

VRI SPACE UPDATE

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1. Galileo & GMES, the key programmes of Europe in space for worldwide services

• Antonio Tajani, ‘Mr. Space’ of the European Commission Barroso II, about the future of space in Europe

Since 9 February, the Barroso II Commission, after being approved by the European Parliament, is operational. As planned, Italian Antonio Tanjani, who was the Commissioner for Transport in the previous Barroso Commission, is the new Commissioner for Industry and Entrepreneurship. He is responsible for the management of the two key programmes, with global dimension, of the Union in space: GMES (Global Monitoring for Environment & Security) with the Sentinel family of operational remote sensing satellites, Galileo, a civilian (dual-use) positioning system with a constellation of navigation satellites. Both programmes, which will be funded with a total amount of some 5 billion € until 2014, are the major efforts of Europe in space applications to efficiently serve the world community for better safety and for greater security.

A few days before his other appointment in the Commission, A. Tajani was interviewed by the French business daily “La Tribune” about his vision of the future for Europe in space.

- Insisting on the recent change due to the Lisbon Treaty: “Now, the so-called “Europe’s space policy” is a legal reality. For this reason, the whole strategy of Europe in space will be under the authority of the same Commissioner. We are putting together Galileo, GMES and EGNOS as well as all activities concerned by space, in the single portfolio of the Industry.”
- About the role of the industry in Europe: “I believe that space is a great challenge for the industry. It is the future. The key which opens a new industrial policy is the innovation. Without that, we are unable to maintain a industrial system which can compete with China, India, USA, Brasil.”
- About the priorities of Europe in space: “Before late this year, I will issue a paper about space to define a European strategy. Space is not only Galileo. In the space domain, we have a lot of competences, such as the research and the action against climate change. The role of the Union will not prevent the member States from developing their own programme of activities in space. But I consider that the national policies will be too restricted to face the challenges of the future against our competitors who are also our partners. We need a strong policy of Europe in space.”

- About the role of ESA in the Galileo programme: “We asked ESA for managing the call for proposals, for selecting the best offers and for signing the contracts. ESA is responsible for these crucial tasks under the control of the Commission. The final decision is always made by the Commission. It is a political decision”.
- **Jean-Jacques Dordain: ESA facing budgetary constraints for its activities during the next two years, but with hopes in 2010 to go ahead with two promising programmes (Ariane 6 concept, EDRS)**

“We are entering a new decade during which space will bring more science and services to the citizens”. This statement was made by Jean-Jacques Dordain, ESA Director General, in his speech at 2010 breakfast meeting with the media. During 2009, Europe achieved a lot of successes in space, which showed its influent role at an international level. Last year, ESA (European Space Agency) started five missions particularly useful for the global community of scientists: the Herschel and Planck observatories put in L2 for astrophysics and cosmology research, the Earth Explorers GOCE and SMOS for environmental monitoring measurements and the micro-satellite PROBA-2 for solar observations and “space weather” measurements.

With two astronauts in the ISS (International Space Station) - Belgian Frank De Winne with OasISS mission from 29 May to 1st December, Swedish Christer Fuglesang with AIISSé mission from 31 August to 8 September - and with many experiments managed by European laboratories and institutes, ESA was an efficient co-owner of the orbital infrastructure. The Columbus module was intensively used for scientific and technological purposes. ESA astronaut De Winne, member of the first 6-people became the first non-American non-Russian commander of the station during 44 days.

However, during the next two years - before the ESA Ministerial Council planned to take place late 2011 or early 2012 in an Italian city - ,the ESA Director General has to face some financial hurdles for programme management, because of budgetary contribution shortfalls from a number of ESA member States. **The ongoing financial crisis has provoked a cash crunch, forcing ESA to freeze spending at 2009 levels through 2011 and to slip anticipated schedule in the development and payment of current activities.** J.J. Dordain is confident that there will be no cancellation of any programmed missions. During 2010, in spite of payment freeze, ESA hopes to go ahead with two challenging activities for the future: the studies of Ariane 6 concepts (in cooperation with CNES Launchers Directorate) and the

development of the EDRS (European Data Relay Satellite) system through PPP (Public Private Partnership).

