

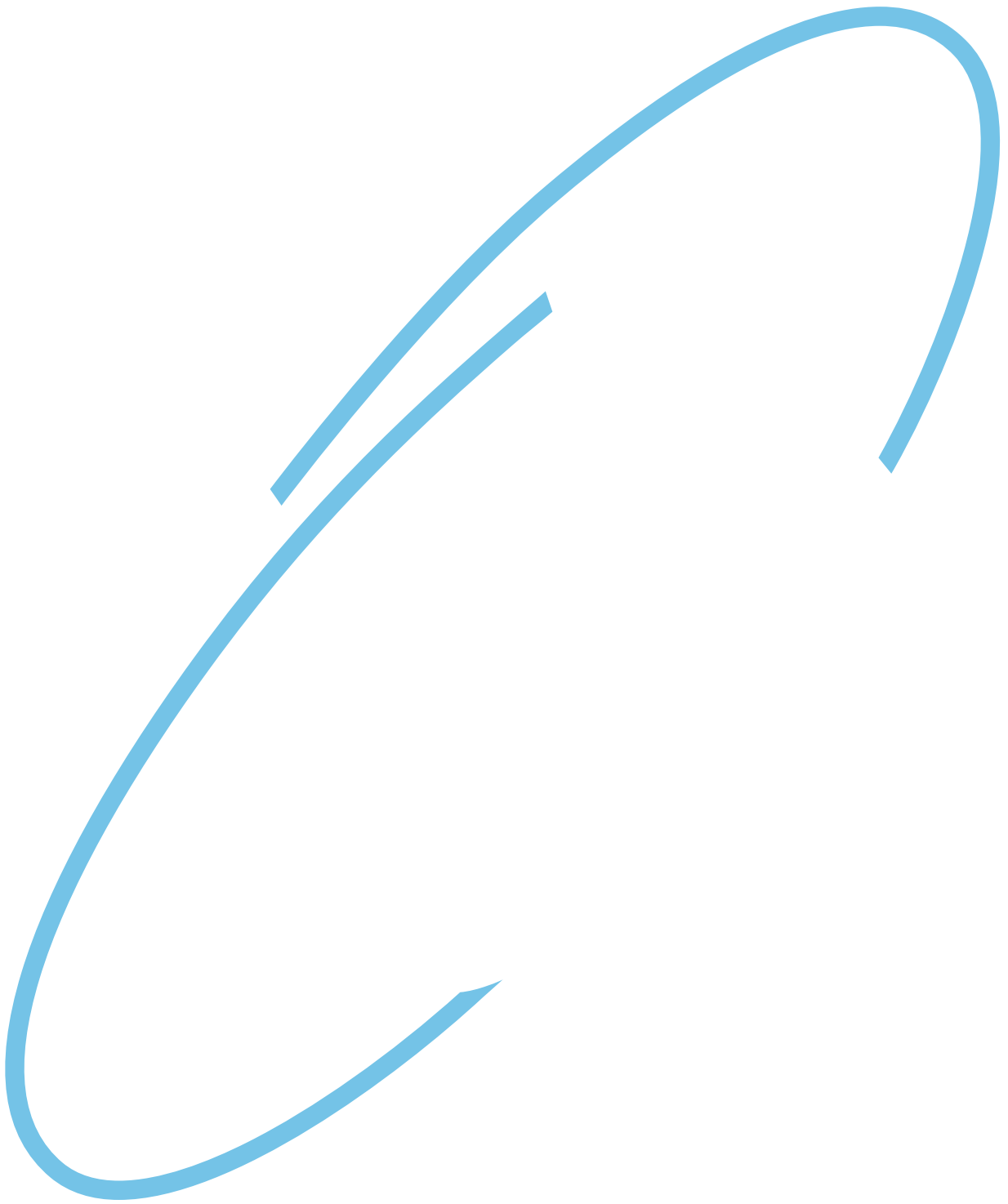


REPORT 2012





The road to space goes through Italy





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STRATEGIES OF INTERNATIONAL RELATIONS

I. 2012 EUROPEAN UNION (EU) ACTIVITIES

Space activities carried out within the European Union (EU) during 2012 may be classified as follows:

- Relationships with EU and with its main institutions: European Commission (EC), Council and Parliament;
- Agreement EU/ESA, based on the ESA/EU Framework Agreement signed by the two institutions in 2003, to develop some joint space activities.

Some of the main activities where ASI played a crucial role during the year 2012 are the following.

Seventh Framework Agreement: ASI took part in the meetings of Space “Program Committee” during which a work program for the “call 2013”, issued in July 2012, was analyzed, discussed and approved.

In this context, the Italian delegation supported the national participation to the EU Framework Agreement of research involving the national space community in the definition of contents of the work program on which the call issued by the EC is based upon.

These calls bring to the attribution of R&S EU funds for the space sector.

In so far, as the Seventh Framework Agreement is concerned, ASI took part in the international launch day of the sixth “space call” occurred in Guildford (UK) in June 2012 as well as in the Conference occurred in Cyprus in November 2012, during which several projects have been illustrated.

ASI usually takes part in such events so to identify potential partners of project and to transfer such information to the national space community. At national level, during the months of May and June

2012, ASI dedicated three days to the presentation of activities carried out by national space actors within the Seventh Framework Agreement starting from the first “call” launched in 2006.

In particular, the three days have been divided as follows: May 29th: workshop on “Space Foundations”, June 26th: workshop on Galileo Program, June 27th: workshop on Global Monitoring for Environment and Security (GMES). The three workshops represented a moment of meeting among representatives of the national scientific and industrial sector, useful to analyze what has been done in the past at national level. The meetings were also a starting point for the preparation of the sixth “space call” and the consequent need to create new unions.

In the month of September 2012, as happened in the previous years, the usual day of national launch of “space call” has been organized. The day has been organized at the Minister of University, Education and Research (MIUR) in collaboration with APRE (Agency for the Promotion of European Research). About 150 people representing agencies, industries, scientific community and other national institutions took part in the event as well as representatives of European Commission and of Research Executive Agency (REA) which is in charge of the evaluation of projects that have been presented.

⇒ **Horizon 2020:** the year 2012 has been a very important year for Horizon 2020. It will be the EU Eight Framework Agreement. Many activities have been carried out both at national and EU level. In particular, ASI, thanks to its representatives, took part in some meetings occurred at MIUR as well as in bilateral meetings with EC. In the same time, for space themes, ASI has given its support for the analysis of documents as well as for the preparation of comments to the text, both directly to MIUR and to the permanent Representation of Italy to the European Union in Bruxelles.

ASI has interacted with representatives of the European Parliament giving its comments to Horizon 2020 Specific Program, with particular regard to the “Industrial Leadership” theme, where the space theme is analyzed.

GMES (Global Monitoring for Environment and Security) Committee: during 2012, ASI took part in each meeting of the Committee analyzing the preliminary documentation and giving its support to the final definition of documents so as to create a national position on different themes.

ASI took part in the following meetings:

⇒ **GEMS Security Board:** a committee mainly focused on GMES security aspects;

⇒ **Space Working Party:** a committee created within the EU Council after the ratification of the Treaty of Lisbon which recognizes to the European Union a competence similar to the one of the member countries in the space context.

During the first months of 2012, under the Danish Presidency of EU, discussions particularly focused on the Council document of Conclusions pertinent to the future financing of GMES within new financial perspectives 2014-2020.

Other themes that have been discussed, under the Danish and Cyprus presidency (July-December 2012) have been the following:

- Horizon 2020;
- Space Situational Awareness;
- Relationships between ESA and EU.

⇒ **Competitiveness Council-Space:** in 2012, two Competitiveness Councils occurred. A session dedicated to space took place in each one. For these Councils, ASI has supported the participation of the Italian Minister of Research. In particular, during February, the theme of the financing of GMES program was discussed while, in the month of December, the theme of relationships between ESA and EU was discussed.

⇒ **Space Policy Expert Group:** the group, created within the European Commission after the ratification of the Treaty of Lisbon, is composed by experts in the space field belonging to 27 EU countries. ASI took part in three yearly meetings.

⇒ **Galileo Program and GNSS European:** ASI followed all the meetings both within the

European Commission and within the Transport European Council, on the European GNSS (EGNOS Program and GALILEO Program). In particular, ASI took part in the following Boards of the European Commission:

- EGPC (European GNSS Program Committee);
- GNSS SB (European GNSS Security Board);
- WG-CSI;
- WG-SOL and
- GSA or Board of Directors of GNSS Agency.

In so far, as the meetings of the Transportations European Council are concerned, ASI took part in the following Committees:

⇒ **Council Working Party** on intermodal questions and GALILEO : the group has worked in 2012 so as to reach an agreed text within the Council for the new European GNSS Regulation.

⇒ **EEAS Workin Group on GNSS Joint Action:** the Agency for external services of European Union (EEAS) in 2012 has continued the works previously carried out by the European Council of Safety Committee GNSS.

Finally, in so far as joint ESA/EU relationships are concerned, in 2012, a single meeting of “High Level Space Policy Group” (assembly which gathers the representatives of EU and ESA member countries created on the base of ESA/UE “Framework Agreement”) took place.

2. 2012 ESA ACTIVITY

The year 2012 has been characterized by a strong preparatory activity, both under the management and under the negotiation and decision-making point of view. This activity brought to ESA Ministerial Council which took place in Naples on November 20th and 21st 2012.

During the year 2012, about 100 meetings took place. ASI delegates represented Italy in these meetings, which included a majority of meetings within the 15 ESA Committees and Boards, 9 meetings at Council level and other 8 working group for the preparation of the Council at Ministerial level (Council Working Group).

The preparation of all the ordinary and ministerial Council meetings has been carried out by ASI in collaboration with the Minister of Research and University, the Minister of Foreign Affairs, the Minister of Finance and of Defense.

⇒ **The Ministerial Council** has been opened by Italian Presidency, which chaired as from 2008 and unanimously elected the new Presidency – for the first time double – of Switzerland and Luxembourg. The Ministerial Council, with the recent adhesion of Poland, has been attended by 20 ESA Member States.

The Italian delegation has been led by the Ministry of Education, University and Research together with ASI President. Experts and delegates of the Premiership, of the Minister of Foreign Affairs, of Education, University and Research and of Economy and ASI representatives were also present. The main Italian objectives have presented by the Minister during his opening speech in his quality of Head of the Delegation. An important success obtained by the Ministerial Council has been the total number of the subscriptions that, even if under a very challenging economic context, has reached 10-billion euro in mandatory activities and optional programs. The fact confirms the high priority of activities in research, technological innovation and industrial applications connected to the space field for the ESA Member States..

ESA Member States indeed have unanimously approved four Resolutions for the following years:

- The “Resolution on the role of ESA in sustaining competitiveness and growth” pertinent to optional programs;

- The “ Resolution on the Level of Resources for the Agency’s Mandatory Activities 2013-2017” pertinent to the financing of the mandatory program (Science and base activity);
- The “ Resolution on the CSG (2012-2017)” for the financing of the Launcher European Space Centre of Kourou in French Guyana;
- The “ Political Declaration towards the European Space Agency that best serves Europe”. pertinent to the European space policy and the relations between ESA and the European Union.

Italy has confirmed its role of protagonist with an overall investment, in terms of subscriptions for optional programs, of 657-billion euros in five years, shared as follows:

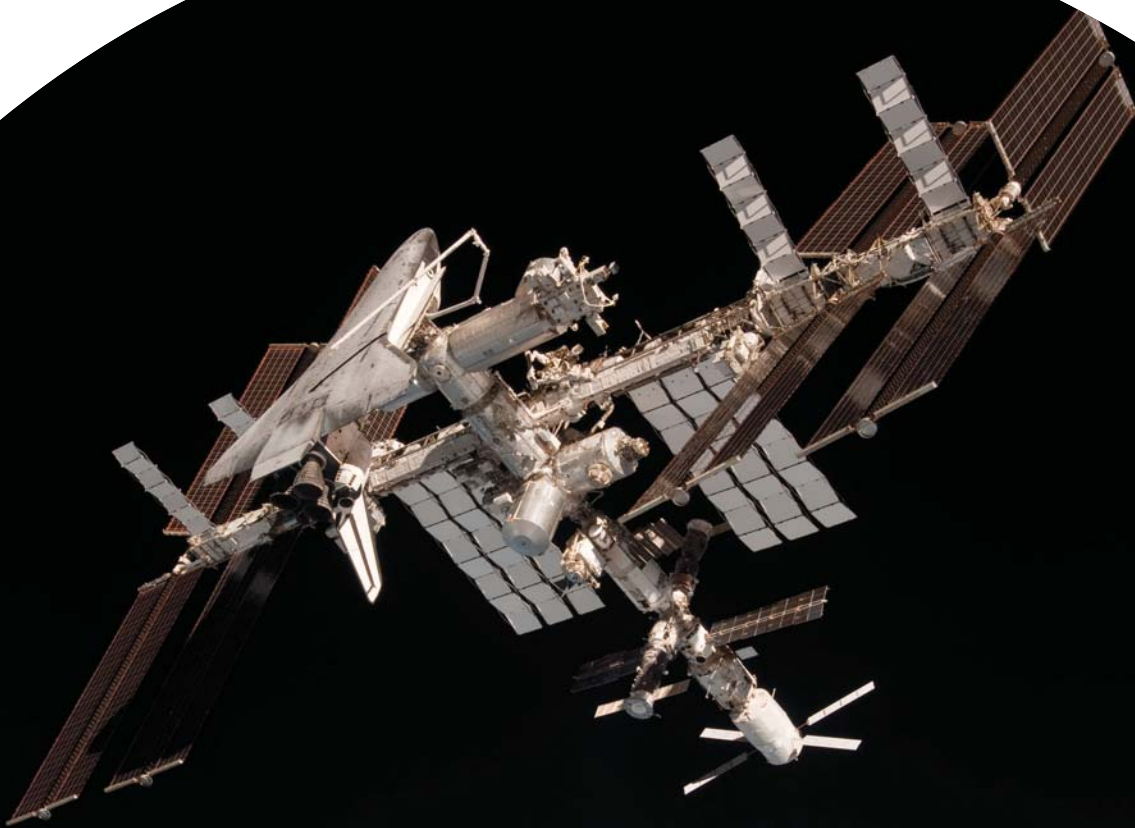
- 137- million € for programs on launchers, including the development of VEGA and PRIDE programs – both under Italian leadership – and connected activities;
- 208-million € for Earth Observation programs in order to guarantee to Italy a proper participation to MetOP SG and EOEP 4 programs;
- 200-million € for projects pertinent to the program of exploration and human flight, shared between the part of utilization and that of development; to this purpose through a “barter” with NASA the development of the Service Module (MPCV) for the ISS has been approved;
- 109-million € for programs in the field of telecommunications, navigation and monitoring of space environment;
- 39-million € for the development of new technologies.

Furthermore, Italy, during the next five years, will contribute to mandatory activities with 500-million €.

Beyond technical aspects, linked to the signing of many optional programs, Italy, thanks to a strong activity of negotiation and of technical and programmatic approach, has reached further important strategic and politic results in the field of launchers:

- a clause on intellectual property rights (IPR) for VEGA and PRIDE programs has been approved. This clause allows that the derived rights from new developments may be granted to ESA and Italy in case of transfer of the company holding them to a non Italian owner. .
- for the first time an involvement of Germany in the VEGA Evolution program (VECEP) has been obtained.

Finally, with the Resolution on ESA evolution started an important dialogue with the EU focus to define a new role of the Agency within Europe after 2020.



3. EXTRA-EUROPEAN INTERNATIONAL ACTIVITIES

The cooperation and the international relations with extra-European countries is based on two directives of bilateral and multilateral relations: contacts with national space agencies but in some cases also with different national Authorities involved in space activities and participation in Committees, Groups and international Conferences.

⇒ Bilateral Relation

UNITED STATES

2012 has been rich of events for bilateral relations between Italy and the US in the space field. ASI and NASA have strengthened their collaboration and have thus celebrated their 50 years of cooperation since the first agreement of cooperation signed in 1962. To this purpose, NASA VICE Administrator Lori Garver has visited Italy in order to meet, with ASI, important representatives of national institutions (Minister of Foreign Affairs, Senate and Chamber). In the month of July the first space representative, Roberto Vittori, started his activity at the Embassy of Washington on the base of the Protocol of cooperation between the Minister of Foreign Affairs and ASI signed in December 2011. Meetings between ASI and NASA have been several both at summit and at technical level. Among these, the meeting of March in Washington, of July in London, of October in Naples. During the month of May, a delegation from ASI has visited NASA centers in California: the Ames Research Center (Ams), the Dryden Flight Research Center and the Jet Propulsion Laboratory (JPL). The exchange of ideas and information has open the way to new agreements and future collaborations.

RUSSIA

Relations between ASI and Roscosmos are intense and supported by very good relations between the two countries. The Italian-Russian council for the Industrial, Economic and Financial Cooperation is a clear expression of this cooperation (the 13th session took place in Moscow in the month of December). Within the Council, presided over by the Minister of Foreign Affairs for Italy and by the Minister of Economy for Russian Federation, the group on space cooperation is led by representatives of the two agencies who have illustrated to Ministers and

to the delegations of the two countries the status of bilateral cooperation. In particular, the collaboration on the project for “Millimetron” space observatory for which ASI, through the University “La Sapienza” of Rome, develops a spectrometer. The launch of the mission is foreseen for 2017.

