EUROPEAN UNION
DELEGATION OF THE EUROPEAN COMMISSION TO THE USA

eufocus

July 2009

The EU and Space

Reaping the Benefits of Space Exploration and Technology

"I don't think the human race will survive the next thousand years, unless we spread into space. There are too many accidents that can befall life on a single planet. But I'm an optimist. We will reach out to the stars."

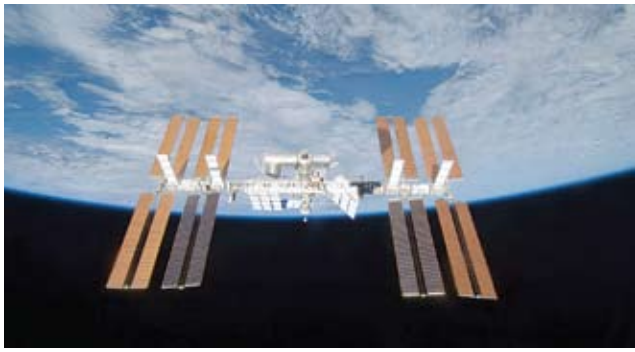
– Stephen Hawking

Forty years ago, the world watched in awe as the first humans stepped foot on the moon. Today, nations routinely rely on space-based technology in areas including communications, navigation, and earth observation. No longer the sole domain of Cold War superpowers, space activities have become strategic and economic priorities not only for the U.S. and Russia, but also for the European Union, Japan, and the emerging economies of China and India.

From satellite communications to weather forecasting, from earth observation satellites monitoring climate change to global positioning satellites that help planes navigate safely, the technological offshoots of space activities offer important benefits to 21st century citizens. Space exploration programs help to develop human understanding of both the universe and our own planet; they help our search for answers to fundamental questions: "Where did life come from? Is human life possible in extraterrestrial environments?" and "How can we harness the natural resources of Mars or other bodies? Can knowledge of and solutions for earthly challenges be found in space?"

However, by their very nature, space ventures are often massive, costly, and complex; they require long-term planning, substantial investment, and strategic vision. Very few nations can accomplish this alone. Even the two original space powers—the U.S. and Russia—are engaged in international cooperation to further their space goals.

European nations long ago joined forces to reap the full benefits of space for their citizens. The European Union's collaboration with the European Space Agency (ESA) provides the scale and expertise necessary to drive European space applications, exploration, science, and technology, and together the EU and ESA have launched a forward-looking vision for European Space Policy.



International Space Station (ESA/NASA)

The European Space Policy promotes two priority EU space program: Galileo and GMES. Galileo, the EU's satellite navigation system, and GMES, the EU's earth observation system, represent significant innovations in their respective domains.

Europe has its own independent access to space through ESA's Kourou launch site on the northeast coast of South America, and has also developed arrangements with the U.S. and Russia for human spaceflight—European astronauts regularly fly to the International Space Station (ISS) from launch sites in both countries.

Right now, multinational crews on the ISS are collaborating on highly complex work in a contained environment miles above the Earth, despite differences of nationality, culture, ethnicity, and language. Europe is a major partner in the ISS; it has constructed an impressive state-of-the-art laboratory module, developed and launched the first in a series of unmanned supply shuttles, and provided a continuous supply of astronauts. Among its many objectives, the ISS serves as a laboratory and platform for the development of technology to further human space exploration…to the Moon, to Mars, and beyond.

inside

European Space Policy

Actors, Objectives, and Processes

Ariane 5 (ESA/CNES/Arianespace/ Service Optique Video du CSG)

"For the first time… space activities at national and European level will be coordinated to achieve maximum complementarity and transparency. More synergy and coordination between defense and civil space programs and technologies will be developed, in full respect of respective competencies, so that each sector can take maximum advantage of the investments of the other. A joint international relations strategy will be developed between ESA and EU Member States."

– European Commission Vice-President Günter Verheugen, responsible for Enterprise and Industry

For nearly half a century, Europe has been actively involved in developing space technology through national and European programs. The European Space Agency (ESA), an intergovernmental agency, was launched in 1975 to promote European cooperation in space.

