

THE EUROPEAN SPACE AGENCY

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“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**

- **Over 30 years of experience**
- **18 Member States**
- **Five establishments, about 2000 staff**
- **3 600 million Euro budget (2009)**
- **Over 60 satellites designed and tested**
- **More than 10 scientific satellites in operation**
- **Five types of launcher developed**
- **Over 180 launches made**

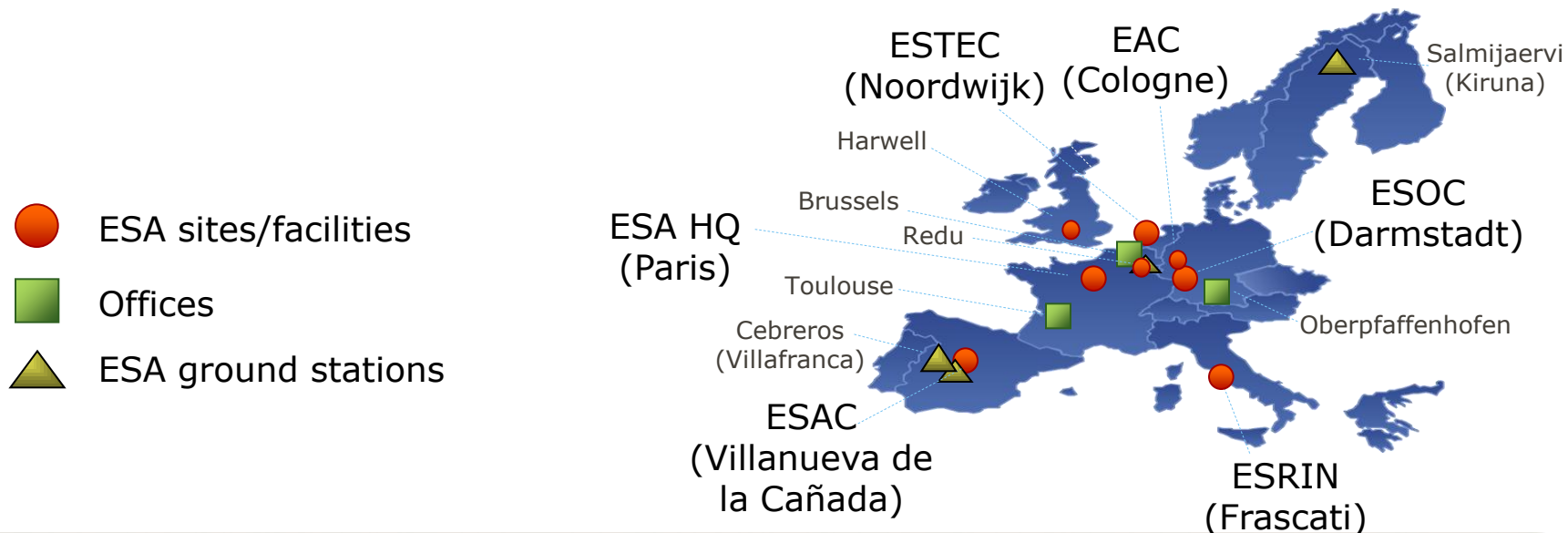


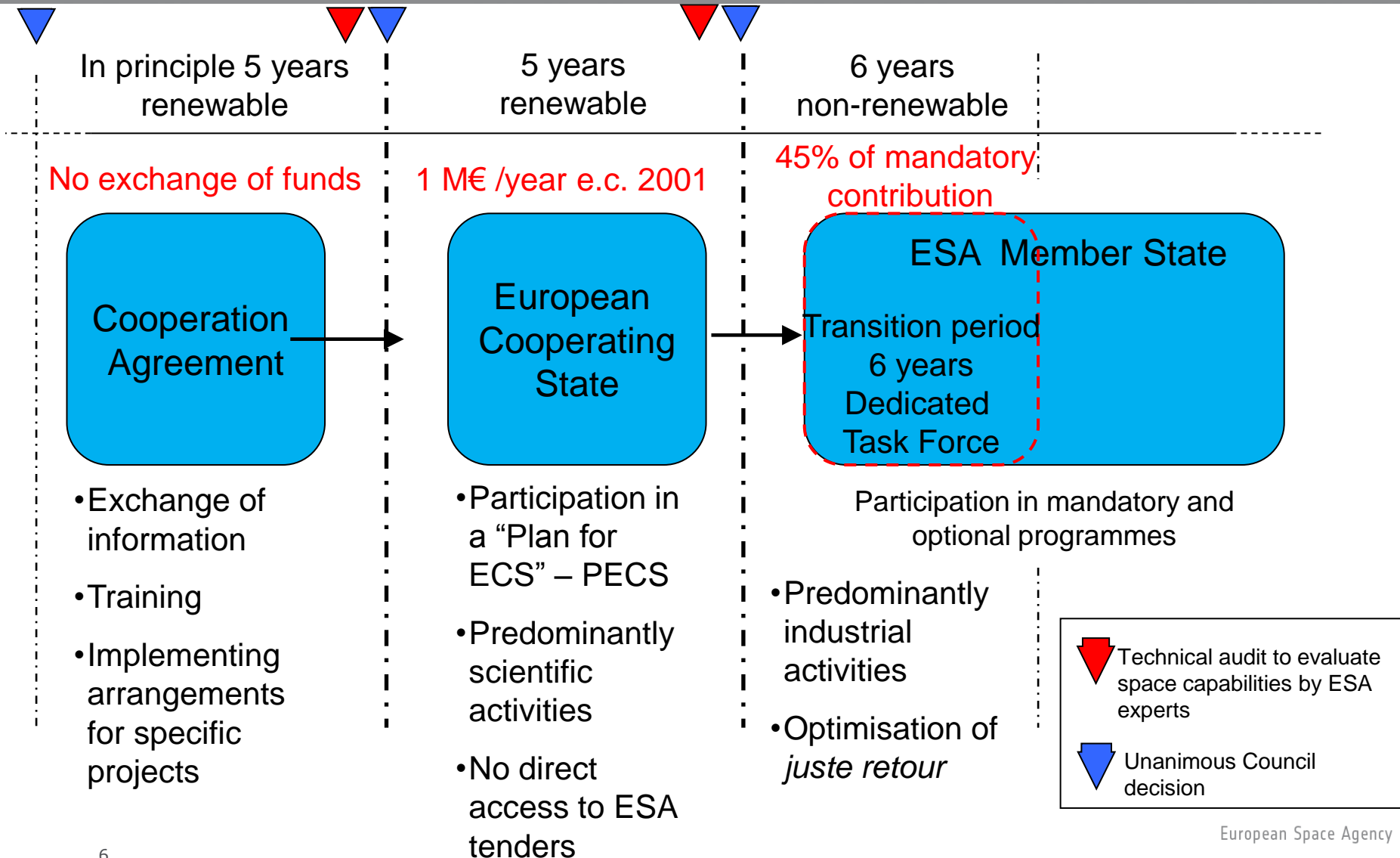
18 MEMBER STATES

- Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Norway, Netherlands, Portugal, Spain, Sweden, Switzerland and the United Kingdom.
- Canada takes part in some projects under a Cooperation Agreement.
- Hungary, Romania and Poland are European Cooperating States.
- Slovenia and Estonia are in the process of becoming European Cooperating States.
- Cyprus, and Latvia have recently signed Cooperation Agreements with ESA.



ESA'S LOCATIONS





All Member States participate (on a GNP basis) in activities related to space science and a common set of programmes (**Mandatory** programmes).

In addition, Member States choose their level of participation in **Optional** programmes.

Mandatory

- General Budget: Future studies, technological research, education, common investments (facilities, laboratories, basic infrastructure)
- Science: Solar System science, astronomy and fundamental physics