ASI and Roscosmos have renewed the agreement for the development of the test on the oxygen-methane propulsion through LYRA. The Italian astronaut Luca Parmitano also trained in Russia in order to reach the International Space Station in 2013 on board the Soyuz. Consultations among the two agencies occurred in the field of experiments of neurophysiology, biochemistry, genetic and biomedicine in microgravity and in the field of Earth Observation for the use of data of COSMO-SkyMed Italian system. Italy has strongly appreciated the collaboration between ESA and Roscosmos for Exomars mission for which our country has the leadership in terms of investments and of participation.

JAPAN

Relations with Japan space agency JAXA are intensive thanks to a mutual respect. Common activities of research in the field of hybrid propulsion and oxygen-methane go on. In 2012 an engineer from JAXA has been for some months in CIRA (Italian Center for Aerospace Research) located in Capua. Joint studies for the development of an automated vehicle of re-entry have been used to demonstrate the technical possibility of a winged space vehicle with precise capacities of re-entry and landing on a conventional runway. In 2012 new research activities in the field of development of composite structures have been carried out. Within the collaboration on CALET Japan project (CALometric Electron Telescope), experiment for the study of cosmic radiation conceived to work on the external platform of the Japan Module (JEM) of ISS, ASI has supplied the high-voltage power supply system and an hodoscope. Finally, good results reached on joint studies in the field of management of natural disasters through the use of Italian satellite COSMO-SkyMed data and of Japanese ALOS. The collaboration has been extended to the monitoring of ships.

CHINA

Relations with China are very friendly. There have been several meetings and visits with Chinese

delegations in Italy during the year. ASI has followed with a particular attention the process of development of space institutions from China also because of the change of political management. Italy and China have been collaborating through the use of the Base in Malindi (Kenya) so as to follow the launch and the communications with Chinese Space Station. Also during 2012, activities in Malindi have been very important for Shen Zhou 9 and 10 missions as China does not have the possibility to have an operative basis from the national territory. In September 2012, in Naples, the second meeting between ASI and China Manned Space Agency (CNSA) for the exploration of new possibilities of bilateral cooperation took place. Technical meetings and bilateral consultations on CSES (China Seismo Electromagnetic Satellite), a scientific mission devoted to the study of the Earth electrical field and of ionosphere and its anomalies, were carried out. In July 2012, a technical meeting between ASI and the Earth Observation System and Data Center Institute of Remote Sensing Applications took place in Rome. On this occasion, the parties exchanged information and ideas for collaboration.

ARGENTINA

Space cooperation between Italy and Argentina, in particular between ASI and CONAE (Commission Nacional de Actividades Espaciales), continues with the realization of two radar satellite from Argentina in L SACOCOM band. They will be integrated to Italian radar constellation COSMO-SkyMed for the creation of the joint system SIASGE. The two national agencies are considering the opportunity to launch the SAOCOM satellites together with two new COSMO-SkyMed satellites. Collaboration between ASI and CONAE on the project of education pertinent to the Institute of Advanced Studies "Mario Gulich" were carried out. In 2012 ASI collaborated in the process of selection of students and supplied teachers for the Master in Emergency Early Warning and Response Space Applications. ASI has granted two biennial scholarships to Italian researchers and has coordinated the hospitality of researchers from Argentina through scholarships granted by the Italian Minister of Foreign Affairs and by CONAE.

ISRAEL

Relations between ASI and Israel Space Agency (ISA) proceeded during the year on the basis of the

cooperation agreement pertinent to the project of definition of SHALOM hyperspectral mission signed in July 2010. The collaboration between the two agencies has been strong and has been sustained by the respective governments. In the last joint declaration of the respective Heads of State in October 2012, the space field has been defined as "strategic" for the cooperation between the two countries. ASI and ISA followed during the year with the exchange of visits in Israel and Italy of the respective Ministers of Research. In October 2012 in Naples, during the General Assembly of International Astronautic Federation (IAF), the Italian delegation supported with success the candidacy of Israel to host the International Astronautic Congress (IAC) in 2014. In December 2012 ASI and ISA, with the support of Italian Minister of Foreign Affairs, signed a new collaboration for the institution of a new Joint Laboratory in space activities permitting the mobility of researchers between the two countries.

KENYA

Activities of tracking and data receipt from the base of Malindi in Kenya continued with success, following the agreements of cooperation with NASA, ESA and China. 2012 has been a year of fruitful negotiations between Italy and Kenya for the definition of a new intergovernmental agreement for the use of "Luigi Broglio" Space in Malindi, Kenya, with a series of meetings occurred in Rome and Nairobi. ASI gave its support for the birth of the Secretariat for space activities which was born with the goal of coordinating national activities and to prepare the birth of a space agency in Kenya.

EGYPT

Relations between ASI and NARSS (National Authority for Remote Sensing and Science) carried out in 2010 and formalized through the signature of an agreement in the field of Earth Observation and applications in 2011 have been subject to the problems connected to political changes. Groups of research have continued to work in particular on the use of satellite data applied to archeology projects.

CANADA

Friendly relations with Canada and with Canadian

Space Agency (CSA) continue. In October 2012 - in Naples - a meeting between ASI and CSA brought a new collaboration for the integrated use of Italian radar system COSMO-SkyMed and of Canadian RADARSAT. The two agencies prepared a “joint call” addressed to Italian and Canadian centers of research for the development of applications on the base of radar data in X and C band.

The Canada-Italy Collaboration in Space forum place at the Embassy of Canada in Rome on November 22nd 2012. Representatives of ASI and CSA took part in the forum together with industries and institutions of the two countries.

AUSTRALIA

Although Australia does not have a space agency, an office devoted for developing space activities has a Space Policy Unit in collaboration with the Ministry of Innovation, Industry, Science and Research.

After the Prague 2010 meeting, in October 2012 in Naples, delegations from the two countries confirmed their interest to work together under the Intergovernmental Framework Agreement of scientific and technological collaboration signed with Italy and Australia in December 2012. ASI's participation in the 12th Australian Space Development Conference is foreseen. This event is dedicated to the development of the space field and will take place in 2013 in Adelaide.

BRAZIL

Consultations and meetings between ASI and Brazilian Space Agency (BSA) continued. The last meeting took place in Naples in October 2012 with the new President Raimundo Coelho. In 2012 Brazil launched the “Science without borders” project involving the space field. BSA President wrote to ASI to invite the agency to collaborate.

CHILE

In March 2012 a delegation from ASI went to Santiago for the event “Feria Internacional del Aire y del Espacio (FIDAE)”. On this occasion, several meetings with representatives of institutions from Chile involved in space research took place: from the Space Agency of Chile to the Minister of Foreign Affairs, from the Science and Technology

Commission to the national system of territorial coordination. In particular, with the Space Agency of Chile, the possibility to deepen the cooperation in the Italian-Argentine system SIASGE was taken into consideration.

MEXICO

On May 24th 2012, in Rome, the third meeting of the Italian and Mexican Commission took place. During the event, the Foreign Ministers of the two countries signed the joint Declaration of strategic partnership between the Italian Republic and the Republic of the United States of Mexico. The sub-commission for the Education, Cultural, Scientific and Technological Cooperation gathered on the same occasion and defined the perspectives in the scientific and technological field. On this occasion, representatives of the two space agencies decided to collaborate through an agreement. In the following months ASI and AEM negotiated a framework agreement of cooperation that was signed in Naples in October 2012.

THAILAND

On July 18th 2012, ASI took part in the “Space Day” event for the COSMO-SkyMed system, organized by the Embassy of Italy in Bangkok. On this occasion the “GeoInformatics and Space Technology Development Agency (GISTDA)” decided to work with ASI on a bilateral basis. In the following months, ASI and GITDA negotiated a framework agreement signed in Naples in 2012.

INDIA

In 2012, ASI and the Indian Space Research Organization (ISRO), on the basis of a 2000 agreement, carried out some meetings. Thanks to the support of Italian Embassy in New Delhi, in July 2012, a bilateral workshop for an exchange of information on programs and activities of the two agencies was organized. Afterwards, a technical meeting for future collaborations was organized.

⇒ Multilateral Relations

European Space Policy Institute (ESPI): ASI is a member of ESPI and takes part in the General Assembly that takes place twice in a year in Vienna. ESPI carries out research and study activities

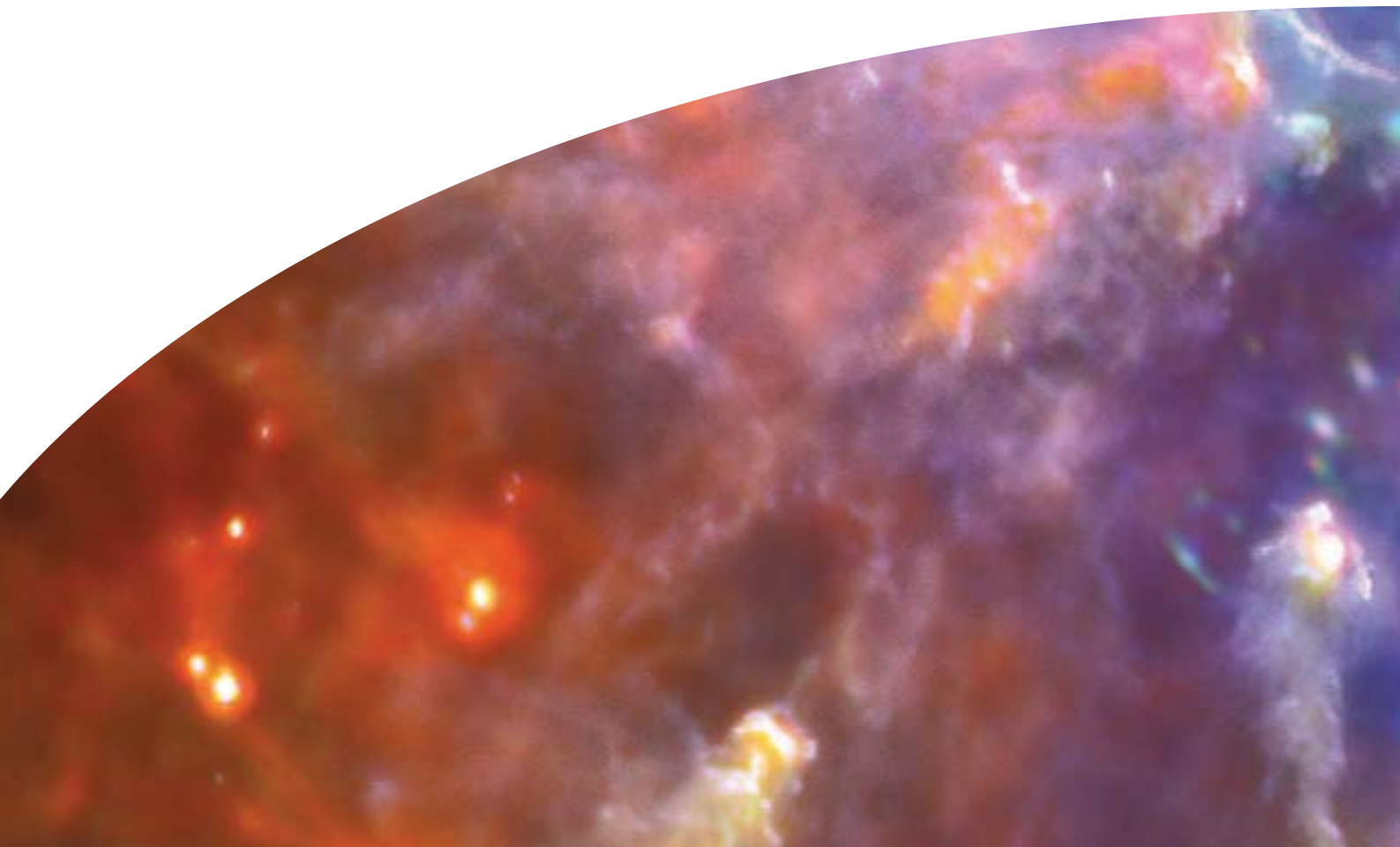
on themes of space policy and has created a forum of discussion between the academic communities of European countries. ASI, in collaboration with SIOI (Società Italiana per le Organizzazioni Internazionali), grants a scholarship of 12 months at ESPI. This scholarship is given to a student who took part in the Master in Institutions and Space Policies co-organized by ASI, SIOI, CNR in Rome.

IAC: from 1st to 5th October 2012, Italy hosted in Naples the 63rd International Astronautic Congress (IAC) with 3,500 delegates from 83 countries. Many space agencies and international organizations took part in this event. ASI was in charge of organizing the local committee and met many European and international delegations. From 28th until 30th September 2012, Italy hosted the 22nd UN-IAF workshop on “Space technologies applied to the needs of mankind: the Mediterraneo experience” in Naples. About 130 people from 50 different countries took part in this event, developing

countries in particular. ASI was the “Liaison Officer” with the United States, through an agreement signed between the Italian government and the Office of Space Affairs (OOSA) of the United Nations and coordinated the Italian participation of experts in different disciplines.

IAF: ASI is a member of IAF (International Astronautic Federation) and participates in its General Assembly (in 2012 took place in Naples, during the IAC) and to the main decisions: location of the IAC and President of the Foundation.

UN-COPUOS: Italy takes part in the Committee for the Peaceful use of extra atmospheric space (COPUOS) of United Nation since its creation in 1958. The committee is made of two sub-committees : the technical and scientific committee and the juridical committee that each year gather at the United Nations in Vienna. In 2012 ASI took

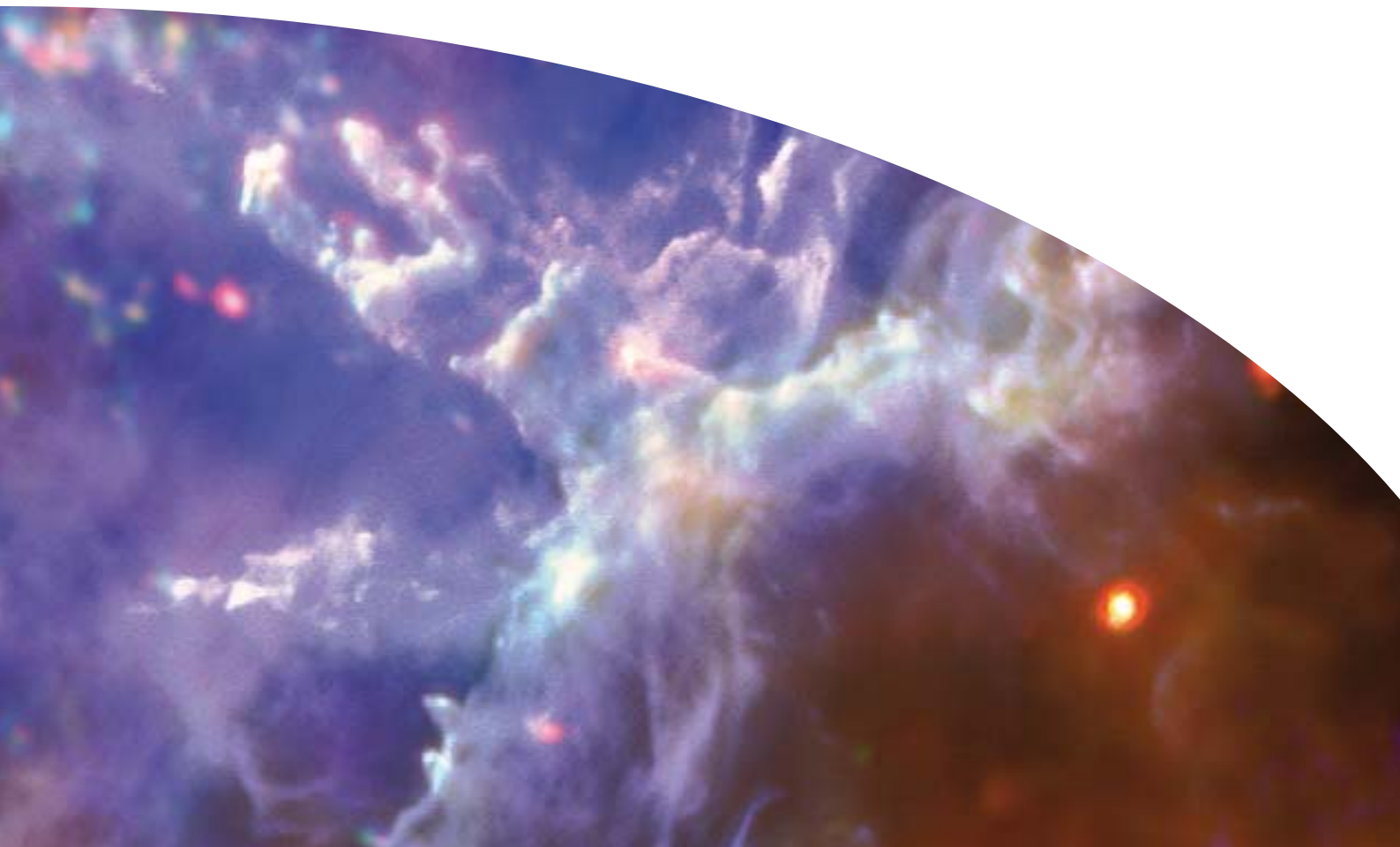


part in the three sessions of the Committee with its proper representatives in support of the Italian delegation headed by the Italian Ambassador at the Vienna International Organizations.

