



VILSPA

the ESA Ground Station in Spain





INTRODUCTION

ESA's Villafranca Satellite Tracking Station, widely known as 'VILSPA', lies in the Guadarrama Valley, 30 km west of Madrid. Its high-tech infrastructure and imposing dish antennas make a striking contrast with the surrounding countryside with its evergreen oak and poplar trees, and the neighbouring castle ruin dating from the 15th century which overlooks the site.

Commissioned in 1975 as a result of an international agreement between

the European Space Agency and the Spanish government, the VILSPA station was officially opened on 12 May 1978 by their Majesties King Juan Carlos and Queen Sofia of Spain.

VILSPA forms part of ESA's worldwide network of state-of-the-art ground stations, known as 'ESTRACK', administered from the European Space Operations Centre (ESOC) in Darmstadt, Germany. It is therefore responsible for providing telemetry, tracking and command support to ESA as well as non-ESA satellites during the critical Launch and Early Orbit Phase (LEOP) and during their subsequent Checkout, Commissioning and Routine Operations Phases. It further serves as the main centre for direct support to the scientific user community for most of ESA's astronomy missions.

Over the years, VILSPA has established a long tradition of involvement in the operation of many of ESA's scientific and applications satellite missions, including the provision of:

- Telemetry, Tracking and Command (TT&C)
- Mission Operations Centre (MOC) activities
- Science Operations Centre (SOC) activities
 - Payload calibration and data processing
 - Science data archiving
 - Data distribution to user communities
 - Software development and maintenance
- Ground-system engineering and maintenance.

One of VILSPA's greatest assets is its creative mixture of technical ground-station staff and specialised scientific and engineering staff, working together in a multinational environment. Their strong motivation and dedication have been key to the success of the many missions operated from Villafranca over a quarter of a century.

Being a centre of excellence in the domains of satellite communications and operations, these days VILSPA also markets its facilities and services on a commercial basis to third parties, including industrial customers and commercial satellite operators.



GROUND OPERATIONS

ESA's network of ground stations, which fall under ESOC's responsibility, is used to communicate with satellites in a variety of orbits and operational phases, from the critical period just after launch (LEOP) until the spacecraft reaches its operational orbit, and then during the subsequent routine operations phase. The ground-system infrastructure at VILSPA therefore consists of a number of antennas – 11 in total – and modern electronic telemetry, telecommand and ranging equipment that allows commands to be sent to control the satellites and their payloads, and the housekeeping and payload data, as well as the scientific data, to be received securely back on the ground. Station operations engineers, working closely with

SCIENCE OPERATIONS

Today VILSPA plays an important role in the launch and operation of ESA's scientific satellites. It has served as the Mission Operations Centre (MOC) and Science Operations Centre (SOC) for the earlier scientific satellites IUE and ISO, two of the most successful missions in the history of astronomy. VILSPA is also the primary Archival Facility for IUE data and products. It currently hosts the Science Operations Centre for the operational XMM-Newton orbital X-ray observatory, and the ISO Data Centre (archival activities), as well as conducting multidisciplinary science activities. VILSPA has also been selected as the default site for the science operations of the Integral, Herschel/ Planck and Eddington missions.

Milestones in the History of VILSPA

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| 1974: ESRO Council decision to establish VILSPA | 1991: Support to ERS-1 and MOP-2 |
| 1978: Official opening of the Station
Launches of IUE (MOC and SOC at VILSPA) and OTS | 1995: Launch of ISO (MOC and SOC at VILSPA) |
| 1979: Installation of a GOES station and participation in NOAA Global Weather Experiment | 1998: First release of the ISO Data Archive |
| 1981: Launch of Marecs-A | 1999: Launch of XMM-Newton (SOC at VILSPA) |
| 1984: Launches of Marecs-B2 and ECS-2 | 2000: Launch of Cluster |
| 1988: Launch of ECS-5 | 2002: LEOP support to Envisat, Meteosat (MSG-1), and First release of the XMM-Newton Science Archive |
| 1989: Support to Meteosat (MOP-1), Olympus and Hipparcos | 2003: Launch of SMART-1, involving station upgrading to support X- and Ka-band transmission/reception |
| 1990: Support to Italsat-1 and -2 | |

Once the health of a newly launched satellite has been confirmed and it has been put into its operational orbit, the 'routine operations' begin, to ensure that the scientific objectives of the mission are fulfilled, and to gather and deliver the scientific data to the research community. VILSPA supports a team of space scientists working on site. Throughout the operational lifetime of the satellite, they plan the schedule for astronomical observations, contribute to the improvement of instrument calibration in collaboration with members of the Instrument Development Teams in the ESA Member States, and monitor the health and status of the scientific instruments, thereby optimising

the ESA network staff, ensure careful coordination of the many activities, detailed resource planning and precise operational execution, all of which are crucial for the success of any satellite mission.

