

ITALY

Space Activities

Year 2007



A photograph of an astronaut in a white spacesuit floating in space. The astronaut is positioned in the upper center of the frame, with their arms slightly outstretched. The background is a vast, deep blue space, and a bright, glowing arc of the Earth's horizon is visible in the lower half of the image. The lighting is soft, highlighting the texture of the spacesuit and the curvature of the planet.

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A background image showing a view of Earth from space, with a bright sun or light source in the upper left corner creating a lens flare effect. The Earth's surface is visible with clouds and landmasses.

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Introduction

In April 2007 the Italian First Minister Romano Prodi nominated Prof. Giovanni Fabrizio Bignami as President of the Italian Space Agency (ASI).

In his first address, Prof. Bignami describes the plan of his mandate as follows:

“The next few years will be crucial for the Italian Space Agency. As it approaches its 20th birthday, ASI and Italy with it, is gaining back the role it deserves in the international context of space science and technology.

My first months as ASI’s president have seen two important and spectacular achievements of the Agency, the launch of two completely Italian satellite after many years, the first one was AGILE (a small satellite for astrophysics), the second one was the first satellite of the COSMO-SkyMed constellation, an advanced Earth observation system.

This achievements show us the path to follow during the next four years, when ASI will have to continue doing its main job: building and launching satellites, making the best use of Italy’s outstanding scientific, technological and entrepreneurial skills. Launching satellites means conducting our own scientific and technological programme, which remains our priority. But it also means being able to support anyone (universities, research institutions, companies) who wants to go to space to conduct scientific research or to exploit market opportunities, for example, in the telecommunications field.

To work at its best, ASI, will further strengthen its relations, already very tight, with the rest of the space world: with ESA first of all, but also with NASA and the other National Space Agencies in the world. It will have to root itself more on the Italian territory, cooperating with the Regions to create other excellence centres like the Matera Base, that has become the national capital of Earth observation programmes.

All this will not be enough though: ASI will also devote more efforts to communicate and inform the public about its activities. It will try to contribute to create a true “space culture” in Italy, one that acknowledge this field as an extraordinary source of innovation and research that will eventually benefit every citizen.” G. F. Bignami

Earth Observation

Italy devotes special attention to earth observation programs. ASI is carrying out the implementation of a sophisticated dual-use (civilian/military) Earth observation satellite system, **COSMO-SkyMed**, dedicated to natural disasters prevention and safety.

June the 7th the first COSMO-SkyMed satellite has been successfully launched, followed by the second one on December 9, 2007, both launched by the US Vandenberg Base in California. The launches of the last 2 satellites will take place at the same time interval in the years 2008-2009.

COSMO-SkyMed system, developed by ASI in cooperation with the Italian Ministry of Defence, is a dual system that makes use of the most advanced remote sensing technology. It is composed by four X-band SAR (Synthetic Aperture Radar) satellites, providing high resolutions imaging - by day and night and by any weather - which are processed by a complex and geographically distributed Ground Segment infrastructure: Matera in Italy, Cordoba in Argentina, Kiruna in Sweden. The entire system is manufactured by Italian industries with Thales Alenia Space as prime contractor.

COSMO-SkyMed system is within the inter-governmental cooperation between Italy and France, based on the Agreement Concerning the Cooperation on Earth Observation signed in 2001, which established a dual system, ORFEO, composed by the Italian COSMO-SkyMed satellites and French Pleiades satellites.

In May 2007 ASI released an Announcement of Opportunity to conduct scientific research and application development projects in Earth Observation using products from the COSMO-SkyMed mission. 200 proposals from 29 different countries are presently under evaluation. The selected proposals will receive COSMO-SkyMed data at no cost.

The first COSMO-SkyMed satellite has already provided with images of natural disasters like the shipwreck of the Russian tanker Volganefit in the Black Sea, the cyclone in Bangladesh and the landslide in Bolzano. The four satellites will provide 1.800 images per day.

COSMO-SkyMed programme is the key element of the Italian Space Agency programme on Earth Observation applications.

