2009 Report

Agenzia Spaziale Italiana

1. Introduction

Space is no longer just a specialized tool mainly for scientific research.
It has become an integral component for industrial and technical activity providing services and information critical to societies around the world.

However the role of the Government in both funding and strategically steering those activities remains central and pivotal. All over the world space activities are mainly driven by public institutions, and quite often private investments are catalyzed by means of government initiatives.

This is particularly the case in Europe, where budgets are limited and the national Space Agencies of each nation, including the Italian Space Agency (ASI), are allied under the European Space Agency (ESA) flag to foster cooperation and make national investments more efficient.

But the European Institutional environment continues to evolve presenting new challenges to ASI.

The relationship between the ESA and the European Commission in 2009 became closer; the satellite navigation project Galileo as well as the Earth Observation programme GMES (Global Monitoring for the Environment and Security) are examples of space activities managed by the ESA on behalf of the Commission.

In 2009 the budget for the space activities of the European Union (EU) through the 2014-2020 financial plan was addressed in order to comply with new responsibilities assumed by the Commission for space activities.
This situation will necessitate, in the coming years, the responsibility to find a balance between the ESA and the EU.
The monitoring role of the national agencies, and the ASI is in the front line, has been since 2009 and shall be extremely important to guarantee equilibrium and respect for national investments in space.

The year 2009 also saw important operative steps for the ASI.

Two important Italian “pieces” with the Space Shuttle STS 130 crew in February. In fact, on board the Shuttle there were the Italian built Node 3 and Cupola, all designed and built in Italy, thanks to the significant agreements signed between NASA with the ASI.

We can nowadays confirm with pride that there is a part of our country working on the leading edge of the innovation and of the high technology, that is the space activity.

And this space competence is also serving our civil community in crisis and emergency.

The dramatic earthquake in April in L’Aquila, which destroyed the city and the surrounding area, was also studied by our space systems, such as the Cosmo SkyMed satellites.
Pointing to the area where the ground shook, the satellites provided data to the Civil Protection National Service allowing continuous monitoring over the area affected by the quake and offering valuable assistance to the machinery of relief that promptly started.
And in 2009 there was an important step to assure continuity to the Cosmo SkyMed space system, with the signature between the ASI and the Italian MoD of the agreement for the funding of the fifth and sixth satellites of the space constellation.

In the year 2009, when the whole world celebrated 40 years since the Apollo 11 landing, the Moon was again the star of a dramatic discovery: water under its surface. This evidence changes several scenarios for the space exploration debate, which is still ongoing on whether to return to the Moon or point to Mars. Together with its international partners, Italy is ready to face this new challenge.

2. Highlights 2009

2.1 General

Enrico Saggese, Commissioner of the Italian Space Agency (ASI) for one year, was appointed President of ASI by the Italian Government on 3 July 2009.

The year 2009 opened in style with the inauguration of the International Year of Astronomy, an event that sparked a myriad of meetings, events, magazines, and initiatives to bring people to the stars.

In particular, the exhibition “Stars and Particles” held in Rome, organized by the National Institute of Nuclear Physics (INFN), National Institute for Astrophysics (INAF) and the Italian Space Agency (ASI) resulted in a resounding success.

2009 was the “*annus mirabilis*” of high-energy astrophysics. New pulsars, cosmic phenomena of resurrection, evidence of dark matter, gamma bursts never seen before, flashes of light, super strong stellar explosions, black holes in action. These are some of the many surprises that have confirmed the excellence of Italy in this fascinating field. The protagonists were:
AGILE, a small Italian “jewel” launched in April 2007, and Fermi, a NASA mission with an Italian “heart” (the instrument LAT, Large Area Telescope, that has been made in our country). The significance of the results has earned the recognition of the National Academy of Sciences, the Henry Draper Medal to Neil Gehrels, chief scientist of the Swift satellite and astronomical telescope Fermi. According to the magazine Science, the new pulsar detected by Fermi is one of the ten most important scientific discoveries ever.
A few hours after the earthquake of 6 April 2009 that struck Abruzzo and destroyed the City of L'Aquila, the satellites of the Cosmo Sky-Med constellation, were pointing towards the area where the ground shook. The data available to the Civil Protection National Service have allowed continuous monitoring over the area affected by the quake and offered valuable assistance to the machinery of relief that promptly started.
Last year was an important one in reaffirming the central role of Italy in the space field. Italy had the first opportunity to manage the Inter-ministerial conference of the ESA with its Ministry of University and Research and obtained, thanks to the candidacy of the City of Naples, the assignment to Italy of the International Astronautical Conference (IAC) 2012.
Among the best activities of 2009, two missions named Herschel and Planck can be considered “the couple of the year.” After a scientific and technological development lasted over 10 years, on 14 May 2009 Herschel and Planck departed in tandem from Kourou on board an Ariane V rocket, two ESA missions with significant Italian contribution, among the most ambitious ever planned. Planck is a sort of time machine that will measure the birth of the universe, by measuring the cosmic background radiation with a precision 10 times higher than the predecessors. Herschel is by now the largest telescope ever sent into orbit, observing ancient galaxies and rising stars in the almost unexplored infrared band. A few months after their cosmic debut, both observers have demonstrated high performances: Planck produced the initial “scanning” of the early universe and Herschel has obtained spectacular images.

2.2 International Meetings

Italy and Russia make an agreement for a super telescope.
ASI and ROSCOSMOS sign a deal to cooperate on Millimetron at Villa Madama. Italy will construct the spectrometer, a key instrument.
3 Dec 2009

Italy and Russia will jointly assemble the Millimetron super telescope. The announcement was made during the Italo-Russo summit at Villa Madama. In the presence of the heads of government of both countries, Enrico Saggese, the president of the Italian Space Agency, and Anatoly Nikolayevich Perminov, the head of the Russian agency ROSCOSMOS, signed an agreement regarding bilateral cooperation on the cosmological observation mission. As part of this agreement Italy will contribute the polarimetric spectrometer, one of Millimetron's principal instruments.

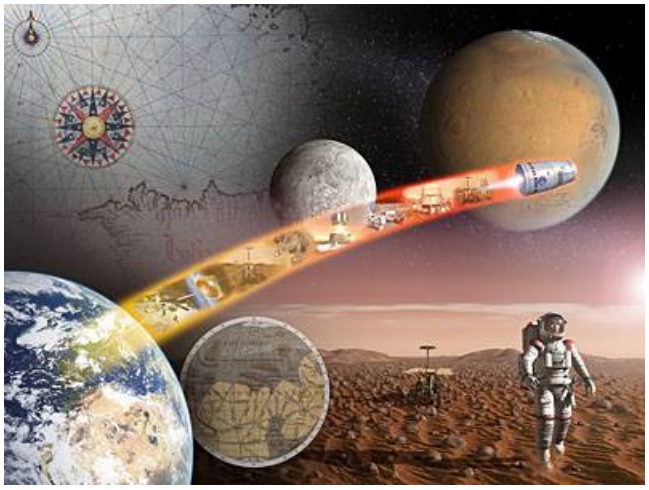
Millimetron is a Russian space mission that plans to construct an orbiting observatory equipped with a mirror 12 metres in diameter, an absolute record in the history of space missions. The telescope will operate in a wide band of the electromagnetic spectrum, in the submillimetre, millimetre and far infrared (a wavelength between 20 μm and 20 mm) wavelength regions and will enable astronomers to observe the universe with unprecedented sensitivity, angular resolution and spectro-polarimetric capacity. These electromagnetic bands are one of the most promising windows for observing the universe, being full of scientific information and relatively unexplored. Millimetron will be able to throw light on the cold universe, the cosmological structures on a wide scale, the nature of dark matter and dark energy, and the evolution of galaxy clusters, galaxies, stars and planets. The images at extremely high angular resolution obtainable in VLBI (Very Long Baseline Interferometry) mode, a technique that connects independent antennae as if they were part of one single, gigantic instrument) will allow us to study, with unprecedented clarity, compact and ultra-compact astronomical objects. The date for launching Millimetron is scheduled for 2018-2019.

The technical capacity of Millimetron, which, for the first time, will allow us to study the universe and its structures in 3D by spatially resolved spectro-polarimetric analyses, requires an innovative and high performance instrument. As part of the collaboration agreement, Italy – under the coordination and supervision of ASI – will supply expertise, feasibility studies, project design and construction of one of Millimetron's most important and pioneering instruments: the FTS (SP-FTS) spectro-polarimeter. The instrument is an innovative evolution of the FTS spectrometer which has already successfully been designed for the Phase-A studio of the minor ASI mission, SAGACE. The project and the feasibility study for the SP-FTS instrument have already received the full support of the scientific community concerned (the universities involved and INAF) and the PMI in the design and scientific use of the instrument. The SP-FTS instrument project, central for Millimetron, makes the Italian scientific community and ASI principal technical and scientific partners in the Millimetron consortium, and in general will contribute to strengthening the multi-project collaboration between ASI and ROSCOSMOS.

Millimetron is part of a long line of scientific and technical developments already initiated by ASI alongside its support of the PLANCK and HERSCHEL missions and the two minor projects

OLIMPO (a long duration stratospheric balloon flight) and SAGACE (a minor spectral-imaging surveying mission).
An international consortium is being formed to accomplish the Millimetron mission. At the moment, the Millimetron consortium is formed by the Millimetron International Scientific Committee (MISC) and the Millimetron Management Committee (MMC).

1st EU-ESA International Conference on Human Space Exploration - 23 October 2009, Štiřín Castle, Prague



Ministers from the 29 European Space Agencies and European Union Member States met in Prague on 23 October for the 1st EU-ESA International Conference on Human Space Exploration, to prepare a roadmap leading to the definition of a common vision and strategic planning for space exploration.

This first step in a process that will lead to the definition of a European vision in this field stems from a Resolution adopted by the 5th Space Council in September 2008. Besides Ministers and delegates from the EU, ESA and third countries, the conference has also been attended by Members of Parliament and representatives of industry and academia.

Europe has gained notable expertise in human spaceflight, starting in the 1980s with the development of the Spacelab laboratory flown by the US Space Shuttle, and now mainly with the International Space Station (ISS) to which Europe is an essential contributor. So far, more than 30 men and women from European countries have flown into space on either US or Russian space transportation systems. Europe contributes to the ISS through the Columbus laboratory attached to its central core, the Automated Transfer Vehicle (the largest ever automatic cargo-carrier space tug) and other elements. For the very first time, an ESA astronaut – Frank De Winne of Belgium – is in command of the ISS.