CEOS: after the Italian Presidency of CEOS (Committee on Earth Observations Satellites) in 2011, also in 2012 ASI took part in its activities. The 100 COSMO-SkyMed images on Vulcans of Hawaii put at disposal of the scientific monitoring group of “supersites” from ASI (Vulcans and seismic zones which are subject of particular international attention) are particularly appreciated.

ISLSWG (International Space Life Sciences Working Group): ASI takes part in the ISLSWG together with ESA, CNES, DLR, JAXA, CSA and NSAU. The working group gathers twice in a year and is hosted – in rotation - by participant agencies. In 2012, two have been the meetings, one in the spring of 16th-19th April and one in the autumn of 22nd-26th October.

ISECG (International Space Exploration coordination Group): ASI takes part in the ISECG, created in response to the document “Global Exploration Strategy: the framework for coordination” (GES), elaborated in 2007 by the 14 space agencies involved. The goal was to work together for the creation of a global strategy for the exploration, giving to the participants a forum of discussion on objectives and plans of space explorations. 2012 has been characterized by an activity of preparation of the second version of the “Global Exploration Roadmap (GER)” drafted in 2011, whose publication is foreseen in May 2013.



OBSERVATION OF THE UNIVERSE

Italy contributes to crossing the boundaries of human knowledge, exploring the mysteries and unknown parts of the universe through the analysis of data acquired by means of technologically advanced and innovative space systems. Such systems can be grouped into three main categories: the exploration of the solar system; the astrophysics of high energies; cosmology and fundamental physics. The data retrieved from scientific space missions are filed in ASI Science Data Center (ASDC).

THE EXPLORATION OF THE SOLAR SYSTEM

Italy is one of the major contributors to the European Mars Exploration program, named ExoMars (Exobiology on Mars), whose goal is to look for any evidence of past/present life trace. The program is implemented by a joint ESA-Roscosmos cooperation, by means of 2 different missions:

- ExoMars 2016 (launch scheduled on January 2016), consisting of the Trace Gas Orbiter (TGO) and Entry Descent Module (EDM)
- ExoMars 2018 (launch scheduled on May 2018), consisting of a Descent Module (DM) carrying on the Rover Module (RM)

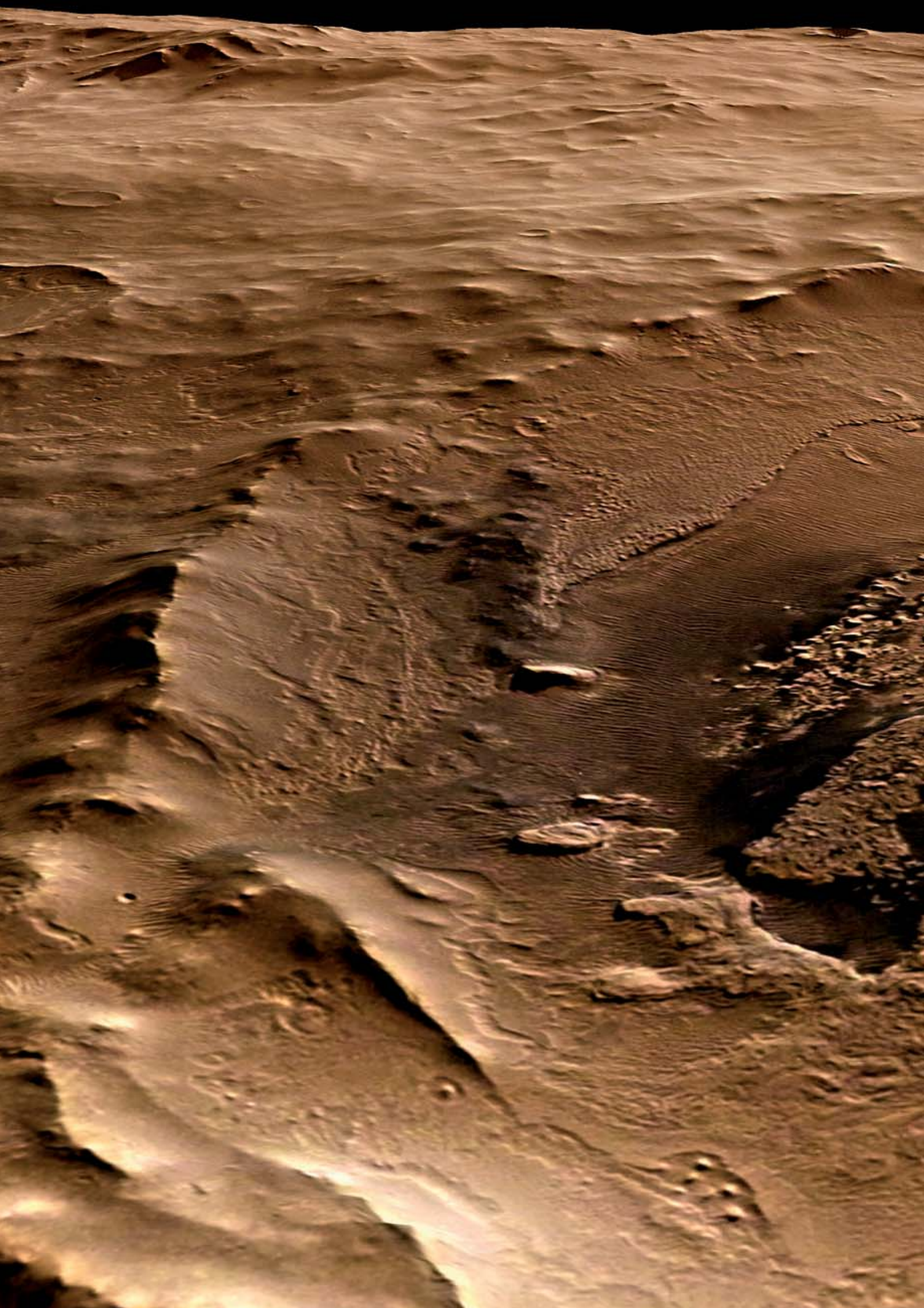
Both mission design is under Italian responsibility. Concerning ExoMars 2016, Italy has the leadership for the EDM science investigation: DREAMS (Dust characterization, Risk assessment and Environment Analyser on the Martian Surface), a suite of sensors for the characterization of Martian environment, and AMELIA (Atmospheric Mars Entry and Landing Investigation and Analysis) experiment. Italy is the leader of two international scientific teams.

The Rover Module of the ExoMars 2018 mission is equipped with a Drill system to collect sample up to 2 meters deep under Mars surface, for further investigation by means of several instruments on

board the rover. The Drill integrates the Ma_Miss instrument in its tool. Ma_Miss (Mars Multispectral Imager for Sub-surface Studies) is a miniaturized spectrometer to analyze the Mars sub-surface during the drilling operations. Both Drill and Ma_Miss are made in Italy.

ASI has ongoing contributions to the exploration of Mars, cooperating in partnership with NASA and ESA. In particular, ASI has developed and currently operates the MARSIS (Mars Advanced Radar for Subsurface and Ionosphere Sounding) radar equipment on board the ESA Mars Express mission and SHARAD (SHAlow RADar) on board of the NASA MRO (Mars Reconnaissance Orbiter) mission. The two instruments have already provided first-time data on the subsoil of Mars, disclosing unknown data about Mars inner structure and the its Polar Caps, together with a precise estimate of the total amount of water therein hidden. Furthermore, the PFS (Planetary Fourier Spectrometer) on board Mars Express is measuring the amount of water vapor and methane in the Martian atmosphere. ASI has also developed a GIS (Geographical Information System) for Mars' surface which has contributed to the creation of the first high-definition geological map of the Red Planet, which is part of ASI Planetary Map Series.

Italy also plays an important role in the exploration of Saturn and its satellites, thanks to the joint NASA/ESA/ASI mission Cassini-Huygens, an extremely successful mission which keeps making new discoveries after more than eight years from its launch. A remarkable finding is the unveiling of Titan's inner structure. ASI also takes part in the NASA "New Frontiers" mission "Juno", for the study of another giant planet: Jupiter. Juno was launched in August 2011 and its goal is to study the planet in detail: the orbiter will investigate the origins of Jupiter, its internal structure, its deep atmosphere (convection and wind dynamics) and its magnetosphere. ASI has provided NASA



with the JIRAM (Jovian InfraRed Aurora Mapper) spectrometer, which allows the acquisition of spectral images in visual and infrared wavelengths and the Ka-Translator for the radio science experiment. Furthermore, the use of the Sardinia Radio Telescope for providing localization services to the missions is being evaluated.

Italy is also involved in the European mission, Venus Express, the , launched on 9th November 2005, reached Venus after a 150 day journey and then entered its orbit for observation activities on May 7th, 2006. The mission duration was much longer than initially foreseen. Considering the potential and full functionality of the probe and its instruments and the important results so far reached, , ESA approved its extension up to 2014. Italy played a crucial role in the realization of VIRTIS (Visual InfraRed Imaging Spectrometer, with Italian INAF leadership) spectrometer and in gathering and analyzing data from ASPERA-4 (Analyzer of Space Plasmas and Energetic Atoms which is led by the "Institute of Space Physics, Kiruna, Sweden").

The BepiColombo mission, whose objective is to observe Mercury, requires the use of two main spacecrafts:

- MPO (Mercury Planet Orbiter), an orbital system for the observation of the planet from a distance between 400 and 1500 kilometers, developed by ESA
- MMO (Mercury Magnetosphere Orbiter), an orbital module for the measurement of the magnetic field and energetic particles fluxes, developed by the Japanese Space Agency, JAXA.

Italian contributions to BepiColombo are the following:

- SIMBIO-SYS (Spectrometer and Imagers for MPO BepiColombo Integrated Observation System), a suite of remote sensing instruments (a high definition camera, a stereo camera and an infrared imaging spectrometer);
- SERENA (Search for Exospheric Refilling and Emitted Natural Abundances), for the measurement of the amounts of neutral atoms and ionized particles from the Exosphere of Mercury;
- ISA (Italian Spring Accelerometer) is a highly sensitive accelerometer for the measurement of inertial acceleration;
- MORE (Mercury Orbiter Radio Science Experiment) to determine the fundamental geodetic

and gravitational characteristics of the planet.

The Italian science team is also involved in the calibration, modeling and data analysis of French spectrometer PHEBUS (Probing of Hermean Exosphere by Ultraviolet Spectroscopy).

ESA's Rosetta mission is on route towards its goal, the comet 67P/Churyumov-Gerasimenko, after being launched in March 2004 from the Kourou European spaceport in French Guyana. The equipment on board are in hibernation since June 2011, waiting for the beginning of the wake-up procedures and tests planned to occur in the first months of 2014, right before the arrival to its final destination. The mission navigation team is defining orbital parameters through which the science teams can plan the operations of instruments on board the probe and the Philae lander. The drilling and sampling mechanism on board of the lander has been developed in Italy: SD2 (Drill, Sample and Distribution) is capable to drill the surface and to collect samples at different controllable depth up to 230 mm.

OSIRIS (Optical, Spectroscopic, and Infrared Remote Imaging System) and in particular the Italian-made Wide Angle Camera (WAC), has provided images of asteroids which Rosetta has encountered during its cruise. Together with the Italian imaging spectrometer VIRTIS (Visible InfraRed and Thermal Imaging Spectrometer), Rosetta has gathered data regarding two of the oldest bodies in the Solar System - Steins in 2008 and Lutetia in 2010 - during brief and short-distance fly-bys; Lutetia was the biggest asteroid to be ever studied by an automatic probe before Dawn reached Vesta.

Dawn, a Discovery mission by NASA, reached one of its two objectives in early 2011: Vesta, a large asteroid that orbits the sun within the asteroid belt.

ASI had provided one of the three instruments which make part of Dawn's scientific instrumentation: VIR-MS (Visible Infra Red Mapping Spectrometer). The probe has completed the observation of Vesta in August 2012: the data collected in more than 12 months of studies have proven that Vesta is in fact a celestial body that has undergone processes of differentiation in a similar way to what happened to terrestrial planets. With its iron nucleus, formed within the first days of the Solar System's existence, Vesta has survived to strong and frequent impacts inside the asteroid belt. Besides the confirmation

that HED meteorites come from Vesta - one of the remarkable results obtained thanks to the Italian spectrometer VIR-MS - this is the most important discovery: Vesta can be classified as a proto-planet, more similar to our Moon than to other asteroids. The Dawn probe is now heading towards Ceres, another object in the asteroid belt: once entered into its orbit, Dawn will claim the title of the first manmade object to have observed two distinct objects of our Solar System with continuity, not with a brief fly-by. Due to its great distance from us and to the absence of meteorites on Earth which were once a part of Ceres, the data today available leaves many unanswered questions: the observations which Dawn will be able to carry out are expected with great enthusiasm by the international scientific community. The probe will reach Ceres in 2015.

ASI has also helped Italian scientists involved in the proposal recently selected within ESA scientific program: Cosmic Vision. The selected class L mission is called JUICE and is devoted to the study of Europe, Ganymede and Callisto, Jupiter's largest moons. Italian contribution consists in low frequency sounder radars, optical cameras, imaging spectrometers, atmospheric sensors and a radio science experiment.

Finally, ASI has an important role in the study of the Sun and of Space Weather. The joint ASI-NASA tool, UVCS (Ultraviolet Coronagraph Spectrometer) on board ESA mission SOHO continues to provide important data on the solar coronas even if it is into orbit from more than 10 years. Following a successful flight on board a sounding rocket, the coronagraph METIS (Multi Element Telescope for Imaging and Spectroscopy) (has been selected to be on board of the new ESA mission Solar Orbiter, to be launched in 2017, as part of the Italian contribution to the core payload. Italy is also providing the Digital Processing Unit for the SWA (Solar Wind Analyser) suite of instruments

High Energy Astrophysics

This field of research plays an important role in ASI scientific activities since the Eighties. After the success of BeppoSAX mission (which was awarded the Bruno Rossi prize by the American High Energy Astrophysics Division), ASI has launched in 2007 a new national mission aimed towards the study of the world of high energy called AGILE (Gamma Light Imaging Astro Revealer). At the core of the mission,

still operative, there is a new generation gamma-ray detector; a consequence of the evolution of detectors used for experiments in the field of physics of elementary particles. This detector has caused two apparently different scientific communities, particle physicists and astrophysicists, to collaborate with great success. AGILE data are distributed by ASI Science Data Center (ASDC), which is also an important part of the Science Operation Center of the AGILE mission. Even though AGILE is classified as a small mission, its results are excellent. One of the most important results is the discovery of the variable nature of Crab nebula, previously thought as a stable emitter and used as reference candle for the calibration of X-ray equipments. In 2012 this discovery has caused the Principle Investigator Marco Tavani and his team to be awarded with the most important international prize for high energy astrophysics, the Bruno Rossi prize, awarded by the American High Energy Astrophysics Division.

The knowledge acquired up today has brought ASI and the whole scientific community to plan national missions such as BeppoSAX and AGILE, as well as to create fruitful cooperation with other space agencies like NASA, ESA, Jaxa, Roscosmos and many others.

The following projects have been carried out in collaboration with NASA:

- Swift, a satellite for the study of gamma rays launched at the end of 2004 which will currently operate until 2014. In 2014 there will be the periodic Senior Review process which will decide if continue to support Swift mission.

- Fermi, previously known as GLAST, for the study of the sky in the highest forms of energy ever known, gamma rays. Launched in June 2008, it is currently operated till 2017 and, as Swift, will have to pass the Senior Review process to be maintained for the next years.

The Bruno Rossi prize has been awarded for the work carried out in both missions (similarly to AGILE and BeppoSAX) and the ASDC played a crucial role.

- NuSTAR, (Nuclear Spectroscopic Telescope Array), is the last high energy X-ray mission in collaboration with NASA, launched in June 2012 and currently operative until the end of 2014, after which the Senior Review will decide if continue to operate it, as for all other NASA missions. ASI provided, through

ASDC, the data reduction software NUSTARDAS and the Malindi ground station.

Data acquired from AGILE, Swift and NuSTAR missions are collected by ASI S band station "Broglia Space Center", in Malindi (Kenya).

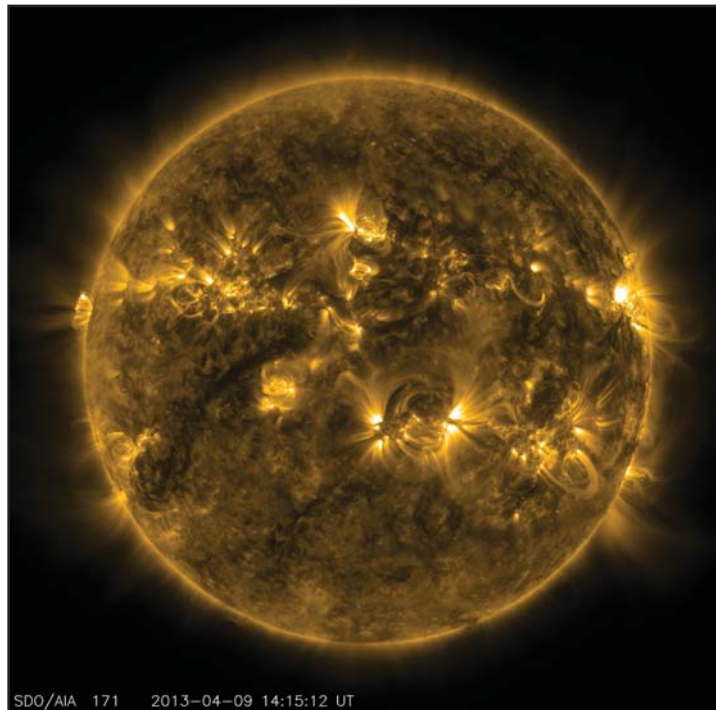
Two more satellites which have been operative for over 10 years, XMM-Newton and INTEGRAL, come from the ESA scientific program. These missions will last until 2014 and are part of ESA program Horizon 2000.

