R&D activities:

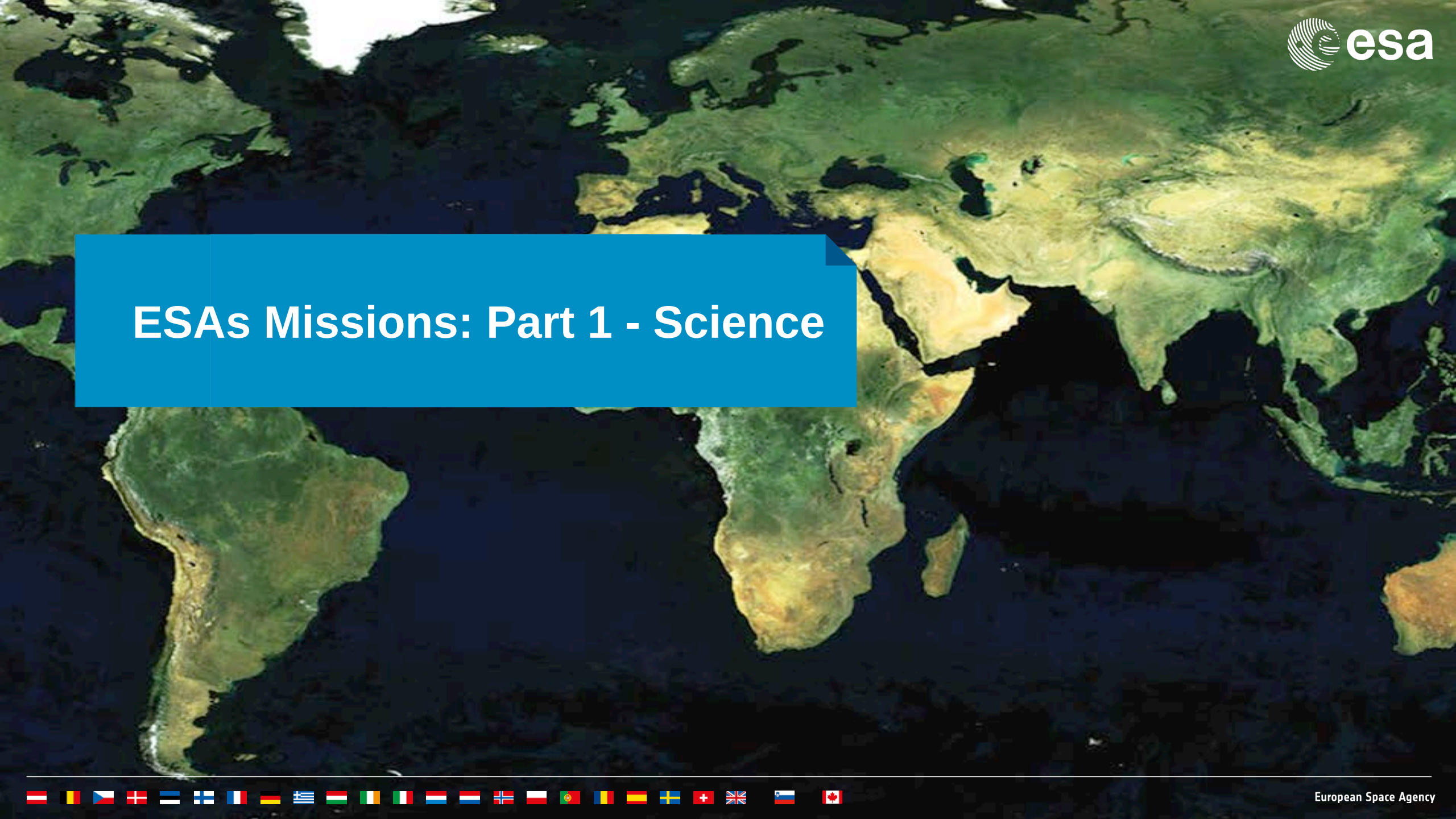
- ESA is implementing two flagship programmes for the EU:
  - Galileo
  - Copernicus
- Horizon 2020 − ESA provides support to the EU in its implementation of space research and technology objectives.
- Defence and Space − ongoing coordination between ESA, EC and EDA through different channels.

Strong ties all over the world

Partnership: one of ESA's key words

As a European research and development organisation, ESA is a programmatically driven organisation, i.e. the international cooperation is driven by programmatic needs and rationale.

- Strategic partnerships with: USA, Russia and China.
- Long-standing cooperation with Japan, India, Argentina, Brazil, Israel, South Korea, Australia and many more…
- EU Members, but not ESA Member States: enhanced cooperation and joint activities.
  - European Cooperating States with PECS programme (ECS): Bulgaria, Cyprus, Latvia, Lithuania and Slovakia.
  - Cooperating States: Malta. Discussions are ongoing with Croatia.



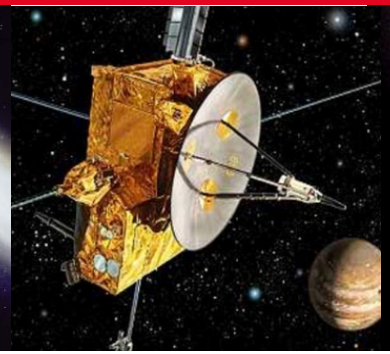
ESAs Missions: Part 1 - Science

MAIN PIONEERS OF SPACE SCIENCE

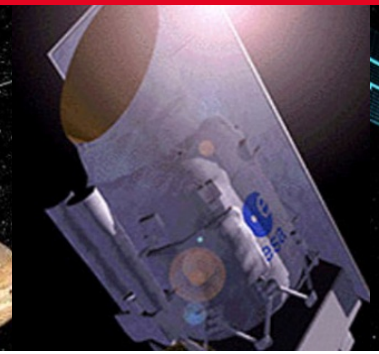
- **Giotto** (1986–1992) first European deep space mission and first to image a comet nucleus
- **Ulysses** (1990–2009) the first spacecraft to fly over the Sun's poles
- **ISO** (1995–8) the first European infrared observatory
- **SMART-1** (2003–6) first European mission to the Moon
- **Planck** (2009–13) detecting first light of the Universe and looking back to the dawn of time
- **Herschel** (2009–13) unlocking the secrets of star birth and galaxy formation and evolution
- **Venus Express** (2005–14) first global investigation of dynamic atmosphere of Venus

