esa

esoc

→ WHERE MISSIONS COME ALIVE



European Space Agency



headquarters
Located in Paris, home to the main programme directorates that steer and formulate ESA policy.



estec
The European Space Research and Technology Centre, Noordwijk, the Netherlands, is the largest site and the technical heart of ESA.



esoc
The European Space Operations Centre, Darmstadt, Germany, tracks and controls European spacecraft, and develops and manages ground systems.



esrin
ESA's centre for Earth observation activities, near Rome, Italy, also develops information systems and hosts the Vega launcher project.



esac
The European Space Astronomy Centre, near Madrid, Spain, hosts the science operation centres and archives for ESA's astronomy and planetary missions.



eac
The European Astronaut Centre, Cologne, Germany, trains astronauts for missions to the International Space Station and beyond.



redu
Redu Centre in Belgium is part of ESA's ground station network and is also home to ESA's Space Weather Data Centre.



ecsat
The European Centre for Space Applications and Technology at Harwell, UK, is focusing on commercialisation and partnerships in space activities.



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.

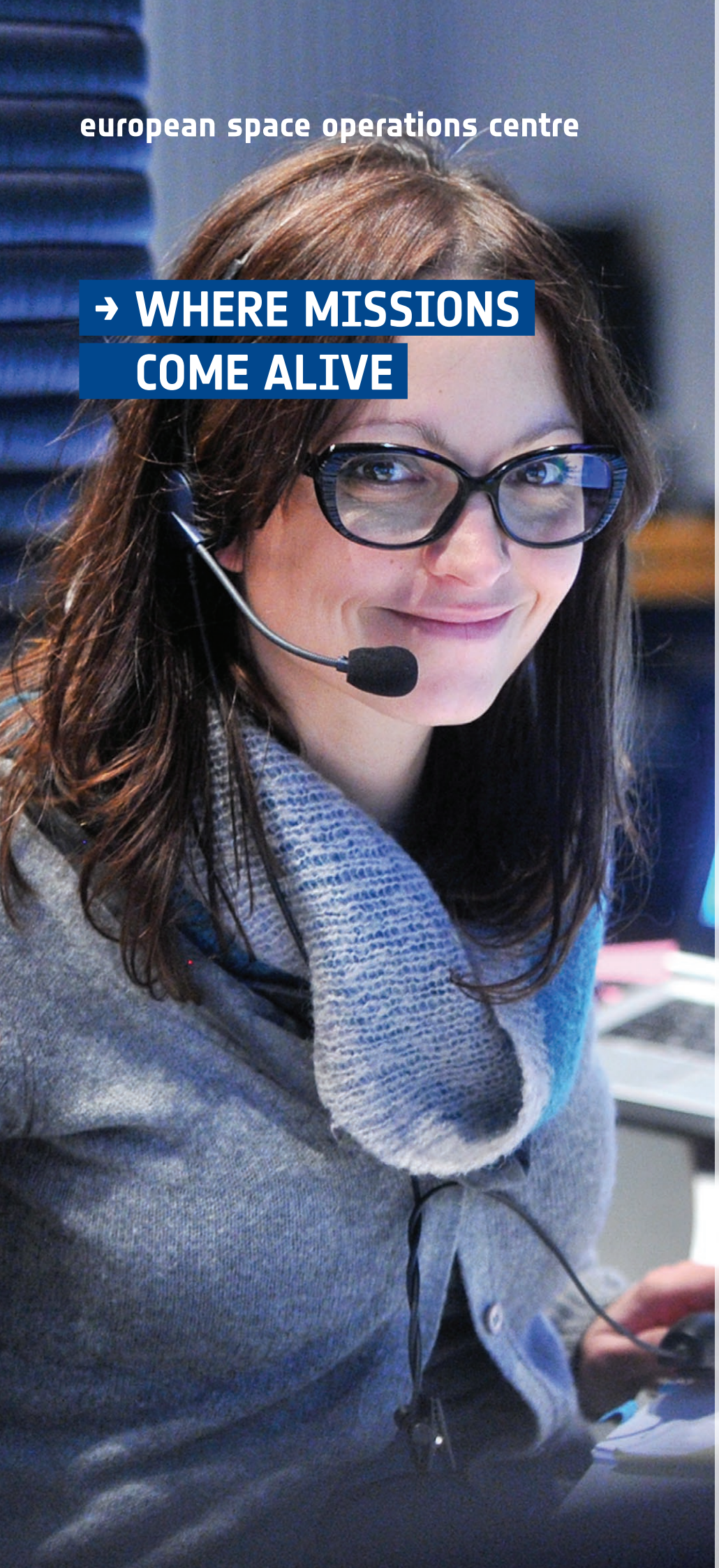
The European Space Agency (ESA) is Europe's gateway to space. We guide the development of Europe's space capability and carry out pioneering research in all areas of space activity.

