ESA'S WINDOW TO THE UNIVERSE
**headquarters**
Paris is the seat of the ESA Council and Director General, and well as some Directors, plus offices of human resources, legal affairs, finance, budget, internal audit, international relations and communications.

**estec**
The European Space Research and Technology Centre in Noordwijk, The Netherlands, is ESA’s largest site. This is where most ESA spacecraft projects are born and guided through their phases of development.

**esoc**
The European Space Operations Centre in Darmstadt, Germany, is where ESA’s ground station systems are developed and the smooth working of spacecraft in orbit is ensured.

**esrin**
ESRIN in Frascati, near Rome, Italy, is ESA’s centre for Earth observation, and develops information systems and hosts the Vega small-launcher project.

**esac**
The European Space Astronomy Centre, near Madrid, Spain, hosts the science operations centres and scientific archives for ESA’s astronomy and Solar System missions.

**eac**
The European Astronaut Centre in Cologne, Germany, is home base for the European astronauts. It is a centre of excellence for astronaut training and medical support for ESA and partner agency astronauts.

**guiana space centre**
ESA’s launchers lift off from Europe’s Spaceport in Kourou, French Guiana. It is jointly operated by the French space agency (CNES) and Arianespace with the support of European industry.
Telescopes in space are humankind’s eyes in the heavens: from their superior observing positions high above Earth’s atmosphere, they provide us with astounding views of the Universe at many different wavelengths.

- ESAC is where some of those views are first studied – signals from black holes and distant galaxies, from neighbouring planets and even from planets far beyond the Solar System, are beamed back to the Madrid countryside.

- ESAC is not only one of ESA’s centres of excellence for space science, but is also a focus for space technology, hosting one of ESA’s two deep-space ground stations. These facilities allow ESA’s engineers to gather data from distant missions in our own Solar System, from Mercury, Venus, Mars and beyond.

ESAC, the European Space Astronomy Centre, is the ‘home’ of ESA’s space-telescope and planetary missions, the place from where science operations are conducted, and where all of the scientific data produced are archived and made accessible to the world.
A CENTRE OF EXCELLENCE FOR SPACE SCIENCE

ESAC is the site for the Science Operations Centres (SOCs) of ESA Science missions, for both astronomy and the Solar System.

“ESAC is rapidly evolving into a scientific hot-spot, a meeting point for top-level international space scientists.”

– Álvaro Giménez, Director of Science and Robotic Exploration, and Head of ESAC

Once a space telescope has reached its operating orbit, or when a Solar System mission is on its way to its faraway destination, then it is the Science Operations Centres’ task to ensure it is used in the best possible way. The SOCs’ engineers and scientists monitor and control the sophisticated instruments being flown. They are also experts in planning and coordinating the various science instrument activities.

The SOCs are also often responsible for the calibration of the instruments on the spacecraft, for processing and archiving the data, and for helping the scientific community in their quest to increase our understanding of how the Universe works. All these tasks mean working closely with thousands of scientists all around the globe.

SOCs at ESAC

XMM-Newton
Launched in 1999, the most sensitive X-ray telescope ever built, used to study violent phenomena, such as active black holes.

Integral
Launched in 2002, a gamma-ray space telescope to detect the most energetic events in the cosmos, such as gamma-ray bursts.

Mars Express
Launched in 2003, studying the ‘Red Planet’ in great detail.

Rosetta
Launched in 2004, the first mission for the long-term exploration of a comet, it will reach Comet 67P/Churyumov-Gerasimenko in 2014.
Venus Express
Launched in 2005, analysing the Venusian atmosphere with unprecedented sensitivity.

Herschel
Launched in 2009, an observatory at infrared and submillimetre wavelengths to observe the first stars and galaxies ever formed, using the largest telescope mirror launched to date.

Planck
Launched in 2009, the first European space observatory to study the Cosmic Microwave Background – the relic radiation from the Big Bang.

Gaia
To be launched in 2013, it will produce a three-dimensional map of the Milky Way.