Giotto

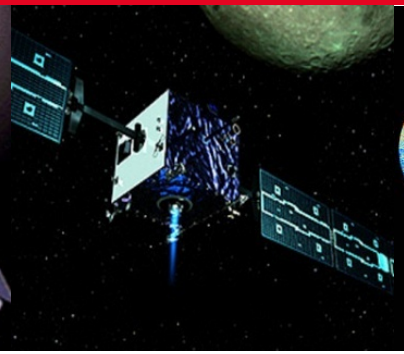
Ulysses



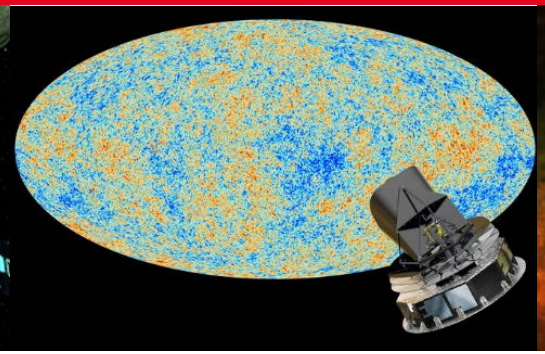
ISO



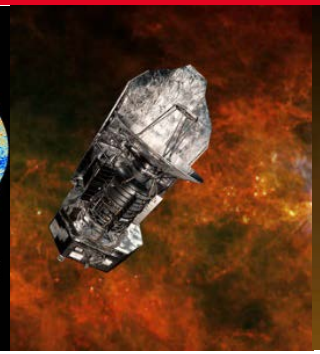
SMART-1



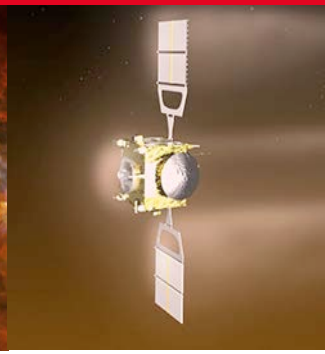
Planck



Herschel



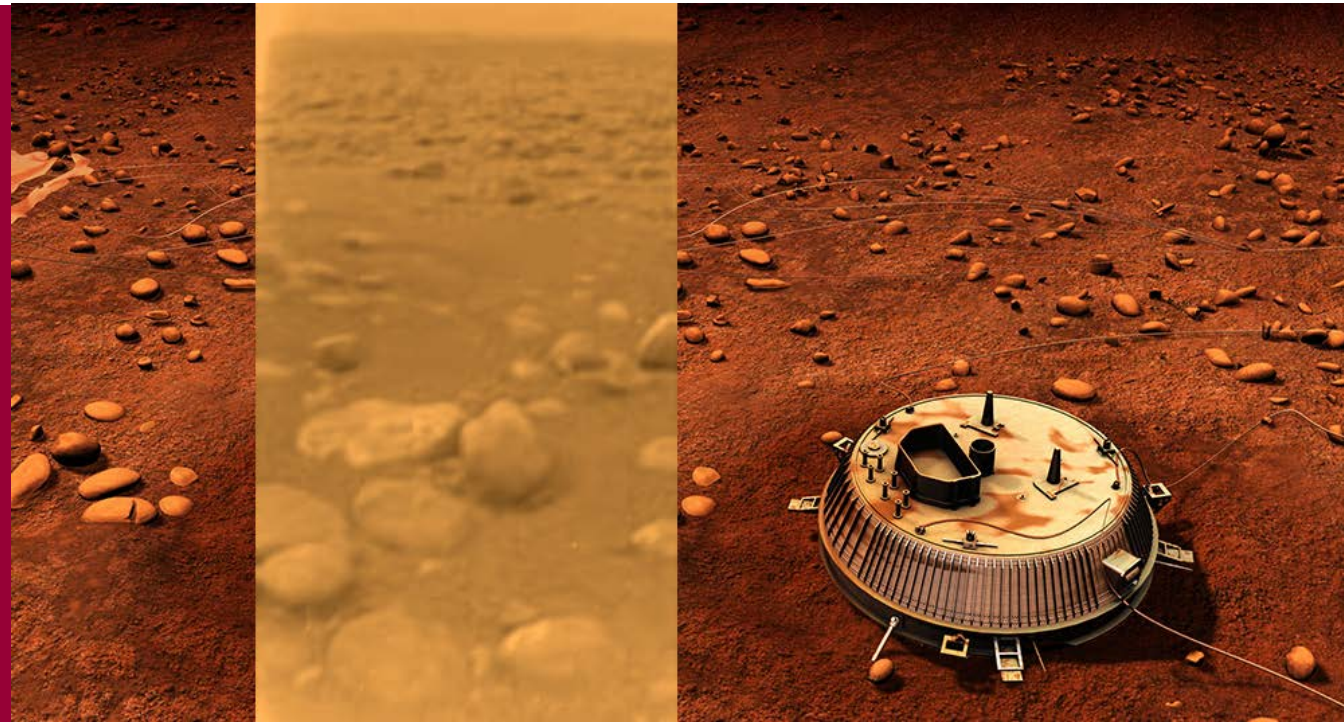
Venus Express



HUYGENS

First landing on a world in the outer Solar System

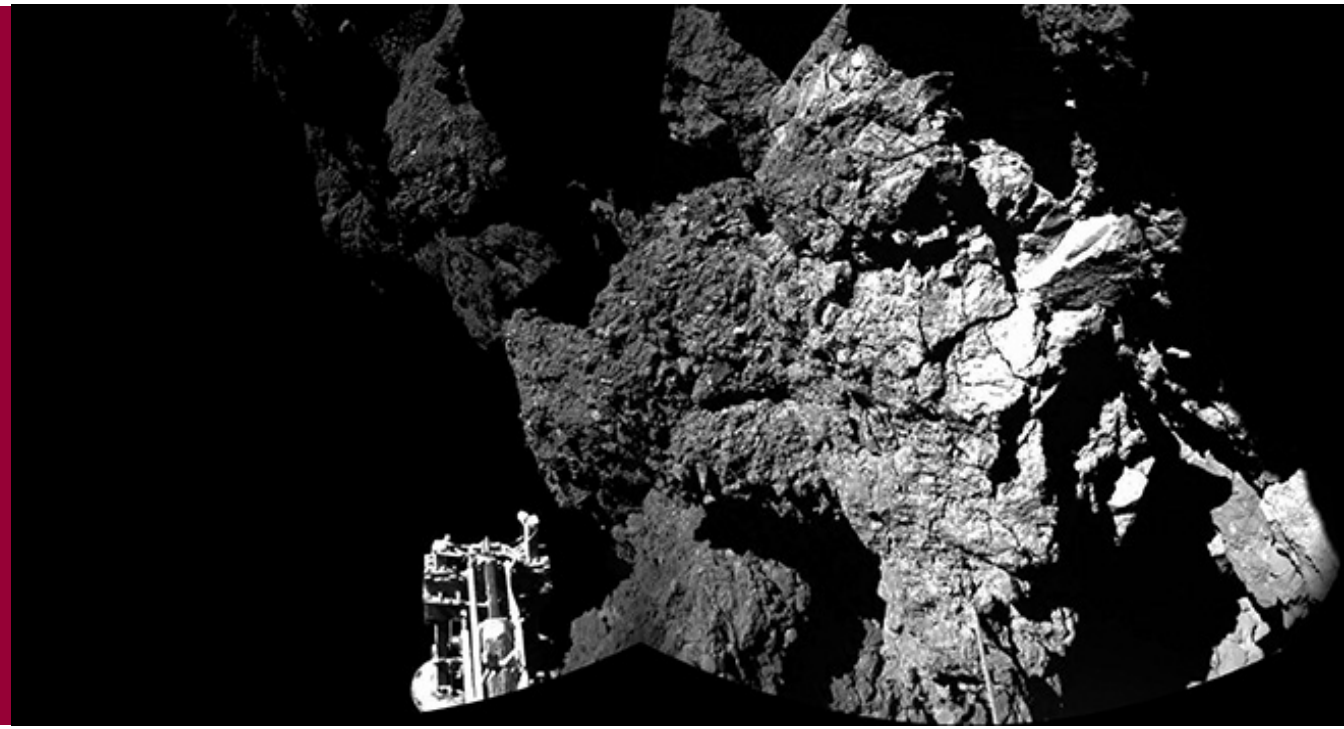
On 14 January 2005, ESA's **Huygens** probe landed on **Titan**, Saturn's largest moon



ROSETTA

First rendezvous, orbit and soft-landing on a comet

- 6 August 2014: ESA's Rosetta is **first spacecraft to rendezvous with a comet**
- 12 November 2014: its Philae probe made the **first soft-landing on a comet** and returned data from the surface

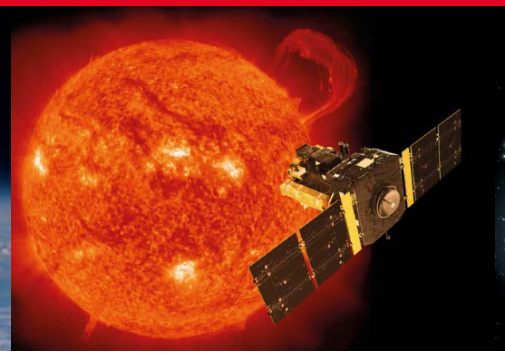


SOME OF TODAY'S SCIENCE MISSIONS

- **Hubble** (1990–) orbiting observatory for ultraviolet, visible and infrared astronomy (with NASA)
- **SOHO** (1995–) studying our Sun and its environment (with NASA)
- **XMM-Newton** (1999–) solving the mysteries of the X-ray universe
- **Mars Express** (2003–) studying Mars and its moons from orbit
- **Gaia** (2013–) mapping a thousand million stars in our galaxy
- **BepiColombo** (2018–) – on its way to Mercury (with JAXA)