ESA has carried out the farthest landing in the solar system so far with the successful Huygens mission on Titan, Saturn's largest moon. It has expanded its robotic presence in the solar system with probes visiting several planets such as Mars (Mars Express) and Venus (Venus Express) and the Moon (Smart-1). More recently, the combined launch of Herschel and Planck marked a new step forward in our understanding of the origin and evolution of the universe.
The Prague Conference was a brainstorming session at a high political level where Ministers had an opportunity to provide initial political guidelines to ESA and the EU on the development of a policy in the field of exploration of our solar system, going back to the Moon or reaching beyond to Mars.

Naples to host IAC 2012
The Italian city was chosen by the International Astronautical Federation
16 Oct 2009

The City of Naples will host the 63rd edition of the International Astronautical Congress, the most important event at the world level in the space field, in 2012. Naples was officially announced as seat of the event during the 2009 IAC in Daejoon, South Korea, after an unanimous vote by the General Assembly of the International Astronautical Federation.
After the announcement, the Italian Ambassador in South Korea, Massimo Leggeri, thanked IAF on behalf of Italy.
The Italian Minister for Education, Universities and Research Mariastella Gelmini and the Mayor of Naples, Rosa Russo Iervolino, gave a joint declaration stating that "this important success acknowledges the work of the Italian Space Agency, the national space industry and the City of Naples".

Sixth Space Council – 29 May, 2009 Brussells

Ministers in charge of space activities representing the Member States of the European Space Agency and the European Union met in Brussels for the Sixth Space Council.

The Council was jointly chaired by Miroslava Kopicová, the Czech Republic's Minister of Education, on behalf of the EU Competitiveness Council, and Mariastella Gelmini, Italian Minister for Education, Universities & Research and current Chair of the ESA Council at Ministerial Level.

Günter Verheugen, Vice-President of the European Commission and Commissioner for Enterprise & Industry, and Jean-Jacques Dordain, ESA Director General, also took part.

The Space Council recalled the outstanding results of the ESA Council meeting at Ministerial level of November 2008 and the EU Competitiveness Council conclusions regarding the GMES programme of December 2008, recognising the progress made on the increased coordination of space and security-related activities between key European Space Policy players.

Ministers called for action to mobilise existing innovation support mechanisms to ensure cross-fertilisation of innovation and ideas between space and non-space sectors, and between space industry, leading research organisations and universities. This followed the conclusions of the European Council of 11-12 December 2008 in support

of the European Economic Recovery Plan and its call for the launch of a European Plan for Innovation which should also include space technology and services derived from it, as one of the main technologies of the future.

The Council specifically highlighted the potential of satellite communications technologies to bring broadband to European citizens and enterprises, ensuring better access to modern Information & Communications Technology, particularly in rural and remote areas, calling on the Commission, ESA, and the EU and ESA Member States to consider integrating satellite technologies in future broadband projects.

The Ministers underlined the importance of rapid implementation of the proposed EU Regulation on the GMES Initial Operations Programme and stressed the need to give funding priority to the operations of the GMES Space Component (GSC). On the long-term arrangements for the GSC, which covers the period from 2014 onwards, the need to define a sustainable funding approach was stressed. ESA and the Commission are requested to elaborate a funding strategy for the remaining elements of the GMES build-up phase.

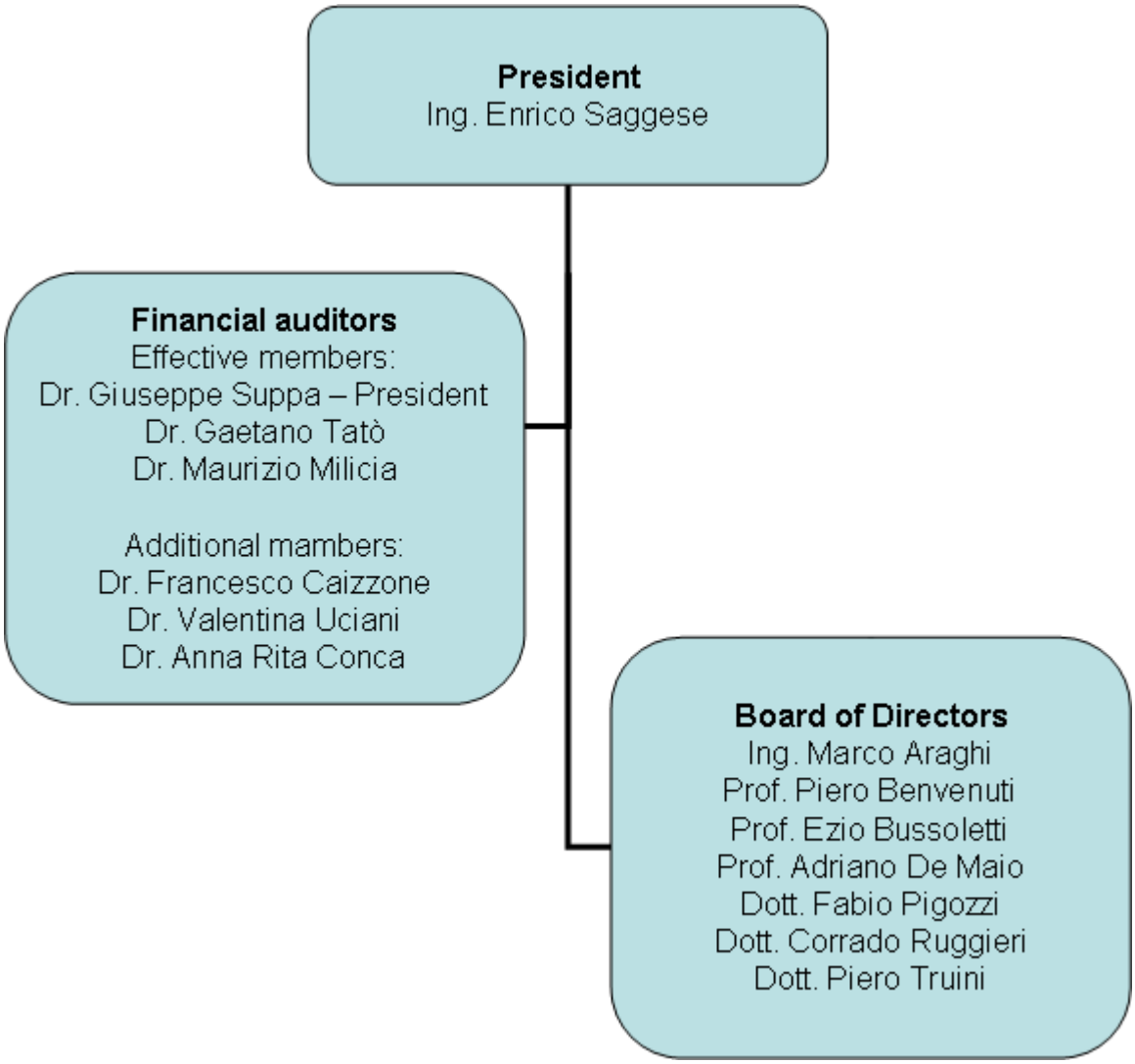
Concerning observations related to operational oceanography and atmospheric composition monitoring, the Space Council invited the Commission and ESA to lead a dialogue with EU and ESA Member States and Eumetsat to coordinate the user requirements for space observations, while respecting ESA's overall coordination role for the GMES Space Component. The Commission and ESA are asked to define the data policy for, and the ownership of, the Sentinel missions.

Furthermore, the ESA-prepared Long-term Scenario for the GSC was identified as a basis for evolution and cost estimates in order to establish an operational GMES programme from 2014 onwards.

On space exploration, the Ministers reaffirmed the need to assess the possibilities offered by EU policies to embed space exploration in a wider political perspective. They looked forward to the proposed High-Level Political Conference on Space Exploration – as previously agreed at Space Council level – as a first step towards the elaboration of a fully fledged political vision on 'Europe and Exploration' encompassing a long-term strategy/roadmap and an international cooperation scheme.

Ministers also welcomed the Commission's initiative of studying options for future EU funding schemes and instruments for space-related programmes, which will provide important input for discussions about the next EU Multi-annual Financial Framework.

2.3 ASI Organization



3. Operative Centres and Participated Companies

3.1 Centre for Space Geodesy "Giuseppe Colombo"

Located in the municipal district of Matera (southern Italy), the Centre for Space Geodesy (CGS) is dedicated to the Professor Giuseppe ("Bepi") Colombo. Dedicated in 1983, the CGS is mainly devoted to Earth observation through advanced space techniques as space geodesy and remote sensing.
The presence of different observing methodologies (satellite and lunar laser ranging or SLR/LLR, very long baseline interferometry or VLBI, GNSS positioning, absolute gravimetry) makes CGS one of the few fundamental stations in the worldwide network, playing a crucial role for global geodynamics monitoring, from the long wavelength geopotential recovery to the materialization of the international Terrestrial Reference Frame.
CGS also hosts the civilian data user ground segment of the COSMO-SkyMed mission.
In line with ASI assignment to promote space technology for environmental managing and protection, ASI is implementing in Matera the CNM (National Multimission Centre) for acquisition, long term archiving, processing and dissemination of EO data and products.
During 2009, the CGS has carried out the whole spectrum of operational and data analysis activities in the fields of space geodesy and remote sensing and has continued to supply the international community with high accuracy results.

3.2 Stratospheric Balloon Base of Launch

- The Stratospheric Balloon Base of Launch located in the region of Trapani-Milo (Sicily) was opened in 1975 and represents a world renowned structure able to carry out the design, the launch and the flight management of this specific technique, with a specialization in the systems of great mass and volume.
- The launch base is located within an old airport 90 hectares large at the outskirts of Trapani, an ideal geographic location for trans-Mediterranean and transatlantic launchs.

The Stratospheric Balloons Launch Facility is dedicated to the planning, development, launch, in-flight management and recovery of scientific and technological missions carried out using stratospheric balloons. The Base operates in collaboration with other agencies and national and international institutes (ARR, CNES, NASA, CNR, ENEA/PNRA, universities and international agencies)
Stratospheric balloons are in fact one way of access to space that Italy can manage autonomously and in which there is the expertise and rare specialization in the international space framework, combined with the special geographical position of the national site.