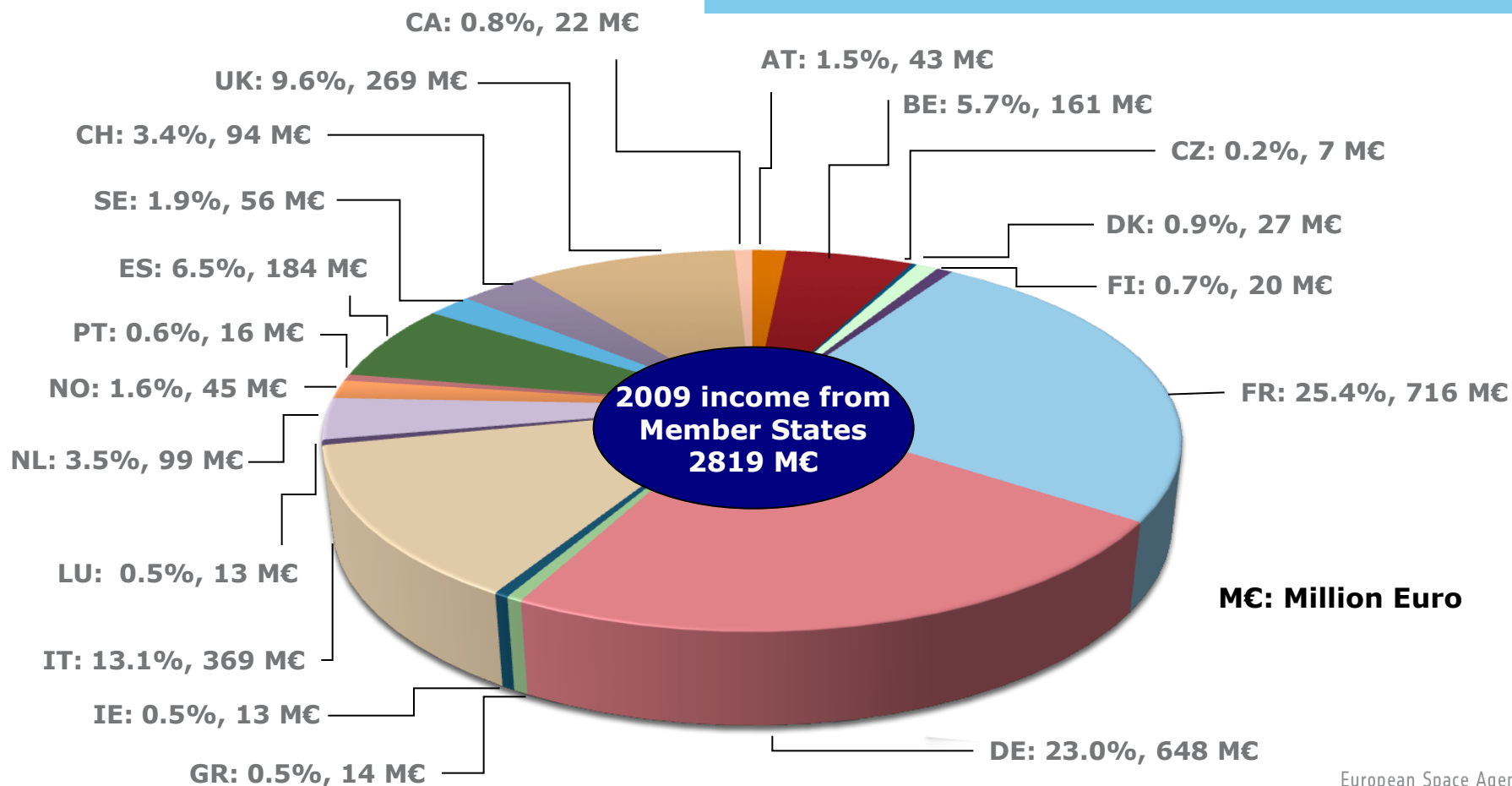
Optional

- Human spaceflight
- Telecommunications
- Earth observation
- Launchers
- Navigation
- Robotic exploration
- Space Situational Awareness