In 2003, the European Commission—the EU's executive arm—and ESA formally joined forces, drawing on each other's complementary strengths to further advance European space applications, exploration, research, and technology in the 21st century.

The European Commission drives the exploitation of space for the benefit of its citizens; ensures the continuity of relevant operational services; develops appropriate regulatory frameworks; and coordinates and promotes a single European position in international forums.

ESA and its 18 member countries—including 16 of the 27 EU Member States—are responsible for the conception and implementation of space programs, space-related scientific research, and the procurement of resources needed for space activities, particularly access to space and technology.

The European Space Policy, drafted jointly by the European Commission and ESA, outlines a unified European vision for the space sector. The policy strives to develop and exploit space applications that serve the needs of Europe; address space-related security and defense issues; apply space technology to improved understanding of climate change; foster a strong and competitive space industry; ensure independent, cost-effective access to space; and promote a European initiative in space exploration.

Through the European Space Policy, Europe has increased its coordination with international partners. For example, the European Commission and ESA jointly represent Europe in cooperation with other strategic partners and closely coordinate European participation in intergovernmental forums such as the Group on Earth Observations (GEO).

Europe's Launch Capabilities

Independent and cost-effective access to space is a strategic priority for Europe, and Europe has its own range of launch vehicles capable of launching the smallest scientific satellite or the heaviest commercial communications device from ESA's Kourou spaceport.

Ariane. Europe's independent adventure in space began on December 24, 1979, with the successful launch of Ariane 1, ESA's first heavy lifter. Today, Ariane 5 is used to launch satellites into geostationary transfer orbit, medium and low earth orbits, sun-synchronous orbits, and earth-escape trajectories. All versions of the Ariane 5 consist of a central core with two solid rocket boosters attached; the actual launch configuration can be adapted to

European Space Agency

Established in 1975, ESA conceives and implements space activities and programs that require the resources of multiple European countries to succeed. ESA's earliest objectives remain valid today: a competitive European space industry; researchers that lead the way in scientific discovery; high-quality satellite-based services for European citizens and governments; and a strong share of the global space market. ESA also encompasses the European Astronaut Corps.

With headquarters in Paris and technical and operations centers throughout Europe, ESA has an annual budget of just over €3 billion. ESA cooperates with all major space powers, particularly the U.S. and Russia. ESA's main spaceport is the Space Center in Kourou, French Guiana, on the northeast coast of South America, a site made available by France.

ESA Member Countries

- Austria
- Belgium
- Czech Republic
- Denmark
- Finland
- France
- Germany
- Greece
- Ireland
- Italy
- Luxembourg
- Netherlands
- Norway
- Portugal
- Spain
- Sweden
- Switzerland
- United Kingdom

As European Cooperating States, Hungary, Poland, and Romania participate indirectly in all ESA procurements and activities. Canada also participates in several ESA activities based on a cooperation agreement.

specific satellite and trajectory requirements.

Vega. Small launchers like Europe's new Vega are necessary for the cost-effective placement of smaller satellites into the polar and low-earth orbits used for many scientific and earth observation missions. The most recent addition to Europe's series of launch vehicles, Vega was designed as a single body launcher with three solid propulsion stages and an additional liquid propulsion upper module used for positioning, orbit control, and satellite release. Unlike most small launchers, Vega will be able to place multiple payloads into orbit, making access to space easier, quicker, and cheaper. The first launch is expected in 2009.

Soyuz. In 2009, a Russian Soyuz launcher will lift off for the first time from a spaceport other than Baikonur, Kazakhstan or Plesetsk, Russia. The Soyuz rocket, expected to launch from Kourou, has been transporting cosmonauts into space since the 1950s. Soyuz, along with the U.S. space shuttle, ensures the continued transport of crews to and from the International Space Station. Soyuz 2, a medium-class launcher, will be able to carry up to three tons of cargo into geostationary transfer orbit from Kourou.

The International Space Station and Human Space Exploration

The International Space Station (ISS) is an unprecedented, state-of-the-art orbiting laboratory complex that enables scientists to push the envelope of space research well beyond current boundaries.