LISA Pathfinder
To be launched in 2014, it will prove the technologies vital for the LISA gravitational wave mission.

BepiColombo
To be launched in 2015, a joint mission with Japan to Mercury, the least-explored planet in the inner Solar System.

Solar Orbiter
To be launched in 2017, an ESA-led mission with NASA participation to study the Sun at close range.

Euclid
To be launched in 2019, this space telescope will map out the large-scale structure of the Universe.

Collaboration
ESAC also plays a role in missions conducted in collaboration with other space agencies, such as Akari, Japan’s infrared sky surveyor, where ESAC provides precise attitude information for the mission’s catalogues and user support to the European astronomers who have observing opportunities. ESAC will contribute to the NASA-led James Webb Space Telescope, the successor to the Hubble Space Telescope.

ESAC also hosts the Spanish Laboratory for Space Astrophysics and Fundamental Physics (LAEFF), an innovative research facility aimed mainly at encouraging young Spanish scientists to enter the fields of astrophysics and fundamental physics.
Our new network of deep-space antennas will help to open up new frontiers in space exploration.

– Lionel Hernandez, Cebreros & Villafranca Stations Manager

Satellites stay in contact with Earth by means of a ground-station network. Engineers send commands to correct their trajectories, manoeuvre them into different orbits and operate their instruments. The satellite transmits back to Earth not only the scientific data that it is gathering, but also the ‘housekeeping’ information needed by the operators to check the satellite’s performance.

ESAC has a number of antennas with modern electronic telemetry, telecommand and ranging equipment that allows commands to be sent to control the satellites and their payloads, as well as the scientific data to be received on the ground. The ESAC antennas currently support Cluster, ESA’s four-satellite flotilla in studying Earth’s magnetic field, together with XMM-Newton, Integral, MetOp-A, as well as the Automated Transfer Vehicle and the International Space Station.

Three decades of reaching into space

ESAC was founded in 2004 on the Villafranca site, which officially opened in 1978 as VILSPA (from VILlafranca SPain), one of ESA’s original satellite tracking stations. VILSPA, operated remotely from the European Space Operations Centre (ESOC) in Darmstadt, Germany, has been responsible for providing telemetry, tracking and command support to ESA as well as non-ESA satellites (in chronological order): IUE, OTS-2, GOES, Marecs-A, Exosat, ECS-1, Marecs-B2, ECS-2, ECS-4, ECS-5, Meteosat-1, Olympus, Hipparcos, Giotto, Italsat-1, ERS-1, Meteosat-2, Meteosat-3, ISO, ERS-2, Italsat-2, SOHO, XMM-Newton, Cluster, Eutelsat-W3, Envisat, MSG-1, Integral, SMART-1, TC-1, Bird, TC-2, MSG-2 and MetOp-A.

The station has also hosted the Science Operations Centres of IUE – which operated for more than 17 years and is still one of the most
prolific astronomical satellites ever launched—and ISO, the world’s first true orbiting infrared observatory, which made more than 30 000 scientific observations.

**Cebreros Deep-Space Antenna**

ESA’s next generation of astronomy and Solar System missions are highly ambitious. Designed to open up new frontiers in space exploration, many of them will be placed very far away in space, not even orbiting Earth. To communicate with these deep-space missions, ESA is building a new network of deep-space antennas.

The powerful new 35 m antenna at Cebreros in Ávila, Spain, is currently one of three ESA deep-space ground stations, the others being at New Norcia in Australia and Malargüe, Argentina. Cebreros provides routine operations support to Venus Express, Herschel and Planck and back-up support to Mars Express and Rosetta, as well as other agencies’ missions. Other interplanetary missions will follow, including BepiColombo.
ESAC has ambitious plans for future activities in additional areas, as well as its expanding role in astronomy and planetary sciences.

“...The SSA initiative will provide complete and accurate information on objects orbiting Earth, the space environment and threats from space.