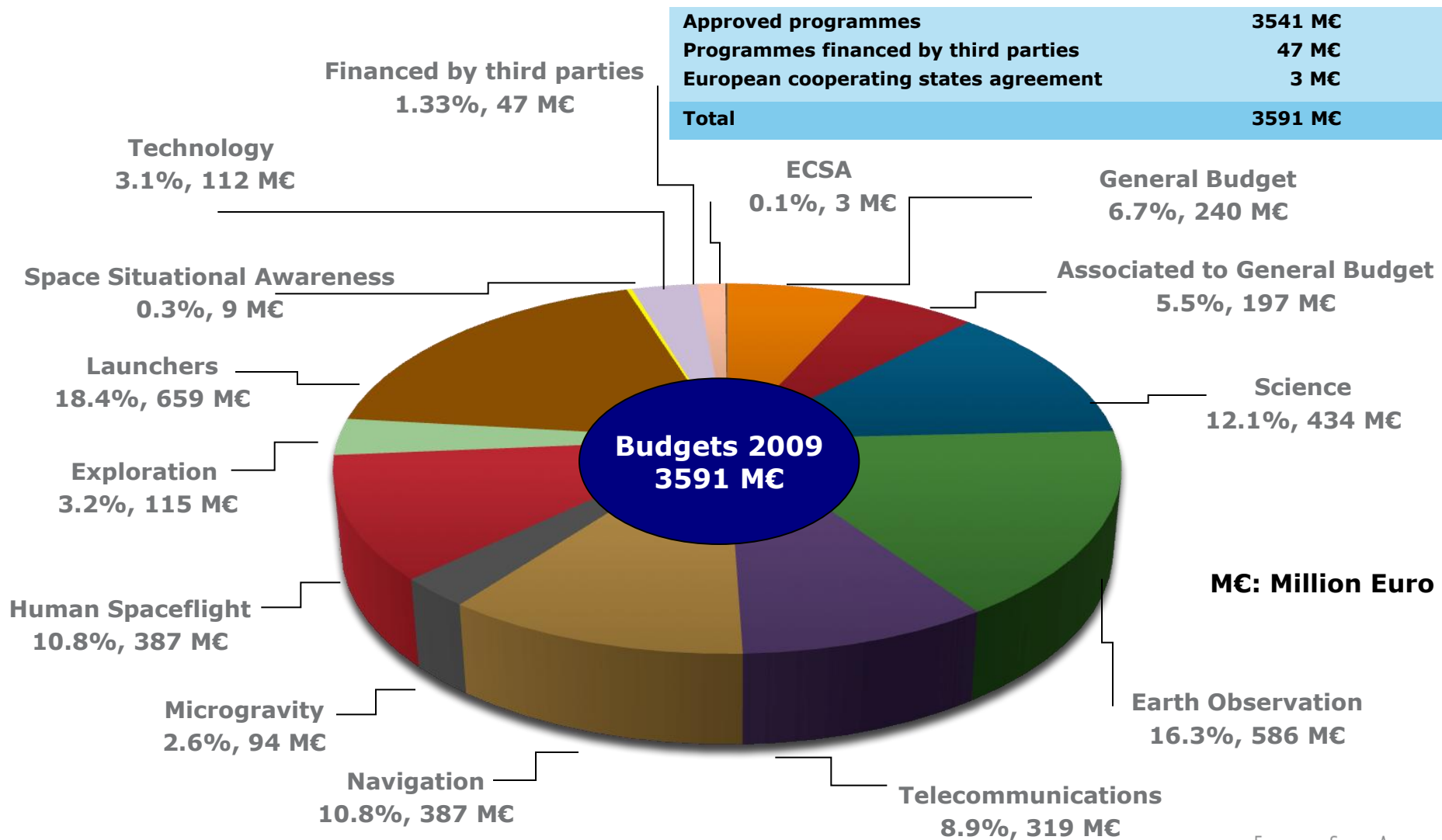
ESA BUDGET FOR 2009



Income from Member States and other states	2819 M€
Income from Member States, previous years	352 M€
Other income	420 M€
Total	3591 M€



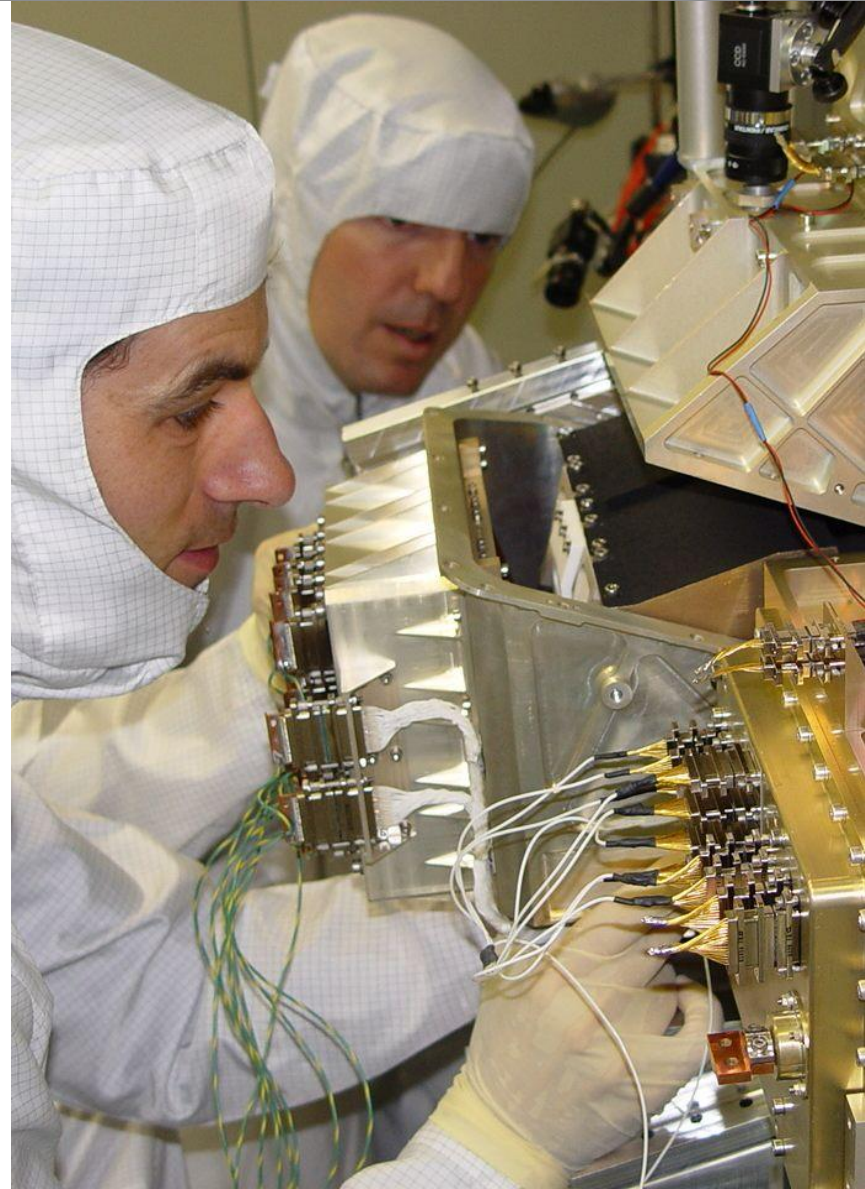
ESA BUDGET BY PROGRAMME (2009)



About 90% 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.