In order to achieve excellence ASI is promoting and encourages collaboration with scientific institutions as research centres and universities with consistent background, which provide competence on specific topics and are actively involved in projects and eventually used as on-site support.

3.3 "Luigi Broglio" Space Centre in Malindi (Kenya)

Italy and Kenya have cooperated in space activities since 1964 through an inter-governmental agreement, the San Marco Project, renewed on 14 March 1995 for a further 15 years and now in the phase of re-negotiation.
In this framework the "Luigi Broglio" Space Centre was developed in Kenya. The Centre is located at 2° 56' South, 40° 12' East, in the Indian Ocean, near Malindi. The location is ideal to launch and support equatorial satellites and acquire Earth Observation (EO) images over the Central and Eastern Africa region.
The Broglio Space Centre (BSC) is subdivided into two main domains (segments):

- The Sea Segment, consisting of 5 offshore platforms equipped for the launch of satellites and sounding rockets and motorboats for personnel and material transportation between the mainland and the platforms;
- The Land Segment, known as Base Camp, covering an area of about 3.5 hectares. It contains a TT&C Complex, with two ground stations that provide real time acquisition, reception, recording, and transmission of satellite data, and a Remote Sensing Centre, dedicated to Earth Observation satellite data acquisition and processing, and includes a geophysical facility.

The space activity is concentrated in the two Ground Stations located at the San Marco Project base: MLD-01 and MLD-02.
MLD-01 is presently active in the acquisition of Swift and AGILE satellites.
MLD-02 is active in the acquisition of:
Tracking from and Hosting Support at Malindi for ESA:

- hosting ESA Equipment;
- TT&C of spacecraft during critical and routine phase (starting in June 2009);
- tracking launchers (starting TBD);
- tracking and payload data downloads of earth observation missions (starting TBD).
- tracking of Arianespace launchers from Kourou CGS
- hosting ESA/CNES equipments;
- tracking support to be provide to ESA/CNES launchers launched by the European Launch Base CGS in Kourou.
- support to Chinese human missions Shenzou.

The BSC is also hosting an experimental GALILEO sensor station to test the reception of the navigation message transmitted by the first two satellites of the constellation: Giove-A and Giove-B. The data collected are then relayed to the European Space Operation Centre (ESOC) in Darmstadt (Germany) for analysis.
The Remote Sensing Centre (RSC) is on standby in the acquisition of Earth observation satellites.
The Joint Steering Committee for the management of the bilateral agreement has appointed a joint Working Group with the task of producing a Feasibility Study for the realization of a Regional Centre for Earth Observation in Kenya. The study is complete and it foresees a distributed facility:

acquisition, pre-processing, archiving and cataloguing will take place at the BSC in Malindi; processing, specific products generation and distribution to users will take place in Nairobi.
Since August 2008, ASI has started the activities to evaluate the possibility to launch stratospheric balloons from the San Marco Base.
The programme foresees a Feasibility Study Phase to understand the wind's behaviour on the ground and in the air column up to the stratospheric level, and will use simulation programs and ground and sounding surveys.
The campaign will last two years, and at the end it will be possible to verify possibilities and to set up a stratospheric balloon launch capability at the San Marco Base, and will prepare an implementation plan. In the case of a positive decision, the Kenyan research community will be encouraged to participate to this new activity.

3.4 ASI Science Data Center

The ASI Science Data Center (ASDC) is a multi-mission, multi-disciplinary, science operation center, data processing and data archiving facility. The ASDC has been built on the experience acquired within ASI with the management of the BeppoSAX Science Data Center in the late 1990s. It is located at the ESA site of ESRIN in Frascati, Italy where it has been in constant evolution since its establishment in November 2000. At the moment it has major responsibilities for three operational high-energy astronomy satellites, Swift, AGILE and Fermi, supports a number of Italian experiments on board solar system exploration satellites (eg. SHARAD, MARSIS, etc.) and the archives for the Herschel and GAIA (ESA) missions. Several new projects are foreseen for the future.
ASDC is fully funded by the Italian Space Agency and it is part of the Observation of the Universe Unit. It operates in cooperation with ESA, NASA, INAF and INFN through specific agreements such as memorandum of understanding, letters of agreement and national cooperation agreements which define the responsibilities and the roles of ASI and ASDC in each program. Each year a detailed plan of activities is proposed by the ASDC Director to the ASDC Board, an external body which includes members of all the national institutes involved in the ASDC. The ASDC internal organisation is based on two main Boards, the Executive Board and the Scientific Board, which manage the supported projects and coordinate the scientific research. The national and international community provides feedback to ASDC through a User Committee.
ASDC scientists belong to the active national scientific community.
In 2009 ASDC scientists contributed to many important scientific activities leading to the publication of over 100 papers in internationally refereed journals. The most important results include the discovery of several gamma-ray bursts with Swift, of the most distant object in the universe (at about 13 billion light years), of many gamma-ray pulsars and blazars with Fermi and AGILE and of the terrestrial gamma-ray flashes with AGILE.
Moreover, AGILE detected the gamma-ray Emission from the Eta-Carinae Region, which is the first experimental confirmation of a gamma-ray emission (E> 100 MeV) from the collision winds in a binary stellar system, and the gamma-ray emission from the Vela Pulsar Wind Nebula, which is the first experimental confirmation of a gamma-ray emission (E> 100 MeV) from a pulsar wind nebula.

http://www.asdc.asi.it/

3.5 e-GEOS

The company's corporate objective consists in the development, manufacturing and marketing of products, services and applications for the Observation of the Earth. In particular the company is concerned with:

- the design, implementation and marketing of applications, products and services for the Observation of the Earth;
- the operation of land plants and services as well as of facilities conceived for the Observation of the Earth;
- management, application and technological advice;
- design and development of pilot applications and dedicated infrastructures;
- access to data and electronic marketing;
- processing and transfer of technologies and skills to support industrial innovation;
- technological research and development of topics concerning the Observation of the Earth, with special care for the development of market opportunities to be exploited directly or through third parties;
- promoting innovative enterprises, including venture capital ones.

http://www.e-geos.it/

3.6 Advanced Logistics Technology Engineering Center S.p.A.

Established in 2001, ALTEC is currently an S.p.A. (public company) participated by ASI (29%), Alenia Spazio (51%) and and ICARUSW (20%).
After the establishment of ALTEC S.p.A., ASI, as per the paracorporate agreements, entrusted Alenia Spazio first and then ALTEC with some contracts for supplying engineering and logistic support services to NASA and for the provision and maintenance of MPLM spare parts as well as for the support of their missions.
In particular ASI has requested the pursuing of sustainable development strategies for long-term programmes by also procuring private contracts and identifying any other funding opportunity from both government and private organizations.
The company's aims include:

- the provision of engineering and logistic support services for the Space Station operation and activities as well as for the employment of other orbital infrastructures to ASI and ESA as well as to other space agencies and any public bodies, scientific communities, Italian and foreign companies and other private organizations. Services are also included for storing, processing and distributing data concerning the abovementioned infrastructures;
- the promotion, marketing and sales of Space Station opportunities and the relative provision of the engineering services required.

3.7 The Italian Centre for Aerospace Research

CIRA S.c.p.A. was founded in 1998. The Italian State controls it through the Italian Space Agency and the National Research Council. The Campania region and the main aerospace companies in Italy also have stakes. Employing

over 300 staff, CIRA is entrusted with the implementation of the Aerospace Research National Programme, as regulated by Ministerial Regulations no. 305 of 10/06/1998.
The Aerospace Research National Programme is a governmental measure, devised in compliance with the National Research Programme and with the National Space Plan which meets the requirements as expressed by Industry and Research.
The Aerospace Research National Programme takes into account the international prospects of the aeronautical and space industry and consists in:

- the performance of scientific and technological research, education and training of aeronautical and space industry workers, to be pursued also through involvement in European and international research programmes, in accordance with the scientific, technological and financial progress of the same industries and in compliance with the relative national and international schemes;
- the execution and management of works, facilities and infrastructures, capital goods and equipment required for the activities mentioned above, which are part of the country's asset.

http://www.cira.it/html/inglese/home/

3.8 ELV SPA European Launch Vehicle

ELV is currently 70% controlled by Avio S.p.A., and 30% by ASI.
The company operates in the aerospace business in Italy and abroad and is in particular concerned with:

- the management of the Vega Programme as prime contractor;
- the implementation, supervision, coordination and the direct and indirect monitoring of the design, production, manufacturing, and modification of the Vega launcher, its components and equipment. In particular it carries out:
  - launcher system analysis;
  - launcher integration and its management;
  - launcher testing;
  - the assignment of Vega Programme implementation activities to sub-contractors selected in accordance with ESA (European Space Agency) principles;
  - the direction of programmes for the implementation, supervision, coordination and direct and indirect monitoring of tests and research programmes concerning the development of small-sized launchers and their components and equipment;
  - strategic marketing of small-sized launchers;
  - study, research and advice services.

4. Main Activities in 2009

4.1 Earth Observation

Italy devotes special attention to Earth observation programmes. ASI is completing the deployment of a sophisticated dual-use (civilian/military) Earth observation satellite constellation (four satellites), **COSMO-SkyMed**, dedicated to natural resources protection and disasters prevention and safety.

On 24 October, 2008 the third COSMO-SkyMed satellite was successfully launched by the U.S. Vandenberg Base in California. The launch of the fourth satellite, originally planned for the beginning of 2010, has been delayed to the last quarter of 2010 due to industrial premise damage that occurred during the huge L'Aquila-Abruzzo earthquake in April 2009.
The 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 consists of four X-band SAR (Synthetic Aperture Radar) satellites, providing high imaging resolutions - by day and night and in 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 was manufactured by Italian industries.
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 have been evaluated. The selected proposals receive COSMO-SkyMed data at no cost.
The four satellites will provide 1,800 images per day. The first two COSMO-SkyMed satellites have already provided images of natural disasters like the shipwreck of the Russian tanker Volganeft in the Black Sea, the cyclone in Bangladesh, the landslide in Bolzan, the floods in Myanmar and Haiti, the earthquake in China and several other emergency events in 2009.
Moreover, a first operational use of these satellites has been made by the National Civil Protection Service during events occurred in our country (the Etna eruption, the floods in Piedmont and Sardinia and the L'Aquila-Abruzzo earthquake).
For further information regarding the utilization of the COSMO-SkyMed satellites data, please see the annex and ASI website (http://www.asi.it).
The COSMO-SkyMed programme is also the key element of the Italian Space Agency programme on Earth Observation applications. At the same time as the development of the COSMO-SkyMed System, the Italian Space Agency has started a programme dedicated to understanding and showing how space observation data could be used to face natural and man-induced disasters.
The civil scope of the programme (until 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 that answer 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 in different areas, so these projects could be seen as the national contribution to the GMES (Global Monitoring for Environment and Security) programme and to Global Earth Observation System of System (GEOSS).
The programme is being developed in close connection with the Italian Civil Protection National Service in order to facilitate in the near future the transition of the existing monitoring and emergency response capabilities from pilot to operational services.