Hubble

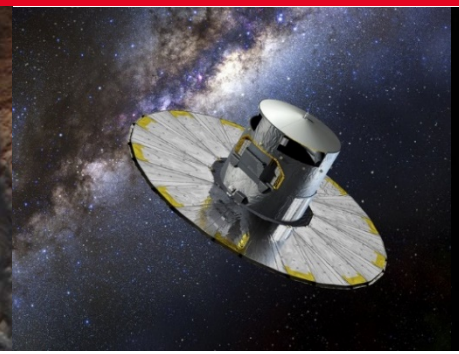
SOHO



XMM-Newton

Mars Express

Gaia

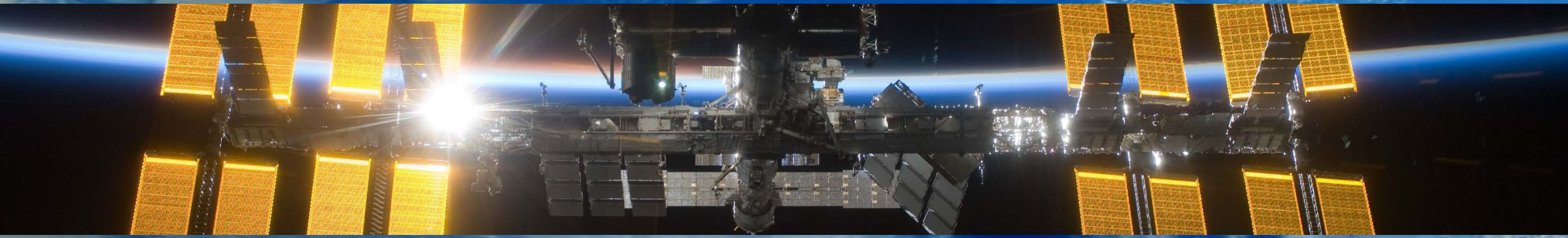


BepiColombo

ESAs Missions: Part 2 – Human and Robotic Exploration

EUROPEAN EXPLORATION ENVELOPE PROGRAMME (E3P)

- **SciSpacE** – Science in Space Environment
- **International Space Station** – Operations expected until 2030
- **European Service Module** – Flying crews to the Moon with Orion (2022)
- **The Lunar Gateway** – Participation in the US-led lunar orbital outpost (2024)
- **Luna-Resource Lander** – Contributions to Russian-led Luna-27 Lander (2024)
- **Mars** – Trace Gas Orbiter and ExoMars2020 rover mission; Mars Sample Return Mission
- **ExPeRT** – Exploration Preparation, Research and Technology



HRE

INTERNATIONAL SPACE STATION (ISS)

The ISS unites USA, Russia, Japan, Canada and Europe in one of the largest partnerships in the history of science. Crews of six astronauts conduct research into life and physical sciences and applications, and prepare for future human exploration missions. Europe's key contribution is the **Columbus** laboratory. It provides a substantial part of the ISS's research capability, specialising in fluid physics, materials science and life sciences. European industry has also provided almost 50% of the pressurised part of the ISS, including **Cupola**, **Node-2** and **Node-3**.

HRE

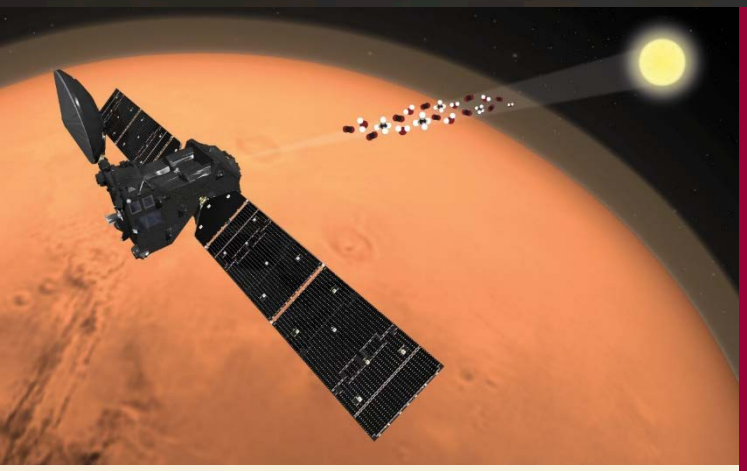
LATEST GENERATION OF ESA ASTRONAUTS

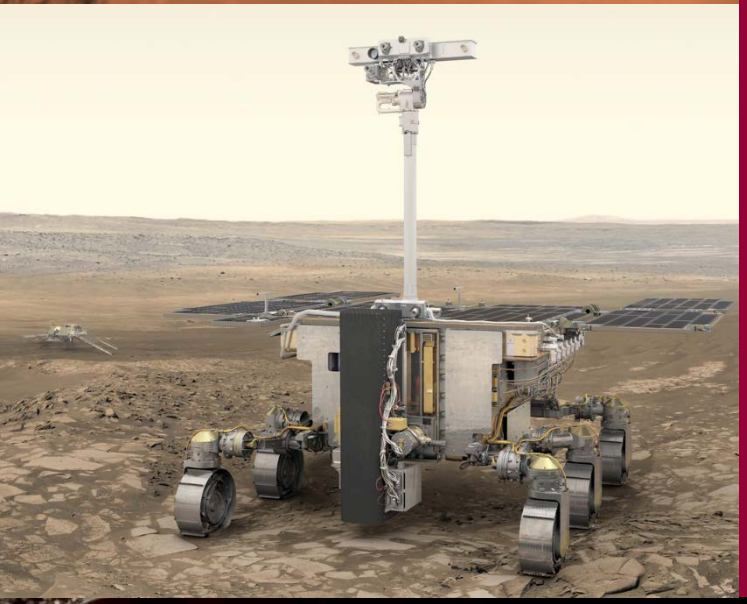
Based at the European Astronaut Centre (EAC), Cologne, Germany:

Luca Parmitano (IT), 2013 and upcoming 2019
Alexander Gerst (DE), 2014 and 2018
Samantha Cristoforetti (IT), 2014
Andreas Mogensen (DK), 2015
Tim Peake (UK), 2015-16
Thomas Pesquet (FR), 2016-17
Matthias Maurer (DE), began training in 2017

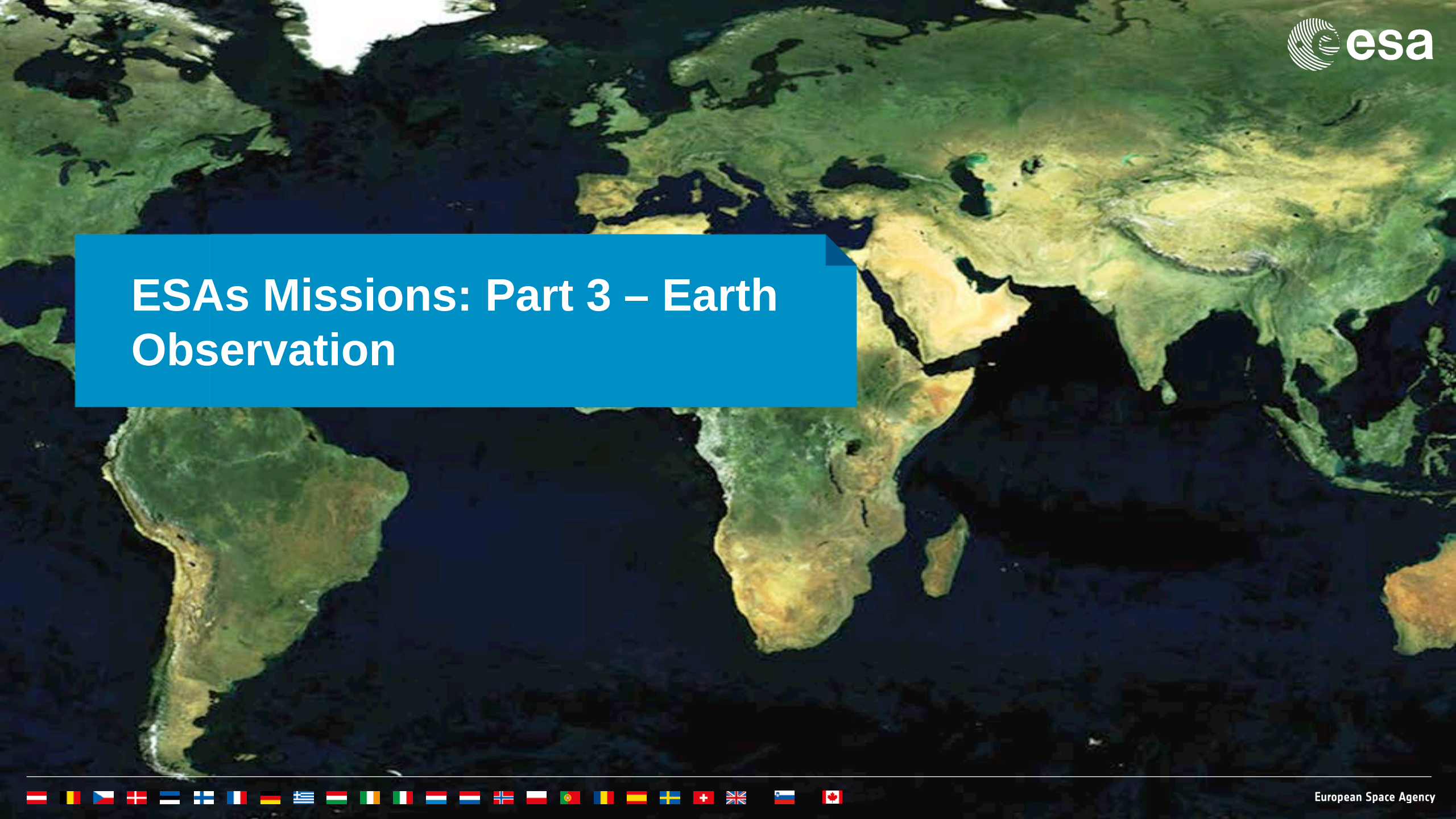
Back: Tim, Andreas, Alex, Luca; Front: Samantha, Thomas, Matthias ▷