Human space exploration presents a unique opportunity to achieve unprecedented scientific and technological progress through international collaboration, but requires significant investment, massive complex infrastructure, and a long-term commitment by all the partners involved. Five space agencies—including NASA and ESA—representing more than 20 countries have worked together to develop, operate, and utilize the ISS, a permanently inhabited space station in low earth orbit. In addition to Europe and the United States, Canada, Russia, and Japan all contribute to the ISS, and each agency provides astronauts to live on board.

ESA astronaut works on Columbus (ESA/NASA)

Once completed, the space station will cover an area the size of a football field, weigh more than 500 tons, and have enough pressurized space to accommodate six crew members and a vast array of scientific experiments.

ESA is exclusively responsible for two key elements in the ISS: the European Columbus laboratory and the Automated Transfer Vehicle (ATV).

Columbus Laboratory. In February 2008, the U.S. space shuttle Atlantis successfully delivered ESA's Columbus laboratory to the ISS.

Columbus—Europe's first permanent human outpost in orbit—nearly doubled the laboratory capacity of the ISS and can support hundreds of experiments annually. The lab is ESA's biggest single contribution to the space station, and is equipped with flexible research facilities both inside the laboratory and on external platforms. A network of User Support and Operations Centers throughout Europe allows researchers on the ground to follow and even interact with on-board experiments in real time.

The ISS is also a platform to prepare for further human space exploration, and Columbus was developed to test both the behavior of humans in a space-based environment and the technologies that can be useful for human exploration of the solar system.

Jules Verne ATV. ESA also contributes to ISS operations through unmanned servicing missions, such as the one carried out in 2008 by Jules Verne, the first of five European Automated Transfer Vehicles (ATVs). Launched by Ariane 5, Jules Verne ferried spare parts, experiments, propellant, crew equipment, and supplies to the ISS, which depends on such regular deliveries. ATVs also re-boost the space station to compensate for its normal orbital decay. ESA's second ATV, the Johannes Kepler, is due to launch in mid-2010.

European Astronaut Corps

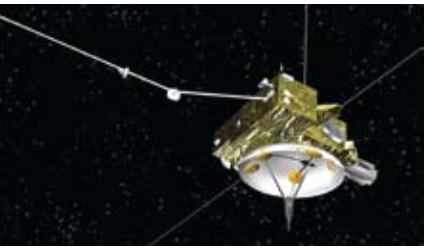
The European Astronaut Corps results from the 2002 integration of the existing ESA astronaut team with astronauts from ESA countries participating in the International Space Station (ISS). The European Astronaut Center in Cologne, Germany, is the home of the European Astronaut Corps and is equipped with training facilities for European astronauts as well as their international counterparts.

When not involved in training or mission support, astronauts contribute to "regular" ESA activities such as technology programs. Twelve European astronauts from seven European countries have flown to the ISS between 2001 and 2008.

Jules Verne ATV (ESA/D. Duclos)

European Space Exploration

Science and Robotics



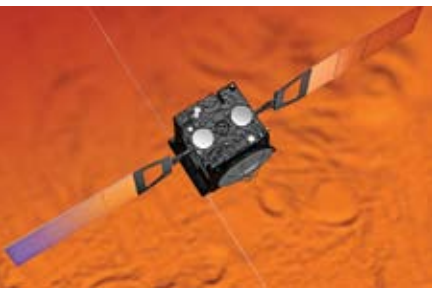
Ulysses (ESA/C.Carreau)

"Ulysses has given us the first detailed view of the sphere of influence of our star the Sun in not only three, but actually four dimensions—three spatial dimensions and time. This voyage of exploration has truly been an odyssey that will serve as a benchmark for space science for many years to come."

– Joint statement by David Southwood, ESA Director of Science and Robotic Exploration, and Ed Weiler, NASA Associate Administrator of the Science Missions Directorate

"Mars Express is the first fully European mission to any planet. It is an exciting challenge for European technology."

– Rudi Schmidt, ESA Mars Express Project Manager



Mars Express (ESA/Alex Lutkus)

Current European space robotic exploration missions are studying various aspects of the solar system, from investigating comets to helping understand the origins of the universe, and from asteroid fly-bys to preparing for eventual human spaceflight to Mars.