In parallel with the development of the COSMO-SkyMed System, the Italian Space Agency has started a program dedicated to understanding and proving how space observation data could be used to fight natural and man induced disasters.

The scope of the program (by now dedicated to hydro-geological risks, geophysical risks and risks related to fires, oil spills and pollution) is to integrate new functionalities, based on Earth Observation data, in the decision support systems of Institutional Users, like Civil Protection, Environmental Agencies, local Authorities.

These functionalities will be implemented and demonstrated through pilot projects, that deal with all the emergency phases (Knowledge and Prevention, Alert and Crisis, Post Crisis) and answer to the priorities and the needs of the Institutional Users.

All the test sites considered in the pilot projects are in Italy, but the methodology can be exported to any areas, so that these projects could be seen as the national contribution to the GMES (Global Monitoring for Environment and Security) program and to Global Earth Observation System of System (GEOSS).

The program is being developed in close connection with the Italian Civil Protection in order to facilitate in the near future the transition of the existing monitoring capabilities from research to operational services.

In this framework an important cooperative effort devoted to the management of the natural disasters and emergencies is the bilateral cooperation between Italy and Argentina within the joint programme, Italo-Argentine Satellite System for Emergency Management (**SIASGE**) based on a ASI-CONAE agreement signed in 2005. The integrated system will use the Italian COSMO-SkyMed constellation and the Argentinean SAOCOM constellation composed by two L-band SAR satellites. The combined use of L-band and X-band SAR data could lead to improved results in several specific applications.

ASI has finalized the development of the instrument **ROSA**, a Radio Occultation Sounding for Atmosphere. It is dedicated to collect important information regarding temperature, pressure and atmosphere humidity contributing to the study and monitoring of climate change. ROSA will be installed onboard the Indian satellite, OCEANSAT-2 (ready for launch in 2008), onboard the Argentinean satellite, Aquarius/SAC-D, scheduled with launch scheduled in 2010 and also onboard the Italian mission **SABRINA**.

Italy is developing hyperspectral technologies. Based on the positive experience of the national project HyPSEO, ASI is developing a new Earth observation system, **PRISMA**, a small national

pre-operative program. It uses electro-optic instruments that integrate an hyperspectral sensor with a middle resolution panchromatic camera. This characteristic shall help to indentify also the chemical composition of the revealed objects.

At European level Italy contributes to the Global Monitoring for Environment and Security (GMES) programme, which will develop information services to be used for the definition and monitoring of EU policies in the field of environment and security.

Some examples of services are:

- Oil spill/discharge detection & monitoring;
- Land cover/land use for policy making and services to farmers;
- Support to civil protection – rapid mapping;
- Environment and health services – ozone monitoring and UV exposure.

ASI participates in many Earth Observation Programs of the European Space Agency (ESA) like DATA USER Programme, Earth Watch-Fuegosat, ENVISAT 1, METEOSAT Second Generation, EOEP Period 1, 2, and 3.

The **San Marco Space Base in Malindi (Kenya)** acquires Earth Observation satellite images both in L-band and in X-band. An average of 12 to 15 images per day are acquired from different sensors, processed and archived. A 6.2 m antenna in X-band is used to acquire MODIS/Terra and MODIS/Aqua. A L-band system is used to acquire NOAA/AVHRR and SeaStar/SeaWiFS. In the next months COSMO SkyMed data will be also acquired by Malindi.

In the spirit of the Italy-Kenya cooperation, the Italian Space Agency is transferring some of the application activities from its Remote Sensing Centre “**Italian Geodesy Center**”, in Matera, to Malindi. The first applications is the Hot-Spot Detection System (HSDS) based on MSG images, devoted to the early detection of wild fires in the Central and East Africa region.