ROBOTIC MARS EXPLORATION: EXOMARS





- The ExoMars Trace Gas Orbiter main science mission started in 2018.
- The ExoMars rover and surface science platform will be launched in 2020 and arrive at Mars in 2021.
- A carrier module will fly them to Mars and they will descend through the planet's atmosphere in a descent module.
- Both missions carry European and Russian hardware and scientific instruments, with ESA and Roscosmos cooperating closely in their scientific exploitation.



ESAs Missions: Part 3 – Earth Observation

Earth Observation Envelope Programme

esa

Scientific & Societal Challenges

Excellence & Innovation

Industrial Competitiveness

Bringing Earth Observation to Society

EARTH EXPLORERS

- **GOCE** (2009–13) studying Earth's gravity field
- **SMOS** (2009–) studying Earth's water cycle
- **CryoSat-2** (2010–) studying Earth's ice cover
- **Swarm** (2013–) three satellites studying Earth's magnetic field
- **Aeolus** (2018) studying global winds
- **EarthCARE** (2021) studying Earth's clouds, aerosols and radiation (ESA/JAXA)
- **Biomass** (2021) studying Earth's carbon cycle
- **FLEX** (2022) studying photosynthesis
- **Earth Explorers 9** & **10** to be selected

EOP

METEOROLOGICAL MISSIONS

MTG ▷

MetOp-SG ▷

Meteosat Second Generation (2002–)**:** series of 4 geostationary satellites providing images of Earth.

Meteosat Third Generation (2021–): series of 6 geostationary satellites providing images and atmospheric sounding.

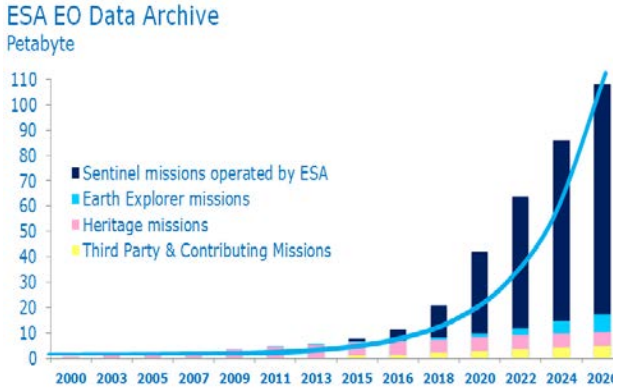
MetOp (2006–): series of 3 satellites providing operational meteorological observations from polar orbit.

MetOp Second Generation (2022–): series of 2 polar-orbiters, continuing and enhancing meteorological, oceanographic and climate monitoring observations from the first MetOp series.

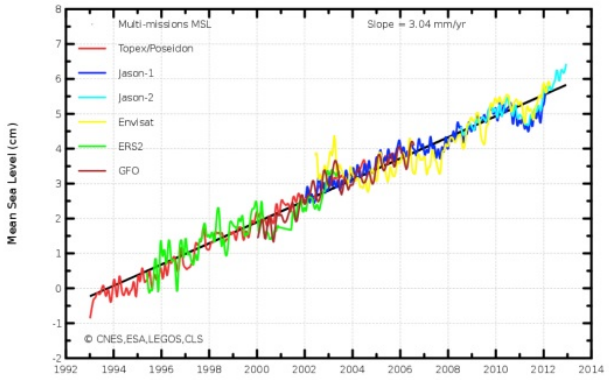
COPERNICUS SPACE COMPONENT: THE SENTINELS

- **Sentinel-1** – land and ocean services, Sentinel-1A launched in 2014, Sentinel-1B in 2016
- **Sentinel-2** – land monitoring, Sentinel-2A launched in 2015, Sentinel-2B in 2017
- **Sentinel-3** – ocean forecasting, environmental and climate monitoring, Sentinel-3A launched in 2016, Sentinel-3B in 2018
- **Sentinel-4** – atmospheric monitoring payload (2021)
- **Sentinel-5** – atmospheric monitoring payload (2021)
- **Sentinel-5 Precursor** – atmospheric monitoring launched in 2017
- **Sentinel-6** – oceanography and climate studies (2020)