For over 50 years, ESA and its predecessors have been shaping and sharing space. We have been managing the research and development programmes needed to keep Europe at the forefront of space exploration and applications. We have been ensuring that investment in space delivers benefits to the citizens of Europe and the world: from jobs and economic growth, to public services, efficient communications and security.

ESA is a prime example of what can be achieved by working together – a model for multicultural and international cooperation. By pooling resources, we are able to develop fascinating projects that would not be possible for individual countries. The results of this cooperation are world-class industry, outstanding scientific discoveries and a stronger, richer European identity.

european space operations centre

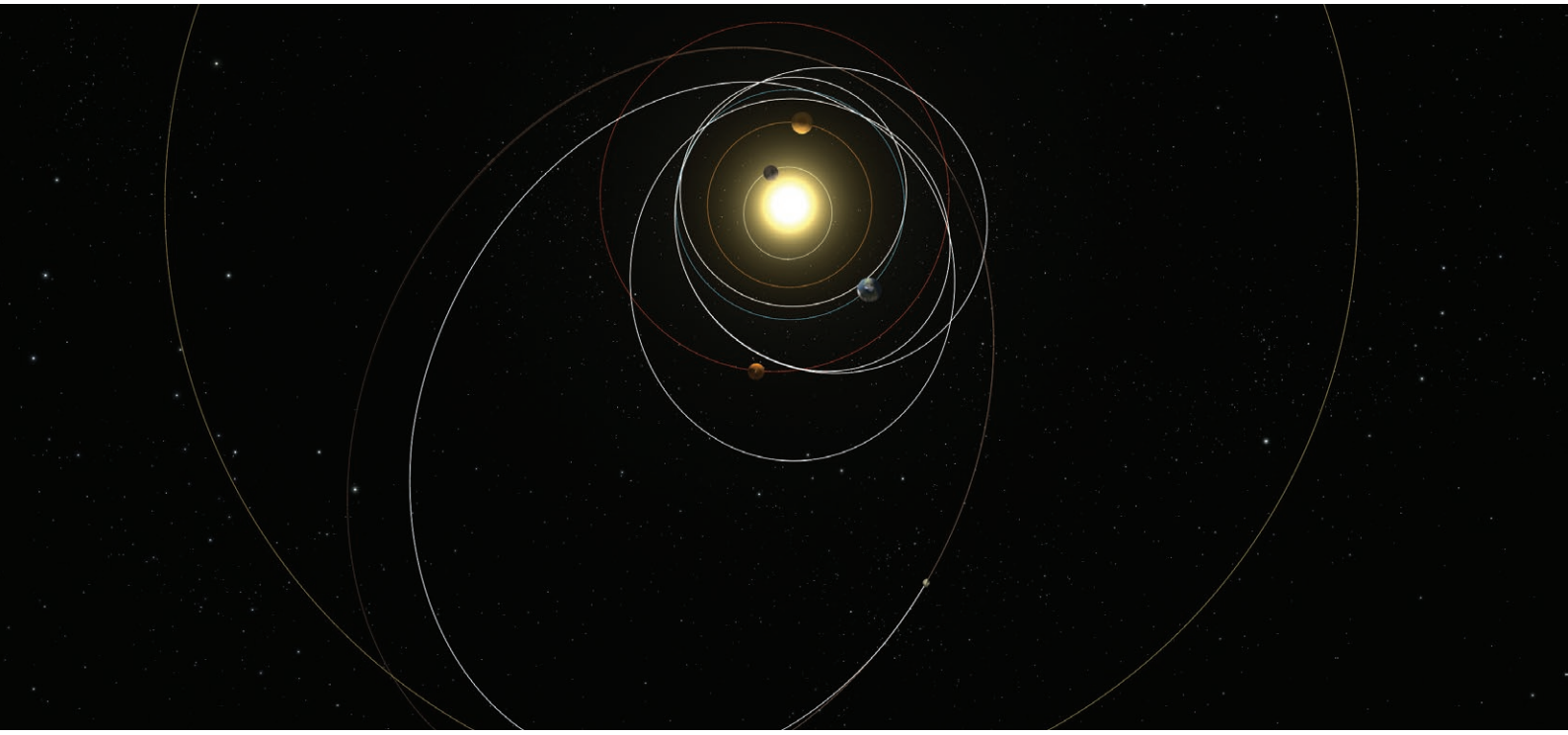
→ WHERE MISSIONS COME ALIVE



As Europe's centre of excellence for satellite operations, ESOC is home to the engineering teams that control spacecraft in orbit and build the systems on the ground that support missions in space.