The COSMO-SkyMed system is part of 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 of the Italian COSMO-SkyMed satellites and French Pleiades satellites.
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 the ASI-CONAE agreement signed in 2005. The integrated system uses the Italian COSMO-SkyMed constellation and the Argentinean SAOCOM constellation consisting of two L-band SAR satellites.
The combined use of C-Band, L-band and X-band SAR data will lead to improved performance in several specific applications.
In addition, Italy, through its contribution to the ESA GMES program, will also have the possibility of programming the GMES Sentinel 1 satellite and using the relevant C-band SAR data.

ASI has finalized the development of the **ROSA** instrument, a Radio Occultation Sounder for Atmosphere. It is dedicated to collect important information regarding temperature, pressure and humidity of the atmosphere contributing to the study and monitoring of climate change. ROSA has been installed on board the Indian satellite, OCEANSAT-2 (launched in September 2009) and on board the Argentinean satellite, Aquarius/SAC-D, scheduled to launch in 2010.
Italy is developing hyperspectral technologies. Building on the positive experience of the project study HyPSEO, ASI is developing a new Earth observation system, **PRISMA**, a pre-operative programme. It uses electro-optic instruments that integrate a hyperspectral sensor with a middle resolution panchromatic camera. This characteristic will help the space observation to also identify the chemical composition of the revealed objects.
In the frame of the ASI small missions programme, **MIOSAT** is an Optical Mission based on a Microsatellite. It has both applicative and technological goals. The microsatellite, weighting 120 kg, will be based on a state-of-the-art reusable and modular microsatellite platform. The payload, consisting of a high resolution panchromatic camera, an imaging interferometer, a Mach-Zehender micro-interferometer and a deployable telescope, will provide high resolution Earth observation data for environmental monitoring. Three technological experiments will be also embarked and tested in orbit.
ASI also supports EO data exploitation by means of a specific programme devoted to disaster management. Several national emergencies have been identified, such as earthquakes, volcanoes, landslides, floods, air pollution, marine oil spills, forest fires, coastal risks. For each one, at least one pilot project has been set up and started, with the scope of developing a pre-operational demonstration system in collaboration with a “reference user” (usually the Civil Protection National Service). Activities are well under way.

At the European level Italy contributes to the Global Monitoring for Environment and Security (**GMES**) programme, an EU-led initiative, which will develop information services to be used for the definition and monitoring of EU policies in the field of environment and security.
With reference to the Italian contribution to the programme, from one side, Italy, through its contribution to ESA, participates in the ESA optional programme GMES Space Component Programme (GSC) managed by the European Space Agency, on the other side, Italian entities (e.g. companies, researchers, public entities and the Italian Space Agency itself) are involved in projects, relevant to GMES services, funded by the European Commission within the R&D framework programmes. Moreover, COSMO-SkyMed is one of the GMES contributing missions which will provide their data to the different services.

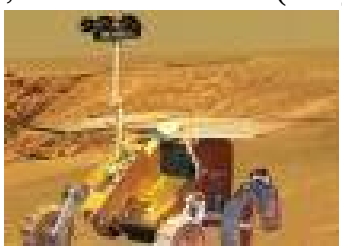
ASI participates in other Earth Observation programmes of the European Space Agency (ESA) like DATA USER Programme, ENVISAT 1, METEOSAT Second and Third Generation, EOEP Period 1, 2, and 3.

At the multilateral level Italy is a member of the Group on Earth Observation (GEO), while ASI is a member of the Committee on Earth Observation Satellites (CEOS). In the framework of the United Nations/COPUOS ASI participates in various international activities and projects.

4.2 Observation of the Universe

Solar System Exploration

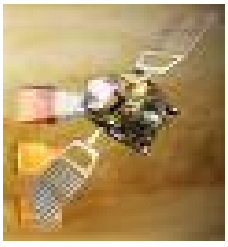
Italy is one of the main contributors to the ESA optional programme, **Aurora**, with the purpose of giving an important contribution to the "Worldwide Vision for Exploration", in the areas of main excellence of the Italian industries and science community: radar instruments, spectrometers, telecommunications, robotics and EDLS (Entry Descent and Landing Systems) subsystems. The long-term goal of the Aurora programme is the human exploration of Mars with Sample Return as a main intermediate milestone whereas **ExoMars** will be the first European mission to have landed elements on the surface of the red planet. The programme is composed by two missions the first one composed by an orbiter and a fixed lander is scheduled for launch in 2016. The second one consists of a rover deployed in 2018 by a NASA landing device (Skycrane). The rover will be equipped with a drill and a scientific package to analyse the samples collected). Italy is interested among, other things, in the drill and the sample management system, the airbags and the parachutes, and will manage the Rover Operation Control Center during the operations on the Martian surface. Two Italian scientific experiments will be provided to the mission and a large number of Italian scientists are involved in several other instruments.



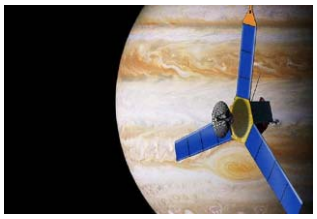
Italy is playing a significant role in the exploration of Saturn and its satellites with the NASA-ESA-ASI mission **Cassini-Huygens** and in Mars exploration through collaboration with NASA and ESA. In particular, ASI developed the radar instruments **MARSIS** (Mars Advanced Radar for Subsurface and Ionosphere Sounding), on board the **Mars Express Mission**, and **SHARAD** (SHAllow RADar), embarked on the NASA mission **Mars Reconnaissance Orbiter**, both with the goal to search for liquid water and ice in Mars' subsurface.

During the year 2009 the two radars continued to send very significant information regarding this topic. In particular, radargrams provided by SHARAD allowed scientists to measure the stratification of the polar ice sheet . ASI also completed the development of a GIS (Geographical Information System) for Mars and other planetary surfaces called **PAGIS** (Planetary Geosciences Information System) that have produced a first high definition Martian Geological map of the ASI Planetary Map Series. ASI is also deploying an on-field test facility in a Martian analogue environment located in the Moroccan desert where it will be possible to test instruments and landed elements or training operation teams in the main frame of the exploration programmes .

The Italian spectrometer **PFS** (Planetary Fourier Spectrometer), on board Mars Express, is mapping the abundance of the water vapour and methane in the Martian atmosphere. Italy is also contributing to the ESA **Venus Express** mission currently orbiting around Venus. Venus Express has revealed detailed atmospheric dynamics and stunning details of the south polar vortex, while also discovering the hydroxyl radical in the Venusian atmosphere; now the main topic of the research is to discover active volcanic activity. The main contributions to these results were achieved thanks to the data provided by the **VIRTIS** (Visible-IR Thermal Mapping Spectrometer) instrument co-led by an Italian and a French PI.



Italy is significantly present on the ESA mission to Mercury **BepiColombo** (scheduled for launch in 2014) with four PI instruments and an important contribution to another four experiments, all taking on the heritage of Italian excellence on the field.
Moreover, ASI-led instruments play a fundamental role in the study of primitive bodies such as comets and asteroids on missions which are currently cruising towards their targets. This year, the instruments on board the ESA **Rosetta** spacecraft, on its way to comet 67P/Churyumov-Gerasimenko, has observed the asteroid Steins during its fly-by which occurred on 5 September. The OSIRIS Wide Angle Camera (**WAC**), made in Italy, produced the first images of the asteroid. In the meantime, the NASA Discovery mission **Dawn** continues her flight towards Vesta and Ceres with on-board the Italian **VIR-MS** spectrometer (Visible-IR Mapping Spectrometer). Furthermore, a feasibility study has been carried out to check the possibility to use a VEGA launch vehicle for the JAXA Hayabusa-2 asteroid sample return mission.
ASI supports the International Lunar Network (**ILN**) initiative with the goal of building up a coordinated network of small geophysical stations to be deployed on the lunar surface to establish the nature of the Moon's core and its internal structure.



The Italian Space Agency is contributing to the NASA 2nd New Frontiers mission **Juno**. Scheduled for launch in 2011, Juno aims to carry out a detailed study of the giant planet Jupiter: the spacecraft will investigate Jupiter's origins, its interior structure, its deep atmosphere (convection and wind dynamics) and its magnetosphere from an innovative, highly elliptical polar orbit with a suite of seven science instruments. ASI started to develop the infrared imaging spectrometer **JIRAM** (Jovian InfraRed Auroral Mapper) and the **Ka-Translator** for the radio-science experiment that will be provide to NASA. Furthermore, the utilization of the **Sardinia Radio Telescope** to provide the tracking service for the mission is currently under evaluation.

ASI is also supporting the Italian scientists involved in the proposals in competition within the ESA **Cosmic Vision** science programme. Among the pre-selected missions, those aiming at the exploration of the Solar System are: **Marco Polo**, a sample return mission from a primitive body to be developed in collaboration with JAXA; **Laplace**, a mission to Europa and the Jovian system, to be developed in conjunction with NASA and JAXA. The Italian contribution to those missions is focused on low-frequency sounding radars, imaging spectrometers, atmospheric sensors, radio-science equipment and, in general, radiation hardened components. Italy is also interested in the **Cross-Scale** mission, the goal of which is to study the interactions between the solar wind and Earth's magnetosphere.
Experimental campaigns performed with stratospheric balloons represent an important part of the Italian endeavour in space: tests and calibration of instruments to be employed in space are carried out through mid- and long-duration flights within the Earth's atmosphere. In late spring 2009 the **SORA** (Sounding Radar) mission was successfully launched from Svalbard base. On board was a radar similar to SHARAD to investigate well known polar and Antarctic areas in order to calibrate the radar data acquired on Mars and other 3 piggy-back experiments. The main experiment suffered a major problem; the data from the other three are under analysis.