Over the years, VILSPA has been involved in supporting many ESA communications and Earth-observation satellites, in addition to its extensive support to the Agency's scientific programme. ESA and third-party missions for which support has been provided include: Cluster, Hipparcos, ECS, Envisat, Eutelsat-W3, Exosat, GOES, Marecs, Meteosat, Olympus, OTS, Italsat-1, ERS-1, ERS-2, Italsat-2, and MTP-1. Current external customers include Eumetsat for the Meteosat Second Generation (MSG) satellites, and the Chinese Academy of Sciences for the Double Star project.



the scientific return from each of the instruments on board the satellite. The system is usually programmed several weeks in advance for a sequence of observations, the data from which are downlinked to VILSPA for processing on the ground and, where appropriate, for



dissemination to cooperating non-ESA centres for final product generation. They are then distributed to the scientist or scientists who requested each particular observation.

When the satellite has reached the end of its operational lifetime, the 'Post Operations' and 'Archival' phases begin, to ensure that the valuable and often unique observations that have been made will be available to future generations of researchers. To serve the entire scientific community, VILSPA maintains an archive of all of the scientific data obtained from the completed and ongoing missions for which it is responsible. This archival data is made freely available to the scientific community for leading-edge scientific research.

As a Science Support Centre, VILSPA supports all activities necessary to ensure that the scientists and researchers obtain the most from space-based observations. They include:

- Spacecraft monitoring, and in some cases commanding, facilities, which allow the scientific instruments aboard the various satellites to be managed to allow swift recognition and correction of anomalies potentially impacting the scientific return.
- The Mission Planning Room, from which observing schedules can be prepared, checked and rearranged to obtain the maximum scientific return from the available satellite observing time, while still ensuring the safety and correct operation of all satellite subsystems
- Planning and execution of instrument calibration activities.
- Visitor support facilities, in which the scientific data from the satellites can be immediately analysed with expert support.





Also located on the VILSPA site is the national Spanish Laboratory for Space Astrophysics and Fundamental Physics (LAEFF), which houses the IUE Newly Extracted Spectra (INES) archive, transferred to the Spanish facility at the end of 2000. The LAEFF's main role is as an innovative research facility for astrophysics and fundamental physics, encouraging young Spanish scientists to enter these fields.

Another service offered free to the scientific community via VILSPA, in its role as a member of the 'Astroweb consortium', is a compilation of resource records in which the topics covered include astronomy, astrophysics and related natural sciences.

ESA Missions Hosted by VILSPA

IUE

The International Ultraviolet Explorer, a joint venture between ESA, NASA and the UK Science and Engineering Research Council (SERC), was the first space observatory totally dedicated to ultraviolet astronomy. Launched in 1978, it proved to be the longest-serving and most prolific astronomical observatory satellite yet launched. VILSPA hosted the Mission Operations and Science Operations Centres (MOC and SOC) for the mission. The 104 000 high- and low-dispersion spectra taken by IUE during its 17 year lifetime have been distributed by VILSPA to 20 national hosts around the World.

For further information, visit: <http://sci.esa.int/iue>

ISO

The spectacular success of the Infrared Space Observatory (ISO) as the world's first spaceborne infrared observatory working in the cool light of the infrared, launched in 1995, has provided an entirely fresh perspective of our Universe in the mostly unexplored wavelength range of 2.4 to 240 microns. The ISO Data Archive contains the results of 30 000 scientific observations performed during the satellite's two and a half years of operation, and is continually maintained with improved data products being ingested. ISO continues to have a major presence in the refereed literature, with more than 1000 articles drawing upon ISO data having been published.

For further information, visit: <http://www.iso.vilspa.esa.es/>

XMM-Newton

The X-ray Multi-Mirror (XMM) observatory, launched in 1999, is the second, cornerstone mission of ESA's 'Cosmic Vision' long-term plan for space science. This High-Throughput X-ray Spectroscopy mission collects data in the portion of the electromagnetic spectrum between 100 eV and 12 keV. By virtue of its large collecting area and highly eccentric orbit, XMM-Newton is able to make long observations of X-ray sources with unprecedented sensitivity. The XMM-Newton Science Archive was released to the worldwide scientific community in April 2002.

For further information, visit: <http://xmm.vilspa.esa.es/>

ASTRO-F

This second-generation infrared sky-survey mission is a Japanese ISAS mission with a planned ESA contribution. ESA is committed to provide tracking support and assistance with the survey data reduction in return for a percentage of the mission's observing time. VILSPA is responsible for: (i) distributing the observing opportunities to the European science community via a 'Call for Proposals', and (ii) assisting with the survey data processing based on its ISO experience.



Contacting VILSPA

The VILSPA station is located in Villanueva de la Cañada, near Madrid.
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