- Designing mission 'ground segments' – the hardware and systems on Earth that enable engineers to control satellites in space and receive and distribute precious data to scientists.
- Maintaining realtime contact with missions near Earth, orbiting the Sun or voyaging deep in our Solar System.
- Determining the realtime position, speed and attitude of satellites in space.
- Planning and selecting the best possible orbits, launch trajectories and launch windows.
- Managing ESA's worldwide Estrack ground station network.
- Cooperating with other agencies and international bodies to define technical standards, share cutting-edge tools and techniques, and supporting European industrial development and competitiveness.
- Recognised internationally as a centre of excellence for space debris studies and services, ground system engineering, the design and development of tracking stations, and satellite navigation.

→ THE LIFE OF A MISSION



> **“Our passion is for humankind’s voyages into the Universe.”**

ESOC links people with spacecraft travelling to the frontiers of human knowledge. Our world is about teams, systems and communication; our passion is for humankind’s voyages into the Universe.

ESOC, and ESA in general, works closely with European industry to advance the state of European technology in the areas of spacecraft operations and communications. This is done by placing research and development contracts and studies, and by transferring the knowledge and experience during the execution of these contracts.

Since 1967, over 100 satellites belonging to ESA and its partners have been operated successfully from ESOC in Darmstadt, Germany.

Spacecraft are operated at ESOC using the mission family concept, under which the same operations methods, facilities, software, tools and procedures are applied to a grouping of related missions. This significantly boosts efficiency, reduces costs and ensures that the best technologies and techniques enjoy quick adoption.

At ESA, satellite missions follow a well-tested lifecycle, starting years before launch with the conception and initial design of the spacecraft; this is done by a dedicated project team located at ESA’s Space Research and Technology Centre, ESTEC, in the Netherlands.

In parallel, at ESOC, work begins at an early stage on the new satellite’s ground segment – the computers, software, systems and networks on Earth that will be used to control the satellite in space.

Mission analysis

To start, mission analysts perform a detailed mathematical assessment of the satellite’s potential orbits. This determines how best to fulfil the mission’s science objectives in terms of fuel allowances, achievable orbits, launch-vehicle capacity, available ground stations, operational complexity and expected lifetime.



This analysis is performed using advanced methods in celestial mechanics, applied mathematics and control and estimation theory. Powerful workstations and a suite of sophisticated software tools allow in-depth analysis of all aspects of orbits and trajectories.

Operations concept

Before the satellite is even built, teams at ESOC formulate the operations concept. This defines the overall scenario for daily operation and control of the satellite and its payload, describing who does what and how and when it should happen, throughout the life of the mission.

This is used to help define the working requirements for both the ground segment and the spacecraft, helping ensure that the 'end-to-end' space-to-ground system can achieve the mission's objectives.

The various mission phases must also be assessed. These include the critical launch and early orbit phase (LEOP), commissioning and the routine phase, running through to mission completion. Each phase must be evaluated carefully, as each will need different support from the people and systems on the ground.

For example, LEOP typically requires a main and backup Mission Operations Team to provide 24-hours/day, realtime control. Later, in the routine phase, and if operating as planned, far fewer engineers are needed and they usually work regular daytime hours.

Feedback to spacecraft construction

The critical mission analysis and ground segment design work done at ESOC prior to launch is assessed in close cooperation with the mission's Project Team at ESTEC. The results are then given to the manufacturer to integrate into the satellite's final design and construction.

Orbits

Spacecraft are designed to travel in certain orbital 'regimes':

- Low- and medium-Earth orbit, 400–1000 km altitude
- Highly eccentric orbit, from a low point of a few 100 km to a high point typically of several thousands of km
- Geostationary orbit, above the equator at about 36 000 km
- Lagrange orbit, at, for example, 1.5 million km from Earth
- Interplanetary travel, trajectories to our Moon, planets or other objects in our Solar System



→ PREPARING FOR LAUNCH



> **To ensure the success of a complex mission, ESOC must provide high reliability, quick response, clarity of information and guaranteed availability of data – with all activities conducted in an unforgiving, real-time environment.**

While the satellite is being built by industry, and subsequently integrated and tested at ESTEC, specialists at ESOC begin building and configuring the ground segment and preparing teams for flight operations.

System of systems

The ground segment is based on the mission data systems: a 'system of systems' comprising the mission control system, the flight dynamics system, a specially designed spacecraft simulator and the mission planning system.

Together, they enable engineers at ESOC to process satellite telemetry – information sent from the spacecraft reporting on its health and status – and prepare the telecommands that must be sent up to effect daily operations. These include commands instructing the satellite where it should point itself, when to turn its thrusters on or off, when onboard platform and payload systems should function, and when to download the mission's precious scientific data.

To ensure the success of a complex mission, the Mission Data Systems must provide high reliability, quick response, clarity of information and guaranteed availability of data – with all activities conducted in an unforgiving, real-time environment.