Finally, ASI plays a leading role in the study of the Sun and the **Space Weather**. In particular, the joint ASI-NASA instrument UVCS (Ultraviolet Coronagraph Spectrometer) on board the ESA mission **SOHO** continues to provide outstanding data on the solar corona after more then 10 years in orbit. On 15 September the **Score** coronagraph was launched on board an American sounding rocket, this is the precursor of the MAETIS experiment that will be embarked on the next ESA solar mission **Solar Orbiter**.

High Energy Astrophysics

After the success of the BeppoSAX mission, ASI was willing 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, with a two-year operational life. The core of the mission is a new generation gamma detector, a natural consequence of the evolution of detectors used for experiments of physics of elementary particles. In 2009 the mission was extended for a period of two years.

Competences acquired so far have 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 the NASA mission, **GLAST**, now renamed **Fermi**, launched in June 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 though the Asi Science Data Center- ASDC.

AGILE and Swift data are acquired at the 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 2010, for at least three years of operation. It will be able 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.

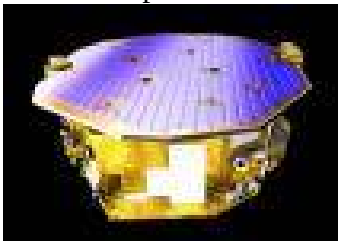
AMS flew with the Italian astronaut Roberto Vittori on board the Shuttle in July 2010.

Since 2000 the **ASI Science Data Center** (ASDC), located at ESA/ESRIN in Frascati (Italy), has been supporting all scientific missions of the Italian Space Agency in the management and preservation of scientific space data.

ASI is also supporting the Italian scientists involved in the proposals in competition within the ESA **Cosmic Vision** science programme. Among the pre-selected missions, those regarding high energy astrophysics are : **Euclid** devoted to the study of the phenomena associated to the dark energy and **IXO** dedicated to x and gamma rays.

Cosmology and Fundamental Physics

The Italian scientific community is participating in the **Herschel** and **Planck** ESA Programmes launched in May 2009. Planck will examine cosmic microwave background radiation with an accuracy never achieved before to test theories of the early universe and the origin of cosmic structures; Herschel will study the evolutionary processes of the galaxies and the inner areas of star forming regions. ASI funds and manages the development of the Italian PI-ship instrument LFI and the Italian contribution to HFI for Planck and the Italian contribution to the instrument hardware and to the Instrument Control Centers for Herschel. The first results of the two missions are confirming excellent performances of the on board instruments.



Italy continues its contribution to the ESA mission **LISA Pathfinder** that will test the concept of detecting gravitational waves from space showing that it is possible to control and to measure the movement of two masses

in a free fall condition. This technology is essential for the future ESA-NASA programme, LISA (Laser Interferometer Space Antenna).
The national effort for the ESA **Gaia** mission is growing. ESA is directly producing the spacecraft and the payload for this mission, whose aim is to obtain a three-dimensional map of our galaxy, revealing its composition, formation and evolution. To participate in the important scientific return of the mission, Italian scientists are deeply involved in the **DPAC** (Data Processing and Analysis Consortium), the consortium of European research institutes that will have the responsibility for reducing and analysing the enormous amount of data that will be produced by the mission.
In the field of cosmology, two experiments on stratospheric balloons are in preparation. **BOOMERanG** (Balloon Observations of Millimetric Extragalactic Radiation And Geophysics) is a microwave telescope that was first launched in 2000 and 2003 from the Antarctic obtaining "images" of the first stages of the universe. The next flight, with a new version of the instrument on board able to measure the properties of the polarization of cosmic radiation, is scheduled for 2011 from the Svalbard Islands.

Olimpo is a long-term mission on a stratospheric balloon to study the microwave cosmic background as well as the primordial galaxies. The first flight from the Svalbard Islands is scheduled to take place in 2010.
In the field of fundamental physics, ASI is managing the realization of the **LARES** satellite, to be launched in 2011 using the new European Space Agency launcher VEGA. The scientific aim of the mission is the accurate measurement of the Lense-Thirring effect, predicted by the general relativity theory.
ASI has also completed the phase A study for the Galileo Galilei mission, dedicated to the experimental test from space of the Equivalence Principle. The final evaluation for the continuation of the programme is in progress.

Italy contributes to the progress of knowledge and expansion of the human knowledge frontiers by exploring the mysteries and the opportunities of the universe, through data obtained from high technology space systems. Along with numerous contributions in international missions, Italy is also carrying out national projects: in 2009 the phase A studies have been completed for five small missions (**SAGACE** – Spectroscopic Active Galaxies And Clusters Explorer, **POLARIX** – X-band polarimeter, **FLORAD** – microsatellites FLOral constellation for RADiometric observations, **MAGIA** – Missione Altimetrica Gravimetrica geochImica lunAre, **ADAHELI** – ADvanced Astronomy for HELIophysics). The selection for the B phase is in progress to finally select the first one to be launched not earlier than 2012.

Space Debris
Italy is constantly involved in the space debris issue with initiatives at national level and supporting international activities to mitigate and prevent damage caused by space debris.
The Italian Space Agency is a member of the Inter-Agency Space Debris Coordination Committee. It supports its work with a coordinated research activity on space debris monitoring, modelling, protection and mitigation.
At the European level, ASI cooperates with BNSC, CNES, DLR and ESA and applies at national level in each new spacecraft development, the prevention and mitigation clauses contained in the "European Code of Conduct for Space Debris Mitigation".
The spacecraft operators of the Italian Cosmo/Skymed satellite constellation performed some collision avoidance manoeuvres during 2009 and following the Iridium 33 accident.
In 2009 the Italian delegation together with the German delegation made a request, that is included in a A/AC.105/2009/CRP.19, for the establishment, under the auspices of the UN, of an international platform of data and information on objects in outer space. This database - supplied on an exclusively voluntary basis and freely accessible to member states - would be for the promotion of a safe and sustainable development of peaceful uses of outer space. This initiative is in line with

and would support and complement the ongoing issue of “long-term sustainability of space activities” proposed by the French delegation.
Consistent with the UNCOPUOS request made at its fifty-second session to Member States of the IADC, ASI, in October 2009, during one session of the IADC informed the steering committee to prompt the STSC in February 2010.

4.3 Space Habitability

Italy plays a relevant role in the development and the utilization of the **International Space Station** (ISS), obtained through the bilateral agreement with NASA, signed in 1997, and the participation in the ESA programme.

After the success of the Italian **MPLM** logistic modules (Multi Purpose Logistic Modules; Leonardo, Raffaello and Donatello) used to transport equipment, supplies and experiments, to the International Space Station and entered in the operational phases in 2001, Italy has been collaborating with ESA in various fundamental projects, such as Columbus, ATV (Automated Transfer Vehicle), **Node 2** and **Node 3** and **Cupola**, which was planned to fly in February 2010.
Columbus Orbital Facility was successfully launched on board NASA’s Space Shuttle Atlantis from the Kennedy Space Centre in Cape Canaveral, Florida on 7 February,2008.
The 11 tonne European Laboratory has been delivered by the Space Shuttle to a berthing site on Node 2, adjacent to the U.S. Laboratory. This facility is accommodating ten racks, five of them for European Space Agency utilization, the other five for NASA and possibly for the other ISS partners. It will be used primarily for research and experimentation in microgravity conditions, mainly in the fields of life sciences, physics and material science. An Italian company has been the prime contractor for the primary Columbus structure and other critical elements.

On March the 9th 2008, **Jules Verne**, the European Automated Transfer Vehicle (ATV), was successfully launched by a special version of Ariane 5 launcher. Jules Verne, with a high Italian industrial participation, is an important space station supply spacecraft, delivering experiments, equipment and spare parts, as well as food, air and water for the permanent crew. Equipped with its own propulsion and navigation systems, the ATV is a multi-functional spacecraft, combining the fully automatic capabilities of an unmanned vehicle with the safety requirements of a crewed vehicle.

4.4 Italian Astronauts

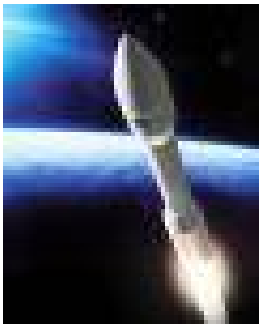
The Italian astronauts are members of the European Astronauts Corps. Presently two astronauts are active: **Paolo Nespoli** and **Roberto Vittori** (see ASI website for their biographies).
From 23rd October to 7th November 2007, Paolo Nespoli flew as Mission Specialist on board Space Shuttle Discovery for the STS-120 flight to the International Space Station. This mission delivered and installed the Node 2, a major building block essential for further expansion of the ISS, including the addition of the European Columbus laboratory. Another important task of that mission was the relocation of one of the four solar arrays which provide power to the Station. Nespoli played a key role as the intravehicular activity astronaut for the mission’s spacewalks, including the installation of Node 2. During the mission, named Esperia, Nespoli also performed a number of experiments for the European scientific community in the area of human physiology and biology. Nespoli also took part in educational activities.

In November 2008, Paolo Nespoli was assigned to Expedition 26/27, a long duration mission to the International Space Station planned to take place from November 2010 to May 2011. He recently started his ISS training in Russia and in the US.
From 25 April to 5 May 2002 Roberto Vittori participated in a taxi-flight to the International Space Station, under an agreement between the Russian Space Agency Rosaviakosmos, the Italian Space Agency ASI and ESA. One main goal of this mission was the successful delivery of a new 'lifeboat' to the Station for use by the resident crew in the event of an emergency.
His second mission to the International Space Station, the Italian Soyuz mission 'Eneide' took place from 15 to 25 April 2005. As flight engineer on both ascent and return, Vittori had an active role in piloting and docking the spacecraft. On board the ISS, Vittori performed an intensive experimental programme.
In January 2009 Vittori started his training in Houston in preparation of a Shuttle mission to the international Space Station that will take place in April 2010.

Among the six new recruits of the European Astronaut Corps that ESA presented on May 20, two are Italian: **Samantha Cristoforetti** and **Luca Parmitano**.
They were selected following a Europe-wide recruitment process that started in 2008. Following thorough psychological, medical and professional screening that started with 8413 valid applications, they are the first new recruits to join the European Astronaut Corps since 1992. Samantha Cristoforetti is the first female European astronaut.