- The Ariane 6 concept, studied for the European transportation system of the 2020's, refers to a French proposal made on 18 May 2009 in Prime Minister F. Fillon report "*L'enjeu d'une politique européenne de lanceurs: assurer durablement à l'Europe un accès autonome à l'espace*" in order to meet the requirements of Arianespace service & solutions. This report notes: "*The historic leadership taken by France in the launcher domain legitimates a French initiative. Such initiative is expected and would be welcome by most of France's partners.*" The European launcher of the next generation would offer a high modularity, the reliable capacity to launch 3 to 6 tons (single payload) into GTO, a great competitiveness at all levels - from development to operations - and a flexible upper stage with restartable engine.
- The European Data Relay Satellite program was tentatively approved by the ESA governing Council in 2008, but the space agency was tasked with resolving unanswered questions about the system and raising more money for the project before receiving the final go-ahead. The European Space Agency expects to finalize a proposed data relay satellite system and secure enough funding to build the network this year. "*Why have we waited until 2010? That's quite simply because we are in the process of developing the EDRS system working together with a private operator,*" Dordain said.

The EDRS network would include two communications payloads mounted on commercial satellites, and at least one dedicated spacecraft. The relays would be spread around the world in geosynchronous orbit to provide near-global coverage for satellites at lower altitudes. The first user for the EDRS satellites would be the operational spacecraft of the GMES program, including the planned Sentinel Earth observation spacecraft. The Artemis communications satellites will probably be used as a test bed for data relay technologies and precursor to the EDRS project. Artemis is expected to be operational until 2013, when the first EDRS spacecraft is planned for launch.

"What we have to do is select the private operator who will be our partner in the EDRS program," Dordain said. *"The selection process always takes a certain amount of time, but this selection will be finalized at the end of June."* Astrium, Eutelsat and Telespazio announced their interest to compete for the job. However, SES could be candidate to welcome additional S-band EDRS payloads on its geosynchronous communications & broadcasting satellites; it already gets contracts of the European Commission to host L-band payloads for EGNOS (European Geostationary Navigation Overlay Services) on Sirius-5 in 2011 and on Astra-5B in 2013. ESA hopes that member States will provide at

least further 60 million € to the EDRS programme by September. The signature of the PPP contract would follow in November, assuming everything falls into place in time.

- **OHB-System, the great winner of satellite contracts for Galileo FOC (Full Operational Capability) and for MTG (Meteosat Third Generation) to be operated by Eumetsat with GMES payload**

Two major contracts for space systems related to public global ventures of Europe in space were announced during the last three months. In both competitions - linked to the Galileo and GMES programmes of the European Union -, OHB-System appears as an influent partner of the winning team against Astrium. The Bremen enterprise, managed by the Fuchs family, is becoming a major member in the European club of satellite manufacturers, along with French-German Astrium (which owns British SSTL/Surrey Satellite Technology Ltd) and French-Italian Thales Alenia Space. Note that OHB-System was a serious candidate to purchase Verhaert Space from QinetiQ.

Galileo FOC (Full Operational Capability). In December, a framework contract was signed with both German OHB-System and Astrium to pave the way for the eventual provision of a maximum of up to 32 navigation satellites. OHB-System as prime contractor (responsible for the bus, for integration and test activities), with SSTL as payload contractor, was selected to win the first order of 14 satellites for a value of 566 million €. Galileo FOC spacecraft have to be put in orbit by Soyuz rockets from French Guyana between late 2012 and mid-2014 to allow pre-operational services for the Galileo system. On January 26, the contract was signed at ESTEC by ESA, acting for the first time on behalf of the European Commission. The remaining satellites for the operational Galileo constellation will be procured in subsequent work orders, each time from either OHB-System or Astrium, depending on which company provides the most advantageous offer. For the first group of 14 operational satellites, the offer of OHB-System was the less expensive one; a difference of some 100 million € was reported.