Big Data Challenges



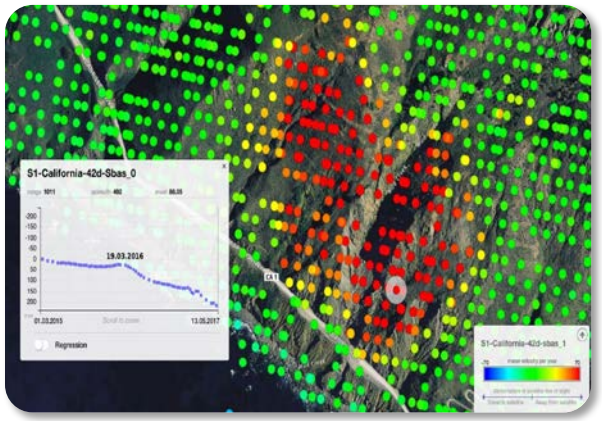
Data volume



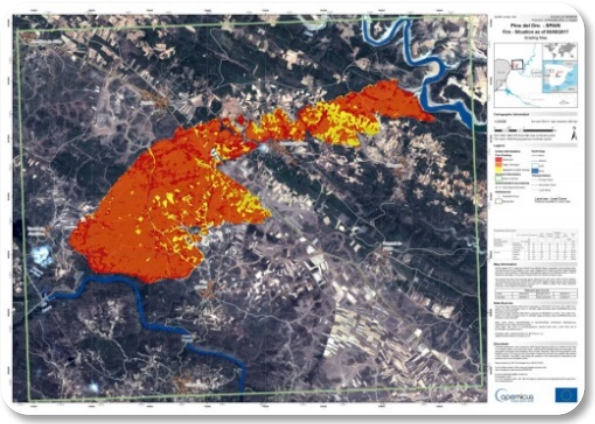
Data continuity

Data sharing

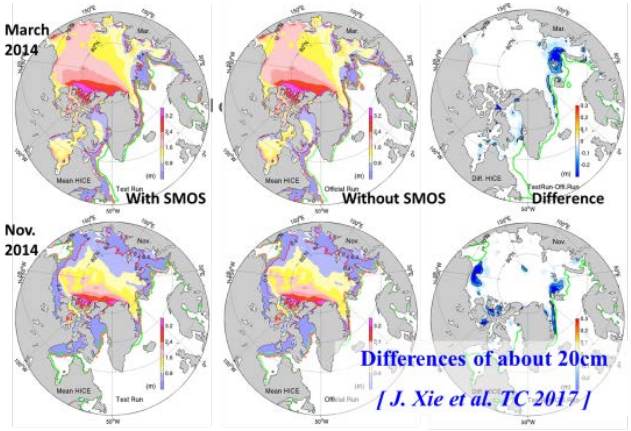
Data quality



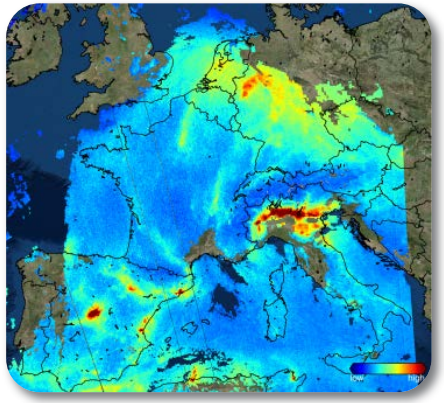
Innovation



Timeliness



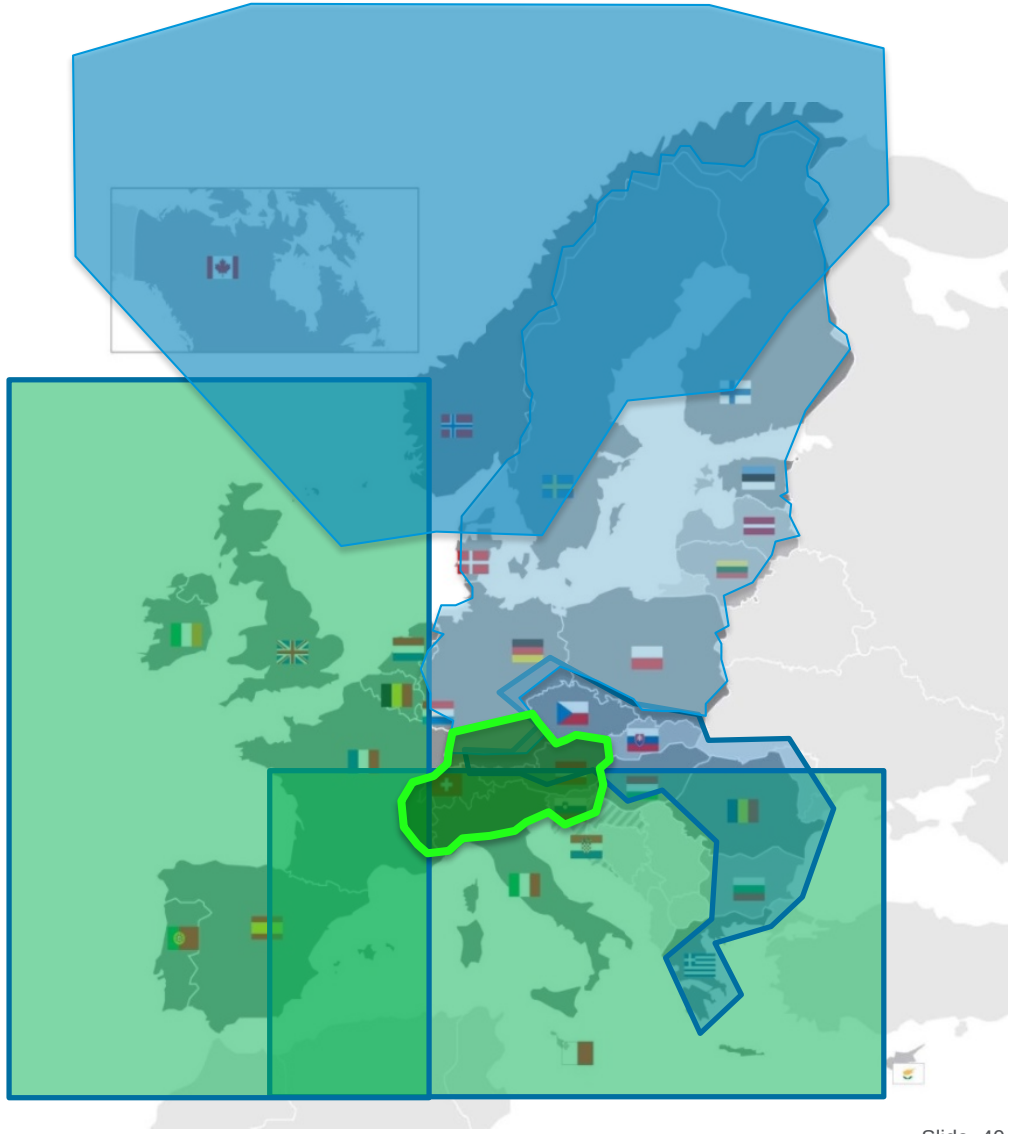
Mission synergies



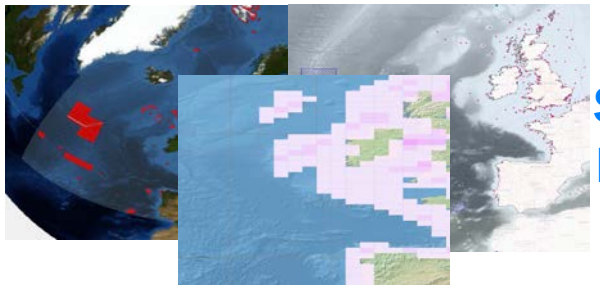
Uniqueness

REGIONAL INITIATIVES

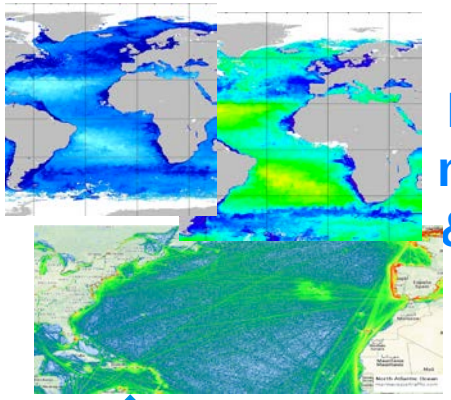
- Set of coordinated activities: **science, public sector, industry growth and infrastructure components**
- **Focus on regional priorities** with high interest for Member States;
- Initial regions: Baltic, Black-sea/Danube, Atlantic, Alps, Mediterranean, Mainly driven by interest of Member States;
- **Link with existing regional institutions, H2020 activities and initiatives**: e.g., Atlantic Ocean Research Alliance, Baltic Earth, BONUS, Black Sea Commission, Danube Delta Commission, etc…



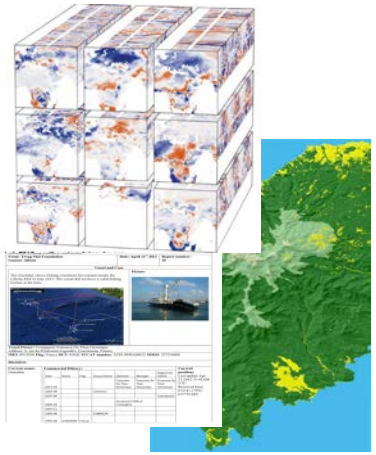
What does this enable?



Support to National & Regional Reporting

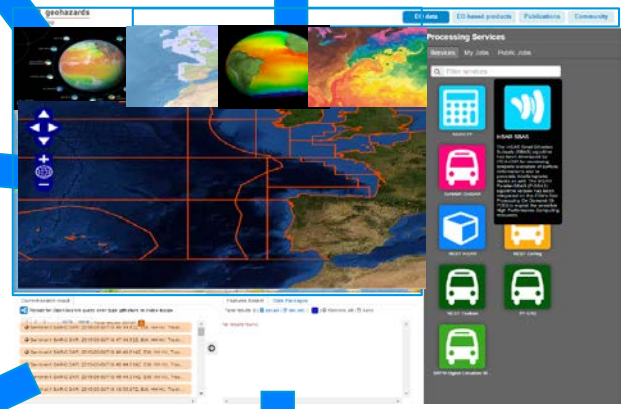


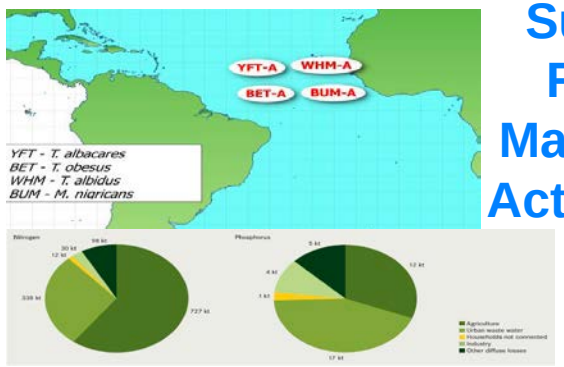
Data access, management & processing



Routine Monitoring & Analysis/ Reference Datasets

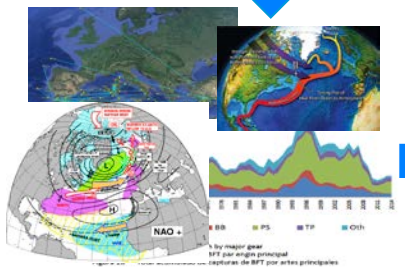
Communication, Education and Citizen Engagement