At multilateral level Italy is member of the Group on Earth Observation (GEO), while ASI is member of the Committee on Earth Observation Satellites (CEOS) and the Integrated Global Observing Strategy (IGOS). In the framework of the United Nations/COPUOS ASI has followed with attention the starting and development of the SPIDER Program

Observation of the Universe

Italy contributes to the progress of knowledge and expansion of the human frontiers by exploring the mysteries and the opportunities of the Universe, through data obtained from high technology space systems. In particular, Italy is engaged in the following sectors:

Solar System Exploration

Italy is the main contributor of the ESA optional programme, **AURORA**, with the purpose of giving an important contribution to the “Worldwide Vision for Exploration”, in the areas of main excellence of the Italian industrial and scientific community: radar systems, spectrometry, telecommunications, robotics and innovative space propulsions. AURORA programme is focused on the robotic and long term human exploration of Mars and other bodies of the Solar System. The ExoMars mission is scheduled for launch in 2013 and consists of a rover equipped with a drill and a scientific payload to analyse the samples collected, as well as a landed platform housing a geophysical and environmental package. Italy is responsible for the drill and sample management system, four scientific experiments and some subsystems of the mission (airbags, parachutes). Italy will also manage the Rover Operation Center during the operations at the Martian surface.

In the exploration framework, ASI, in collaboration with ESA, organized three Workshops in Spineto (Tuscany), in order to discuss possible mechanisms of cooperation among international partners and, as member of the Global Exploration Strategy (GES) Group, hosted one of the GES meetings in Rome.

Italy has played a significant role in the exploration of Saturn and its satellites with the NASA/ESA/ASI mission Cassini/Huygens and in Mars exploration through collaboration with NASA and ESA. In particular, ASI developed the Radar System, **MARSIS**, on board the Mars Express Mission, and the Radar System, **SHARAD**, embarked on the NASA mission Mars Reconnaissance Orbiter, both with the goal to search for liquid water in the subsurface of Mars. During the year 2007 the two radars have collected very significant information regarding this topic. Moreover, in the framework of the Mars exploration strategy, a collaboration on the Russian mission Phobos Grunt was initiated. **Phobos Grunt** is a Phobos sample return mission to be launched not earlier than 2009. ASI is also leading in Europe, through the dedicated development program **PAGIS**, the research in the georeferentiation of the Martian data for the production of geological thematic maps.

The ASI spectrometer **PFS**, on board Mars Express, has mapped the abundance of water vapour and detected methane traces in the Martian atmosphere. Moreover, ASI's instruments play a fundamental role in the study of primitive bodies like the comets (**Rosetta** ESA mission), asteroids (**DAWN** NASA mission to Vesta and Ceres) and **VENUS** (Venus Express ESA mission). Last, Italy is significantly present on the ESA mission **BepiColombo** (scheduled for launch in 2013) with four PI instruments and an important contribution to other four experiments.

Following an Announcement of Opportunity issued in 2006 and focused on a Vision for Moon Exploration, ASI has coordinated a series of national studies in science and technology in order to assess its capabilities and interests to cooperate with other space agencies in the exploration of the Moon.

The Italian Space Agency participates to the NASA New Frontiers mission to Jupiter **JUNO** scheduled for launch in 2011, whose goal is to perform a detailed study of the giant planet Jupiter. ASI is planning to provide to NASA the infrared imaging spectrometer **JIRAM** and the **Ka Translator** for the radio science experiment as well as mission tracking with the **Sardinia radio Telescope**.

The Juno spacecraft will be placed in a polar orbit around Jupiter. This will allow it to perform detailed gravitational measurements in order to detect the possible existence of a Jupiter's icy and rocky core beneath its clouds of hydrogen and helium. The mission will also study the composition of Jupiter's atmosphere, determining its amounts of water and ammonia. Another investigation will be a study of convection within Jupiter's atmosphere and the profiles of deep winds. In addition, Juno will explore the magnetosphere of Jupiter, especially in the unmapped polar regions, and will attempt to determine the origin of the Jovian magnetic field.

ASI is also supporting the active participation of Italian scientist in the study phase of the Solar System missions pre-selected in the frame of the **ESA's New Vision program**: Marco Polo for the sample return from a primitive body, Tanden for the detailed study of Enceladus and Titan, Laplace for the exploration of Europe and other Jovian satellites.

Finally ASI plays an important role in the study of the Sun and Space Weather. In particular the joint ASI-NASA instrument **UVCS** on board the ESA mission **SOHO** is still providing after more than 10 years in orbit important data of the solar corona. The Solar data base **SOLARNET** is

situated in Italy. Currently the proposals for the participation in the payload of the new ESA mission Solar Orbiter are in preparation.