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

Navigation: Galileo (with EU)

Launch services: Arianespace

Telecomms: Eutelsat and Inmarsat



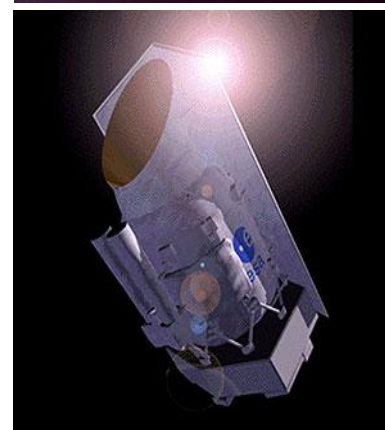
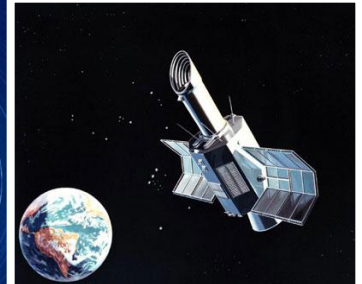
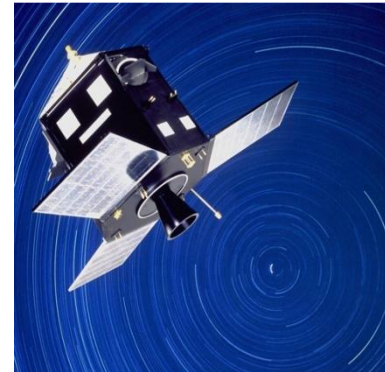