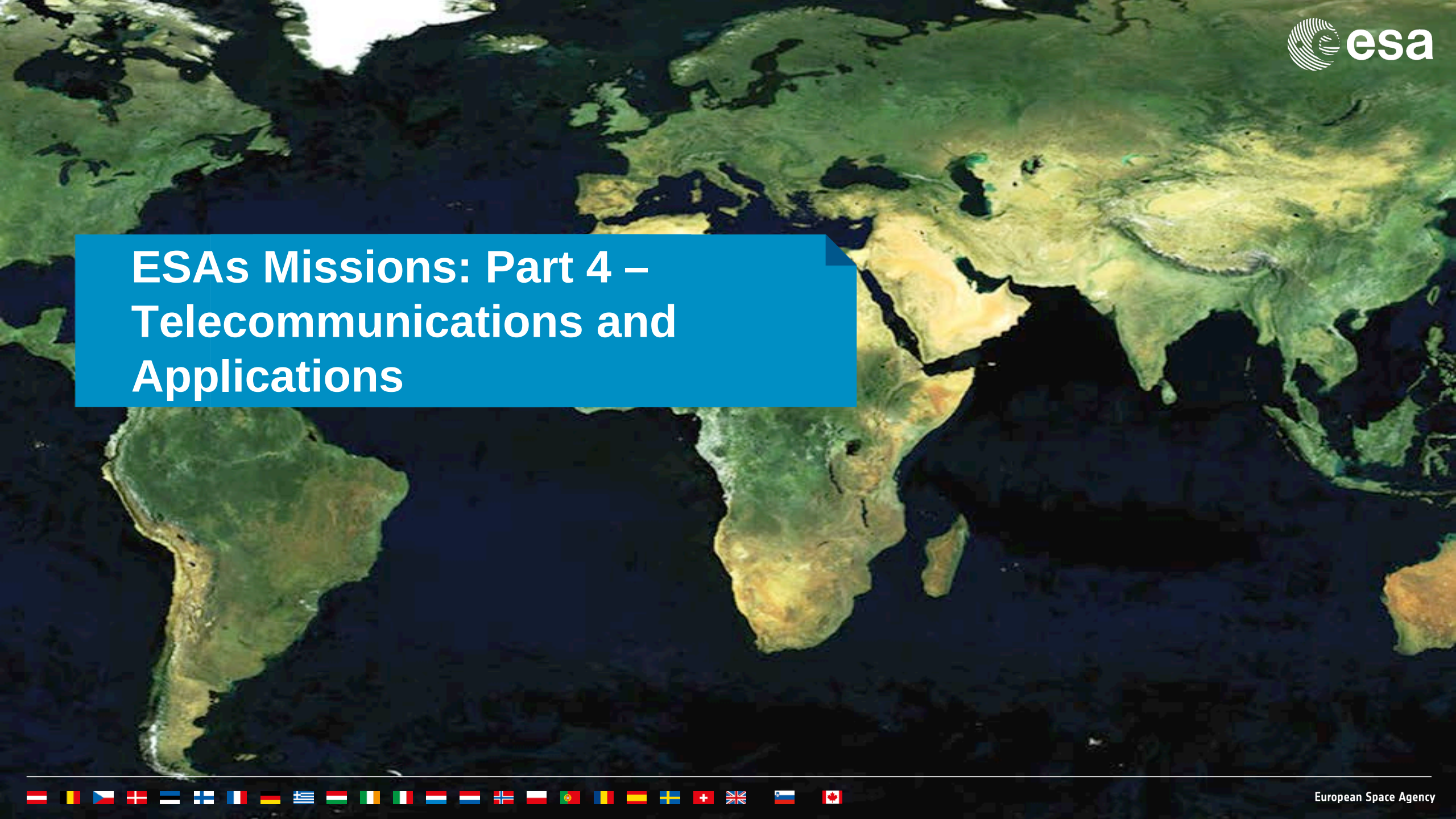
Support to Regional Management Actions/Plans

Development of Customized Regional Applications & Services



Support to Regional Earth Science Research

Support to Regional Cooperation Initiatives



ESAs Missions: Part 4 – Telecommunications and Applications

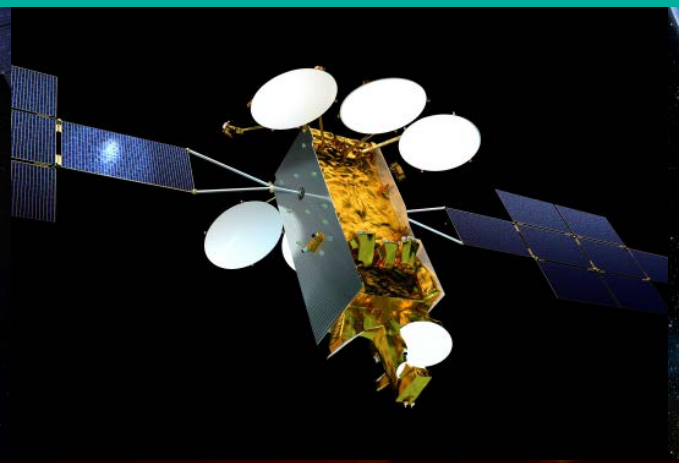
ARTES SATELLITE PLATFORMS

- **SmallGEO** – for the 3-tonne market, with OHB (first launch on Hispasat's H36W-1, 2017)
- **Spacebus Neo** and **Eurostar Neo** – for the 3- to 6-tonne market, with Thales Alenia Space and Airbus Defence and Space (first launches from 2019 through 2021)
- **Electra** – first fully electric propulsion OHB satellite (first launch for SES in 2021)