MTG (Meteosat Third Generation), as part of the Sentinel-4 mission of the GMES (Global Monitoring for Environment & Security) programme. Thales Alenia Space associated with OHB-System for the provision of the geosynchronous Luxor platform was declared as the winner of the industrial competition against Astrium. An ESA tender-evaluation board, acting for the Eumetsat operator, reviewed three times - in November, December and early February - the two bids before finalizing its selection. However, political pressure (especially from Germany which looked for getting the prime contract through Astrium). The MTG contract for a total of six meteorological satellites -

four imagers and two sounders (+ Sentinel-4 payload on each) planned for launches between 2016 and 2025 – has a total value around 1.4 billion €. The final decision was delayed until March 17. French CNES called for an outside audit on the MTG evaluation process.

- **The French space agency CNES looking for 1 billion € of Government Bond “Le Grand Emprunt” as economy stimulus package, to develop innovating ventures with space systems for the society**

On February 11, CNES President Yannick d’Escatha met the media for a presentation of the current missions and the prospective orientations of France in space: *“CNES is ready to challenge new ambitions in its second multi-year contract with the State around a vision of space made by constellations of satellites (guardian angels) to keep our planet a living place for the generations of the future and by spacecraft (great explorers) to explore the Cosmos as automated pioneers (robots) before manned systems.”*

The French space agency is counting on an unforeseen cash injection of up to \$1 billion from France’s economic stimulus package - “Grand Emprunt” law to be approved by the French Parliament in March - to enable it to start programmes that otherwise would not be funded, even as it finances and reduces its debt (325 million €, because of the French backing of the Ariane 5-ECA recovery plan after December 2002 failure) to the European Space Agency (ESA) until 2015. The planned government bond issue sets aside up to 750 million Euros (\$1.03 billion) for space-related programmes to sustain and guarantee high-tech R & D efforts in France. This available money is divided into two parts:

The main part which concerns space programs, intended for **CNES-led projects**, represents a total investment of about 500 million € to be divided among proposals set by CNES as priorities for this decade:

- the development of **Microcarb**, a carbon dioxide-monitoring micro-satellite to be launched in 2013, and of **CHARME** (CH₄ Atmospheric Remote Sensing Explorer) micro-satellite to monitor atmospheric methane and to be built with Germany for launch in 2014;
- the French contribution to the NASA-led **SWOT** (Surface Water Ocean Topography) ocean-altimetry satellite (mission of the Jet Propulsion Laboratory, to prepare the successors of Jason oceanography satellites);
- the co-financing of hardware or the advance purchase of capacity for the commercial **SPOT-6 and SPOT-7** Earth Observation satellites under construction by Astrium Satellites to continue SPOT Image products and services;

- the start of design work on a next-generation launch vehicle, called **Ariane 6**, to succeed today's heavy-lift Ariane 5 rocket. This Ariane 6 preparatory work will be presented to the ESA Ministerial Council in 2011 or 2012 as first step to the development of the launcher for the 2020's.

The second funding line of 250 million Euros is devoted to spreading **broadband access** to regions of France outside current terrestrial-broadband coverage. CNES is proposing a Ka-band satellite called **Megasat** to provide low-cost broadband access. Note that the ATHENA-FIDUS broadband satellite, jointly developed by France and Italy, is mainly for dual-use applications, especially for military purposes; Belgium, interested in this mission, has not yet taken any decision about its contribution.

- **NEREUS Position Paper: a regional approach to the European Navigation Satellite System (GNSS) programme**

While the European GNSS, with EGNOS (European Geostationary Navigation Overlay System) and Galileo navsat constellation, is taking form to provide users with high accurate positioning measurements, the NEREUS (Network of European Regions Using Space Technologies – leading regions are Midi Pyrenees and Bavaria, while members in Belgium are Wallonia and Brussels Capital (but not yet Flanders) - expresses its views about the current situation. In a Position Paper describing the regional approach to European GNSS applications, it defines three key priorities:

- **Priority 1: reduction of uncertainties.** Regretting the loss of time and the lack of impetus during the last two years, NEREUS suggests that binding commitments should be made very soon on Galileo to recover and restore the confidence of the industry and user organisations.
- **Priority 2: capabilities development and support.** NEREUS recommends the opening of continuous discussions with the relevant European bodies (GSA, ESA, EU institutions) on the link between R & D and the operational phase in order to improve the involvement of regional and local authorities in the GNSS projects, to increase the R & D Framework Programme and the European Regional Policy Funds.
- **Priority 3: improved communication.** NEREUS insists on its role to provide a unique route for engaging actions with local citizens, businesses and end-users. It can play a catalyst role in promoting ongoing activities in the area of GNSS services and can provide a forum for developing information and education materials for the needs of the regions in the Union.