4.5 Space Transportation

Italy supports the development and realization of transportation systems that contribute to the strategic independence of European access into space by means of several projects regarding the current European launcher family and future (expendable and reusable) launchers. Activities are supported within the frame of contribution to ESA programmes or of national development programmes.
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 Guyana Space Centre (development support).



Italian main contributions to ARIANE 5 related programmes, such as evolutions and upgrades, infrastructures, support to production, surveillance, include solid boosters and the first stage turbo pump.
Italy is the main sponsor of VEGA with 65% of the total cost. VEGA is a small launch vehicle for satellites up to 1.5 tons in Low Earth Orbit.
This programme includes the development both of the launcher and of the ground infrastructure at CGS (Guyana Space Centre), which are deemed as necessary for the integration and exploitation of the launch vector.
The year 2009 is marked with a final series of successful firing tests of solid rocket motors that confirm the performance capability of the VEGA launch system. In addition, the Italian satellite LARES, developed under ASI contract and selected by ESA as the first payload to be embarked on VEGA qualification flight, is ongoing its design and realization phases. The main scientific objective of the LARES mission is the measurement of the dragging of inertial frame due to the Earth's angular momentum, or Lense-Thirring effect, and a high precision test of the Earth's gravitomagnetic field with accuracy of the order of a few percent. The LARES System will provide a significant contribution to accomplish the objectives of the VEGA qualification flight, whose first launch is now scheduled for the first half of 2011.
Italy supports the ESA Soyuz programme that includes all necessary activities to launch the Russian vector Soyuz from the European base of CSG at Kourou.

With the aim of studying evolutions of the Vega launcher, ASI is supporting the **LYRA** project on a national basis. In the framework of a Memorandum of Understanding on the Cooperation on Launcher and Space Propulsion, Italian and Russian industrial companies, under the provisions of national agencies, have started a cooperation concerning the development, manufacturing and testing of a new demonstrator engine operating with liquid methane as fuel. The propulsion activities are supported by launch vehicle system studies, aiming to provide possible architectures for the future evolution of the Vega Launch Vehicle, together with Guidance Navigation and Control (GNC) improvement activities.
On a national basis, ASI is supporting several other research and development projects, focused on the investigation and evaluation of key technologies for future space transport systems (expendable and/or reusable): among others, there are the ASA project (innovative materials and structures for hot structures) and the CAST project (Aerothermodynamics and Aerodynamic for lift-off and re-entry). Further future initiatives are foreseen (Hybrid propulsion, Nanotechnologies, 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, and mainly on experimental re-entry vehicle.

4.6 Telecommunication and Navigation

ASI participates in satellite navigation and telecommunication programmes in order to foster the research activities and demand of such services in the citizen 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 still supports **ARTEMIS** operations through ESA.
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 in the development of new services and applications such as Tele-education, Institutional Telecommunication for Security and Emergencies, Telemedicine through prototype projects in collaboration with other public administrations.
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**. For this purpose three phase A feasibility studies have been carried out, which deduced that - by using current technologies - high frequency systems may be put into practice. Three A2 phases are in progress.
Concerning the Q/V band, ASI is developing the first experimental telecommunication civil network in the world operating at 40/50 GHz. It is composed by a space segment that will be flown on board the Alphasat ESA satellite, and a ground station network that includes Earth stations in Italy and throughout Europe. Phase B studies on W and Optical bands will be started soon.

An important Italian project in cooperation with France is **ATHENA-FIDUS**. The project will develop a geostationary satellite for dual broadband communications services dedicated to independent users and for Italian and French dual government use. The use of frequencies oriented towards providing broadband telecommunications services in the entire hemisphere of the geostationary orbit is also foreseen to support military actions and Italian institutional and humanitarian missions abroad.
Athena-Fidus will realize a telecommunications infrastructure that can substitute/integrate ground networks in case they are not available or if they are damaged.

The system will provide the following services:

- Broadband access to Internet for fixed or portable terminals located in areas with low levels (or degraded levels) of communications infrastructures (for the management of natural or harmful disasters in situations of general emergency)
- Broadband telecommunications services for police force terminals (for example, access to remote multimedia databases)
- "Seamless" interconnections (LAN-to-LAN, Virtual Private Network) between sites that have local telecommunications infrastructures
- Telecommunications services to provide remote surveillance in critical areas (ports, airports, railways in both natural disaster and non-disaster areas, etc.)
- Telecommunications services for the armed forces that complement existing military solutions or those foreseen in the near future.

TELESAL is an applicative pilot project in telemedicine, managed and co-funded by ASI and the Italian Ministry of Health. TELESAL is an open system of applications and telecommunication systems that connect users with healthcare needs to centres providing telemedicine. It provides quality assistance also outside the hospital structures and in this way it helps to avoid their logistic congestion.
TELESAL technology will be on board the Italian Costa Crociere fleet's flagship, and will provide cruisers and crew with a real virtual emergency room, working around the clock to support the resident medical staff.
In general, TELESAL aims to assure the maximum propagation of medical education. It also intends to provide health assistance in developing countries.

Italy has recognised the potential of satellite navigation in fostering many applications for a long time and has undertaken initiatives to develop pre-operational projects to pave the way to its extensive use.
The Italian Space Agency funds the **GALILEO** projects (one of the four major founders), takes part in the GALILEO & EGNOS European Management Boards and Technical Control Bodies, promotes and develops the 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 safety in the transport sectors and in general of improving territorial safety and security. Satellite navigation helps to increase 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, developed in strict coordination with the Ministry of Transport and Infrastructure: a **maritime project** focused 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 ENAV, aimed at introducing EGNOS services and GALILEO services into the world of ATC/ATM.
Another development regards a specific project aimed at introducing the use of GALILEO Public Regulated Service (**PRS**) to the governmental entities devoted to the safety and security of national territory.
Furthermore, there is a project aimed at sustaining Infomobility and providing new services for traffic control, road tolling and billing. Then, a specific project has been set up to develop new services for urban mobility of blind people in order to provide them with detailed navigation both outdoors and indoors.
There are also technological project studies aimed at developing innovation in the field of satellite navigation **Signal Generation**. 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 users the updating of their own data as well as their own position at a better rate than that which is currently available, as well as more precise and accurate services. Furthermore, the possibility of applying signal optimization techniques with the aim of exploiting part of the available band as a communication channel between users has been studied.
Considering the reference clock on navigation satellites, ASI is supporting the development **of two atomic clocks** for Galileo second generation (in substitution of the present clocks, in particular of the hydrogen maser PHM). Both projects, POP and ORA, respond to the above mission objective with some differences:

- POP (atomic clock using the Pulsed Optical Pumping technique), offers a stability close to that of the passive hydrogen maser (PHM) of the Galileo constellation, but with less operational constraints and lower mass, size and power consumption;
- ORA (Optical Atomic Clock based on neutral Strontium (87Sr)) explores the possibility of developing a clock whose performances exceed the values foreseen for PHM, and characterized by very high long-term stability.

ASI has strongly contributed to the UN-COPUOS Working Group on Satellite Navigation, as co-chair with U.S., and favoured the establishment of the **International Committee on Satellite Navigation (ICG)**, which started its work in 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 and will chair and host the 2010 ICG Assembly in Turin in the week 18-22 October 2010.

4.7 Medicine and Biotechnologies

Italy is committed to enhance knowledge through space research and transfer it to diagnostic, therapeutic, preventive and biotechnological applications.
During 2009 the main activities were as follows:

1. **ALTEA**, Anomalous Long Term Effects in Astronauts is the third instrument developed by ASI for life sciences experiments on board the ISS. It was launched on board Discovery Mission STS-121 in July 2006. The mission ended in August 2007. In 2008 an agreement was signed with NASA to utilize this instrument as a detector for operational purposes. Thanks to this agreement Altea is today operative on board the ISS in DOSI mode.

2. **ELITE-S2**. The ELITE S2 facility, the fourth ASI ISS payload for biomedical experiments, was launched on board Discovery in August 2007. The system is able to represent the movements of astronauts with extreme precision (less than one millimetre), and it is aimed at performing neuro and motor control studies in microG. The large amount of scientific data resulting from the experimental campaign conducted in 2008 is being evaluated by scientists. The instrument is still on board the ISS waiting for other experimental sessions planned in 2010.

3. **MDS**. The MDS facility is an experiment with small rodents on ISS; the facility was uploaded to the Station in August 2009, and is at the moment fully functional. The long-term experiments being conducted through the MDS facility aim to bring new light on the genetic mechanisms which drive the physiology and pathologies of bone mass.

4. **BED-REST**. In the field of the national programmes in Osteoporosis and Muscle Atrophy (OSMA) and Disorders of Cardiorespiratory and Motor Control (DCMC), the second entirely

Italian Bed-rest study took place in August 2008. The activity was in collaboration with the University of Primorska (Capodistria, Slovenia).

5. Call for Ideas: **MARS 500** is an international project which regards a simulation of a human mission of long duration. Two Italian experiments were selected in 2008 and were performed inside the Russian NEK facility, in Moscow, during the summer in 2009. The experiments are now concluded and the results are being evaluated by the scientific community.

6. Call for Ideas: **VUS**. In foresight of the flight of the Italian astronaut Roberto Vittori on the ISS, MED has originated a call for ideas; life sciences experiments are now being selected and will be performed in orbit during Roberto's time in orbit in April 2011.

7. **DCMC**. After three intense years, the DCMC project has ended producing interesting results. "Disorders of Motor and Cardiorespiratory Control" is a national programme aimed at developing scientific and clinical know-how in the field of gravitational physiology and at finding application of space fallouts to rehabilitative treatments of neuromotor and cardiorespiratory diseases.

8. **OSMA**. Osteoporosis and muscle atrophy are strictly connected pathologies, both related to ageing and to degenerative pathologies. The ASI OSMA project aims to explain the unresolved problems connected with these pathologies that with incredible similitude are noticed both in old age and in astronauts. The OSMA programme will conclude its studies at the end of 2009, with the study of the first in-flight results of the Italian payload MDS.