ESA'S SPACE PROGRAMMES

SPACE SCIENCE PIONEERS



- **Hipparcos** – most comprehensive star-mapper (1989–93)
- **IUE** – longest-living orbiting observatory (1978–96)
- **Giotto** – closest ever flyby of a comet nucleus (1986)
- **Ulysses** – first craft to fly over Sun's poles (1990–2008)
- **ISO** – first European infrared observatory (1995–8)
- **SMART-1** – first European mission to the Moon (2003–6)



SPACE SCIENCE TODAY'S MISSIONS



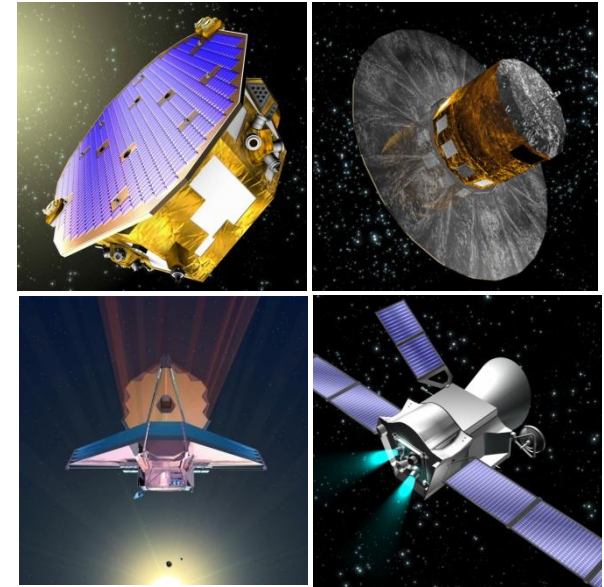
- **Hubble** (1990–)
- **SOHO** (1995–)
- **XMM-Newton** (1999–)
- **Cluster** (2000–)
- **Integral** (2002–)
- **Mars Express** (2003–)
- **Rosetta** (2004–)
- **Venus Express** (2005–)
- **Herschel** and **Planck** (2009–)