High Energy Astrophysics

After the success of the **BeppoSAX** mission, ASI intended to carry out a new national mission for the study of the high-energy Universe: **AGILE**, (Astrorivelatore Gamma a Immagini Leggero). The launch took place in April 2007 from the Indian Base Sriharikot with the Indian rocket PSLV-C8. The core of the mission is a new generation gamma-RAY detector, a natural consequence of the evolution of detectors used for experiments of elementary particle physics.

Competence acquired so far has led ASI and the scientific community not only to the AGILE national mission, but also to collaborating in the realization of **SWIFT**, an American satellite for the study of gamma-ray bursts launched at the end of 2004, and to NASA mission, **GLAST**, scheduled for early 2008. This mission, together with new extremely sensitive detectors within ground laboratories, will allow gamma-ray astronomy to take the decisive step from the explorative phase to full maturity.

AGILE is able to focus gamma-ray sources with an excellent resolution, as well as quickly analyse data in order to supply the results for their quick diffusion to the scientific community.

AGILE's main feature is the combining of two image detectors simultaneously working within bands of gamma energy and hard X-rays, which merge into a single instrument with a great scientific potential.

Thirty scientific groups have participated in the first Announcement of Opportunity for the AGILE Mission presenting research projects based on the utilisation of AGILE γ and X data. The approved proposals will have access to the data for one year.

AGILE and SWIFT data are acquired at San Marco Space Base in Malindi (Kenya).

Italy participates in the international project for the development of the **AMS** (Alpha Magnetic Spectrometer), which represents a high energy particle physics experiment in space to be installed on the International Space Station, in 2008, for at least three years of operation. It is designed to investigate the composition of cosmic rays and will provide the most sensitive search for the existence of anti matter nuclei and for the origin of dark matter.

Since 2000 the **ASI Science Data Center (ASDC)** has been supporting all scientific missions of the Italian Space Agency in the management and preservation of scientific space data. ASDC provides up to date services to the scientific community in the field of scientific data management and archival research. ASDC is located at the European Space Agency's establishment of ESRIN, Frascati, Italy. In 2007 ASDC has been appointed to supply some of its core-application to the US led mission GLAST. This crucial contribution has been inserted in the MOU between ASI and NASA and signed early 2007.

Cosmology and Fundamental Physics

The Italian scientific community is participating in ESA Programmes **Herschel** and **PLANCK** that are expected to be launched in 2008. Planck will examine the cosmic microwave background radiations with an accuracy never achieved before.

Italy continues its contribution to the ESA mission, **LISA Pathfinder** that will test the general concepts and technologies needed for highly accurate formation flying and precise measurement of

the separation between two very distant spacecrafts. This technology is essential for the future ESA-NASA programme, **LISA** (Laser Interferometer Space Antenna), which aims, *inter alia*, at searching for gravitational waves. The launch of the LISA mission is scheduled for 2012.

The stratospheric balloons launch Base located in Trapani-Milo, (Sicily), at 38°01N, 12°35'E includes integration facilities, environmental testing equipments, flight control center and data acquisition station, weather forecasting and monitoring station, in support of stratospheric balloons flights.

ASI performs launches of stratospheric balloons, (flight at 38-40 km), carrying scientific payloads for investigation in Atmospheric Physics, Astrophysics, Biomedicine, and for re-entry test flights.

The service encompasses integration and test, launch, flight control and mission operations, data acquisition, payload separation and recovery.

The balloon flights can be in boomerang/turn-around or drop tower mode, launched from Trapani and recovered near the site on the ground or in the sea, and trans-mediterranean, in the summer timeframe, from Trapani to Spain, with a 20 hours flight duration.

Space Debris

Italy is highly interested in the space debris issue with initiatives at national level and supporting international *fora* in order to mitigate and prevent damages caused by space debris.