In the framework of the Medium mission class program in the Cosmic Vision 2015-2025, ASI is carrying out the Assessment Phase for the LOFT mission. The Large Observatory for X-ray Timing (LOFT) is designed to study the behaviour of matter in close proximity to black holes and neutron stars. High-time-resolution X-ray observations will be used to investigate strong-field gravity, to measure black hole masses and spins, and to study the equation of state of ultra-dense matter. In February 2014 is foreseen the downselection of the next M3 mission.

As far as astroparticle physics is concerned, i.e. the study of primary and secondary cosmic rays as well as high energy photons, ASI has a productive and historical partnership with the National Institution of Nuclear Physics (INFN) with which ASI has carried out many different missions, the most recent of which are PAMELA (made in collaboration with

Roscosmos, in orbit since 2007), AMS-02 (made in collaboration with NASA and on board the ISS since 2011) and CALET (made in collaboration with JAXA, the launch of which is planned for July 2014).

The PAMELA mission scientific objectives are to search for structures in cosmic ray spectra from e.g. dark matter or new astrophysical sources, new form of matter, e.g. strangelets, antinuclei with a anti-He/He sensitivity of 10^{-7} and to study cosmic-ray acceleration and propagation mechanisms, solar modulation effects, solar flares emissions, particles in the Earth's magnetosphere.



The Alpha Magnetic Spectrometer (AMS-02, successor of the AMS-01, a prototype which flew with the Discovery Shuttle in 1998) is currently the biggest scientific payload to be ever installed on the ISS: 6.9 tons by 64 cubic meters. AMS-02 was put into orbit by the Endeavour Shuttle having on board the Italian astronaut Roberto Vittori and was successfully assembled on

the station on May 19th, 2011. After a few hours the experiment was turned on and started to gather data.

The goal of AMS-02 is to provide answers to problems which are at the heart of elementary particle physics: from the research of primordial antimatter to the identification of dark matter through the study of cosmic rays that cross its sensitive section and ordering them in terms of type, charge, speed, energy and trajectory inside the magnetic field generated by its permanent magnet. AMS-02 has registered 24 billion events in 18 months

of activity and will continue to make observations for, at least, ten years. The amount of data gathered is now enough to allow the publication of some results: the first publications, revealed in March 2013, are on the electron/positron relationship, a vital study to provide theories on the existence on other sources of positrons greatly related to “dark matter”.

CALET (Calorimetric Electron Telescope) is an experiment for the study of cosmic radiation conceived to operate on the Exposure Facility platform (JEM-EF) placed outside the Japanese Experiment Module (JEM) on the International Space Station. One of the mission main goal is to measure the inclusive spectra of cosmic electrons and positrons in an interval of energy from a few GeVs up to around 10 TeVs. The Italian contribution to this project is the Charge Detector (CHD), an odoscope made up of two orthogonal planes of plastic beamers capable of taking measures of the abundance of cosmic nuclei in an interval of energy between a few GeVs (10^9 eVs) and the PeV scale (10^{15} eV) with enough resolution to identify every nuclear species in charge from the proton to the Fe ($Z=26$) and beyond. Two agreements have been signed between ASI and Jaxa so as to decide the dates of delivery of the flight models for the high tension alimentation, which has in fact been delivered in April 2013.

COSMOLOGY AND FUNDAMENTAL PHYSICS

In the field of cosmology, ASI and the Italian scientific community are involved in two main initiatives: the national contribution to the missions of ESA Scientific Programme and the planning of national experiments conceived for flying on stratospheric balloons.

Italy has strongly contributed to the designing of equipment on board ESA missions Herschel and Planck, launched in May 2009. Today Italy is fully participating in the reduction and scientific analysis of the data acquired so far, also giving its contribution for the operations of instruments in orbit. Planck studies the background cosmic radiation with high angular resolution and great accuracy so as to verify the theories on the primordial stages of the universe and the origin of cosmic structures. Two cutting-edge instruments are on board the satellite: the Low

Frequency Instrument (LFI) and the High Frequency Instrument (HFI), planned and developed by an international consortium of scientific institutions with the support of the industrial sector. Italy produced the LFI, a device which works in 30, 44 and 70 GHz bands and made up of 56 radiometers cooled to 20K (-253°C); for HFI, which is made up of 48 barometers cooled to 0.1K operating at frequencies between 100 and 857 GHz, Italy provided the cryogenic amplification (the PI-Ship is French). HFI completed its observations in January 2012 because, as was stated in the plans, after 30 months of activity the satellite wasn't able to ensure the very low temperature required for observations at these frequencies. The LFI, which works at higher temperatures, is still operative. Waiting for the first cosmological results that will be presented in April 2013 after a very demanding reduction of data, interesting scientific results were published regarding galactic and extragalactic sources. The Early Release Compact Source Catalogue was produced and the infrared background due to the high degree of stellar formation in primordial galaxies was measured with a high accuracy. Other discoveries include the sightings of gas filaments in masses of galaxies which could reveal the presence of unknown baryonic matter.

Herschel, on the other hand, has been conceived for the study of the formation and evolution of galaxies and the observation of regions where stars are formed. The satellite has three and a half meter wide telescope passively cooled at 80K, which operates in the far infrared and sub-millimeter. Three instruments realized by research institutes are on the focal plane; they are able to obtain diffraction limited wide band and line images between 60 and $500\mu\text{m}$ and to take high definition spectroscopic measurements between 150 and $500\mu\text{m}$. Italy has realized qualified technological parts for all the three pieces of equipment and has participated in planning the observations and in preparing the data analysis procedures. The observations obtained so far by Herschel have confirmed the excellent performance of the equipment on board and have allowed the publication of numerous discoveries in all fields of astrophysics, such as the giant toroidal ring of steam water around Saturn planet, at the height of the orbit of its moon Enceladus, great quantities of water steam in a region of stellar formation and the production of huge amounts of debris by supernovae. The Italian scientific community is very active in the reduction and analysis of Herschel's

data. It also withholds the PI-Ship of the observing program “Hi-Gal -Survey of the galactic plan with Herschel” the main key-project of the mission both in terms of observing time assigned on a competitive basis (about 1000 hours) and in terms of covered area (over 720 cubic degrees), which results are considered among the most important ones of the whole mission. Discoveries such as a very massive structure made up of molecular nebulae orbiting around the center of the galaxy and filaments attracting concentrations of mass which will become new stars are memorable. As stated in the program, Herschel will terminate its observation in Spring 2013 because of lack of cryogenic liquid.

In June 2012, ESA confirmed “Euclid” as the second Medium class mission of its “Cosmic Vision 2015-2025” programme. Euclid satellite will be launched in 2020 with the goal of constructing a large scale map of the three-dimensional structure of the Universe in the last ten billion years, so as to acquire information on the dark energy and dark matter which compose the Universe. The two instruments on board Euclid, VIS (Visual Instrument) and NISP (Near Infrared Spectroscopy and Photometry Instrument) and the Science Ground Segment of the mission will be provided by the Euclid Consortium that comprises scientists from 13 European countries, including Italy. In particular, Italy is responsible for the Science Ground Segment that will receive and analyze the data gathered on board in order to satisfy the ambitious scientific goals and for relevant subsystems of the two instruments.. In 2012 ASI started up the process for awarding contracts to selected scientific institutions and industries, in order to carry on Italian activities in Euclid.

Italy continues to give its contribution to the realization of ESA mission LISA Pathfinder which will fly in 2015 with the goal of showing that it is possible to detect and accurately measure the movement of masses in free-fall. The validation of this technology is necessary to demonstrate the possibility of a future mission aimed towards the detection of gravitational waves in space. Italy is responsible for the “LISA Technology Package” (LTP), the instrument at the core of the mission, that is made up of two sample masses whose movement is read by a laser interferometer.

In so far as experiments on stratospheric balloons are concerned, the flight of Olimpo experiment is planned for the summer of 2014, to be followed by the flight of Boomerang-B2K, an improved version of experiments launched from Antarctica in 1998 and 2003 which allowed the identification of the Universe geometry for the first time, as well as the study of the polarization of the cosmic background. Thanks to the possibility to measure radiation in frequencies between 150 and 500 GHz simultaneously and at high angular resolution, obtained thanks to a telescope 2.6 meters wide, Olimpo will mainly study the anisotropy of the cosmic background from primordial galaxies, thus allowing the investigation of the evolution of clustering in the Universe. Boomerang-B2K’s goal is to measure the polarization of cosmic background radiation and the emission of interstellar dust with a greater angular resolution compared to other contemporary experiments, in order to study the signal produced by the gravitational waves during the inflationary stage directly after Big Bang. Both experiments require a circumpolar stratospheric flight.

Following the closure of the Trapani base and the suspension of ASI direct management of balloon flight, the Olimpo flight campaign from the Svalbard Islands, planned for June 2014, has been assigned to the University “La Sapienza” of Rome. The DUSTER (Dust in the Upper Stratosphere Tracking Equipment and Return) experiment will also be on board Olimpo’s flight in order to carry out research on interplanetary, interstellar and comet dust.

The preparatory activities for the next balloon experiment, LSPE (Large Scale Polarization Explorer) are in process. LSPE aims at studying the polarization of the cosmic background of microwaves in large scale with extremely high precision, confirming the functionality of new technologies developed in Italy, necessary for a future international mission with ESA or NASA in the same sector, and providing the Italian scientific community with the opportunity to obtain groundbreaking scientific results, similarly to Boomerang.

GAIA is an ESA mission devoted to carry out a census of the entire sky up to the magnitude of $V=20$. With the data acquired from the mission, it will be possible to locate extra-solar planets and observe asteroids, galaxies and quasars and identify

around 1,000,000 objects. Gaia will measure the positions, proper motions and parallaxes with a precision between 10 and 200 microarcseconds (two hundred times more accurate than the previous mission, Hipparcos), with the simultaneous use of multi-band photometry and spectroscopy to provide an precise cinematic and chemical mapping of a large part of our galaxy. The information on the different spectral bands luminosity will allow the detailed study of the origin, dynamics, chemistry and evolution of the observed objects. Gaia's launch is planned in Autumn 2013.

ASDC

ASI Science Data Center (ASDC) was founded in 2000 in order to have a sole national Data Center able to provide products and innovative services for the analysis of astrophysics data to the scientific community. Its main goal is to acquire, file, process and publicize all the data gathered from ASI observational missions of interest to the scientific community, maintaining its quality and developing software for its analysis and supporting as well the community in the analysis of such data. The ASDC is in charge of the Multi Mission Interactive Archive (MMIA), which contains all archives and public data catalogs deriving from different missions. In such a way, the scientific community has the possibility to compare and analyze all the archived data with data

analysis software developed by ASDC personnel (Scientific Tools).

Once a satellite has been placed into orbit, the scientific community dedicates itself to the data analysis acquired by the mission and, in order to proceed, it makes use of the ASDC's equipment such as sophisticated packets of specially made software, customized calculators, etc. making the most of the mission's scientific equipment. The Center is in continuous evolution. The permanent archive of concluded missions (such as BeppoSAX, Rosat, ASCA, Einstein and more) is also supported by the development and maintenance of the data archives of numerous ongoing missions- such as Chandra, Swift, AGILE, Fermi, Herschel, Planck and Nu-star - or upcoming missions, such as Gaia and Euclid. The center also is an important part of AGILE's Science Operation Center, one of the three official archives of Swift, the official counterpart of Fermi, and will be part of EUCLID's ground segment. The center hosts part of the farm of calculators necessary to manage project AMS's enormous load of data from the tracker and is contributing to the analysis of the photons detected by the experiment. Other projects which are currently in process within the center are the study of seismic phenomena from space and the contribution to the CTA (Chereknov Telescope Array) program.





EARTH OBSERVATION

Earth Observation studies and develops missions, satellite payloads and methods of measurement, so as to define the dynamic behavior of our planet, with a particular interest for Italy and the Mediterranean area, in a huge context of space, spectral and temporal resolutions. The main goal is to provide a unique and fundamental contribution for the analysis of natural phenomena, including those provoked by man, and their relevant processes through the use of information deriving from space system data, in order to better understand these phenomena and give a contribution for preventing and monitoring their evolution

- The programs of Earth Observation Unit may be classified as follows:
- “End to end” missions (PRISMA, OPSIS, ROSA, SHALOM);
- scientific research, development of innovative methods and preparatory studies for future missions;
- international collaborations.

“END-TO-END” MISSIONS

ROSA (Radio Occultation Sounder for Atmosphere) is a “Flight Opportunities” mission. The ROSA payload is able to measure humidity, pressure and temperature in the atmosphere thanks to the Radio Occultation of GPS and GLONASS signals. There are currently three ROSA payloads on board three space missions: the Indian OCEANSAT-2, NASA-CONAE Aquarius/SAC-D and the French-Indian Megha-Tropiques.

Italy is especially active in the development of hyper-spectral observation technology. On the

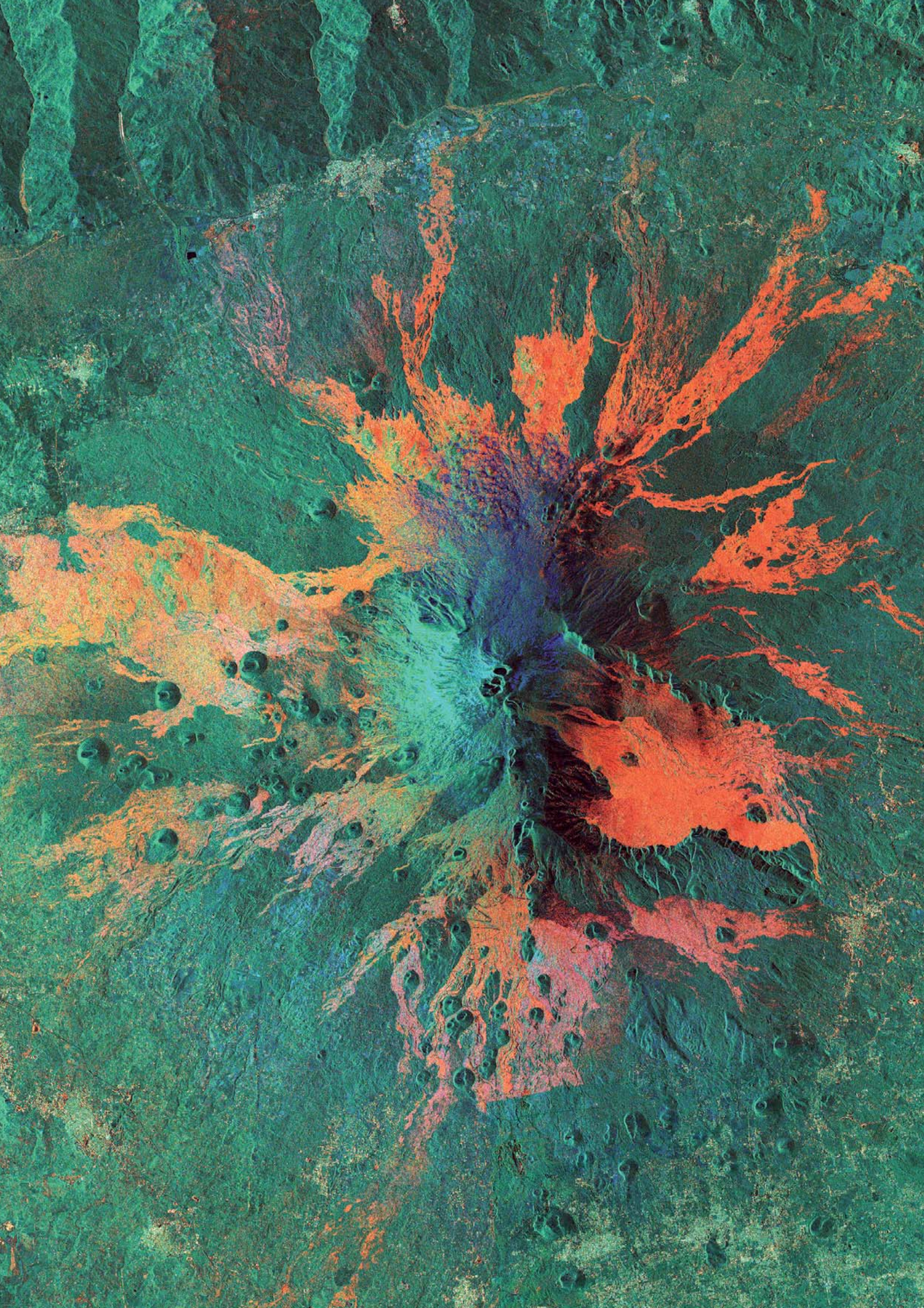
heritage derived from HyPSEO and JHM (Joint Hyperspectral Mission), Italy is working on a new system of Earth Observation called PRISMA.