— Nicolas Bobrinsky, Head of the SSA Programme Office

ESAC has experienced a tremendous growth in the last few years, with about 300 people working there today. With more than 35 years of history in various ESA activities, the site at Villanueva de la Cañada has become an important element of ESA. The centre is still expanding: ESA’s Exploration initiative for the next decade, for example, will profit from the new activities and facilities managed by ESAC, and the management of the new Space Situational Awareness (SSA) programme adds to its responsibilities.

**Space Situational Awareness**

ESAC hosts the team for the new European Space Situational Awareness Preparatory Programme. The SSA initiative will provide Europe and its citizens with complete and accurate information on objects orbiting Earth, on the space environment and on threats coming from space.

In developing this European SSA system, the objective is to establish the future European SSA system; governance, data policy and data security aspects; and precursor services in the areas of space surveillance, space weather and Near-Earth Objects.

The SSA programme will, ultimately, enable Europe to autonomously detect, predict and assess the risk to life and property due to remnant man-made space objects, reentries, in-orbit explosions and release events, in-orbit
collisions, disruption of missions and satellite-based service capabilities, potential impacts of Near-Earth Objects, and the effects of space weather phenomena on space- and ground-based infrastructure.

**SMOS Payload Operations and Data Processing Ground Segment**

ESAC is also involved in Earth observation activities. ESAC hosts the Payload Operations and Data Processing Ground Segment of ESA's Soil Moisture and Ocean Salinity (SMOS) satellite, the second Earth Explorer.

Launched in November 2009, SMOS is designed to observe soil moisture over Earth's land surfaces and salinity in its oceans, which are exactly the kinds of data urgently needed by experts studying the global climate system, and also feeds data in near-real time to improve medium-term weather forecast. ESAC takes care of the payload programming for SMOS, receives all the scientific data transmitted to ground, and generates and disseminates the final products to the community.

**Corporate Communication Office**

With the growing importance of ESAC, a dedicated Corporate ESAC Communication Office has been created.

This office is responsible for official ESA communication activities in Spain and Portugal, and space science activities, as well as the organisation of launch and major events at the centre and coordination of launch events in major universities and national institutions and interactions with the media.

The office also supports projects with universities and educational centres all over Europe, notably in systems engineering, satellite navigation and science research.
These archives are frequently a mine of unexpected discoveries.

– Christophe Arviset, Head of Science Archives

The vast amounts of scientific data obtained during a space science mission have a much longer lifetime than the satellite mission itself. The data are archived and made freely accessible online to the world scientific community, and these archives are frequently a mine of unexpected discoveries. They allow researchers to study, for instance, the evolution of a certain celestial object with time, or its appearance at different wavelengths as observed by different telescopes.

The archives for all of ESA’s astronomy and Solar System missions are kept at ESAC so researchers have a single entry point for accessing the wealth of scientific data. Data from the ISO, XMM-Newton, Integral, Herschel, Planck and SOHO missions and from the interplanetary spacecraft Mars Express, SMART-1 (the Moon), Rosetta (Comet 67P/Churyumov-Gerasimenko), Huygens (Titan), Venus Express and Giotto (Comet Halley) are already available in ESAC’s state-of-the-art archival system, and are regularly consulted and retrieved by more than 3000 registered users.

The World Wide Web has no borders, so why not link all of the existing astronomical archives? That is the goal of the international Virtual Observatory (VO) programme, to which the ESAC archives are contributing. As a data provider and as an active partner in these activities, ESAC is becoming the VO node for European space astronomy. Soon, scientists will be able to transparently access all astronomical data from their desktops, in much the same way as they currently access documents on the internet.
ESAC is located 30 km west of Madrid, in the Guadarrama Valley. The evergreen oaks and a neighbouring 15th century castle ruin make a spectacular backdrop for the high-tech vista of ESAC’s large antennas and modern buildings.

If you want to know more about ESAC, please have a look at our web site, www.esa.int/esac

If you want to get in touch with ESAC and ESA, please send your question to comunicacionesac@esa.int

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