ASI is member from 1998 of the Inter-Agency Space Debris Coordination Committee (web site <http://www.iadc-online.org/>) whose primary purpose is to exchange information on space debris research activities (monitoring, modelling, protection and mitigation) between member space agencies, to facilitate opportunities for cooperation in space debris research, to review the progress of ongoing cooperative activities and to identify debris mitigation options. .

At national level, every contract signed by ASI with the industries contains prevention and mitigations clauses.

At ESA level, ASI signed the European “Code of Conduct for the Space Debris Mitigation” elaborated by ASI, BNSC, CNES, DLR and ESA.

Italy has participated in the Space Debris Working Group of the UN/COPUOS Scientific and Technical Subcommittee (STSC) since 24 February 2004 with the chairmanship for 2 years. Together with NASA, ROSCOSMOS, JAXA, ESA, ISRO, CNES, BNSC and DLR, ASI subscribed its final Document regarding the Guidelines for the Space Debris Mitigation which was then presented and approved by the UN/COPUOS Subcommittee

Telecommunication and Navigation

ASI participates in satellite navigation and telecommunication programmes in order to foster the research activities and promote the demand of such services everyday life.

New satellites are being aimed at a number of different missions: mobile communications, multimedia services, and satellite navigation for accurate positioning of air, sea and ground transportation. Italian industry is now present in advanced sectors such as Ka band systems, L band systems, communication systems for civil protection, etc. ASI has now started to experiment and develop new services and technologies for the ground segment as well as for the space segment.

For multimedia and interactive communication (Tele-education, Telemedicine) ASI participates in the **ARTEMIS** and **ARTES 3** programs (Euroskyway, Shared).

Italy develops telecommunication payloads and services able to increase the quality, quantity and variety of data offered to the end-users. The Italian scientific and technological community is committed to the development of new services and applications through prototype projects in collaboration with other institutional users, such as Tele-education, Institutional Telecommunication for Security and Emergencies, Telemedicine.

ASI supports the development of high frequency communications capacity through research and innovation. In particular, ASI is carrying out three projects concerning experimental communication payload in W, Q/V and Optical bands. To this purpose three studies of feasibility at phase A have been carried out, which concluded that - by using current technologies - high frequency systems may be put into practice. Three A2 Phases are in progress.

Since long time Italy has recognised the potentiality of satellite navigation in fostering many applications and has undertaken initiatives to develop pre-operational projects to pave the way to an extensive use of it.

The Italian Space Agency funds **EGNOS** and **GALILEO** projects (one of the four Major founders), takes part in the **GALILEO & EGNOS** European Management Boards and Technical Control Bodies, promotes and develop National Application Projects aimed at fostering the use of satellite navigation, harmonizing them with European Projects.

The national satellite navigation projects answer to the specific public demand of increasing the Safety in the Transport Sectors and in general improving territory safety and security. Satellite navigation helps to increase this safety but at the same time its use has to be suitably “protected”.

The ASI plan of activities comprises a set of macro Projects in the transport sector: A **maritime Project** focussed on sea-highways and personal navigation, a **Dangerous Goods Transportation Project** aimed at supporting all the phases of this delicate transport activity, a **Civil Aviation Programme**, developed together with the National entity for Air Traffic Control, aimed at introducing EGNOS services and GALILEO services in the world of ATC/ATM.

A number of other projects are directed to ground transport, vehicle traffic, road toll and billing, support to disabled people. A specific project is aimed at introducing the use of GALILEO Public Regulated Service (**PRS**) into the governmental entities devoted to the safety and security of national territory.

There are projects studies aimed at developing innovation in the field of satellite navigation Signal Generators. The projects study and carry out second-generation signal generators of navigation supplying, by exploiting frequency bands already assigned to the satellite radio-navigation system Galileo, best performances in terms of coding and modulation, to guarantee to users the updating of their own data as well as their own position at a better rate than the one which is currently available, as well as more precise and accurate services. Furthermore, the possibility of application of signal optimization techniques with the aim of exploiting part of the available band as a communication channel between users has been studied.