Operations Control Centre

While the Mission Data Systems are the heart of the ground segment, many other teams, facilities and systems are needed to carry out mission operations. The worldwide ground tracking stations and communication networks have to be configured and tested for the specific needs of the mission, and any necessary additional capability or functionality must be developed, tested and integrated.

Finally, all systems must be validated together in a realistic, end-to-end (spacecraft-to-ground) testing campaign. This is achieved through a series of System Validation Tests, which make use of the actual spacecraft while it is located on ground at the assembly and integration site.

→ BUILDING A TEAM



During the pre-launch period, an experienced Spacecraft Operations Manager (SOM) is appointed to lead the Flight Control Team and serve as the central figure responsible for leadership, technical management and mission operations success.

The team typically comprises up to 15 experienced system engineers, analysts and other experts provided from within ESA or by industrial contractors. All undergo training, studying the spacecraft, its systems and its scientific goals, learning in immense detail how every step of the mission should proceed.

The Flight Control Team is also responsible for the design requirements for all the ground segment systems to be used for the mission, and is responsible for the final acceptance testing of the ground segment, including the Mission Data Systems, the Operations Control Centre facilities and ground station network.

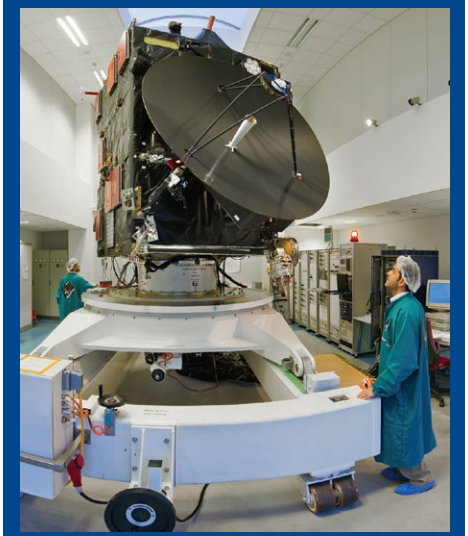
They work together in a number of specialised control rooms, all designed to foster teamwork and effective technical management of a mission. These control rooms provide the crucial data links between ground controllers and their satellites in orbit.

Our technical facilities – the places where we do what we do – include ESOC's large, general purpose Main Control Room (MCR), multiple Dedicated Control Rooms (DCR – smaller control rooms dedicated to specific missions or mission families) and the Estrack Control Centre, which controls our tracking station network. ESOC provides rooms and facilities for flight dynamics, network management, software support, simulations and training and other specialised functions.

Our control rooms and engineering facilities are perhaps the most eye-catching indication of what goes on at ESOC. But the essence of what happens at ESOC occurs in the human realm: building teams, training engineers, developing technical managers and working with partner agencies and organisations around the world.

Engineering models

For some missions, like Rosetta and Huygens, a duplicate of the real satellite is maintained at ESOC. This enables engineers to conduct realistic testing of newly developed software before sending it up to the actual satellite in orbit.



→ LAUNCH CAMPAIGN



“All positions in the briefing loop, please stand by for the roll call...”

By the time liftoff is only a few months away, the ground segment has been designed and built, a Dedicated Control Room has been fitted out and a Flight Control Team has been assembled. Activity intensifies as the Centre enters the launch campaign.

With the ground segment in place, preparations for launch enter an intense phase about six months before liftoff with the start of simulation training. Simulations are a crucial aspect of launch preparations at ESOC.

Training a ‘team of teams’

The main objective of the simulation campaign is to train the permanent Flight Control Team together with other supporting specialists from flight dynamics, ground systems, the satellite manufacturer and the Project team from ESTEC.

Together, these are trained into a single, integrated Mission Control Team focusing on the time-critical launch and early orbit phase, as well as contingency operations.

A series of intensive, realtime mission scenarios are rehearsed again and again, until the Mission Control Team (and their backups) are able to handle all routine as well as unplanned situations. Simulations cover every moment of the mission, from before liftoff until the satellite enters the correct orbit with all systems functioning as expected. Failures in systems on board the satellite and in the ground segment are also simulated, in order to train the team to resolve emergency situations and recover from them. ‘Sims’ often run 8 to 12 hours, with an extensive and detailed debriefing at the end of the day. If a mistake is made, the team repeats the simulation, until they know the process by heart and can react correctly in any situation.

Ready to go

The launch campaign culminates shortly before launch with full readiness of all ESOC facilities, services and teams and the ‘freezing’ of all software systems, hardware and documentation. At this point, the entire Centre is ready for launch.

→ COUNTDOWN



The launch campaign is complete, the systems and teams at ESOC are ready.

At Europe's Spaceport, in Kourou, French Guiana – or at the site of one of ESA's other launch service providers – the satellite sits on top of its launcher, ready for the command that will send it into space, watched by the experts at ESOC.