9. **MoMa**. This programme aims to improve the level of scientific knowledge of the aging processes in Space and on Earth, and to develop countermeasures against the effects of severe and extreme environmental conditions. With this acquired knowledge, adequate preventive, diagnostic and therapeutic strategies will be elaborated. Innovative countermeasures for human health in space, and the subsequent improvement in the quality of life of the elderly on Earth are the end targets of these activities. The programme, coordinated by the University of Udine, involved 57 research institutes and successfully concluded its first phase in July 2009.

4.8 Space Education

ASI promotes and funds scholarships for Masters and higher education courses to allow Italian students to have access to aerospace studies. In order to encourage the Italian participation also in international higher education courses, ASI promotes different initiatives such as the "Summer School at Alpbach" that is organized annually by ESA and the Austrian Space and Research Agency.
An agreement among ASI and the University and Polytechnic of Bari regulates the cooperation on joint educational programmes in the field of Earth Observation and its scientific applications. A two-month course on SAR technology and applications was organized In summer 2009. The course was held at the ASI Space Geodesy Centre in Matera. Lessons, practice and case studies were conceived for new graduate students and young researchers who wanted to increase their knowledge of new technologies and applications in the field of Earth observation.
On the basis of an agreement with the Conference of the Italian University Rectors, ASI organize internships for university students and new graduates, chosen among the most motivated. This is the main internship programme, but ASI – to increase the number of participant students - has recently signed some more agreements with single universities and educational institutions. ASI usually awards internship holders a monthly scholarship, in relation to the evaluation of the achievement of educational objectives.
In addition, ASI supports the education and culture of the space technologies and applications also through several projects dedicated to teachers and students, and by promoting the use of high-tech

and computer technology. In particular, ASI, in cooperation 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 Internet educational modules regarding aerospace topics suitable for younger students. In support of this programme is a web-site (www.spazioallescuole.it) that is a cultural bridge between schools and the institutions on favour of the spread of aerospace culture.
ASI has finalized the development of "**Star4Physics**", an original video-game via internet, named edutainment, (education-entertainment) that aims at teaching young people the fundamentals of physics.
The Italian Space Agency is also deeply involved in developing new communication and promotional activities oriented towards primary schools students. In particular, ASI produced three comic books on space topics (astronauts, EO and astrophysics) and completed a didactic and fascinating performance on astronomy, called "*Minuetto Astronomico*". At the moment, ASI is working on a new 3D didactic puzzle of the COSMO-SkyMed satellites.
Every year ASI takes part in several educational events and fairs, such as "ABCD Italian Educational Fair" in Genoa and "Science Festival" in Rome. From October 2009 to February 2010 ASI participated in a space exhibition called "Stars & Particles, the words of the Universe" at the Palazzo delle Esposizioni in Rome.
Italy is engaged in several educational space initiatives with international partners.
In the frame of ASI's annual participation in the "Mario Gulich" Institute (Cordoba, Argentina), the Italian Government offers some fellowships to Argentinean students and researchers that offer them the possibility to study in Italian Universities and remote sensing research centres.
The Mario Gulich Institute was originated in an agreement between the Argentine National Space Agency (CONAE) and the National University of Cordoba (UNC). From its creation the Italian Space Agency has had a significant participation in the Institute. A new Masters in Emergency Early Warning and Response Space Applications (AEARTE) has started and all the 13 students will spend six months in Italian universities for a specialised placement.
In the frame of the inter-governmental agreement between Italy and Kenya regarding the San Marco Project in Malindi (Kenya), ASI supports the technical education and professional training of Kenyan students. Scholarships have been offered by the Italian Government to Kenyan researchers for PhDs in Italian universities.
Moreover, the first step of a medium-term project that regards the participation of Kenya in a small space mission started in 2008. An 18-month scholarship funded by ASI was awarded to three young Kenyan graduates. The three Kenyan engineers attended a six-month Master in Satellites and Orbital Platforms organized by the University of Rome "La Sapienza" and are now doing twelve months training on the job in the Italian space industry. The students are given the opportunity to develop both technical and managerial capabilities and skills.

4.9 International Relations

Bilateral and multilateral space cooperation is a fundamental pillar of Italian space policy, which is promoted and managed by the Italian Space Agency.
International space cooperation is articulated on two levels: the participation in the European Space Agency with the contribution to the European Space Policy and the bilateral relations and cooperation with European and non-European countries, besides the participation in international organizations.
Currently, Space agreements with many space agencies or countries are in force, among the others: ESA, CNES, DLR, Spain, Norway, NASA, ROSCOSMOS, CONAE, CNSA, CNES, ISRO, JAXA, BSA, ISA, Argentina, China, Russia, Kenya. However, close relations are in place with other countries in order to finalize new fields of collaboration.
At multilateral level, Italy is member of the UN/COPUOS and actively follows its activities through the Scientific and Technical Subcommittee and the Legal Subcommittee. In particular, Italy is

interested in providing a relevant contribution to the global sustainable development through some COPUOS issues, such as space debris, the global navigation satellite systems, the joint group COPUOS-IAEA (International Atomic Energy Agency), the implementation of the recommendations of UNISPACE III, the support to a disaster management space-based system. Italy participates in many international space organizations and committees, such as GEO (Group of Earth Observation), CEOS (Committee on Earth Observation), ICG (International Committee on GNSS), the OECD-Global Forum on Space Economics (GFSE) and the Inter-Agency Space Debris Coordination Committee (IADC). ASI is also a member of other international association and institutes such as IAF, ESPI, EURISY.

5. Financial resources

5.1 ASI budget: breakdown of funds (commitments) – by spend area

(€ millions)	2009
Revenues	
Government funding	570,73
Other funding	15,31
Surplus 2008	76,31
Total revenues	**662,35**
Expenditures	
Italy's contribution to ESA	**399,26**
National Space programme	**171,85**
Earth Observation	69,84
Telecommunications	4,20
Medicine and Biotecnology	9,24
Exploration	65,96
Launchers	12,14
Tecnology and Science Support	3,74
Manned Exploration	6,73
Operative Centers	**12,55**
External training	**2,86**
Human resources and infrastructure	**75,83**
Total expenditures	**662,35**

5.2 Balance sheet: assets at 31 December 2009

ASSETS (in € millions)	2009		
	Gross	Depreciaiton and provisions	Net
Intangible assets (A)	**467.119,20**	**147.434,98**	**319.684,22**
Land	633.015,39	401.643,94	231.371,45
Buildings	128.164.751,15	86.452.745,27	41.712.005,88
Technical facilities, equipment	85.861.869,57	83.100.652,86	2.761.216,71
Satellite	2.086.572.425,67	1.606.446.500,85	480.125.924,82
Other intangible assets	3.335.401,84	2.344.788,83	990.613,01
Tangible assets (B)	**2.304.567.463,62**	**1.778.746.331,75**	**525.821.131,87**
Capital assets (C)	3.040.113,09		3.040.113,09
FIXED ASSETS (A+B+C)	**2.308.074.695,91**	**1.778.893.766,73**	**529.180.929,18**

ASSETS (in € millions)	2009
Credits not istitutional	185.925,00
Advances	5.192.032,51
Credits for istitutional activities	690.586.226,23
Other credits	2.573.731,91
Liquid assets	117.483.030,74
CURRENT ASSETS	**816.020.946,39**

6. Main events: conferences, workshops, fairs and exhibitions

6.1 Conferences

SpaceLand 1st Expo-Congress 2009: Chia Laguna, 21-22 September

With the Patronage of the Italian Space Agency, European Year of Creativity and Innovation, Region of Sardinia, European Space Agency, University of Sassari, and the University of Cagliari.

In the European "Year of Creativity and Innovation", the SpaceLand Expo-Congress from 21 to 22 of September at Chia Laguna (Cagliari, Italy) presented at an international level those opportunities stemming from the aerospace business for the progress of medicine, science, technology, culture and socio-economic development.

Through the myriad interdisciplinary synergies generated thanks to research and educational "parabolic flight programs" implemented and carried out in Sardinia to fly scientists, general public and experiments in "Moon-gravity", "Mars-gravity" and "microgravity" flight conditions, the aim is to systematically involve the medicine & science world together with high-tech industry and entrepreneurs with the local economic entities, including SMEs, school and university populations, cultural and tourism workforce and infrastructure.

Such a system also addresses the new segment of "aerospace tourism", with educational, communication and work opportunities featuring a high level of innovation, providing new stimuli for the local economic development and enlarging the cultural and tourism activities for the national and international public.

The relevant added value for science, technology, culture and economic development can thereby trigger a new virtuous cycle activating in a fully integrated way, 12 months a year, local and national excellences within the above mentioned fields, respectively, in order to link past heritage and future growth of a unique land ready to become the world's first "Space Island".

Private Public Partnership - A joint way for the future
Rome, 28 May. To discuss cooperation between different institutions in the space field

Governmental institutions and privately owned companies, investing together to build space infrastructure. It is the so-called PPP (Public Private Partnership) business model, which is becoming increasingly important in the space field. The Italian space Agency promoted a one-day conference to discuss PPP projects in the space field.

33rd International Symposium on Remote Sensing of Environment (ISRSE)
Stresa, Italy, 4-8 May 2009

The 33rd International Symposium on Remote Sensing of Environment (ISRSE) took place on 4-8 May 2009 in Stresa, Italy. This 33rd Symposium has represented a major event in the long series of

internationally recognized ISRSE meetings. The overall theme of the symposium was the use of Earth Observation systems and airborne techniques for understanding and managing the Earth's environment and natural resources. The Italian Space Agency was among the sponsors, and the Italian Space industry (with Thales Alenia Space and Telespazio) among the exhibitors

ISRSE-33 took place at a strategic moment, when science and technology are expected to play a greater role in contributing towards sustainable development objectives faster and in a more equitable manner. Earth Observation, in particular, now has become an essential component of the global effort to deal with global challenges. Poverty reduction, food security and agricultural production, integrated water resource management, natural resource management (especially forests and biodiversity), migration, urbanization, land degradation and, perhaps most importantly at present, climate change, are all inextricably linked, whether in developed or developing countries. ISRSE-33 will specifically address the UN Millennium Development Goals and be structured along the societal benefit areas of the GEO (Group on Earth Observations) initiative.

At the ISRSE-33, European efforts (EC, ESA and Member States) towards establishing the now active Global Monitoring for Environment and Security (GMES) initiative -which was conceived nearby on the Lago Maggiore ten years ago- were described and discussed.