The system uses electro-optical equipment which contains a hyper-spectral sensor and a standard panchromatic camera. Hyper-spectral techniques allow the identification of the geometric and chemical features of the scene under observation. In order to support the development of PRISMA mission, ASI is carrying out several scientific studies which show the value of hyper-spectral measurements and their potential application. In 2012 the possibility to conduct an Italian-Israeli hyper-spectral mission called SHALOM was tested. Another possible mission is the one related to OPSIS program, a mission which consists of a single flying unit having on board high resolution optical equipment, with a panchromatic channel and 4 multi-spectral channels (red, green blue and NIR).

SCIENTIFIC RESEARCH AND DEVELOPMENT OF INNOVATING METHODS AND PREPARATORY STUDIES FOR FUTURE MISSIONS

The “Natural Hazard and Disaster Risk Management” program, which is active since 2003, has generated preoperative systems useful for managing, monitoring and preventing emergencies, as well as to control the territory and the environment, thanks to the following pilot projects:

- Earthquake risk: SIGRIS and SISMA
- Volcanic risk: SRV
- Oil Spill: PRIMI
- Forest fires: SIGRI



- Landslides: MORFEO
- Air quality: QUITSAT
- Flood: OPERA
- Nowcasting: PROSA
- Coastline monitoring: CIRCE and COASTSAT.
- The pilot projects QUITSAT, PROSA, OPERA, MORFEO, SIGRIS, SISMA, SRV and SIGRI as well as the preliminary projects CIRCE and COASTSAT were concluded. In 2012 and 2013 a lot of these systems were operated by scientific organizations to support the National System of Civil Protection in cases of emergency.
- Due to the results of the process of selection for the “Second Call” of Earth Observation projects, dedicated to small and medium enterprises, such as PTA 2010-12, fourteen industrial research and development projects are under development. They will approximately last two years:
- The NFS project, whose goal is to develop an integrated platform for the distribution of products and services based on satellite and in-situ data; this platform is mainly dedicated to risk management and emergency response and allows the development of a coordinated and well-positioned system of services that, arising from the request of the final user, may allow the realization of thematic maps by different service providers and experts, positioned in a well-defined geographic area;
- The REDUM-3D project, designed to develop a system for monitoring movements of territory and aims at defining the hardware for a ground based measurement system with Dual Transport Units (DTUs) and a method of analysis and interaction with a SAR satellite, so as to study the three components of motion (East, North and Vertical);
- The LMTS project objective is to create a system for monitoring the last mile of logistic services and for detecting pollution through the use of a model where parameters revealed by constellations of satellites made for Earth observation will be integrated;
- ADF's goal is to project a system based on innovative algorithms for data fusion and change detection applied to OT data automatically extracted from archives, based on the requirements for the application for which the algorithms were projected, in order to provide the information requested by the user;
- CATARSI aims at developing and improving the methods based on satellite data made to monitor the environment, in order to allow an easier and more economical use of forest resources as well as to promote sustainable production of bio fuels;
- SATENBERG develops planning and monitoring services for the energetic production of renewable resources using EO satellites and modeling techniques;
- SAR4BAT, “SAR data fusion for bathymetric researches and underwater archeological sites”, was carried out for the development of a prototype platform able to generate bathymetric maps as well as maps of possible areas of submarine archaeological sites by using EO satellite data, in particular SAR data.
- The VULSAR project aims at developing a prototype platform able to generate on a large and semi-automatically scale seismic vulnerability maps through the use of EO satellite data and modeling techniques.
- SIMDEO, or “Integrated system for monitoring waste dumps with EO data” is an experimental industrial research project which aims at creating an integrated system for the identification and environmental control over waste dumps
- WHERE, or “World HERitage monitoring by REMote sensing” aims at developing and displaying an efficient and low-cost operating service based on satellite images for monitoring UNESCO sites in urban areas
- SOS-MT-MONITORING (SOil Slow MoTion-MONITORING) goal is to develop a prototype for the generation of products able to monitor

both natural or man-made phenomena generated by slow movements of the ground, through the use of remote sensing data from heterogeneous sources (GPS/Radio occultation, SAR, hyperspectral technology)

- CRES (Cosmo Radar Expert System of Processing) optimizes the radar-grammetrical processing (StereoSAR) and inter-ferometric (InSAR and PSInSAR) algorithms, adapting them to COSMO-SkyMed images in a suite capable of accompanying the user from the planning of the acquisition up to the final DEM production. Final DEM is the one generated by one of two techniques (InSAR, StereoSAR), depending on the situation and needs of the user;
- SIMO, the goal is to develop an integrated monitoring system for gas transportation grids through the use of data acquired by various aerial and satellite sensors within a system of data management, analysis and visualization based on the GIS/WEBGIS model-.

INTERNATIONAL PARTNERSHIPS

On 18th September 2009, the Italian Space Agency (ASI) and the Japan Aerospace Exploration Agency (JAXA) signed a Memorandum of Understanding to jointly carry out disasters monitoring from space. In particular, they agreed to carry out the following programs:

- Feasibility study and demonstration on improvement of observation frequency and coordination during emergencies, using COSMO-SkyMed, ALOS, COSMO-SkyMed 2nd generation and ALOS-2;
- Cooperation in joint SAR research activities related to disaster monitoring;
- Upon completion of the feasibility study and demonstration, and research activities, the Parties will explore the possibility of concluding a separate MOU in order to cover the mutual cooperation in the satellite disaster monitoring.

Following this agreement, ASI and JAXA, after having agreed a Project Implementation Plan (PIP) signed

on May 13th 2010 and afterwards renewed in 2011, 2012 and 2013, and are now carrying out a joint activity of research for monitoring disasters from satellite based on the use of SAR data in X and L band and are also working together for the study of new methods and techniques which can support decisions in case of emergency. The collaboration also concerns the following thematic areas: change detection, oil spill and ship detection, seismic and volcanic deformation. For each thematic area, ASI has started national research projects, with the cooperation of other scientific organizations involved in such themes.

In this context, three projects are under developing at different levels of maturity: SAR4Volcanoes, based on the study of volcanic deformation, MUSA, based on the study of seismic deformation and the oil spill and ship monitoring project. Project regarding change detection is under definition.

Between 2008 and 2010 the World Meteorological Organization (WMO) together with the Space Task Group have conducted activities for the International Polar Year which ended with a conference in Oslo in June 2010. The activities regarding the Polar Space Task Group continued throughout 2012 and 2013.

In 2013 more agreements were signed :

- a project with Canada (CSA) to promote the synergic use of SAR sensors in C and X bands for research and development, methodology and applications;
- a project with China (CNSA) to contribute through Italian payload to the realization of Chinese mission CSES dedicated to the study of the earth's electric field and of the ionosphere and its anomalies and possible correlation with seismic events.

Concerning CEOS activities, ASI is involved in various working groups (CEOS Social Benefit Area Disaster, Supersite initiative, DRM ad hoc group), whose activities contribute to GEO.

In the first semester of 2012, in particular, the "COSMO-SkyMed data for GEO's Hawaii Geohazard Supersite" project started in order to gather COSMO-SkyMed data on Hawaiian volcanoes and make them



proposals to increase and strengthen the role of Space Agencies in different phases of emergency management and an “observation strategy” which is a response to a collection of observation requirements from the user community to enable the delivery of three coordinated pilots to be rolled out over 2014-2016 in three thematic areas: floods, seismic hazards and volcanoes.

The activity will be kept in direct relationship with the International Charter.

Within ESA, ASI participates in working groups where agency collaborates within GMES context (Ground Segment Coordination Body/ GMES Operation Consultation Group). In this context ASI represents the national requirements and needs (institutional, scientific or commercial).

available to the international scientific community within the Geohazard Supersite initiative. ASI participates in CEOS ad hoc Disaster Team, founded after CEOS Plenary of 2011 and made up of the most important international Agencies. The team has prepared a study (“Consensus Report of the CEOS ad hoc Disaster Team”) which aims at providing a series of



COSMO-SkyMed OPERATING SYSTEM

COSMO-SkyMed SATELLITE CONSTELLATIONS

The 2003-5 National Space Plan has foreseen the realization of an Earth Observation Dual Use System, the COSMO-SkyMed System, for the monitoring of Resources, Natural Disasters and National Security having as its main goal the improvement of the planet Earth knowledge, of its natural and its antropical phenomena as well as the quality of life and the citizen level of safety. The observation of the territory, through the elaboration of satellite images is, in fact, an essential tool for providing homogeneous information.

Italy plays a crucial role at world level thanks to the planning, realization, launch and operational activities of the COSMO-SkyMed satellites constellation which is Italian biggest investment in the Earth Observation field.

COSMO-SkyMed program has been developed in the context of an industrial policy which aims at a wide and qualified participation and valorization of the best national competences also involving Small and Medium Enterprises. Among the most important benefits of this initiative, it is possible to mention the growth of national abilities both in Europe and all over the world, the promotion and the development of the Earth Observation data market as well as the development of specific centers of excellence in this field. The management of the system realization and of its use is coordinated by the Italian Space Agency with the support of the Italian Ministry of Defense.

COSMO-SkyMed is a dual (civil and military) multi mission system, able to integrate itself with other space system so as to satisfy the needs of a wide community of users. Thanks to its unique character-

istics, it can observe any part of our planet, under any weather and lighting (day/night) condition providing high resolution space images in very short times.

The COSMO-SkyMed system is made as follows :

- a space segment made of a constellation of 4 satellites equipped with SAR sensors (synthetic aperture RADARs) operating in X band and equipped with a highly innovative and flexible system for acquiring and transmitting data;
- a ground segment made of geographically distributed infrastructures for:
 - the management and the control of the whole constellation;
 - the reception of observation requests and the relevant activities of planning and programming;
 - the reception, filing and elaboration of relevant data as well as the distribution of generated products;
 - thanks to its ability of expansion through the addition of more programming and production data which may be deployed in any worldwide site, it may operate together with other systems;
 - an integrated logistics and operations segment which allows the operational management of the constellation according to efficiency and cheapness criteria, thus guaranteeing the same management even in the case of expansion of the system through the addition of further programming stations and production of data.

The COSMO-SkyMed system was projected with the goal of providing information for improving the safety level and has been designed and made to operate in conditions of safety.

The launch of the fourth satellite of the constellation, occurred in November 2010, completed the

first generation constellation (CSK), which is fully operative since May 2011, and thus guaranteeing the necessary amount of availability of the service.

In the meantime ASI, together with the Ministry of Defense, has started the engineering activities for the designing and realization of the COSMO-SkyMed Second Generation (CSG). The preparatory operations for the definition of the contract for the realization of the satellite started last year.

The operational continuity and the improvement of COSMO-SkyMed system represent the main objective of CGS system which, also exploiting the peculiar expandability, interoperability and multi-sensing/multi-mission (IEM) characteristics of COSMO-SkyMed system, will allow the development of new applications and functionalities not currently supported.

The most noticeable differences between CSG and CSK are the following:

- The introduction of an acquisition method with a sub-metrical resolution which will allow to better identify close targets;
- The space resolution of the image which is doubled for specific acquisition modes;
- The ability to fully acquire the characteristics of a target thanks to the introduction of a polar-metric acquisition mode which allows the simultaneous transmission of horizontally (H) and vertically (V) polarized electromagnetic waves reflected by the target;
- An enhancement of the quantity of equivalent images per satellites (CSK vs CSK) of a 2 factor;
- Better response times.

There also are other differences which are not immediately visible to the user such as:

- An enhancement of each satellite operational life up to 7 seven years;
- A reduction of the processing time of raw data to roughly half of CSK's time, thus increasing the daily workload;
- An enhancement of the system interoperability, expandability and multi-mission/multi-sensing (IEM) in order to have a flexible configuration capable of satisfying the compatibility needs with MUSIS;
- The full responsibility of operational needs con-

nected to the planning in a multinational context including the partitioning of the system resources and to the evolution of the system management (ILS&OPS).

- These characteristics reflect the requisites imposed to the system which have caused the development of innovative technological elements whose validation was concluded last year. The most important innovations are the following :
- The RADAR antenna which will implement two reception chains (H and V), thus enhancing sensitivity and guaranteeing full coherence among received signals;
- The satellite control system which guarantees a better agility of the satellite reducing the slew time of 50% to transit from Right Looking to Left Looking;
- The on board memory capacity increases of 70%;
- The duplication of download Data Rate with a Bit Error Rate (BER) improved of 3 orders of magnitude compared to CSK;
- The strongest and fastest planning system that uses genetic algorithms for the research of the best acquisition plan so to enhance acquisition requests;
- The data gathering and elaboration system which introduces new processing algorithms which allow higher performance in terms of image quality in a shorter time.

All the changes stated above will allow the capitalization of the initial investment pertinent to COSMO-SkyMed program and will enhance its operative value in Earth Observation, thus satisfying all of the country current and future needs. CSG will also be able to provide a perfect observation of Earth (in terms of imaging and derived applications) which may be shared in the context of international agreements as already foreseen within the European military context (where the Italian Defense takes part) of MUSIS Earth Observations.

COSMO-SkyMed: the management of the System and its potentiality

A system as complex as COSMO-SkyMed, requires an equally complex management system.

The organization in charge will have to consider

its characteristics of duality through an integrated Civil-Military management system, as well as the “interoperability”, “expandability” and “multi-mission/multi-sensing” (IEM) characteristics through the use of adequate management processes which allow the insertion and subsequent cost-efficient management of expansions of that same system (for example the addition of more user centers) or of its interoperability/integration with different systems (Optical systems, for example). Internationally, CSK system includes another user center operated by the French Ministry of Defense (FDUGS), developed and qualified within the French cooperation called “ORFEO” as well as other “light user centers” located worldwide and named CUT (Commercial User Terminal) aiming at granting to international commercial users the ability of data planning and data elaboration.

Due to this complex infrastructure, the system management (MCO) continuously guarantees the maintenance of the operative configuration (flight and ground segments, as well as their expansions) 24 hours a day, which consists in error solving, satellite substitution forecasting and de-orbiting of non-operative satellites, system updates (for ground and onboard software), technical performance reporting, technical changes, Integrated Logistic Support, the continuous evaluation of returns from the campus and the relative “trend analysis”, the development and qualification of new applications necessary to provide a service which is always relevant to the effective and ever changing needs, considering

that the system is based on cutting edge technology and organization and thus ready for new requests from users and ASI-Defense committee.

All these experiences and capabilities contribute to the designing and realization of new generation systems through the direct involvement in the definition of the characteristics, in the technical programmatic management with the purpose of significantly contribute to the development of new generation systems based on the relevant space segment (SS), ground segment (GS) and integrated logistics & operations segment (ILS&OPS).

For this reason, the organization of the system management (also called MCO= Maintenance of Operative Conditions) is divided into three parts: programmatic management, exercise of engineering capabilities (SET) and realization of operational and logistic activities.

In the context of a programmatic management, a complex system of control allowing the ASI/AD collaboration (considering its dual nature) able to rapidly react to situations such as the risk of orbital collision and to monitor the system through a complex of “indicators” which assess the system capabilities performances (efficacy) as well as the resources used in respect of the results obtained and the relative costs (efficiency) is put into effect. SET guarantees the continuous analysis of the returns from the field and the needs of the users and of ASI-Defense collaboration, conveyed through specially



automated systems of collection and management as well as through the identification of the best technological solutions and /or operational through proper processes having engineering requisites.

Last but not least, the management of operational and logistic activities is based on the deployment of qualified and updated resources, able to operate and maintain the systems safely and supported by a sophisticated data management and activity control system made for:

- monitoring the operational activities of the system as well as the level of availability of resources;
- monitoring and evaluating the global availability of the service, its efficiency and the required performance;
- coordinating the system nominal activities (Very Urgent mode, constellation reconfiguration phases) so as to guarantee the complete correspondence of the system to the expected response time, the chronology of activities and the performance required;
- supporting the decision process for the system reconfiguration and the scenarios of the system modes;
- monitoring the operational procedures;
- monitoring the HW/SW configuration and spare parts.

COSMO-SkyMed: Data management and their distribution worldwide

Since the launch of its first satellite, COSMO-SkyMed constellation has provided a huge amount of images and information which have been applied in several fields such as agriculture, maritime surveillance, geology, landslide management and security.

Thanks to the peculiar characteristics of the system, ASI has been able to sign a series of agreements for the exchange of satellite data with the most important space agencies, providing a relevant contribution to the management of emergencies caused by natural disaster. One notable example of international cooperation is the agreement signed by ASI and the Japanese Space Agency (JAXA) regarding the joint research and support in the monitoring of natural disaster through the use of SAR images

in X band (COSMO-SkyMed) and L band (ALOS). As a part of this agreement, ASI has provided JAXA with over 200 images which have allowed to monitor and manage the emergency deriving from the terrible earthquake of 2011 and the subsequent tsunami.

The synergy in the use of different electromagnetic emission bands is also the reason of the cooperation with the Argentine space agency (CONAE) which allows the exchange of COSMO-SkyMed data (X band) with images taken from the Argentine SAOCOM (L band) satellites for the creation of an integrated system of systems called SIASGE.