With just hours to go before liftoff, the Mission Control Team at ESOC holds the final pre-launch briefing to review (one more time!) every detail of the mission plan.

At the briefing, team leaders and functional experts from the Mission Control Team are joined by the satellite's project team and the launch service provider.

Just before launch, all connections between ESOC to the outside are again verified; telephone, voice intercom, data and even fax links to the Launch Control Centre and the ground tracking stations are tested.

Countdown begins

Finally, after years of preparation, the moment arrives when the clocks in the Main Control Room (MCR) start counting down to the spectacular start of a new mission. Typically, the MCR timer begins ticking 12 hours before the planned liftoff.

GO/NO-GO roll call

Two hours before launch, the first shift of the Mission Control Team takes over in the MCR, and continues monitoring the satellite and countdown progress. The team conducts a GO/NO-GO roll call via the 'voice loop' intercom system; each engineer confirms to the Flight Operations Director that their individual systems both on the ground and on board the spacecraft remain ready for launch.

Once the internal ESOC roll call is complete, the Flight Director reports the Centre's readiness via the voice loop to the Launch Control Centre. This confirms that ESOC is ready to assume control of the spacecraft just minutes after launch and insertion into orbit.

Europe's Spaceport

Europe's Spaceport in Kourou, French Guiana, is where the powerful Ariane 5 heavy-lift launcher, as well as the Soyuz and Vega vehicles, leave Earth for space. ESOC controllers are in contact with the Launch Control Centre at Kourou to confirm their readiness to assume control of satellite missions.




SPACECRAFT
DATE
LAUNCHER
ISEE 2 22 10 77 THOR D
MET 1 23 11 77 THOR D
IUE 26 1 78 THOR D
OTS 2 11 5 78 THOR D
GEOS 2 14 7 78 THOR D
MET 2-APPL 19 6 81 ARIANE
MARECS A 20 12 81 ARIANE
EXOSAT 26 5 83 THOR D
ECS 1 16 6 83 ARIANE
ECS 2-TLC 1 4 8 84 ARIANE
SPACECRAFT
DATE
LAUNCHER
MARECS B2 10 11 84 ARIANE
GIOTTO 2 7 85 ARIANE
ECS 4 16 9 87 ARIANE
MET P2 15 6 88 ARIANE
ECS 5 21 7 88 ARIANE
MOP 1 6 3 89 ARIANE
OLYMPUS 12 7 89 ARIANE
HIPPARCOS 8 8 89 ARIANE
ULYSSES 6 10 90 SHUTTLE
ITALSAT F1 15 1 91 ARIANE
SPACECRAFT
DATE
LAUNCHER
MOP 2 2 3 91 ARIANE
ERS 1 17 7 91 ARIANE
EURECA 1-L 31 7 92 SHUTTLE
EURECA 1-R 1 7 93 SHUTTLE
MOP 3 20 11 93 ARIANE
ERS 2 21 4 95 ARIANE
ISO 17 11 95 ARIANE
ITALSAT F2 8 8 96 ARIANE
MTP 2 9 97 ARIANE
HUYGENS 15 10 97 TITAN IVB
SPACECRAFT
TEAMSAT
XMM
CLUSTER II-3
CLUSTER II-2
CLUSTER II-1
CLUSTER II-4
ENVIDAT
MSG-1
space operations centre
european space operations centre


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→ THE MISSION COMES ALIVE



Minutes before launch, the atmosphere in the Main Control Room is tense. Engineers watch their screens, waiting for the moment when years of preparation come to fruition. A voice on the intercom loop reads the countdown: 10, 9, 8, 7…

The launcher's main engines ignite and reach full power in just a few seconds. The vehicle rises from the launch pad, gaining speed and altitude.

For near-Earth missions, depending on the desired orbit, the satellite separates from the upper stage and reaches orbit within just 30 minutes. For missions to higher orbits – such as geostationary, Lagrange or interplanetary destinations – separation from the launcher may occur several hours or longer after liftoff.

ESOC assumes control

The teams in the Main Control Room assume control of the mission as soon as the ground station receives the first radio signal from space. This is called 'AOS' – or 'acquisition of signal'. Success means that the Mission Control System has established contact via the ground station with the spacecraft, and telemetry data are flowing to Earth.

All eyes in the MCR are then on the Ground Operations Manager (GOM) who is watching for the first indication that a signal has been detected. When the signal is seen, the GOM often simply gives a modest 'thumbs up'; the team cheers: months of hard work have come to fruition and the mission is alive!

During the launch and early orbit phase (LEOP), the Mission Control Team staffs the MCR 24 hours a day, overseeing a critical series of actions designed to deliver the satellite into a stable operational mode, move it into its correct final orbit and fully check out the health of all systems.