Ulysses. Constructed in Europe and launched in 1990 on NASA's space shuttle Discovery, Ulysses successfully orbited the poles of the sun for more than 17 years, giving scientists an unparalleled view of the heliosphere—the magnetic bubble created by solar wind that carries the solar magnetic field well beyond the outer reaches of the solar system.

One of the mission's major objectives was the study of the solar wind, a constant stream of charged particles expelled by the sun. The solar wind's gusts and shocks can cause geomagnetic storms that may influence the weather on Earth, and harm satellites, power supplies, and communications. Ulysses' rich scientific harvest has completely changed scientists' view of the sun's magnetic influence on the charged particles that populate the space in which Earth's satellites and astronauts operate.

Mars Express. Launched in 2003 from the Baikonur Cosmodrome in Kazakhstan, the Mars Express orbiter and lander were designed to investigate the Martian atmosphere, providing high-resolution photo geology and mineralogical mapping. ESA's first planetary visit also seeks to answer fundamental questions about the history of water and the potential for life on Mars.

Although the lander, Beagle 2, was lost on landing, the Mars Express orbiter has taken breathtaking high-resolution images of the planet's surface, including images of the snow-laden North Pole. Recent data from the Mars Advanced Radar for Subsurface and Ionosphere Sounding (MARSIS) on board Mars Express has revealed that both polar ice caps are 3.5 kilometers thick. MARSIS is the first radar instrument ever flown to Mars, and continues to send back pioneering subsurface sounding measurements that indicate underground water and ice deposits.

The orbiter has also discovered mineralogical evidence of the presence of liquid water throughout Martian history, studied the density of the Martian crust in detail, and was the first orbiting spacecraft to detect methane in the planet's atmosphere.

ExoMars. Due to launch in 2016, ExoMars marks an important milestone in potential human exploration of the Red Planet. ExoMars is the first element of a series of joint NASA-ESA robotic Mars missions, and consists of an orbiter to support future Mars missions as well as a descent module that carries a rover with a drill and scientific payload.

ExoMars Rover (ESA)

Venus Express Launched from the Baikonur Cosmodrome in late 2005, Venus Express is a virtual twin of Mars Express. Since its arrival, Europe's first mission to Venus has been investigating various aspects of the planet's atmosphere to gain a better understanding of why Earth and Venus—two planets so similar in size, mass, and composition—have evolved so differently over the past four billion years.

Venus Express has revealed astonishing details of the dynamic Venusian cloud system, detected water molecules escaping into the atmosphere, found evidence of lightning in the atmosphere, and provided infrared glimpses of the hot surface. Scientists have mapped the planet's thick, noxious atmosphere globally for the first time in 3D, and used the data to produce the first extensive meteorological maps of Venus, providing measurements of wind fields, temperatures, and the chemical composition of the atmosphere.

Rosetta. Designed to orbit and land on a comet, Rosetta was launched from Kourou in 2004 and will be the first space vehicle to thoroughly explore a comet at close quarters. Rosetta aims to study the origin of comets, which are among the most primitive objects in the solar system, to better understand the evolution of the universe. En route to the comet, Rosetta has already closely observed one large asteroid (Steins) along its path, with another (Lutetia) to come in 2010.

After entering orbit around Comet 67P/Churyumov-Gerasimenko in 2014, Rosetta will release its small lander onto the icy nucleus and spend the next two years orbiting the comet as it heads towards the Sun.

Rosetta will also investigate whether comets striking Earth might have played a role in the origin of life on our planet, since they carry complex organic molecules. Comets also carry volatile light elements that may have contributed to forming Earth's oceans and atmosphere.

Huygens-Cassini. ESA's contribution to the NASA Cassini Saturn Orbiter, Huygens is an atmospheric probe that successfully provided detailed data on the physical, atmospheric, and meteorological aspects of Titan, Saturn's largest moon. The Huygens probe parachuted to Titan's surface in early 2005 after an interplanetary journey of nearly seven years—the only landing to occur in the outer solar system and the furthest from Earth.

Rosetta (ESA/C.Carreau)

Herschel and Planck

Spring 2009 witnessed the combined launch of ESA's Herschel and Planck spacecraft, which will study the origin and evolution of the universe and its components. Although they launched in tandem, the spacecraft will part ways shortly after escaping the Earth's gravitational pull.