▽ SmallGEO

▽ Spacebus Neo

▽ Eurostar Neo

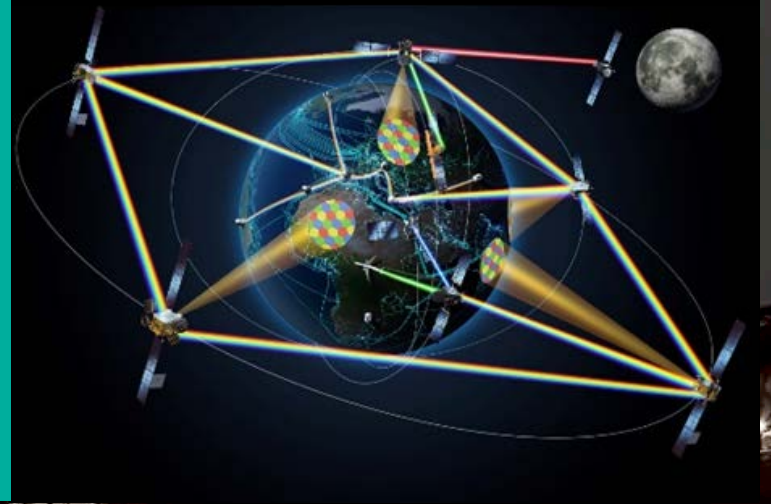


▽ Electra

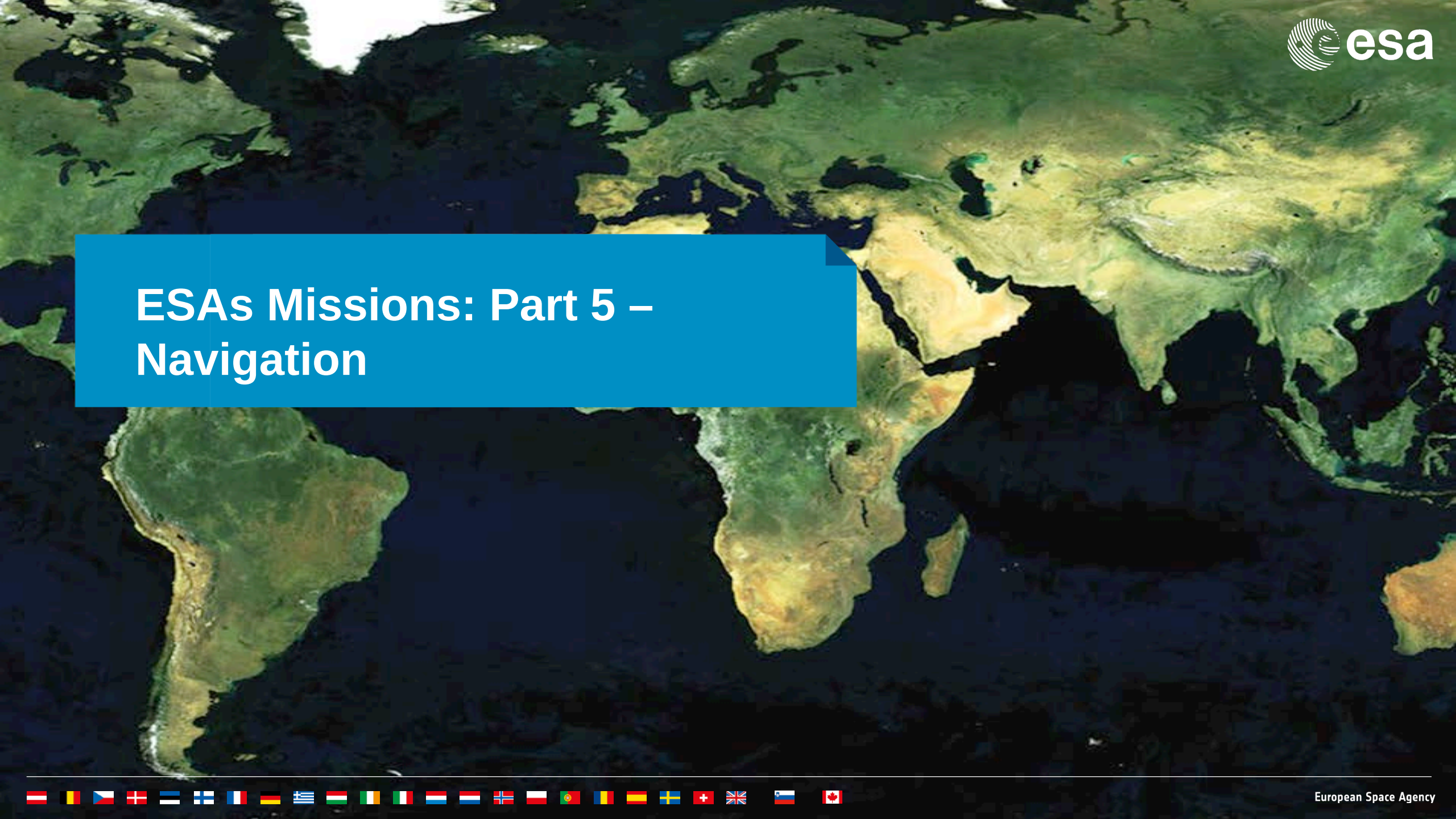
ARTES INNOVATION AND NEW TECHNOLOGY

Quantum ▷

EDRS ▷



- **EDRS** – first launch, 2016; second launch, 2019
- **Quantum** – 2019/20
- **ScyLight** – includes HydRON, a high throughput “fibre in the sky”
- **Novacom** – partnerships with primes/integrators for next-generation satcom systems
- **4S** – Space System for Safety and Security



ESAs Missions: Part 5 – Navigation

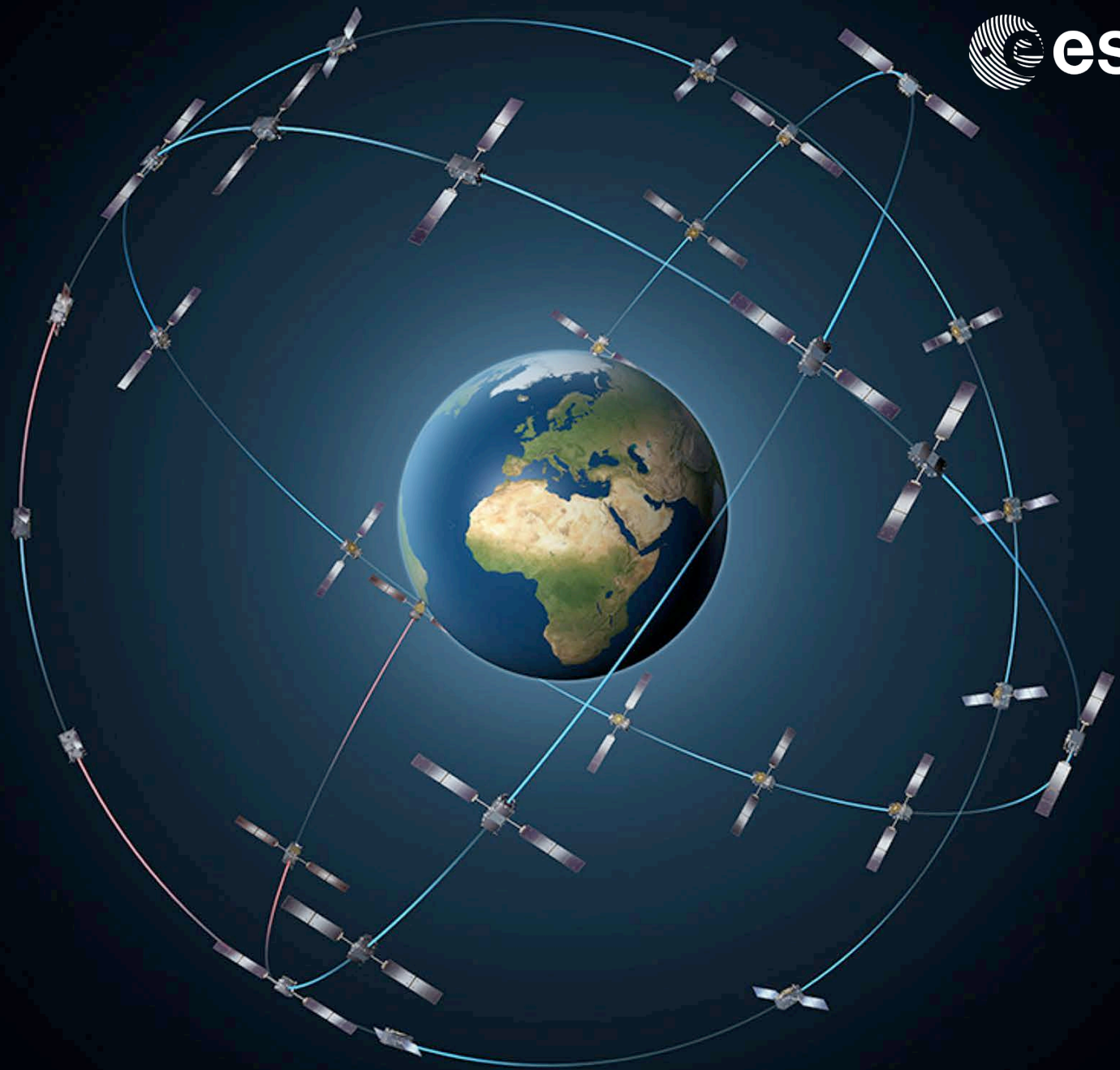
GALILEO: ‘MADE IN EUROPE’

Putting Europe at the forefront of this strategically and economically important sector, **Galileo** will provide a highly accurate, guaranteed global positioning service under civilian control.

Full Operational Capability – 26 satellites now in orbit.