SPACE SCIENCE UPCOMING MISSIONS

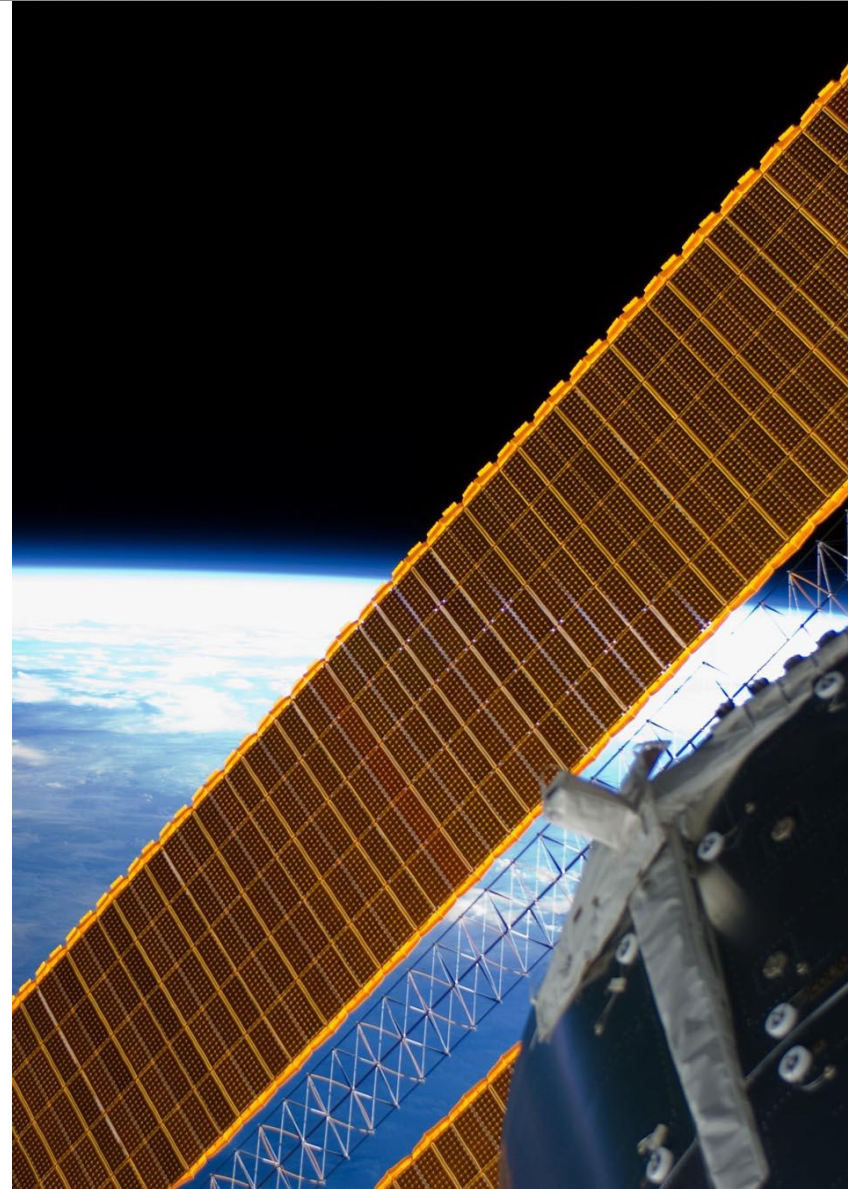


- **LISA Pathfinder** – testing technologies for gravity wave detection (2011)
- **Gaia** – mapping a thousand million stars in our galaxy (2012)
- **James Webb Space Telescope** – studying the very distant Universe (2014)
- **BepiColombo** – a satellite duo exploring Mercury (2014)



The development of technology, along with access to space, is one of the enabling activities of ESA. The drivers for ESA technology development activities:

- Enabling the future European Space missions,
- Fostering innovation and enhancing European technological independence and the availability of European resources for critical technologies.
- Supporting European industrial competitiveness
- Transferring technology from space to non-space applications ('spin-off'), and bringing innovations from outside the space sector to use in the design of new space systems ('spin-in').



HUMAN SPACEFLIGHT INTERNATIONAL SPACE STATION (ISS)



The ISS is a masterpiece of global cooperation, uniting the USA, Russia, Japan, Canada and Europe in one of the largest partnerships in the history of science.

Its crew of up to six astronauts conduct research into life and physical sciences and applications, and it provides a platform to prepare for future human exploration missions.

Europe's two key contributions are the multipurpose science laboratory, **Columbus**, and the **Automated Transfer Vehicle** (ATV). Columbus provides a substantial part of the Station's research capability, specialising in fluid physics, materials science and life sciences.



EARTH OBSERVATION

EARTH EXPLORERS



Part of ESA's '**Living Planet**' Programme, these missions address critical and specific issues raised by the science community, while demonstrating the latest observing techniques. The first two were launched in 2009:

GOCE – studying Earth's gravity field

SMOS – studying Earth's water cycle

The next missions are:

CryoSat-2 – studying Earth's ice cover

ADM-Aeolus – studying the atmosphere

Swarm – three satellites to study Earth's magnetic field

EarthCARE – an ESA/JAXA mission to study Earth's clouds, aerosols and radiation



EARTH OBSERVATION DEVELOPMENT OF OPERATIONAL MISSIONS



'Living Planet' also includes the next generation of missions dedicated to weather and climate.

Meteosat Third Generation – taking over from Meteosat 11 in 2015, the last of four Meteosat Second Generation (MSG) satellites. MSG is a joint project between ESA and Eumetsat following the success of the first-generation Meteosat satellites.

MetOp – a series of three satellites to monitor climate and improve weather forecasting, the space segment of Eumetsat's Polar System (EPS).

MetOp-A – Europe's first polar-orbiting satellite dedicated to operational meteorology (2006).



EARTH OBSERVATION DEVELOPMENT OF OPERATIONAL MISSIONS



A joint ESA/European Commission initiative, **Global Monitoring for the Environment and Security (GMES)** is the response to Europe's need for geo-spatial information services. It will provide autonomous and independent access to information for policy-makers, particularly for environment and security issues.

ESA is implementing the space component: developing the **Sentinel** satellite series, its ground segment and coordinating data access.

ESA is also starting a **Climate Change Initiative**, for storage and production of essential climate data.



TELECOMMUNICATIONS PIONEERS



1968 – Europe started to develop communications satellites. The **Orbital Test Satellite** (OTS) was launched 10 years later. OTS, and its follow-up ECS, was used for more than 13 years by ESA and Eutelsat.

Olympus – an experimental satellite, at the time of launch it was the largest civilian telecommunications satellite in the world (1989)

Artemis – introducing a new range of telecommunication services to the world, with this latest multi-purpose telecommunications and technology demonstration satellite (2001)



TELECOMMUNICATIONS ENSURING COMPETITIVE AND INNOVATIVE INDUSTRY



- Helping European (and Canadian) industry to compete on the world stage;
- Supporting technological R&D and pioneering developments to bring new technologies near to market readiness;
- Building partnerships capable of creating wealth, jobs and new services for the citizens of Europe;
- Improving our daily lives, from health services to civil protection and rescue operations.

ESA's **Advanced Research in Telecommunications Systems** (ARTES) programme promotes the development of technology, products and systems in partnership with industry.