Herschel, ESA's cutting-edge space observatory, carries the most powerful infrared telescope ever launched into space and will undertake a pioneering study of the origin and evolution of stars and galaxies to understand how the universe evolved. As the first observatory to cover the entire range of infrared wavelengths, Herschel will tap into unexploited wavelengths, studying phenomena out of reach for other observatories. The telescope's primary mirror is 3.5 meters in diameter, more than four times larger than any previous infrared space telescope, and almost fifty percent larger than the Hubble telescope.

Planck is Europe's first mission to study the Cosmic Microwave Background (CMB), the leftover radiation from the Big Bang 15 billion years ago, which was probably released a mere 300,000 years after the Big Bang. Because the CMB radiation required billions of years to reach the Earth, it offers a snapshot of our universe when it was very, very young.

Astronomers will use Planck as a "time machine" to examine the beginnings of space and time as we now know them. The spacecraft will measure tiny fluctuations of the CMB with unprecedented accuracy to test and verify theories on the birth and evolution of the universe.

Planck will carry a telescope with a 1.5 meter primary mirror; its routine science observations should begin within six months of its launch and last at least 15 months.

Future missions include **Bepi-Columbo,** due to launch in 2013 to map Mercury, the planet closest to the sun. Europe has already completed a mapping mission to the Moon, and intends to participate in ongoing efforts that will lead to the eventual establishment of a permanently manned **Lunar Space Base.**

ESA astronaut Hans Schlegel (ESA/NASA)

Saturn and moons (NASA/ESA/ Hubble Heritage Team)

Space Technology

Keeping Europe Competitive, Benefiting Citizens

Galileo (ESA/P. Carril)

"The EU has now a Common Space Policy. It focuses on space applications, as a means to achieve public policy objectives for the benefit of its industries and citizens. Galileo and EGNOS in satellite navigation and GMES in earth observation are the first EU-wide projects implementing this policy."

– European Commission Vice-President Antonio Tajani, responsible for Transport

Space systems and space-based technologies are now a critical part of daily life. From telecommunications to television, from weather forecasting to global financial systems, most key services depend on space to function correctly, and a viable space industry plays a crucial role in maintaining Europe's industrial and technological competitiveness.

The space sector is a €90 billion market worldwide, growing by seven percent annually. Europe is home to three of the world's five largest satellite system operators, and European companies claim 40 percent of the commercial markets for satellite manufacturing, launch, and services.

Europe's public sector investment in civilian space activities is approximately €6 billion, with half invested through ESA and the remainder through national programs. In addition, the EU has increased its own funding to €1.4 billion (2007–2013) to support the European space program through its 7th Framework Program (FP7) for Research and Technological Development.

FP7 promotes cooperation between universities, industry, and research centers across the European Union, as well as collaboration with non-EU countries, including the U.S. Eighty-five percent of FP7 funding for space-related activities supports GMES, the EU's global earth observation system; the remainder contributes to space foundations which encourage the development of new concepts in space transportation and space technologies, as well as to reduce the vulnerability of space-based systems and services.

Galileo (the EU's global navigation positioning system) and GMES are priority EU programs with applications ranging from tracking agricultural yields and climate change to extending the use of positioning and navigation services to improve transport safety and efficiency.

European Research and Development: Current and Upcoming FP7 Projects

GMES

- **geoland2:** Informs decision makers about current environmental conditions and predictable trends.
- **MyOcean:** Sets up infrastructure and services in preparation for the GMES Marine Services, including information about the present and future impact of rising sea levels on coastal areas.
- **SAFER:** Provides a rapid mapping capacity in response to natural disasters and humanitarian emergencies.
- **G-MOSAIC:** Supports EU external relations policies.
- **MACC:** Combines computer simulations with worldwide observations to monitor and forecast the composition of the Earth's atmosphere and predict regional air quality.