Up to a half dozen ground stations, operated by ESA or by partner networks, are called in to support communications during LEOP, providing extra telecommanding 'passes' – time slots when the satellite is in view of a single station. This provides mission controllers extra flexibility when complex command stacks or additional software must be uploaded to troubleshoot any problems that arise.

Typically, LEOP lasts for three days, and ends when the spacecraft is correctly oriented in a stable orbit, and all systems are functioning as expected. Mission control is then moved to the Dedicated Control Room, where the commissioning phase is conducted, lasting up to several months depending on the mission. Once all systems and payloads have been activated and commissioned, the routine mission phase can start.

For interplanetary or Lagrange missions, the routine phase will however not begin until after a complex 'cruise phase' or 'orbit entry' manoeuvre, which may mean that routine operations start only months (or even years) after launch.

→ DAILY OPERATIONS



With the spacecraft safely in orbit, the Flight Control Team settles in for what may turn into years of routine daily activities.

The key elements of success at ESOC include long-term planning, accommodating changing conditions as the mission progresses through eclipses or orbital evolutions and – always – anticipating the unexpected. After launch, the Flight Control Team works closely with the mission's Science Operations Centre (for ESA's planetary, observatory and solar missions), or the Payload Data Ground Segment (for ESA's Earth observation missions), to plan and carry out the daily observation activities of the satellite.

These plans must not only take into account the scientists' requests for specific observations, for example radar imaging of a particular region of a planet's surface, but also they must consider the constraints associated with operation of the satellite, such as available power.

Mission operations during the routine phase involve, for most missions, certain critical events that require particular attention and many months or even years of preparation. For instance, most interplanetary missions experience several critical events in their lifetime, from 'swingbys' – planetary gravity assists – to fast 'flybys' of small Solar System objects like asteroids or comets.

These operations require highly precise trajectory determination and a complex sequence of actions that have to work perfectly the first time, as they do not offer a second opportunity. Other types of missions also experience critical events during their 'routine' phase: such as reentry or deorbiting operations at the end of life, special trajectory adjustments or collision avoidance manoeuvres.

Since the 1960s, ESOC has built up the tools and expertise required to perform these and other complex actions in a robust and safe way.

Not all missions progress smoothly, however, and in the harsh environment of space unexpected events sometimes occur.

Problems can arise in the ground segment as well; at least these have the benefit of happening in equipment or software that engineers can physically examine or replace.

For every alarm condition raised, spacecraft controllers identify the anomaly and take immediate recovery actions, using the flight control procedures developed at ESOC before launch.

End of mission

A spacecraft is designed to fulfil the mission objectives for a defined period of time, ranging from two to ten or more years. In some cases, mission termination can be unexpected and dramatic, but normally termination is planned, applying space debris mitigation measures so that they do not pose a danger to active spacecraft.

Whatever the fate of the satellite, the mission is considered permanently ended once ground contact is no longer possible.

→ MISSION SUCCESS



The mission operations phase is generally the final and arguably the most critical phase in a space project, during which the return on investment is realised; the return in this case is the quantity, quality and availability of mission products or services.

ESA currently (at time of publication) operates 15 spacecraft from ESOC, with 20 more in preparation.

Space Science

ESA's Solar System exploration missions focus on understanding Earth's relationship with other planets, an essential step for exploring the wider Universe.

rosetta, ESA's comet chaser, spent ten years travelling through space to enter orbit around Comet 67P/Churyumov-Gerasimenko. In August 2014, it started close-up observations of the comet. The data returned are giving scientists a better understanding of the beginnings of our Solar System and the origins of our planet. The Philae lander was deployed on 12 November 2014 and touched down on the surface of the comet, also delivering valuable data. Both the orbiting of a comet and the landing on its surface had never been tried before and represented a major achievement for ESA.

gaia's primary objective is to survey one thousand million stars in our galaxy and local galactic neighbourhood in order to build the most precise 3D map of the Milky Way and answer questions about its origin and evolution.

mars express is performing a series of remote-sensing observations around the Red Planet and is giving us vital information about the martian atmosphere, the planet's structure, geology and composition.

venus express studies the interactions between the atmosphere and the interplanetary environment (solar wind) to better understand the evolution of Venus.

cluster is a constellation of four satellites working together to investigate the small-scale structure of Earth's plasma environment. This enables scientists to build a three-dimensional model of the magnetosphere and to better understand the processes taking place inside it.

integral is providing new insight into the most violent and exotic objects of the Universe, such as black holes, neutron stars, active galactic nuclei and supernovae. This helps us to understand processes such as the formation of new chemical elements and gamma-ray bursts, the most energetic phenomena in the Universe.

xmm-newton, the largest science spacecraft ever built in Europe, is detecting X-ray sources to solve many cosmic mysteries, from what happens in and around black holes to the formation of galaxies in the early Universe.