Another significant example of international cooperation consists in the support needed from European Space Agency (ESA) after Envisat failure and provided supplying COSMO-SkyMed data within Dragon-3 program to find a solution for the temporary absence of SAR data and waiting for the launch of the first Sentinel satellite of GMES program.

In the field of emergency management due to national and international environmental disasters, ASI, thanks to COSMO-SkyMed, has provided an important contribution to uncountable cases such as the Haiti earthquake and flood (2008); the Myanmar flood (2008); the earthquake in China (2008); the earthquake of L'Aquila (2009); the Deepwater Horizon oil refinery platform disaster in the Gulf of Mexico (2010); the already mentioned Tohoku earthquake and subsequent tsunami in Japan (2011) until arriving to prove data for the earthquake which occurred in the region of Emilia in 2012 and Lunigiana in 2013 and for the satellite monitoring of the Costa Concordia's stability after its wreck.

Thanks to these activities and to the daily surveillance of national and international territory, the use of the system has been continuously increasing through the years allowing the creation of a scientific data catalogue of priceless value which reached more than 500.000 images in 2013.

The Center for the Interpretation of Earth Observation Data (CIDOT)

ASI wishes to give value to the investments so far obtained in the field of Earth Observation, encour-

aging the development of innovative projects proposed by public subjects such as public administrations and organizations as well as private firms and organizations.

For this reason, ASI has founded CIDOT, the Center for the Interpretation of Earth Observation Data, in the Center for Space Geodesy in Matera, having the following main objectives :

1. The interpretation of Earth Observation data with:

- priority in the use of COSMO-SkyMed data;
- use of multi-sensing and multi-platform data and subsequent integration;
- development of pilot applications with high innovative content for the Defense and control of the territory, identifying significant informative content within products and services;
- study and development of innovative, high performance (HW and SW) platforms for the processing of remote sensor data;
- creation and use of tools for the elaboration as well as the “alteration” of data as well as the assisted and the automatic interpretation;
- definition of criteria for the control of data quality products and services for data interpretation.

2. The definition and implementation of the technical and operative requirements (procedure, HW and SW) for the validation and certification of the products and the certification of the same products (user oriented activities upon request);

3. The creation of a permanent guideline for the technical and scientific training and qualification of operative personnel.

The following activities have been carried out nationally:

- management of 167 contracts and agreements regarding COSMO-SkyMed Announcement of Opportunities; the main themes deal with data processing, interferometry techniques, marine applications, hydrology, classification and use of the soil, identification and monitoring of changes, natural and anthropic risks, EM interaction, monitoring modules and natural and anthropic risk management;
- preparatory activities for the launch of CRESP

“COSMO Radar Expert System of Processing” contract regarding the implementation and optimization of radar-grammetric and interferometry algorithms for the production of DEMs from COSMO-SkyMed images;

- project for the optimization of DEM COSMO-SkyMed elaboration techniques through the use of Artificial Adaptive Systems. This project aims at proving the improvement of the quality of DEM, generated through the use of COSMO-SkyMed data and using specific algorithms called “Gen.D” instead of “classically” generated algorithms;
- management of SOS monitoring project: “Study and prototyping of an innovative application for the monitoring of slow movements in the soil through the use of satellite data integrated with data gathered from heterogeneous sources”;
- project for the development of a Monitoring System (SIMO) able to integrate and intersect territorial information (optical territorial variations maps, volumetric variations, thermic anomalies, presence of methane);

Territorial information are produced using data acquired from COSMO-SkyMed mission and from the Geocart multi sensor platform and made up of a laser-scanner system for the production of high space resolution Digital Terrain Surface Models (Up to 50cm), a metric camera with a resolution of 39 mega pixels and a hyperspectral system operating in the VNIR and SWIR fields (from 400nm to 2500nm), a 0.05°C precision thermal camera, creating together a 4-sensor aerial platform. The system will be applied in GIS and WEBGIS environments so as to allow an optimal data management, analysis and online publication of available data and analysis results;

- A “Slow Movement” Project: CIDOT presented this “Slow Movement” project to MIUR. This project, whose goal is to prove the possibility to identify the slow movements of the soil and of man-made structures on a large scale and in high geometric resolution, won a prize. These activities will study vast areas of Italian land. A second project could follow this one, for the engineering of the S/W prototype and of procedures which started in the first project and the definition of requisites in terms of capital, human resources and equipment, for the efficiency of a permanent service for the analysis

and identification of slow movement on a national and global scale. This second project also foresees the possibility to choose public and private subjects available to participate even in PPP in the commercial exploitation of the results,;

- Activity with the Ministry of Defense for the production of inter-ferometric and radar-grammetric DEMs
- Scientific articles and education.

Internationally, preparatory activities for the pilot project "Poseidon & Hephaestus", which will be developed thanks to a series of agreements between ASI and NASA/Jet Propulsion Laboratory have been carried out. The project, that will take place in 2013, will create a system for rapid responses to natural or manmade risks. The project includes the exchange of know-how, products, data and software developed by both parties. The data will be used for the JPL and ASI-CIDOT input chains. InSAR and DinSAR will be the main techniques used, applied to a long and dense sequence of multi-temporal data in order to produce Digital Elevation Models, velocity and deformation maps on various seismically and volcanically remarkable sites such as Los Angeles, the San Andreas fault, the Vesuvius and Campi Flegrei and the Region of Basilicata. Other sites could be selected if necessary.

COSMO-SkyMed for the competitiveness of national industrial unions, including small and medium enterprises.

The big national programs represent a unique opportunity for the participation and growth both in terms of quantity and quality of national industrial unions and thus also of SMEs. The CSK program foresees technological and utility operations carried out by national SMEs exceeding a value of 7% of the total financing. The CSG program was started by ASI so as to guarantee much larger percentages of cooperation of national SMEs and non-SMEs, particularly for Ground Segment activities. This will require a significant commitment of the Programming Office in order to contain the possible risks caused by the involvement of multiple participants.

Another new factor that ASI asked to its contractors consists in the rules at the basis of the competitive selection of participants to the various phases of the program together with informative procedures which request a bigger participation of national firms. This participation is even more significant because ASI encourages the joint participation of national SMEs and non-SMEs to the program. Thus, the response capabilities expected from national companies will be the natural proof of the competitiveness which the national industrial union, especially SMEs, will be able to express and which will influence the sector future strategies.



Athena-FIDUS

In 2013 the activities of Athena-Fidus program reached the final steps before the launch. ATHENA-FIDUS is a new Satellite System promoted by the Italian and French Space Agencies and Ministries Of Defence, for broadband communication services aimed at military, governmental and civilian users. The Space Segment, manufactured by Italian and French industry, is based on a geostationary satellite operating in Ka (Civilian and Military Users) and EHF bands (Italian Military Users), with high transmission capacity. The satellite platform is a SpaceBus 4000; it embarks the Italian and French payloads providing for the space segment communication resources designed to achieve the target System performance, in cooperation with the dedicated Italian and French on-ground communication infrastructures.

The ATHENA-FIDUS Satellite System will offer broadband communications services to Italian Military and Institutional/Civilian users over the Italian National Coverage in EHF and Ka bands. Transparent star and mesh communication channels will be available for Military and institutional/civilian users are.

The Ground Segment of the ATHENA-FIDUS is composed of several elements, each of them is configured to support the pre-operative verification and validation phases of the system.

The satellite launch is scheduled for the beginning 2014 and the system is expected to be operational in the second quarter of 2014.

Technologies and telecommunication equipment in Q/V band

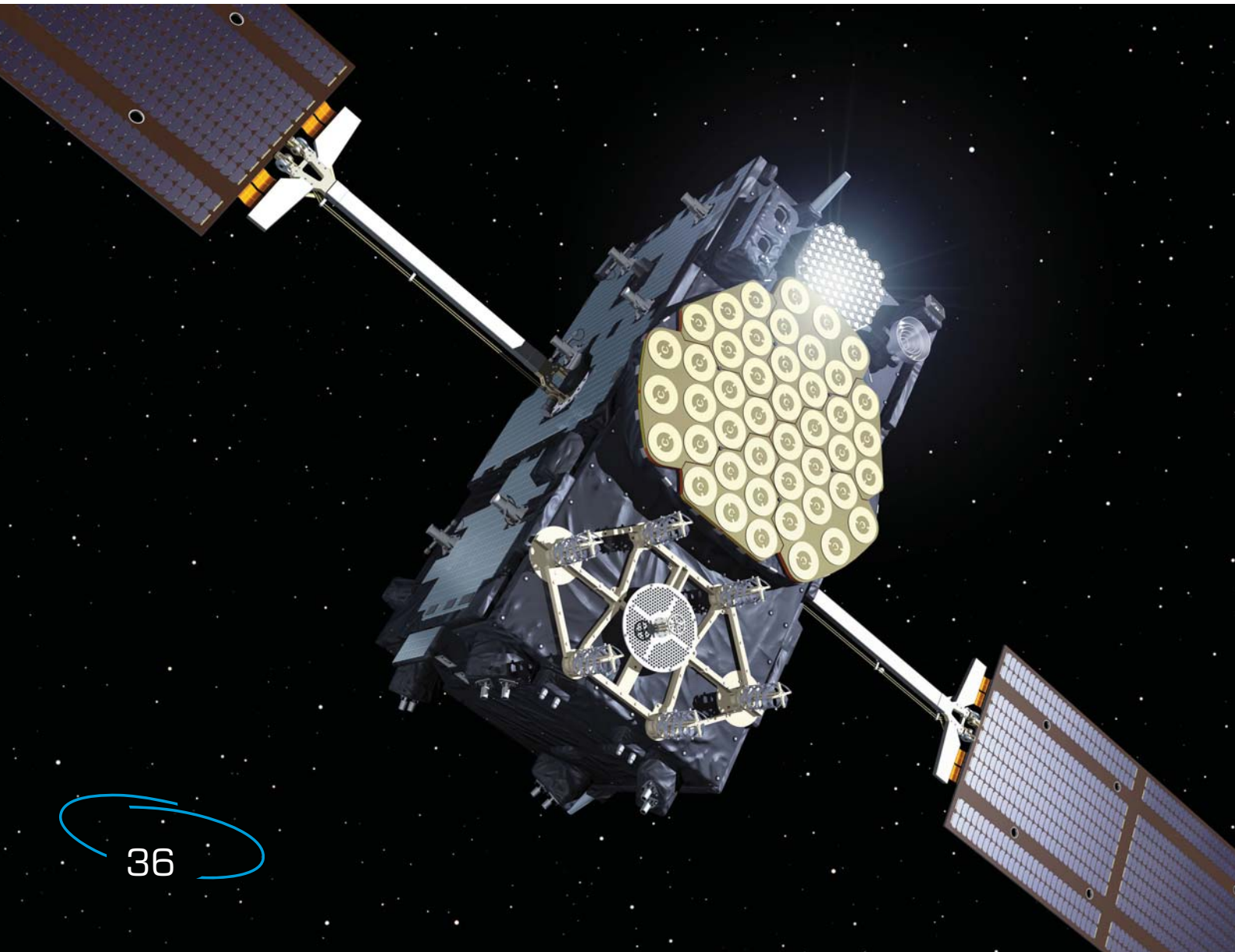
The strategic importance of probing higher and higher frequencies has been recognized by the Italian Space Agency since the times of SIRIO and Italsat missions.

In this view the Q and V bands, 40-50 GHz, will play an important role in the near future for TLC in broadband applications. Since 2003 ASI has been carrying on a testing program of telecommunication channels and propagation in the frequency bands at 40 and 50 GHz. As a result of first feasibility phase, the initiative culminated in Alphasat "Aldo Paraboni" pre-operational mission based on a payload in Q/V band financed by ASI which has been launched on July 25th 2013 on-board ESA Alphasat satellite. The payload is named after Prof. Aldo Paraboni, an outstanding scientific investigator, who collaborated with ASI since the time of SIRIO satellite and was the promoter of this initiative. The Mission Segment (stations and ground infrastructures necessary for carrying out experiments) has been realized in parallel to the Space Segment. The system will allow Italian investigators to study advanced techniques of degradation compensation caused by the propagation in the atmosphere as well as to study the characterization of the communication channel in the new frequency bands. The ground segment will be distributed on three sites: Tito (PZ), Spino D'Adda (CR) and Graz (Austria). The ground segment has been developed under a national contract that will be concluded by the end of 2013 and will provide stations for telecommunication and propagation experiments.

Call for Small and Medium Enterprises

In 2013 ASI concluded the national bid for Small and Medium Enterprises (SME) for the prototypal and pre-competitive development of new technologies/products/services in TLC and Integrated Applications. The goal of this initiative is to enlarge and strengthen, because of the effect of an action of promotion and financial support, the SME techno-

logical basis able to offer new products and new services. A great number of small and medium enterprises have answered to the Call as a proof of their vitality in such a sector. ASI concluded the selection process of the received proposals. Selected projects will last two years maximum and will be finalized to the optimization of the national industry competitiveness level.



NAVIGATION

Since long time, the Italian Space Agency has recognised the potential of satellite navigation promoting many applications (just to mention that currently the European Commission estimates that the direct revenues level coming from the use of Global Satellite Navigation Systems (GNSS) will reach 165 B€ in 2020) and has undertaken initiatives to develop pre-operational projects to pave the way for its extensive use.

The Italian Space Agency, as one of the four major founders, has funded Galileo, the European GNSS now in development phase, and participates in the GALILEO & EGNOS (European Geostationary Navigation Overlay

System, which is a Galileo precursor system aimed to increase the existent GNSS performances to allow Safety of Life applications) European Management Boards and Technical Control Bodies; moreover it promotes and develops the National Application Projects aimed at fostering the use of satellite navigation, harmonizing them with European projects.

The ASI 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".

One of the main ASI Plan of activities (2010-2012) development regards the specific project aimed to introducing the use of GALILEO Public Regulated Service (PRS) to the governmental entities devoted to the safety and security of national territory.

This objective has been pursued with the Presago project dealing with the requirements of the PRS national system; moreover, following the 2011 European Parliament and Council decision 1104/2011/

UE on PRS use, an Italian PRS Competent Authority has been set up. ASI is working in strong coordination with the Presidency of Ministers to drive at European level the implementation of the PRS service and, under a program agreement among ASI, Ministry of Scientific Research and University and Presidency of Ministers, is acting to provide the PRS Authority with adequate capabilities, including a National Security Centre for PRS Service.

Among others applications and technologies developments (for example maritime transport applications, dangerous goods transportation) ASI is carrying out, together with the National Entity for Air Traffic Control ENAV, SENECA, a very comprehensive national program for the full introduction of the satellite navigation in the Civil Aviation field.

With the PEGASUS program, ASI is taking care of the development of a navigation receiver for Safety of Life applications; moreover is pursuing the use of navigation for rail management through the support of ESA specific program.

ASI is driving the European program for GNSS evolution, via participation to the relevant ESA board and funding the program; as important strategic point of the ASI



Plan activities (2010-2012) for GNSS (Geostationary Navigation Satellite System) ASI is supporting as European project, among others, the development of the atomic clock for Galileo second generation.

ASI is also acting to give advice to Italian Delegation in the legislative process for the European GNSS Regulation which is going to be approved by European Union to rules

the GNSS activities and programmes in the 2014-2020 period.

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 Satellite Systems and as focal point for international information exchange related to its activities, after having hosted the ICG 2010 meeting, ASI has attended the ICG 2011 (in Tokyo) and 2012 (Pechino) and is preparing ICG 2013 to be held in United Arab Emirates.





LAUNCHERS AND SPACE TRANSPORTATION

Italy supports launchers and space transportation systems design and development in order to make Europe strategically independent in its access to space. Italy contributes to the various ongoing European launcher projects and future launchers. Space activities are supported both in the context of participation to ESA programs and through technological development programs at national level in synergy with ESA ones. The main part of Italian activities as far as financial point of view, focuses on European ESA launchers programs. Italy takes part in the production and support to future evolutions. It sustains development and production and provides its support to launching activities from Guiana Space Centre. Italian main contributions to Ariane 5 - such as production and national surveillance, evolution and infrastructure - mainly consist in the solid propeller boosters, the liquid oxygen turbo pump (LOx) for the first stage of the Vulcain motor, and the LOx turbo pump for the new cryogenic motor for the upper stage VINCI, which will be used in future versions.

Italy is the main contributor of VEGA, with 63% of total development. VEGA is a small vehicle for launch into Low Earth Orbit (LEO) of satellites up to one and a half tons in weight at reference orbit parameter of 700 km in polar orbit and SSO. This program includes the development of the launcher and of ground infrastructures on the space center located in Guiana (CGS), deemed as necessary for the use of the launcher. As concerns VEGA Launching Vehicle, Italy, through the company ELV (participated by ASI at 30%) is the main contracting partner and industrial Architect being also in charge of System activities, design and production of solid propellant rocket motors (P-80, Z-23 and Z-9A), AVUM, the liquid 4th stage, and of 2-3 inter-stage structure.

In so far as the ground segment is concerned, the Italian industry Vitrociset is the Prime Contractor with responsibilities for civil infrastructures, for the

control desk (BCV) as well as the general and fluid mechanic equipment with CGS, Rheinmetaal-Italy and SIEM as subcontractors. After the qualification flight, which was successfully carried out on February 13th 2012, the production of the first five launch vehicles has been implemented through ESA program VERTA which supports the development of the launcher in all its performances; VERTA includes the development of a new qualified flight software (FPS-A) under the complete control and authority of Italy, to be used starting from the first VERTA flight, which took place with another great success in May 2013, having the European satellite PROBA-V on board.