Space Foundations

- **AEROFAST:** Enhances mobility between Earth and space.
- **AGAPAC:** Establishes a space-compatible European supply chain.
- **GRASP:** Develops green propellant to make spacecraft more environmentally friendly, while securing independent European access to space.
- **HAMLET:** Builds a three-dimensional model of the radiation dose distribution in an astronaut's body.
- **HiPER:** Performs basic research and proof-of-concept experiments on space transportation technologies.
- **HPH.com:** Optimizes and develops a new type of space plasma thruster.
- **ORPHEE:** Increases hybrid rocket engine performance and paves the way for future space missions.
- **PRoVisG:** Improves the processing and representation of visual data transmitted by robotic planetary probes.
- **SOTERIA:** Improves space weather forecasting.

Global Positioning

EGNOS and Galileo

Europe has followed a two-step approach to develop its own global navigation satellite system. The European Geostationary Navigation Overlay Service (EGNOS)—the forerunner to Galileo—was developed by ESA in partnership with the EU and EUROCONTROL, the European Organization for the Safety of Air Navigation.

EGNOS, already available throughout Europe and the Mediterranean, utilizes a network of ground stations and transponders installed in geostationary satellites to improve the accuracy of information derived from U.S. GPS signals. Financed by the EU, EGNOS is the first European-owned and operated satellite navigation infrastructure, and contributes to safer and more efficient air traffic management.

Galileo, the EU's first flagship space program and a state-of-the-art global satellite navigation system, will provide a highly accurate, versatile, and secured global positioning and timing service by 2013. A joint ESA-EU program, it is the first such system entirely under civilian control and is fully compatible with the American GPS and the Russian GLONASS systems. Once its full array of 30 satellites is operational, Galileo will be able to accurately determine positioning to within a meter, even in high-rise cities.

EU-U.S. cooperation has paved the way for the full compatibility and joint use of Galileo and GPS and has simplified the manufacture of equipment capable of receiving both signals. The European Commission is the program manager for the deployment phase of the Galileo program, which will be financed entirely by the EU. In July 2008, the EU allocated more than €3.4 billion (2007–2013) for EGNOS and Galileo.

"Galileo is now entering a new era where space age technology brings down-to-earth benefits for every citizen and business in Europe. With Galileo, the European Union will buy a state-of-the-art satellite navigation system that will increase economic efficiency and reduce congestion and energy consumption throughout the transport sector. That means boosting growth and jobs and helping to tackle climate change, while also making everyday life safer and easier."

— European Commission Vice-President Antonio Tajani, responsible for Transport

GMES

Global Monitoring for Environment and Security

Launched in 1998, GMES is an EU-led initiative that combines satellites in earth orbit with ground, air, and sea-based measuring instruments to provide data to support the needs of policymakers and citizens. Initially developed as a scientific project, the joint EU-ESA GMES program has begun to evolve into a system that will contribute to a number of key priorities, including:

- Understanding and managing global change by providing data and validating models for phenomena such as El Niño, the carbon cycle, and climate change;
- Enhancing civil security by using observation systems to prevent and/or evaluate catastrophes, including fires, floods, and earthquakes;
- Providing information on rapidly changing "security" situations, such as those affecting peacekeepers, civil protection authorities, relief and medical personnel, and entities dealing with organized crime or terrorism.

The European Commission identifies user needs, provides for the development of services, and defines global governance of the system; ESA manages project implementation.

GMES will be the main European contribution to the Global Earth Observation System of Systems (GEOSS), which links together existing and planned observation systems around the world and supports the development of new systems where gaps exist.

Earth observation missions operated by European national and commercial owners and by EUMETSAT (the European Organisation for the Exploitation of Meteorological Satellites) are core elements of the GMES space component.

To meet the needs of the GMES program, ESA is also developing five types of dedicated new satellites, called Sentinels, to supplement existing satellite missions. Sentinel-1 will provide 24-hour all-weather radar imaging of both land and ocean; Sentinel-2 will provide high-resolution optical imaging for land only; Sentinel-3 will provide ocean and global land monitoring services; and Sentinels 4 and 5 will provide data for atmospheric composition monitoring from two different orbits. The first three Sentinels are currently under industrial development, with Sentinel-1 slated to launch in 2011.

Cyclone as captured by Envisat (ESA)

European Earth Observation Satellites

European space technology is producing practical results that bolster EU policymakers' ability to deal with global challenges, including weather-related natural disasters and the impact of climate change.