Observing the Earth

ESA has been dedicated to observing Earth from space since the launch of its first meteorological mission in 1977. The series of Meteosat satellites, as well as ERS-1, ERS-2, Envisat and more, have provided us with invaluable data about Earth, its climate and changing environment.

cryosat-2 measures ice thickness very precisely on both land and sea to provide conclusive proof as to whether there is a trend toward diminishing polar ice cover, furthering our understanding of the relationship between ice and global climate.

swarm, a constellation of three satellites, is unravelling one of the most mysterious aspects of our planet: the magnetic field and electric currents in and around Earth which generate complex forces that have immeasurable impact on everyday life.

sentinel-1 is the first in a new series of seven satellites which will provide all-weather day-and-night radar images in support of the EU Copernicus user services.

Past missions

Huygens culminated with the successful descent and landing on Saturn's moon Titan in 2005. The scientific data sets returned by this probe provided fascinating insights into this remote world.

giotto returned the first image of a comet nucleus in 1986, when it encountered Comet Halley. It went on to explore a second comet, Grigg-Skjellerup, two years later.

smart-1 demonstrated solar-electric propulsion to travel a complex 100-million km spiral journey to the Moon. This also enabled experts to develop and test innovative ground control systems.

herschel had the largest single mirror ever built for a space telescope and was able to observe across the far infrared and sub-millimetre wavelengths to provide data about the formation of galaxies and the creation of stars.

planck has delivered the most precise all-sky image of the Cosmic Microwave Background which is enabling us to test a huge variety of models of the origin and evolution of the cosmos.

envisat orbited Earth more than 50 000 times to deliver valuable data on the workings of the Earth system, including insight into factors contributing to climate change.

goce was dedicated to measuring Earth's gravity field and modelling the geoid with unprecedented accuracy and spatial resolution. The data has improved our knowledge of ocean circulation, energy exchanges around the globe, sea-level change and Earth-interior processes.

Visit our website to see the complete list of satellites and their current status.

→ CENTRE OF EXCELLENCE



> **“ESOC strongly supports European industrial competitiveness.”**

In addition to its core business of satellite operations, ESOC serves as a ‘European Centre of Excellence’ across a number of related domains.

These include international technical standards, space debris studies and services, space situational awareness, developing software and systems, designing and developing tracking stations and satellite-based navigation services. ESOC strongly supports European industrial competitiveness through, for example, the sharing of intellectual property.

Estrack: Europe’s tracking network

Mission control is achieved through regular communication with the satellite, sending up telecommands and receiving back scientific data and spacecraft status information – telemetry – from orbit.

The most dramatic and visible elements of ESA’s ground facilities are the Estrack ground stations, located on three continents and controlled remotely by teams working at ESOC. The core stations, designed and developed at ESOC, include three, huge 35 m-diameter deep-space stations in Australia, Spain and Argentina, employing some of the world’s most advanced radio-signal tracking technology.

Our ground stations routinely support missions flown by other agencies, and we use tracking capacity provided by other networks, boosting cost efficiency for all.

Space debris research and services

Space debris research activities within ESA, and cooperation with European and international partners, are coordinated by ESA’s Space Debris Office at ESOC. Research activities focus on ground-based observations and *in situ* measurements, debris and meteoroid environment modelling, hypervelocity impact tests and protection concepts, and space-debris mitigation measures. The office also provides ‘conjunction warning’ services to European customers and serves as ESA’s



representative to numerous national and international bodies related to space debris.

Space Situational Awareness (SSA) programme

The objective of the SSA programme is to support Europe's independent utilisation of, and access to, space through the provision of timely and accurate information, data and services regarding the space environment, and particularly regarding hazards to infrastructure in orbit and on the ground. In general, these hazards arise from possible collisions between objects in orbit, harmful space weather and potential strikes by asteroids and other natural objects that cross Earth's orbit. Teams at ESOC are involved in developing software, tools and techniques that will be integrated into the final systems.

ESA Navigation Office

ESOC is playing a key role in the emerging field of data products and tools related to Global Navigation Satellite Systems and services. The core service of the Navigation Office is calculating and predicting highly accurate GPS, Galileo and Glonass satellite orbits, in near-real time, every six hours, around the clock. These data are then used to improve GPS position accuracy, paving the way to even more sophisticated applications, such as scientific studies, large-scale climate monitoring and tracking of long-term changes in Earth's geology.

Developing space software

We design, develop, test and maintain custom data systems dedicated to each of the missions that ESA operates from ESOC, including mission control, mission planning and simulator systems. We focus on ESA's science, Earth observation and navigation missions, and support the flight control teams throughout the life of a mission, beginning, in some cases, up to several years before launch. Experts also develop software as part of an overall ground control infrastructure. This covers, in particular, the generic elements of mission control systems, simulator systems and ground station data systems.