Two additional technological support projects are transversally sustaining these application projects: a project to foster the **Software Radio** technology within the satellite navigation terminals and a GALILEO geographic Test Bed, called GTR (**GALILEO Test Range**) aimed at developing a test area for signal analysis performance and terminals evaluation. It allows for a number of

supports in Satellite Navigation programs: Emulation of Galileo signals generation, GNSS signals analysis and performance evaluation, support development of GNSS standards, validation of Terminals and sustain development of innovative applications and services of satellite navigation. The Galileo Test Range, which will constitute a Excellence Centre for satellite navigation, has been developed in its First Stage by Regione Lazio and ASI that is going to bring this facility to its full development in the Second Stage of development. The location of the main infrastructures is in South-East of Rome.

ASI strongly contributed to COPUOS WG on Satellite Navigation, as co-chairman with US, and favoured the establishment of the **ICG**, the International Committee on Satellite Navigation, which has started its works since 2005. Italy supports the objectives of the Committee, in particular its function as coordinator among providers of the **Global Navigation System of Systems** and as focal point for international information exchange related to its activities.

Human Space-flight

Italy plays a relevant role in the program of development and utilization of the International Space Station (ISS), gained thanks to its significant participation in the ESA European program for the accomplishment of **Columbus Orbital facility** and to its bilateral agreement with NASA.

After the success of the Italian logistic modules Leonardo, Raffaello and Donatello **MPLM (Multi Purpose Logistic Modules)** - used to transport to the International Space Station equipments, supplies and experiments through the U.S. spaceship -, Italy has been collaborating with ESA for different projects. The first is the development of **Columbus**, a Laboratory ATV (Automated Transfer Vehicle).

Italy has been also developing other programs such as the **Crew Rescue Vehicle (CRV)**, the **Cupola** and the **Nodes 3**, after **Node 2**.

ESPERIA (the name given to the Italian peninsula by the ancient Greeks) is the name of the mission which carried the Italian astronaut **Paolo Nespoli** onboard the Space Shuttle launched on 23rd of October 2007. The mission, which was managed jointly by ESA and ASI, was part of the Italian contribution to the completion of the International Space Station. Paolo Nespoli used the second of the six flight opportunities granted to the Italian Space Agency in exchange of Nodes 2 and 3. The main goal of this very successful mission was the deployment of Node 2, a pressurized module built by the Italian industry. Node 2 was the first European module to reach the ISS, and it serves as a connecting passageway for ESA's Columbus laboratory, the US Destiny laboratory and the Japanese Kibo laboratory, as well as the attachment point for the Japanese HII Transfer Vehicle. It also carried a docking adapter for the Space Shuttle that serves as an attachment point for the logistic modules Leonardo, Raffaello e Donatello.

Medicine and Biotechnologies

Italy is committed to enhance knowledge through space research and transfer it to diagnostic, therapeutic, preventive and biotechnological applications.

During the year 2007 the main activities have been the followings:

1. **ALTEA**, Anomalous Long Term Effects in Astronauts, the third instrument developed by ASI for biomedicine programs, is in the field of Osteoporosis and Muscular Atrophy, Motion Control,

Cardio-respiratory problems and Biotechnologies applications. It was launched on board the Discovery Mission STS-121 in July 2006. The Mission ended in August 2007 but the facility will be utilized by NASA.

2. **ELITE-S2.** The facility ELITE S2, third Asi ISS payload for medical study, has been launched on board Discovery in August 2007. The system is able to allow the movements of astronauts with extreme precision (less than one millimetre), and is aimed at performing neuro and motor control studies in microG. The first experiments on the hardware have been carried out in December 2007. New developments of the program are being planned.

3. **ASI FOTON-LIFE on FOTON M3.** On September 14, 2007, 13 Italian experiments have been launched on board the Russian automatic satellite FOTON M3 inside the Foton capsule. It was the first Italian mission on a Russian automatic satellite launched with Soyuz vehicle .

4. **BED-REST.** In the field of the national program Osteoporosi Atrofia Muscolare (OSMA), in July 2007 the first entirely Italian Bed-rest has taken place. The activity was carried out in collaboration with the University of Valdosta (Capodistria, Italy).