The Symposium has devoted attention to the US National Land Imaging Program and its Landsat Data Continuity Mission which represent significant steps towards the broad availability of satellite data for development.
Applications in Africa have been the focus of dedicated sessions. The Symposium has also offered a platform for describing and discussing new remote sensing programmes in all countries of the world. The latest developments in the setting up of interoperable Earth Observation and Spatial Data Infrastructures through international arrangements were also included in the Symposium's programme.

The Symposium has included plenary and thematic sessions, poster sessions and side events on issues of interest to scientists, policy makers and resource managers in the public and private sectors. The programme featured speakers from around the globe sharing their experiences and knowledge on remote sensing applications and programmes. By attending the ISRSE-33 remote sensing practitioners, scientists, system engineers and policy makers has been able to get a full view of the current situation in a range of fields now deemed critical in improving the Earth's sustainable management. Students were also encouraged to participate and share their knowledge and views on new R&D activities and technologies through pre-conference tutorial initiatives.

On 4 May, a special session was devoted to the COSMO-SkyMed satellite system for Earth Observation, with speakers representing ASI, Thales Alenia Space and Telespazio

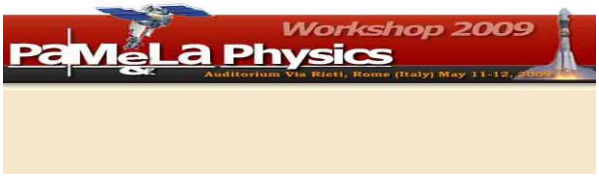
European Navigation Conference (ENC)
Naples, 4-6 May

Since its inception 13 years ago the European Group of Institutes of Navigation (EUGIN) organizes a yearly European Navigation Conference, Global Navigation Satellite Systems (ENC-GNSS), which is hosted by a different EUGIN country member every year.

The objective of the conference was to create an opportunity to exchange news and information about the technology progress in the radio navigation sector, with emphasis on satellite, ground segment and user segment technologies in the frame of the global navigation satellite system.
The ENC-GNSS conference was a unique opportunity to meet all the key players in the navigation area and to be informed on the latest developments in navigation and positioning systems.

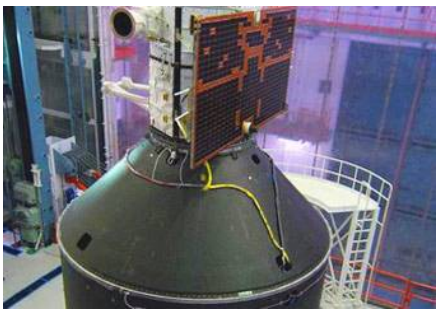
6.2 Workshops

PAMELA physics
Rome, 11-12May. An overview on the scientific issues, implications and perspectives in the field of cosmic ray physics, dark matter and solar physics in the light of the recent results of PAMELA



On 15 June 2006 the PAMELA satellite-borne experiment was launched from the Baikonur cosmodrome and it has been collecting data since July 2006. The core of the instrument is a silicon-microstrip magnetic spectrometer combined with a time-of-flight system, a silicon-tungsten electromagnetic calorimeter, a shower tail catcher scintillator, a neutron detector and an anticoincidence system. This telescope allows precision studies of the charged cosmic radiation to be conducted over a wide energy range (100 MeV - 100's GeV) with high statistics.
Aim of this workshop was to provide an overview on the scientific issues, implications and perspectives in the field of cosmic ray physics, dark matter and solar physics in the light of the recent results of PAMELA and other space and balloon missions, and in view of the planned future ones. The talks have covered presentations of the experimental results as well as theoretical and phenomenological interpretation and modelling. Correlations between astroparticle and particle physics at accelerators (namely LHC) have also been reviewed.
The aim of this workshop was also to convene scientists from different scientific communities in a same place to discuss and debate - in an informal way - on these very exciting topics and to give indications for the future.

Agile: two years after
New ideas for the future of the mission. Congress Hall, INAF-IASF, Milan, 22-23 April, 2009



The Mini-Workshop was aimed at providing an overview of the mission highlights and hot topics related to the current high-energy missions from the point of view of the AGILE scientific users and collaborators. The workshop covered the following topics:

- High energy/multifrequency properties of AGNs and theoretical insight based on recent AGILE and Fermi observations.
- Our Galaxy: high-resolution gamma-ray observations and diffuse emission.
- Pulsars, pulsar wind nebulae and supernovae remnants.
- Galactic jet sources and black holes.
- Panchromatic studies of GRBs.
- Exotic phenomena (terrestrial gamma-ray flashes).

At the end of the second day, a special session was devoted to the discussion of future scientific objectives of the AGILE Mission.

Workshop: National Opportunities for Human Space Flight
Rome, Casa dell'Aviatore, 9 April 2009

The Italian Space Agency and the Aeronautica Militare in the framework of ASI-NASA bilateral agreements that provide for the assignment of an Italian astronaut for a short-term flight opportunity on board the Shuttle and two long-term flight opportunities for a stay of six months on board the International Space Station and in execution of the Executive Agreement for Collaboration in Human Space Flight Activities, have presented and proposed the possibilities which Italy can make use of microgravity environment research to the scientific and national technological community on board the only orbiting laboratory in the world; the International Space Station.
ASI and AM intend to start up a common process open to the national community in reference to define an experimental programme that will be linked with the missions of European astronaut Roberto Vittori. During the course of the workshop a Call for Ideas was presented and launched. It invited all interested parties to propose innovative experiments for using the Space Station resources, for relative opportunities in particular, but not exclusively, in the field of life sciences, physical sciences and innovative technologies.

6.3 Fairs, Exhibitions and Outreach Events

Stars and particles
The Universe is on show at the Palazzo delle Esposizioni in Rome from 27 October 2009 to 14 February 2010

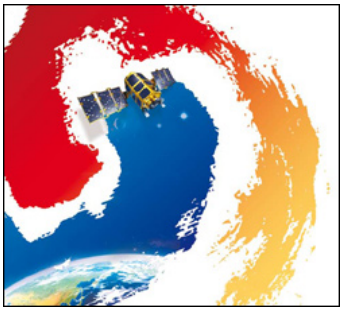
Light and elementary particles; the echo of remote events; the mysteries and secrets of space; and the sophisticated observatories scanning the depths of the Cosmos are all part of the voyage of discovery that is the "Stars and particles. The words of the Universe" exhibition at the Palazzo delle Esposizioni in Rome from 27 October 2009 to 14 February 2010. The exhibition was organised by the National Institute of Nuclear Physics, the National Institute of Astrophysics and the Italian Space Agency, with the scientific direction of Roberto Battiston.

Starting from the traces and the signals that continuously reach us from remote places in space and time, the exhibition recounts the great experiments, the telescopes and the detectors built in the most extreme environments on the planet to decode and interpret the words of the universe. By means of an involving and captivating visual design, the visitors were lead into the depths of the sea or deep inside mountains, and on to vast deserts studded with enormous telescopes. Also to space, where sophisticated observers orbit the Earth.

The exhibition was part of the calendar of events of the International Year of Astronomy, 400 years after Galileo Galilei's first observation of the sky using a telescope. Passing through the exhibition the visitor could learn about the work of the scientists who listen to and interpret the messages of the Cosmos to measure the dimensions and the age of the universe and to study its composition, to imagine how it will evolve or to go back in time until the first moments of its life, even recreating them in a laboratory.

The scientists of today and of yesterday accompany the public who could discover what we still do not know; these are the great scientific questions of our time that researchers all over the world are trying to answer. And the questions that are still unanswered, the mysteries that have always fascinated people even when they only had their eyes to look towards the sky.
The exhibition was accompanied by a catalogue, including a brief history of the Italian research bodies that study the physics of elementary particles, astrophysics and the space sciences and numerous interviews with Italian scientists at the frontiers of knowledge of the universe.

International Astronautical Congress 2009
Daejon (South Korea), 12-16 October 2009



The theme of IAC 2009 Daejeon was "Space for Sustainable Peace and Progress."
IAC 2009 Daejeon:
- Served as a place for the extensive exchange of global space technology and information in order to spark the development of human space technology.
- Helped create a peaceful atmosphere on the Korean Peninsula by adopting the idea of the peaceful use of space.
- Contributed to human prosperity and welfare by allowing developing countries to benefit from advanced space technology and information with regard to environment and agriculture.
- Offered the public, especially the youth, an educational opportunity to learn about space science.
- Provided participants with significant opportunities for networking and business interaction in the field of space science and technology by hosting a variety of technical sessions and exhibitions.

IAC 2009 Daejeon offered many attractions, sights and amusement, and various IAC programmes that provided everyone with a memorable and wonderful experience.

AGILE and the Galileo telescope in two postage stamps
The official presentation on 7 May in Padova

Two postage stamps, valued 60 and 65 eurocents, dedicated to astronomy and Galileo Galilei, celebrated the International Year of Astronomy and the 400th anniversary of Galileo's first telescope observations.

The 60 eurocent stamp pictures the "Galileo" observatory of the National Astrophysics Institute, in the Canary Islands.

The second stamp has a face value of 65 eurocents and presents the Earth and the ASI"Agile" satellite, launched on 23April, 2007.

The series started circulation on 7 April, and were presented in Padova, where Galileo lived and worked.

ASI at SATEXPO 2009
Rome, 19-21 March

Galileo Navigational System and UAV's, Earth Observation and homeland security, space research and transportation, integrated telecommunications, were the four themes and focus of the 2009 SAT EXPO Europe, the international exhibition dedicated to space services and applications, that took place at the New Rome Fair pavilion from 19 to 21 March.

GOCE takes off
Main event in Frascati, near Rome, for the launch of the ESA satellite

GOCE was successfully launched on 17 March at 15:21 CET (14:21 UT). The launch followed a delay of 24 hours due to a problem with the launch tower doors, which did not open during the countdown.

The rocket launcher took GOCE northwards over the Arctic and 90 minutes later – after one orbital revolution and two Breeze-KM upper-stage burns – the spacecraft was released into orbit 280 km above the surface of the Earth. Moments later, the all-important signal was received by the Kiruna ground station in Sweden indicating that GOCE was in good health.

GOCE data will be crucial for obtaining accurate measurements of ocean circulation and sea level changes, both of which are affected by climate change. The data will help to better understand processes occurring inside the Earth which are linked to volcanoes and earthquakes.