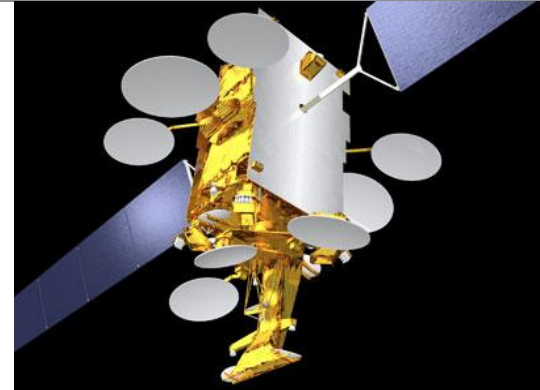
TELECOMMUNICATIONS CURRENT MISSIONS



Alphabus – multipurpose platform exploited by European industry to build future high-power communication satellites. Its first mission, **Alphasat**, is due for launch in 2012.

Small GEO – general-purpose small geostationary satellite platform, with subsequent mission in 2012. Will strengthen position of European industry in commercial medium-sized telecoms platform market.

Hylas – ‘Highly Adaptable Satellite’ project, due for launch in 2010. A hybrid Ka/Ku band satellite with European coverage that uses generic, flexible and innovative payload technologies.



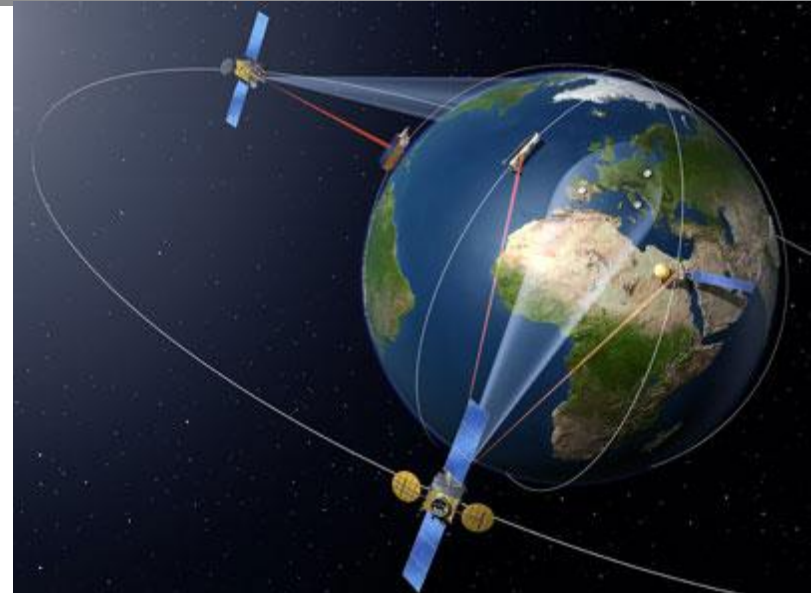
TELECOMMUNICATIONS NEW PROJECTS



EDRS – the European Data Relay Satellite system, planned for 2012. An independent European system to reduce time delays in transmission of large data quantities, making on-demand data available at the right place, at the right time.

Iris – developing a new air-to-ground communications system for air traffic management, the satellite-based solution for the Single European Sky ATM Research (SESAR) programme.

Integrated Applications Promotion - bringing together diverse space infrastructures to facilitate innovative solutions, leading to sustainable services.



NAVIGATION

GALILEO: SATELLITE NAVIGATION



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.

While providing autonomous navigation and positioning services, Galileo will also be interoperable with the US GPS and Russian GLONASS military systems. The full Galileo system will consist of 30 satellites and the associated ground infrastructure. Galileo is a joint initiative between ESA and the European Commission.

GIOVE-A - first Galileo test satellite, 2005

GIOVE-B - launched in 2008, successfully validated the technologies.



NAVIGATION EGNOS AND GALILEO APPLICATIONS



EGNOS is a precursor to Galileo that augments GPS and GLONASS, making them suitable for safety-critical applications, such as aviation.

Galileo is expected to spawn a wide range of useful applications, including value-added services for transport by road, rail, air and sea, infrastructure and public works management, agricultural and livestock management and tracking, even e-banking and e-commerce authentication.

Galileo will be a key asset for the provision of public services, such as rescue operations, law enforcement and crisis management.