ESA's partnership with industry

ESOC has been working closely with European companies to develop expertise in ground segments and operations. The majority of a mission's operations budget flows to European industry, which provides trained experts, furnishes sophisticated ground segment hardware and software, and delivers operational services.

In addition to powering dozens of ESA and partner agency missions, ESA's ground segment applications are being shared with European industry under innovative, royalty-free licensing schemes.

Regionally, ESOC has teamed up with the government of Hesse, research organisations, IT companies, banks and future Galileo navigation users to launch 'cesah', a business incubation centre (BIC). cesah has supported over 50 start-ups as part of an ESA Europe-wide BIC initiative.

→ CONNECT WITH US



On the web

To get more detailed information on any of our many activities, we welcome you to explore the ESOC website. Through articles, videos, images and text, you will get an in-depth view of the operations environment. If you're looking for up to the minute reports, try one of our social channels.

Rocket Science Blog

Our blog is operated as an unofficial source of information for the general public, media and anyone interested in the European Space Operations Centre. It is updated by members of the ESA team at ESOC, with timely input from mission controllers, spacecraft experts, engineers, scientists and senior managers.
blogs.esa.int/rocketscience/

Facebook

We regularly post operations-related images and stores on the ESA English and German Facebook pages. We welcome your 'Likes', comments and shares.
www.facebook.com/europeanspaceagency

Twitter

@esaoperations is the fastest way for us to get information out to you. As soon as we know it, you know it too. If you prefer, **@esa_de** will give you the German version of our tweets. For many of our launches or other large events, we regularly hold tweetups.

Flickr

ESA has an extensive collection of albums on Flickr. Many of these are of ESOC launch and establishment events. See the faces behind our work – catch their expressions and the action.
ww.flickr.com/photos/europeanspaceagency
www.flickr.com/photos/esa_events

YouTube

YouTube is a great source for all of our video material. Here you can find, for example, interviews with ESOC engineers or virtual tours.
www.youtube.com/esa

Livestream

We livestream all our events. If you can't be here, this is the next best way to watch the action as it unfolds. During a launch, watch the operations team as they go through their go/no go roll call, or feel the tension as they wait to get that first signal from space. Links to livestream feeds are reposted on our website. Streams are archived in case you'd like to watch the event at a later time.
new.livestream.com/esa

Google Hangout

Hang out with us while we talk about our latest missions with a panel of experts, engineers or scientists. Dates and times are posted on our web sites and blogs.



Visit us

www.esa.int/esoc

Schedule a guided tour
www.darmstadt-marketing.de

Contact us

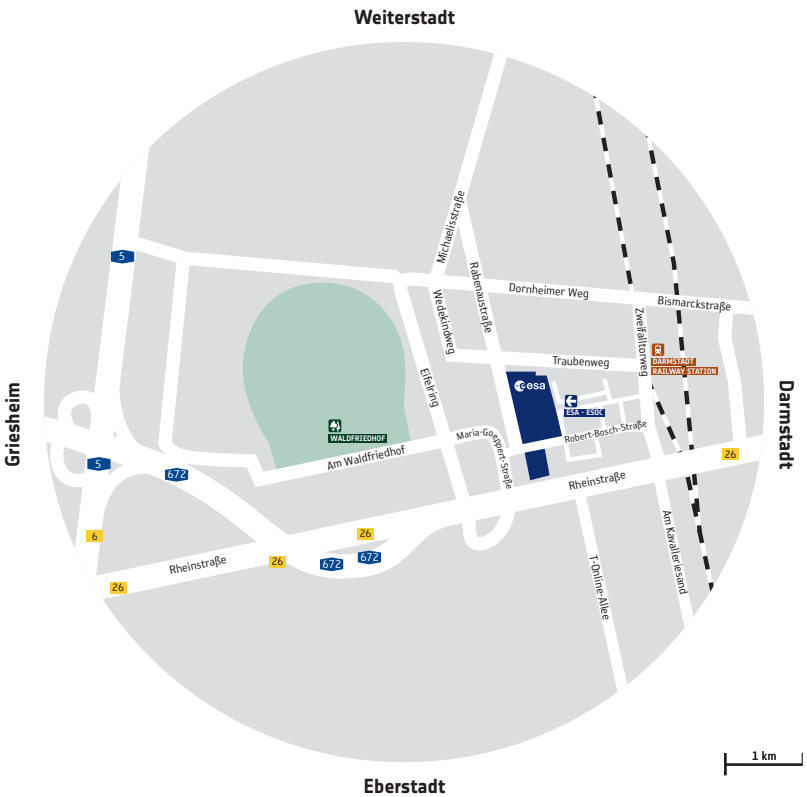
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