In November 2012, on the occasion of the Ministerial Council, Italy joined the VECEP program, through which ESA will consolidate the configuration of VEGA (particularly the redesign of a more powerful first stage, and the European production of propellant tanks for the liquid 4th stage, AVUM), as well as the study of future evolutions of the launcher configuration towards a class with a slightly superior payload.

Italy participates in Soyuz ESA program, which includes all necessary activities deemed as necessary to allow the launch of the Soyuz launcher from the CSG European base in Kourou, Guiana. Soyuz's first flight was successfully carried out in October 2011, with the launch of two IOV Galileo satellites, and numerous other successful flights have followed.

Italy participates in other ESA initiatives regarding the preparation of future launches (FLPP) by developing and enhancing system performance, solid and liquid propulsion, materials, structures and technology for re-entry vehicles. Italy, through TAS-I, plays a particularly important role of industrial responsibility and system authority in the Intermediate Experimental Vehicle (IXV) project. The launch of IXV is planned for 2014, on board a Vega flight.

VEGA qualification flight occurred in 2012. It was successfully carried out, as fully demonstrated by

the post flight analysis reports. The Italian satellite LARES, developed under a contract signed by ASI and selected by the European Space Agency as Vega first payload, is perfectly operating and is allowing the acquisition of data in order to measure the Lense-Thirring effect, that is the effect of traction in an inertial quadrant due to the Earth's angular momentum, thanks to the highest precision of measurements of the Earth's gravitational and magnetic field.

In order to analyze possible evolutions of Vega launcher, the Italian Space Agency is supporting the project, on a national basis and in the frame of a "Memorandum of Understanding on the Cooperation on Launcher and Space Propulsion" between ASI and the Russian Agency Roscosmos: in this context, Italian and Russian industries, respectively controlled by their agencies, are cooperating on development activities of a new motor which makes use of liquid methane and oxygen as propellants. In September 2012 the project led to a firing test of an Italian-Russian combustion chamber and foresees a firing test of a whole demonstrator within the end of 2013. Furthermore, propulsion activities are being supported by system studies aimed at identifying possible ways to enhance future versions of Vega, together with an update of GNC approaches and algorithms.

On a national basis, ASI is supporting various other technological researches and development projects focusing on research and evaluation of new key technologies for future systems of space tran-

sportation: a project on innovative materials and design concepts for hot structures, a project on aerothermodynamics and aerodynamics for taking off and landing studies and the Theseus project dealing with hybrid propulsion.

The international cooperation is necessary and active on many projects, particularly with Japanese space agency JAXA, with which studies on the development of oxygen-methane propulsion have been carried out. These studies will be of great use for Lyra program. As far as reentry vehicle technologies are concerned, a feasibility study for a new vehicle has been carried out, to be launched with VEGA and with autonomous landing abilities on a runway. On the occasion of the Ministerial Council occurred in November 2012, Italy has subscribed a new study program named PRIDE, with the intent of creating a strong synergy and give value to the experience within the IXV European program and in the national USV program, developed by the Italian Center for Aerospace Research (CIRA), whose main shareholder is ASI and also the collaboration with JAXA.

Other interesting areas for future ASI projects are nanotechnology, grid structures made of composite materials for the structural parts of the launcher, technologies for a controlled re-entry of Vega's third stage and electrical propulsion for a Vega service module. The goal is to allow the launcher to have a greater versatility for what concerns its performance.





HABITABILITY IN SPACE / BIOMEDICINA

HABITABILITY IN SPACE / BIOMEDICINE

Italy plays an important role in the program of development and use of the International Space Station (ISS), thanks to its bilateral agreement with NASA signed in 1997 and to its active participation in ESA programs regarding the ISS.

Following the success of Italian pressurized logistic modules (Multi-Purpose Logistic Modules: Leonardo, Raffaello and Donatello) used since 2001 for the transportation of equipment, supplies and experiments towards the International Space Station, in 2009, NASA and ASI signed an additional bilateral partnership in order to transform one of the modules (FM I Leonardo) into a permanent module (Permanent Multipurpose Module-PMM) of the Station, suitable for hosting experiments, equipment and material deemed as necessary for the life of astronauts on board the Station. PMM, which was brought on board the ISS during the STS 133 mission, was successfully integrated in March 2011, thus becoming the "Italian room" of the International Space Station. In this context, activities of engineering support and of management of PMM operations carried out by ALTEC, a company established in 2001 by Alenia Spazio, local organizations from Piedmont and ASI, play a key role. During 2012, these operations led to very important results.

In early 2012, the Project for Human Space Flight for Research and Technological Demonstrations onboard the International Space Station was launched. Its goal was to select experiments to be associated to the missions with Italian astronauts in 2013 and 2015. Furthermore, in 2012, the tender procedure for the assignment of sustaining engineering services in support to ASI for the ISS started.

Within ESA, Italy takes part in the ISS Exploitation program concerning the activities of management and support to the utilization of the International

Space Station as well as the operations and the maintenance of the parts of the Station developed by ESA, including the supply of ATV. In 2012, on the occasion of ESA Ministerial Council, Italy confirmed its support to ESA programs of management and use of the ISS, approving a new component, the MPCV Service Module, as barter element with NASA.

MICROGRAVITY - CHEMISTRY AND PHYSICS

ASI withholds the option to use ISS resources which, as it is known, can be considered a unique laboratory for experiments in microgravity and/or other conditions which are proper to space (such as radiation, vacuums, thermal excursion, etc.). Such options can be realized through experiments carried out in pressurized or external environments, especially through experiments which make use of equipment already existing onboard the ISS or whose launching has already been planned.

Thus, ASI has published a permanent invitation for the presentation of proposals of partnership for projects of activity and use of the ISS, in response to which one proposal (Green Air) has been selected for testing biofuels in the Combustion Integrated Rack of the ISS as well as for the testing of a sensor of combustion products onboard the ISS. Green Air is also part of the experimental programme of the mission of Italian astronaut Luca Parmitano on board the ISS since May 2013.

Furthermore, in 2012, the operations regarding COSMIC project proceeded. This project studies the synthesis processes of combustion at zero gravity. In the same year, the second parabolic flight campaign in reduced gravity was completed.

In 2011, together with ESA, the preparatory activities for GLOBE (Gas-Lubricated Oil Bearings) experiment started. The goal was to create a testing facility, mainly for use onboard the ISS, able to obtain the suspension as well as the isolation from residual

acceleration in microgravity of a solid sphere, upheld by liquid stands lubricated by natural gasses. The next step is the creation of a demonstrator of isolation from residual gravity to be put inside the sphere. Once the facility has been developed, it can be placed onboard the ISS for a possible phase of space qualification. In the future it will be possible to realize an application facility for testing into orbit.

MICROGRAVITY - MEDICINE AND BIOTECHNOLOGY

ASI activities dedicated to Programs of Medicine and Biotechnology specifically aims at gaining knowledge through space research in microgravity and then transfer and use it in biomedical applications on Earth, as well as to identify medical and pharmacological countermeasures deemed as necessary to support life in space for prolonged amounts of time. It is thus necessary to promote and carry out missions (or simulations) on a stable basis for the pertinent scientific community. A process for the ISS use dedicated to human and animal physiology has started.

As a consequence, in 2012 the following programs were carried out:

- GPM (Genomics, Proteomics and Meta-bolomics), related to the mechanisms which are at the core of the greatest alterations of cellular functions due to space environment in (microgravity and magnetic fields);
- LIGRA (Life in Gravity), which goal is to examine the theoretical foundations of interaction between gravity and human beings in depth as well as to study the effects of microgravity in dosimetrical and temporal reversibility terms;
- MCC (Molecular Control of Circadian rhythms during space flight), multidisciplinary study on circadian cycles completed in 2012;
- RA (Radiation, Microgravity, Apoptosis), for the study of countermeasures to eyesight damages which may occur during long-term space flight;
- CRUSOE (Cruising in Space with Out-of-body Experiences), a study having the goal to pursue in the long term the goal of creating a system able to





simulate a virtual “second life” for long term space exploration mission, based on out-of-body Experiences in immersive, cooperative and multi-sensor environments, completed in 2012;

- NIMURRA (Non Invasive Monitoring by Ultra wide Radar of Respiratory Activity of people inside a spatial environment), for the study of non-invasive monitoring systems of respiratory activity for humans in space, completed in 2012.

Another important research front is the one which studies equipment realized by ASI for the ISS currently on board the International Space Station:

- Elaborator of Television Images (Elite-S2) : it is an optoelectronic system for the collection and data analysis of human movement in three dimensions space. The goal is to characterize strategies and mechanisms of adaptation used by the central nervous system to control movements in space;
- ALTEA: the ALTEA instrument, whose goal is the electrical-physiological monitoring of the nervous central system and to evaluate the risks of brain dysfunction caused by cosmic radiation during long-term missions, was brought on board the ISS in July 2006 with the STS-121 Mission and was used throughout 2006-7. In December 2007 ASI and NASA signed an agreement for the use of ALTEA in DOSI (Active dosimeter) mode without a human being in the context of NASA medical operations. A second agreement between ESA and NASA was

signed for carrying out ESA ALTEA SHIELD experiment. Both experiments ended successfully in 2012.

- FEBO: in 2011 the B phase of this project started and ended successfully in 2012. The experiment aimed at creating a facility to be put outside the ISS for experiments on UV light and cosmic radiation of biological samples as well as for collecting extraterrestrial material.

The important results obtained from these programs have shown the high competences of our national scientific community as well as the potentiality of their research, not only for medicine and biology in space but also for therapeutic methods on Earth. In order to give continuity to these activities, in 2012 a new announcement for “Biomedicine and Biotechnology research in Space” was launched, in an attempt to co-finance research projects relating to Biomedicine in Space, which mainly represent the strategic lines as defined by ASI and which aim at confirming and increasing the results obtained by researches made by ASI.

Within ESA, Italy also participates in the European Life and Physical Sciences (ELIPS) program, through which ESA selects experiments, realizes equipment and offers flight opportunities to the European scientific community. These experiments require grants from National Agencies to support the research activity.





BASES AND OPERATIONAL CENTERS

CENTER FOR SPACE GEODESY “BEPi COLOMBO” - MATERA

Located in the province of Matera, in the South of Italy, the center for Space Geodesy (CGS) is dedicated to professor Giuseppe (“Bepi”) Colombo. Founded in 1983, CGS mainly works on earth observation programs thanks to very advanced space techniques like space Geodesy and remote-sensing.

The presence of different methods of observation (satellite and lunar laser ranging or SLR/LLR, radio-interferometry on a very long base or VLBI, GNSS positioning, absolute gravimeter) makes CGS a “core station” of GGOS (Global Geodetic Observing System), with a crucial role in the geodynamic world control, from the creation of geo-potential to the materialization of the international framework of terrestrial reference. CGS also hosts the ground segment for the analysis of civil data of COSMO-SkyMed Mission. Following ASI guidelines for space and protection control, ASI created in the town of Matera the CNM (Centro Nazionale Multimissione) for the acquisition, long-term filing, elaboration and spreading of EO products and data. During 2009, CGS has carried out operational activities of data analysis in the field of space geodesy and remote-sensing and gave to the international community very accurate results.

SPACE CENTER “LUIGI BROGLIO” MALINDI (KENYA)

Italy and Kenya have been collaborating in the field of space activities since 1964, thanks to an inter-governmental agreement called “San Marco Project” signed on March 14th 1995 and renewed for further 15 years. The agreement

has now been re-negotiated.

In this context, ‘Luigi Broglio’ Space Center was created in Kenya. The center is situated at 2°56’ South, 40°12’ East, on the Indian Ocean near Malindi. Its position is ideal for launching and controlling equatorial satellites as well as for acquiring images on Earth observation on the region of Central and East Africa.

The Broglio Space Center (BSC) is divided into different segments:

- the maritime segment: it is made of five offshore platforms for the launch of satellites and probe rockets and of motorboats for transportation of people and material from land to platforms;

- the ground segment, known as Base Field, covering an area of about 3.5 hectares. It contains a TT&C complex, with two Ground stations for receiving, acquiring, recording and broadcasting satellite data in real time and a Remote Sensing Centre, for collecting and elaborating satellite data on Earth observation, including a geophysics station. Current activity is concentrated in the two Ground Stations situated in the bases of San Marco project, named MLD-01 and MLD-02.

MLD- 02 is presently active in :

- TT&C and Data Downlink for AGILE (ASI), NuStar and SWIFT (NASA) scientific satellites (daily routine activity);

- Supporting ESA for TT&C services for satellites and launchers in LEOP phases of routine and emergency;

- monitoring of ESA/CNES ARIANE, VEGA and SOYUZ launches from Centre Spatial Guyanais CSG in Kourou (French Guyana);

because of the relative position of BSC and CSG, many of the critical phases of equatorial launches take place in visibility of Malindi;



- LEOP support and of routine of satellites from other international agencies;
- Supporting communications for the Chinese Tiangong and Shenzhou programs

MLD-01 station of Rome University “La Sapienza” is occasionally involved in GS activities when MLD-02 is fully busy or in maintenance. .

Within BSC, activities of collection and spreading of Earth Observation data are carried out. BSC is also testing the experimental sensor GALILEO for monitoring the receiving of navigation signal

broadcasted by the first two satellites of the constellation, Giove-A and Giove-B. The data acquired are then re-transmitted to the European Space Operational Centre (ESOC) in Darmstadt (Germany) in order to be analyzed.

The Joint Executive Committee of the bi-lateral agreement has nominated a joint work team having the goal to carry out a feasibility study for the realization of a Regional center for Earth observation in Kenya. This broad initiative involves the BSC for acquisition, pre-elaboration, filing and cataloguing of data, while the elaboration and the specific generation of products as well as the distribution to users will take place in Nairobi.

Starting from the month of August 2008, ASI has started a procedure to evaluate the possibility of launching stratospheric balloons from the San Marco base. This program includes a phase of feasibility study for understanding the behavior of the wind on the ground and along the air up to the stratospheric level, and will use simulation and Earth programs as well as sound scanning. The campaign will last two years and at the end it will be possible to realize a launching procedure of a stratospheric balloon at the San Marco base, for which a proper actuation plan is planned. In case of success, the research community of Kenya will be encouraged to take part in this new activity.

ASI SCIENTIFIC DATA CENTER

The ASI scientific data center (ASDC) is an operative multi-mission, multi-disciplinary, scientific, elaboration and data center. ASDC was built on the experiences acquired within ASI with the management of BeppoSax Scientific Data Centre at the end of 1990. Located within ASI -HQ, it is in continuous evolution since its foundation in November 2000.