LAUNCHERS

THE EUROPEAN LAUNCHER FAMILY

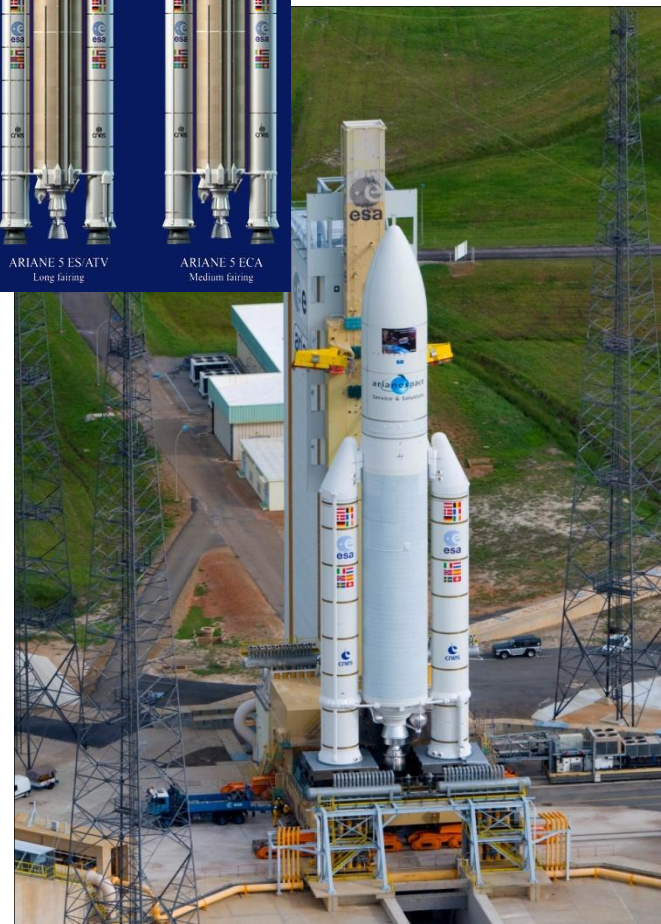


The launchers developed by ESA guarantee European access to space. Their development is an example of how space challenges European industry and provides precious expertise.

Ariane is one of the most successful launcher series in the world, soon to be complemented by Vega and Soyuz, launched from the European Spaceport in French Guiana.

European launchers lift off from the Guiana Space Centre (CSG), Kourou, in French Guiana.

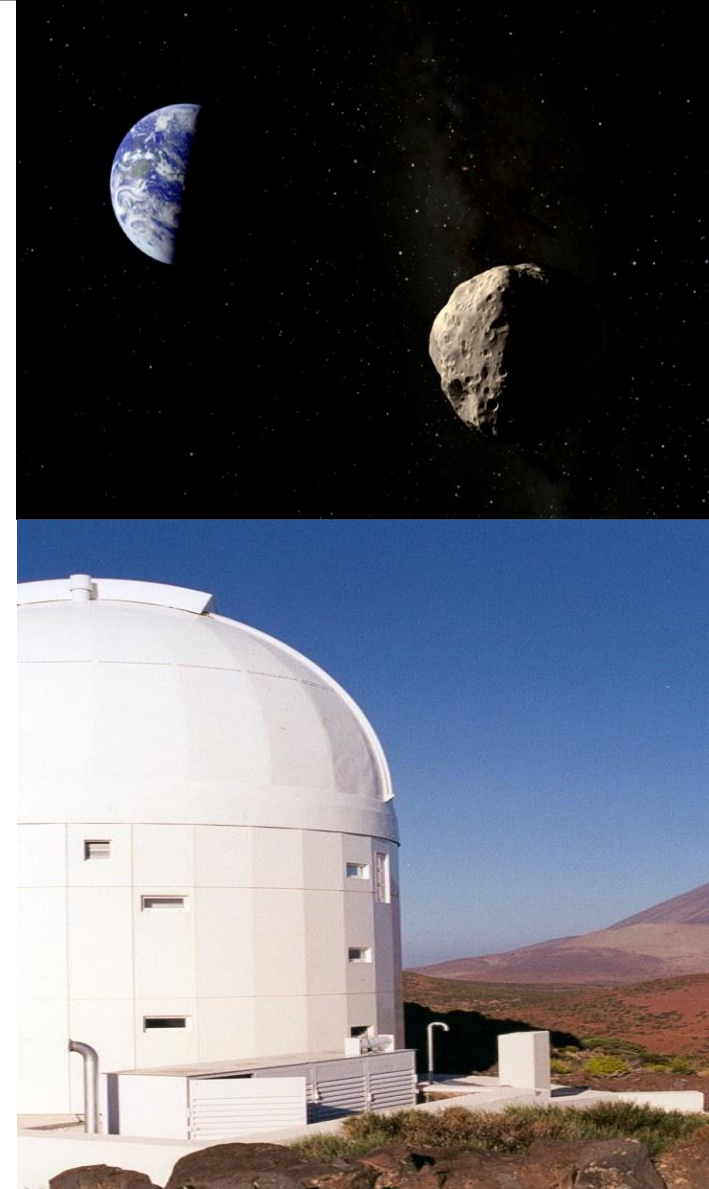
CSG is operated by the French space agency CNES and Arianespace, with the support of European industry. ESA owns the launch infrastructure for the Ariane 5, Vega and Soyuz launchers.



The **Space Situational Awareness (SSA)** initiative aims to provide Europe and its citizens with accurate information about objects orbiting Earth, the space environment and threats, such as asteroids.

The initiative supports the autonomous capacity of Europe to securely and safely operate its critical space infrastructures.

The SSA system will also tell us more about 'space weather' (solar activity affecting satellites and ground infrastructure). It will identify and assess asteroids and comets, known as Near-Earth Objects (NEOs), that pose a potential risk of collision with Earth.





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European Space Agency