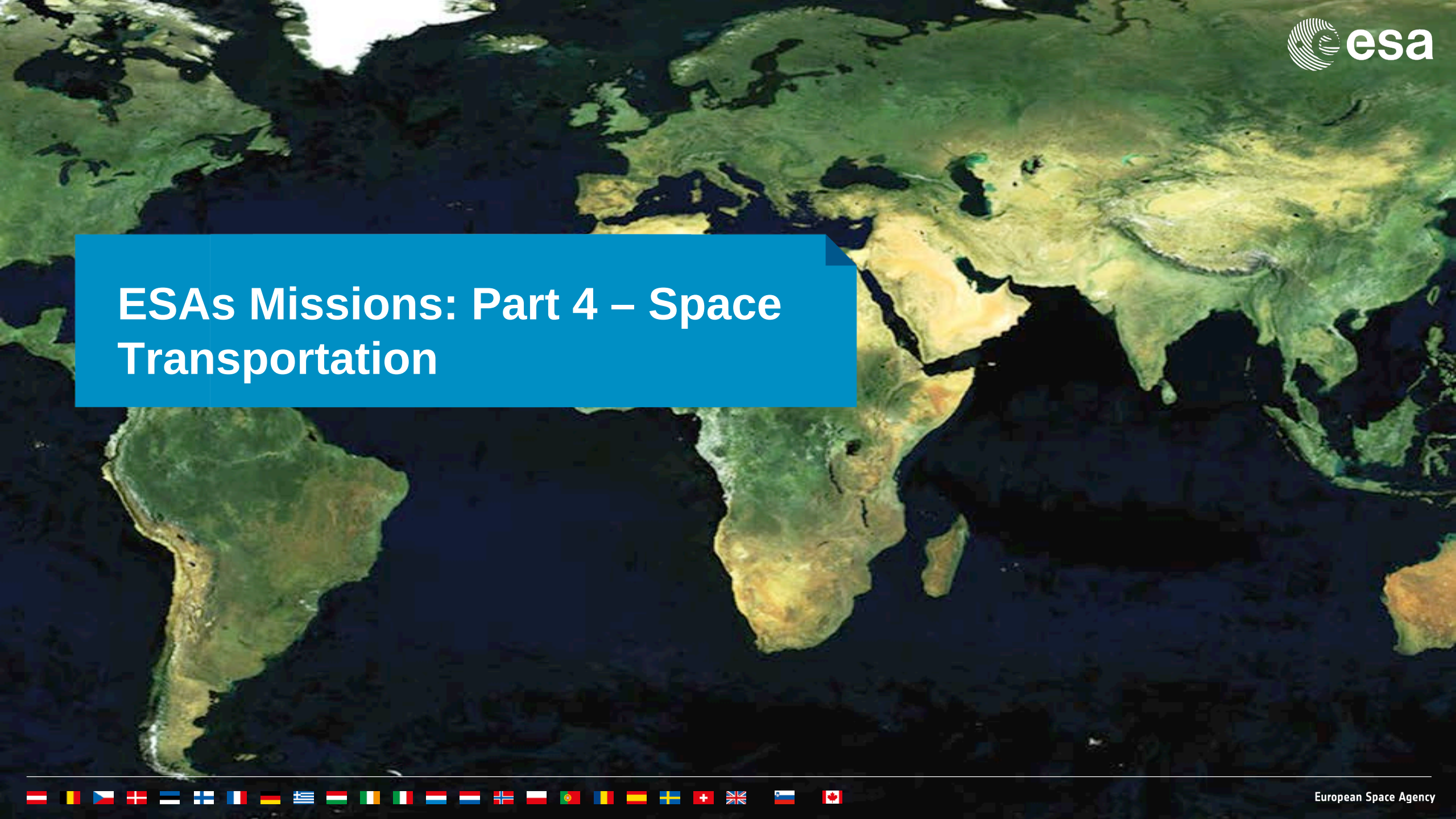
ESA is the system architect for Galileo, managing its design, development, procurement, deployment and validation on behalf of the EU. The European GNSS Agency is designated by the European Commission to run the system and provide Galileo services.

Dec 2016 – start of Galileo Initial Services



EGNOS, GALILEO APPLICATIONS AND NAVISP

- Since 2010, EGNOS has been improving accuracy and augmenting GPS, offering safety-critical applications for aviation users.
- Galileo is expected to spawn a wide range of applications, based on positioning and timing for transport by road, rail, air and sea, infrastructure and public works management, agricultural and livestock management and tracking, e-banking and e-commerce.
- It will be a key asset for public services, such as rescue operations and crisis management.
- With the new ESA Navigation Innovation and Support Programme (NAVISP), research will focus on integration of space and terrestrial navigation and new ways to improve GNSS.



ESAs Missions: Part 4 – Space Transportation

THE EUROPEAN LAUNCHER FAMILY

The **Ariane** and **Vega** launch vehicle families developed by ESA guarantee European autonomous access to space.

Their development and successful exploitation is an example of how space challenges European industry and provides precious expertise.

Ariane is one of the most successful launcher series in the world. Complemented by Vega (since 2012) and **Soyuz** (since 2011), they are all launched from Europe's Spaceport in French Guiana.

STS

EUROPE'S SPACEPORT

European launchers lift off from **Europe's Spaceport** in **French Guiana**.

The launch range is co-funded by ESA and France and is operated by the French space agency CNES.

The launch infrastructure for the Ariane 5, Vega and Soyuz launchers at CSG is owned by ESA, maintained and operated by Arianespace, with the support of European industry.

STS

SPACE TRANSPORTATION & TECHNOLOGY OF THE FUTURE: ARIANE 6 AND VEGA C

- **Ariane 6** – modular three-stage launcher with two configurations, using two (A62) or four boosters (A64)
- **Vega C** – evolution of Vega with increased performance and same launch service cost
- common solid rocket motor for Ariane 6 boosters and Vega C first stage
- new governance for Ariane 6 development and exploitation allocating increased roles and responsibilities to industry
- Vega C and Ariane 6 first flights – 2020

ESA PECS Briefing to Industry

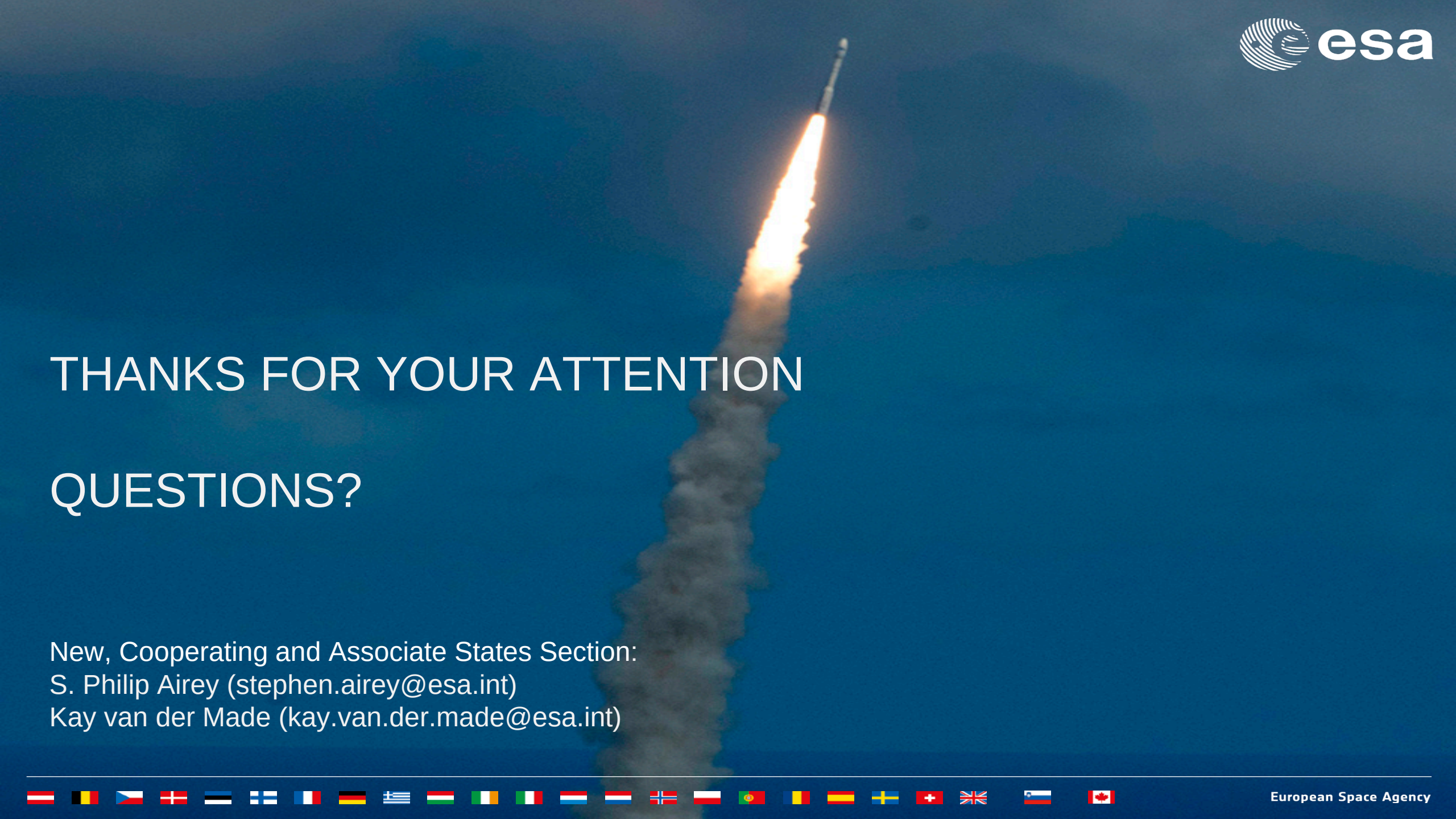
SK5 Briefing is tomorrow (19/9/2019):

9:30-13:15 @ MŠVVaŠ SR Centrum vedecko-technických informácií SR

Lamačská cesta 8/A Bratislava

The briefing announces the annual PECS invitation to tender details and tells you:

- The key dates (e.g. proposal submission dates)
- Where to get the ITT documents
- The programmatic constraints (what is covered, what not, financial envelopes)
- How to write a proposal (and what NOT to do)
- How they will be marked and the process to be followed
- Offers you the chance to talk directly to ESA about your ideas.



THANKS FOR YOUR ATTENTION

QUESTIONS?

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