5. **ESPERIA-STS 120-Shuttle Discovery.** During the mission STS-120, the Italian astronaut Paolo Nespoli performed several ASI and ESA experiments. Among them, IMAGINE, MAIS and CHIRO for the study of cognitive processes, motor control, muscular atrophy and an analysis of the cerebral damages caused by aerospace flights. These experiments have been performed through the sensorized glove HPA, on board the Space Station since August 2003.

6. **Call for Ideas – MARS 500 and Biotechnologies for human aerospace exploration.** In September 2007 two new calls for Ideas directed to the national industry and research communities have been published. MARS 500 regards a simulation of a mission on Mars and will be realized in Moscow. The second Call for ideas, Biotechnologies for human aerospace exploration, is based on innovative biotechnologies for human life in aerospace.

Italy is a member of the International Space Life Sciences Working Group (ISLSWG), led by NASA. In this field, ASI coordinates the national scientific community, particularly in the areas of musculoskeletal system, neurophysiology and biotechnological applications, which are in compliance with the ISLSWG strategic planning.

Space Transportation

Italy supports the development and realization of transportation systems that contribute to the strategic independence of European access space by means of several projects regarding actual European launchers family and future (expendable and reusable) launchers. Activities are supported within the frame of contribution to ESA programs or national development programs.

Most of the Italian activities dedicated to the actual European launchers family sector are included in the ESA Programmes, such as **ARIANE 5** (production and evolutions support), **VEGA** (development support) and Soyuz at the Guiana Space Centre (development support).

Italian main contributions are to the ARIANE 5 related programmes, as evolutions and upgrades, infrastructures, support to production, surveillance, et al. Main task of the Italian activities are solid boosters and the first stage turbo pump.

ASI is the main sponsor of VEGA contributing 65% of the total budget. VEGA is a small launch vehicle for satellites up to 1,5 tons in Low Earth Orbit. This program includes the development both of the launcher and of the ground infrastructures to CSG (Space Center of Guyana), which are deemed as necessary for the integration of the launch vector.

Italy supports the ESA program Soyuz that includes all necessary activities to launch the Russian vector Soyuz from the European base of CSG at Kourou.

In the aim of studying evolutions of Vega launcher, ASI is supporting on national basis the **LYRA** project. In the framework of a Memorandum of Understanding on the Cooperation on Launcher and Space Propulsion, Italian and Russian agencies and industrial companies have started a cooperation concerning the development, manufacturing and certification of a new engine operating with liquid methane as fuel.

On national basis, ASI is supporting several research and development projects, focused on the investigation and evaluation of key technologies for future space transport systems (expendable and/or reusable): among others, are the ASA project (innovative materials and structures for hot structures); the CAST project (Aerothermodynamics and Aerodynamic for lift-off and re-entry). Further future initiatives are foreseen (Hybrid propulsion, Nanotechnologies, Nuclear propulsion, etc).

In the field of the future launchers, Italy is also involved in the ESA Future Launcher Preparatory Programme, with activities on System studies, Materials development, Propulsion, Experimental re-entry vehicle.

Space Education

PhD and Masters are funded to allow Italian students to have access to studies in the field of aerospace.

ASI promotes the education and culture of the space technologies and applications. Several programmes are dedicated to teachers and students, by promoting the use of high-tech and satellite technology. In particular, ASI, in collaboration with the Italian Aerospace Research Centre, CIRA, is coordinating the activities concerning the programme “**Aerospace Educational Web Channel**”.

The main purpose of this programme is to broadcast via satellite educational modules regarding aerospace topics suitable for younger students. Supporting this programme is a web-site (www.spazioallescienze.it), representing a cultural bridge between schools and the institutions, which promote the spread of aerospace culture.

ASI has finalized the development of an original video-game via internet, named *edu-tainment*, (education-entertainment), which aims at educating young people to the basics of physics.

A group of students has prepared an experiment in biology that has been launched on board Discovery last October 2007. During the mission, a two-way radio contact between students and the Italian astronaut Paolo Nespoli has been realized with success.

On the occasion of the Discovery mission, a comic has been published and distributed through the Italian Magazine ‘L’Espresso’.