MetOp—Improved Weather Forecasting. Launched in October 2006, MetOp is Europe's first polar-orbiting satellite dedicated to operational meteorology. It represents the European contribution to the new Initial Joint Polar System (IJPS), an agreement between EUMETSAT and the U.S. National Oceanographic and Atmospheric Administration (NOAA) to provide data to monitor climate and improve weather forecasting.

A joint venture of ESA and EUMETSAT, MetOp is a series of three satellites to be launched sequentially over 14 years, forming the space segment of EUMETSAT's Polar System.

MetOp carries instruments provided by the U.S. as well as a new generation of European instruments that offer improved accuracy of temperature humidity measurements, readings of wind speed and direction, and atmospheric ozone profiles. Such augmented data have been used to monitor tropical cyclones and will be vital in monitoring extra-tropical winter storms.

Vital Data on the Polar Regions. ESA's Envisat, the largest earth observation spacecraft ever built, carries ten sophisticated optical and radar instruments that continuously observe and monitor the Earth's land, atmosphere, oceans, and ice caps. Envisat's Advanced Synthetic Aperture Radar (ASAR) sensor is particularly well suited for monitoring polar regions because it can acquire images through clouds and darkness.

Long-term satellite monitoring over polar regions provides authoritative evidence of climate trends and allows scientists to make predictions. Envisat and an earlier generation satellite, ERS, have been providing information on the Arctic region for the past 17 years—long-term data sets that are key to implementing EU policy on the Arctic region.

In Antarctica, scientists warn that the April 2009 collapse of the ice bridge that connected Wilkins Ice Shelf to Charcot Island may lead to a situation that could put the entire ice shelf at risk of further disintegration. Envisat surveys the area daily to monitor developments and disseminate up-to-the-minute information.

On the Web

- **European Space Agency**
  http://www.esa.int
- **European Astronauts**
  http://www.esa.int/esaHS/astronauts.html
- **European Space Policy**
  http://ec.europa.eu/enterprise/policies/space/index_en.htm
- **European Space Research and Development**
  http://ec.europa.eu/enterprise/policies/space/research/index_en.htm
- **ESA Space Science**
  http://www.esa.int/esaSC/index.html
- **GMES**
  http://ec.europa.eu/gmes/index_en.htm
- **International Space Station**
  http://www.esa.int/esaHS/iss.html

Next Stop: Mars

Imagine spending more than three months traveling to the nearest planet: sharing a small space, living and working with other crew members, rationing available food so that it will last the entire journey, and improvising to resolve emergencies.

On March 31, two European and four Russian crew members were sealed inside a special habitat at the Institute of Biomedical Problems in Moscow for a 105 day simulated mission to Mars. *Mars 500* will help prepare for a future human mission to Mars.

ESA selected crew are Oliver Knickel, a mechanical engineer in the German army, and airline pilot Cyrille Fournier from France. The two EU participants are accompanied by four Russian crewmembers: cosmonauts Oleg Artemyez and Sergei Rvazansky, Alexei Baranov, a doctor, and Alexei Shpakov, a sports physiologist.

During their stay, the participants will experience all aspects of a real Mars mission, including the launch, the long journeys to and from the planet, and an excursion to the surface of Mars. Assigned tasks will be comparable to an actual space mission, including realistic delays in communication, and participants will encounter simulated emergency situations.

Scientists will examine the impact of isolation on crew members to assess psychological and physiological aspects such as stress, hormone regulation and immunity, quality of sleep, mood, and effectiveness of dietary supplements.

The 105-day study precedes a full simulation of a 520-day mission to Mars, due to start late in 2009.

EUROPEAN UNION
DELEGATION OF THE EUROPEAN COMMISSION TO THE USA

EU Focus is published bi-monthly by the Delegation of the European Commission to the United States.

Anthony Smallwood
Spokesman and Head of Press & Public Diplomacy
Editor-in-Chief

Stacy Hope
Editor

Melinda Stevenson
Writer/Assistant Editor

ISSN: 1830-5067
Catalogue No.: IQ-AA-09-04-EN-C

Delegation of the European Commission to the United States
2300 M Street, NW
Washington, DC 20037
202.862.9500

www.eurunion.org
email:delegation-usa-info@ec.europa.eu

For further information: http://www.eurunion.org/eufocus