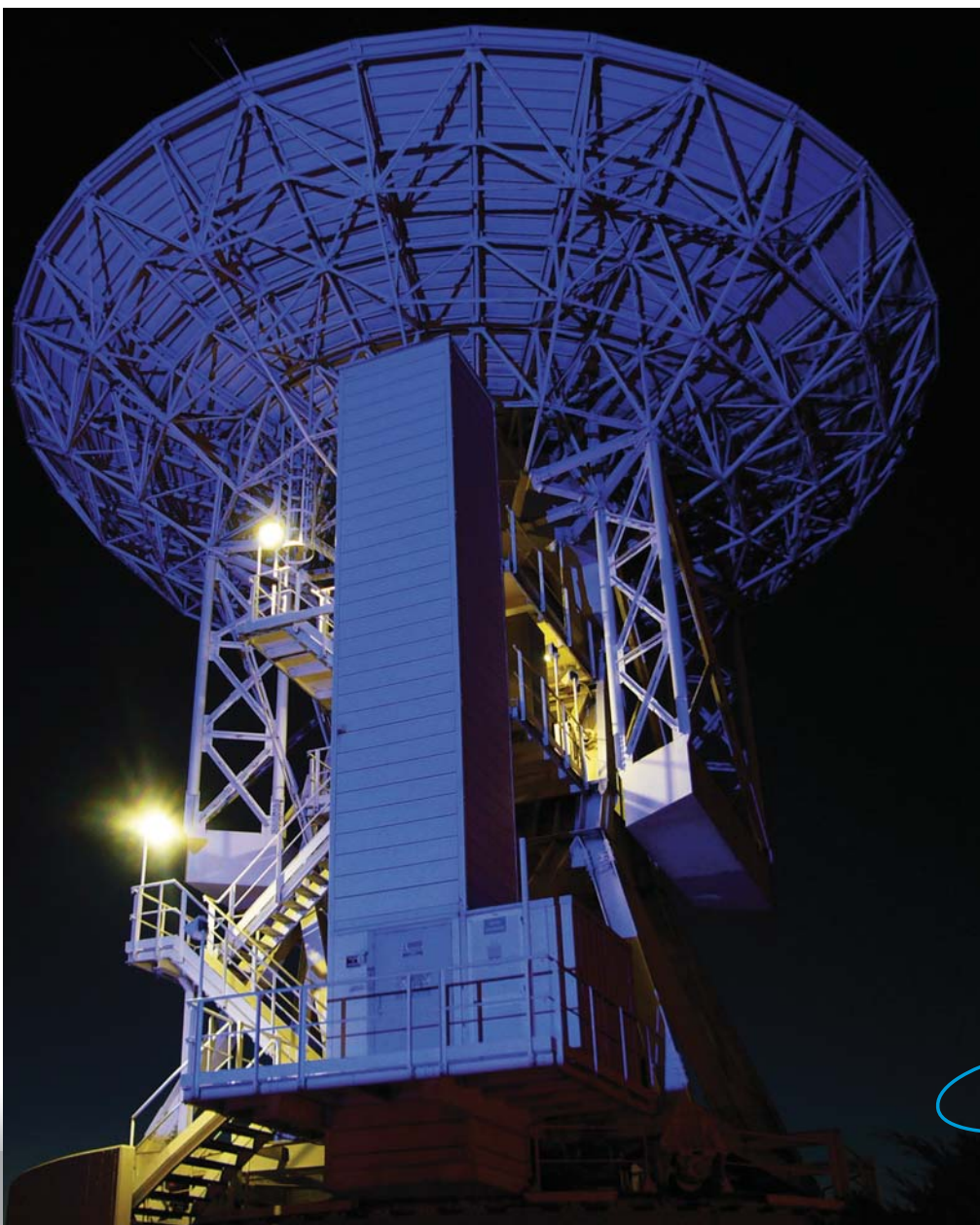
At the moment, it takes on the responsibility for high-technology astronomy satellites like SWIFT (NASA), AGILE (ASI) and FERMI (NASA) and gives its support to a number of Italian experiments onboard satellites for solar system exploration (ex: SHARAD, MARSIS, etc.) and the archives for Herschel, GAIA missions (ESA). Since 2011 the center hosts also astroparticle data coming from AMS (NASA) and PAMELA (Roscosmos) space missions and in 2014 the data from CALET (JAXA) will join the center. Different new projects are planned in the near future, such as the ESA Cosmic Vision 2015-2025 selected and under evaluation programs (EUCLID, PLATO, LOFT ect). ASDC was



entirely created by Agenzia Spaziale Italiana and makes part of the Exploration and Observation of the Universe Unit. It works in cooperation with ESA, NASA, INAF and INFN through specific agreements as memorandum of understandings, contracts and national cooperation agreements, which define the responsibilities and the roles of ASI and ASDC in each program. Each year a detailed activity plan is proposed by the Board of Directors of ASDC, an external body including members of all national institutions involved in the Centre. The internal organization of ASDC is due to two main organisms, the Executive Committee and the Scientific Committee, which manage the projects coordinating the scientific research. The national and international Communities provide information to ASDC through an Users Committee. Scientists working at ASDC belong to activities of the National Scientific Community. In 2009 scientists of ASDC have contributed to many important scientific activities that have brought to the publication to more than 100 works on international magazines

of this sector. The most important results are the discovery of some Gamma ray flashes through SWIFT satellite, of the furthest object in the universe (at about 13 billion light years), of several Pulsar Gamma Rays and Blazar with Fermi and AGILE satellites and flashes of terrestrial Gamma Rays with AGILE. Furthermore, AGILE detected gamma ray emissions of Eta-Carinae region, the first experimental confirmation of Gamma Rays emissions ($E > 100$ MeV) from the collision winds of a binary star system, and the emission of gamma rays from the wind of pulsar nebula VELA, the first experimental confirmation of an emission of gamma rays ($E > 100$ MeV) from a Plerion (www.asdc.asi.it). ASDC has won four times the most important Prize of the American High Energy Astrophysical Division, the Bruno Rossi Prize. These 4 Prizes were awarded to the teams of BeppoSAX, Swift, Fermi and AGILE missions to which ASDC has strongly contributed.

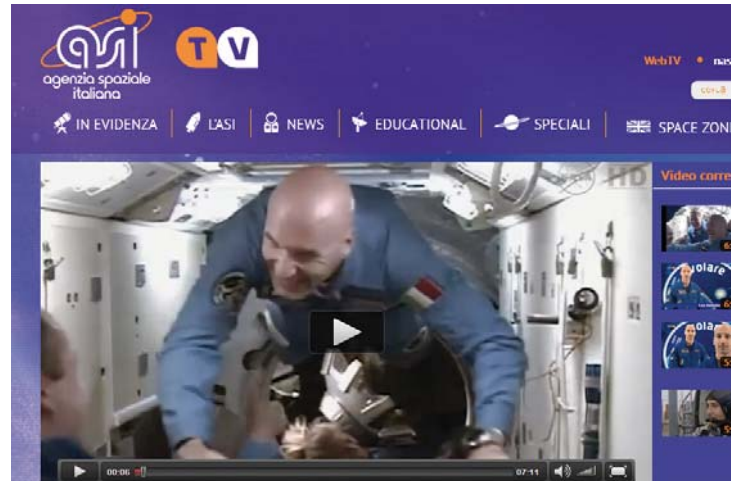
www.asdc.asi.it



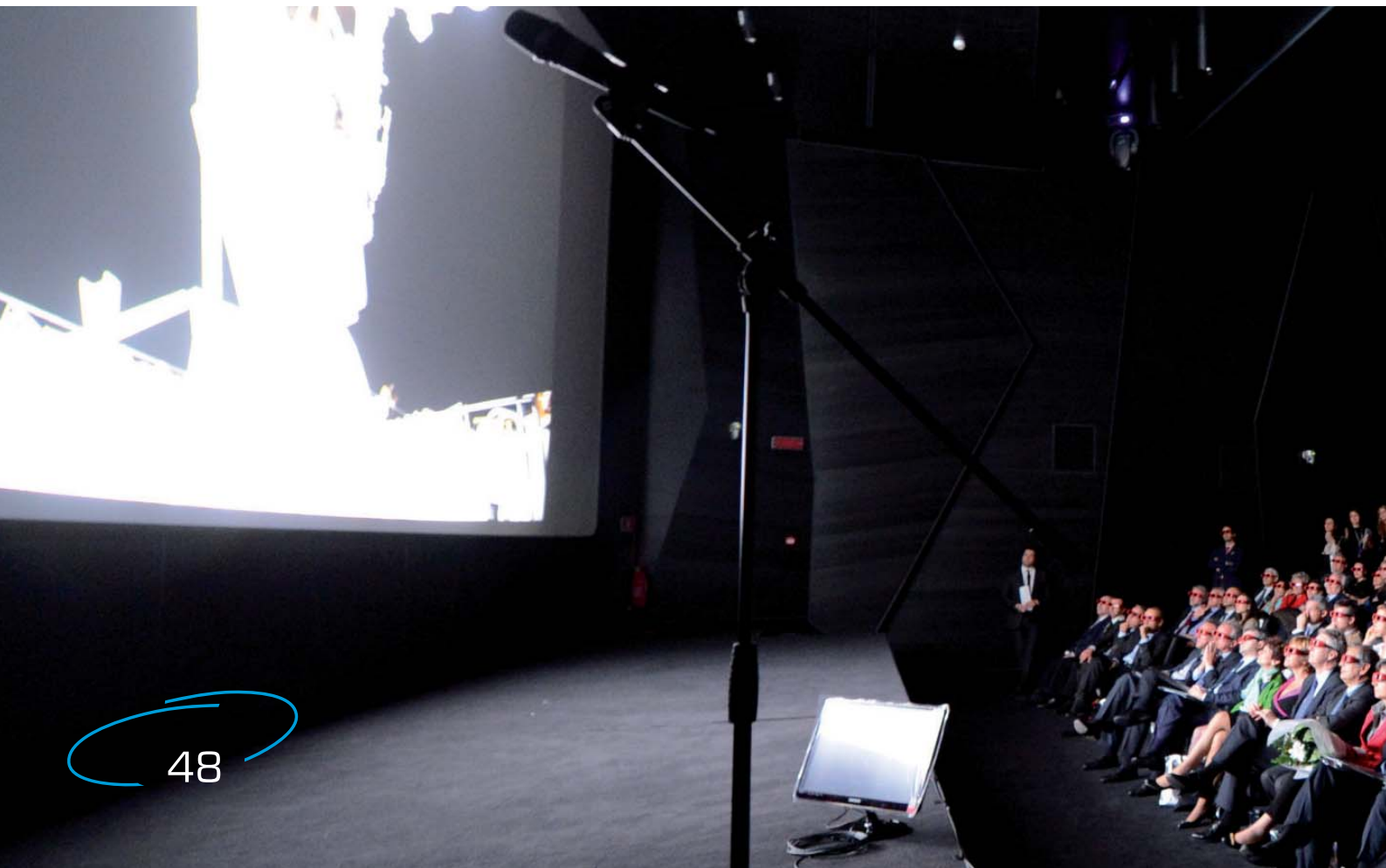
COMMUNICATING THE SPACE

During last year the current growth of all the activities of communication of the Agency was confirmed together with the improvement of outward visibility of such activities. This positive trend, proven by the numerous and prestigious national acknowledgements awarded to ASI, started with the full efficiency of ASI URP unit: Office of Relations with the Public, formally established in 2009 after the approval of the new macro-organization of the Agency, which came into effect the following year.

ASI institutional communication activity responds to principles and goals established by the national legislator for public offices, as mentioned in institutional documents, such as the Statute, the Document of Strategic Vision 2010/2020 and the Triennial Plan of activities 2012/2014 currently in force. Furthermore, it is part of one of the Board of Directors programs.



In detail, URP "primary objective is to create stable relations based on the quality between the institution and the relevant public, with the ultimate goal of acquiring a notoriety within society and a public image suited to its goals and activities".



coherence with said principles and following the strategic directions defined by ASI presidency, this sector is divided into 7 general areas:

1. the implementation of ASI website, through the improvement of its text and videos. The website has been recently subject to an intense restyling so as to improve the graphic interface, the accessibility and the overall performance;
2. the constant growth, both in terms of quality and quantity, of ASI WebTv, which was born in July 2010;
3. the strengthening of ASI presence on the main social networks (facebook and twitter) and on Youtube video platform;
4. the reinforcement of editorial partnerships with the main actors of national and international media, being them specialized or non-specialized;
5. the realization of specific products such as the Newsletter (In collaboration with IISole24Ore), a periodic focus on the activities of the Agency and its collaboration to initiatives such as "SpaceMag" magazine;
6. the participation in the most important worldwide fairs, festivals and conventions

dealing with space, with its own exhibits and stands as well as a rich agenda of events all over the country;

7. Internal communication;
8. the valorization of all activities related to education.

The performances obtained have been highly satisfactory. In detail:

- the website has reached an average of 27,000 users with 60,000 contacts; www.asi.it has become a primary source of information and a point of reference for media and citizens;
- ASITv, ASI web tv, has more than 100,000 contacts;
- Facebook, the world's most used social network: ASI runs various, constantly updated pages with over 500 users joining in a month;
- Youtube: in the past few months around 1.000 ASI videos have been watched;
- Twitter: the twitter account was set up on the occasion of Roberto Vittori's last mission and has already received a great feedback.





EXTERNAL RELATIONS AND EDUCATION

One of Italian Space Agency institutional tasks is to spread aerospace culture. This task is carried out through the use of a correct and efficient advertising of ASI activities as well as its educational and professional growth in the field of science and the designing and application of space technologies. The External Relation Unit of the Agency carries out educational projects aimed at different types of audiences, aimed at spreading the institutional activities of the agency as well as its relevant projects through media, participation in national and international events and creation of education programs.

Due to the big amount of success and positive results obtained up today, the Agency supports and promote the economic and social role internationally acquired so as to grant to the technological and scientific community the highest levels of scientific knowledge and innovation.

During 2012 ASI took part in the following international space exhibitions with its own booth:

- Satellite 2012 (Washington D.C, 2013);
- FIDAE 2012 (Santiago, Chile);
- Space Ops 2012 (Stockholm);
- Toulouse Space Show 2012 (France);
- Farnborough Air Show 2012 (England);
- 63° IAC 2012 (Naples);
- Japan International Aerospace Exhibition (Nagoya, Japan).



Different institutional communication initiatives have also been organized. For example, the organization of institutional delegations at the first launch of VEGA European vector at the spaceport in Kourou, French Guyana.

The main scientific conventions organized in 2012 are the following:

- a convention for the “VII Programma Quadro”, in Rome
- a workshop for the presentation of the Announcement of Opportunity (AO) COSMO-SkyMed results in Rome;
- DAMA event at CASD (Center of High Studies for Defense) headquarters in Rome, which had the participation of astronaut Roberto Vittori and representatives of companies which contributed to the success of the DAMA STS 134 mission;
- “Astrophysics from radio to the sub-millimeter wavelength- the Planck view and other experiments temperature and polarization” convention at CNR headquarters in Bologna;
- “Science and Industry- New synergies for the Country’s economic growth” event at the Via Ri-

eti Auditorium, Rome, which had an attendance of around 100 people, among whom some of the ASI’s most important members and other researchers, as well as representatives of the political, institutional and academic sectors;

- “SIGRI” (Integrated system for the Risk Management of Fires) workshop, which took place in the Department of Civil Protection offices in Rome;
- a workshop with the scientific community of Earth Observation in the “Via Rieti” Auditorium, Rome.

Educational projects for schools use a method based on the edutainment or “learn by playing”, formula. In 2012 the main projects which were carried out in the education field included the following initiatives:

- Aerospace Web Channel - the Aerospace Web Channel, which reached its fourth edition in 2012, is ASI most important educational project for high schools. Its goal is to develop useful conditions to increase the knowledge of the potentiality that space science and technology can offer to students in this age group; an important part of the project is the use of “Experiential Learning” through the realization of concrete experiments regarding scientific phenomena;



- Mission X-Train like an Astronaut is an international educational project for primary and middle schools having the goal of teaching the importance of physical exercises and nutrition to children aged between 8 and 12, thus encouraging them to learn by astronauts the principles of a healthy lifestyle;

- Communication and educational events - in 2012 ASI carried out the competition “Draw and Define Luca Parmitano’s mission” to promote ISS Mission 36/7, which will see Luca Parmitano on board the ISS for six months, starting from the end of May 2013; in 2012 ASI has also participated in other educational scientific events such as “Giornalisti nell’Erba”, Discovery on Film and the Genoa Science Festival: these events have allowed the agency to promote space science in an informal context with a simple vocabulary;

- Educational products- whose goal is to catch the attention of students. ASI realizes educational products such as comics, three dimensional puzzles, educational video games, an educational kit on

Earth Observation and Space Kids magazine. These products stimulate children’s curiosity and aim at involving young students in scientific issues and orienting their career choices.

ASI projects in high education field are addressed to university students and young researchers. Their goal is to support those who have already chosen to study technological-scientific subjects, enhancing their capabilities and promoting their cultural and professional growth.

In 2012 the main programs developed in the technological-scientific education field include the following initiatives:

- ASI/CRUI apprenticeship programs, which offer to graduated young people the chance to spend some time at ASI headquarters in Rome and Matera so as to carry out a period of apprenticeship aimed at giving them a concrete knowledge of the world environment, particularly in the aerospace field, with the ultimate goal of orienting their career choices; the program, realized through a framework agree-





ment, involves 41 Italian Universities and grants a scholarship following the Directive of Public Functions n. 02/05; in 2012, 15 interns from CRUI were accepted.

- Other internship programs : ASI carries out internship programs with private Universities such as LUISS, LUMS, and the Polytechnic of Bari for specific internships in Earth Observation field together with other institutions involved in highly specialized education such as SIOI and SISSA; in 2011, 12 internships derived from these agreements;

- Scholarship programs for highly specialized courses/masters and research work: ASI allows new graduates and young researchers to participate in specialized courses, such as summer schools and masters, giving them the possibility to carry out activity of research in the field of interest of the agency. ASI grants scholarships for Alpbach Summer School, organized by the Austrian Space Agency (3 scholarships), for the Summer School in Space Transportation organized by the Communauté Villes Ariene in collaboration with “La Sapienza”

University and ISSNAF; On 26th March, following decree n. 034/2010, an ASI-ISSNAF agreement was signed for the programming of high technological -scientific education activities addressed to specialized university students; ISSNAF is a no-profit organization which promotes the exchange of knowledge between researchers and scholars in Italy and North America, through the assignment of scholarships and the identification of significant research opportunities for the academic and industrial world; in 2012 two scholarships were assigned (after a process of selection) so as to give to two deserving specialized University students the possibility to spend 2 months as interns in American research centers and labs in order to study scientific subjects of interest to ASI. The scholarships also include the costs of the journey, stay and insurance.

- Master in Technologies, for Space Remote Sensing organized by ASI and the Polytechnic of Bari (6 scholarships) and Master in Space Science and Technology organized by the University of “Tor Vergata” in Rome (4 scholarships): ASI has also given a scholarship for a project of research dealing with in-



ternational relations and strategies at ESPI in Vienna;

- Program for PhD research: in 2010 ASI started a new scholarship for a PhD research in order to promote the development of research on subjects of its own interest in the best PhD schools within Italian Universities; 10 scholarships were given to 10 selected schools; in 2010, 5 scholarships were awarded to students with adequate CV for the study of subjects of interest for the Agency; the other 5 were awarded on the following academic year due to the lack of suitable candidates;

- Voucher programs for high education and research activity – POR, Basilicata 2007/13: in 2011 ASI ended its involvement with this POR, initiated in 2009 in collaboration with the Region of Basilicata; ASI welcomed 5 young researchers at the Matera headquarters, for the study of 5 vouchers for the Earth Observation project.