2. Belgium in space: promising results of PROBA-2, encouraging prospects for the PROBA family of technological micro-satellites

- **PROBA-2 not only a technological demonstrator but an efficient observatory of the Sun and of the “space weather” around the Earth**

Since its launch on 2 November 2009 with a Russian 2-stage Rockot booster, the technological PROBA-2 (Project for On-Board Autonomy) microsatellite of 130 kg follows the successful path of its predecessor, the PROBA-1 of 94 kg. Launched in October 2001 by an Indian PSLV, this first spacecraft “made in Belgium” by Verhaert Space for ESA is still operated by ESA station in Redu to make earth observations of specific sites. Both miniaturized compact spacecrafts, sized as a washing machine, are developed in the framework of the GSTP (General Support Technology Programme) of ESA. Packed with some 17 technological devices for in-orbit testing, it also provides, with four scientific instruments, new views of the Sun and measurements of its activity on Earth’s ionosphere.

The first results were presented on January 26 at the Royal Observatory of Belgium. They showed the efficiency of PROBA-2 as solar observatory (for the continuity of SOHO/Solar and Heliospheric Observatory imagery) and as tool for “space weather” data. The PROBA-2 mission has a cost of some 21 million € (including ground operations of 1 million € and launch price of 870 000 €). For David Southwood, ESA Director of Science & Robotic Exploration, who insisted on the Belgian competences in the observations of the Sun, “*PROBA-2 is a beautiful mix of science and of technology. At the same time, it has a look on our star, the immediate surroundings of the Earth and its effects of the Sun on the life. It demonstrates how to improve technologies in the space age. Its instruments are evolved from those on SOHO and are testing detector and software technology required for Solar Orbiter, envisaged as Europe’s next big solar mission*”.

- **The PROBA family: towards a great variety of “lightsat-type” missions for space innovations**

The successful development of the first two PROBA micro-satellites made Michel Courtois, ESA director of Technical and Quality Management, particularly happy with what the “made in Belgium” spacecrafts of Verhaert Space (with Spacebel software) are achieving in orbit for low-cost missions and with COTS (Components Off The Shelf) utilization. He is confident about the future of the PROBA concept as “lightsat-type” solution: *“The main problem is to find economical launch opportunities for the next missions in preparation”*. Among these missions, he gave some indication:

- PROBA-V(egitation) of 150 kg, carrying a very compact multispectral instrument to monitor the global vegetation - as the continuity, with higher resolution, of the Vegetation-1 and Vegetation-2 sensors onboard SPOT-4 and SPOT-5 -, will be launched in 2012.
- PROBA-3, developed with CNES, will consist of two micro-spacecraft to validate the metrology and actuation techniques for formation flying tests to be useful for astronomical observations. This very sophisticated mission – the “made in Belgium” PROBA will be the larger satellite with solar telescope to be used for coronagraphy, while the other craft is maneuvered to mask the disc of the Sun. Its launch is planned in 2014.
- PROBA ALTIUS (Atmospheric Limb Tracker for the Investigation of the Upcoming Atmosphere) is proposed by the BISA (Belgian Institute for Space Aeronomy) to fill the gap of atmospheric data when the giant Envisat will stop its observations (in 2013-2014). Its spectral imager capable of observing the atmospheric limb in the ultraviolet, visible and near-infrared bands will measure chemical profiles of the atmosphere with high accuracy (in solar and stellar occultation modes).
- PROBA IP (Interplanetary Probe) is dedicated to the exploration of NEOs (Near Earth Objects).
- PROBA Altimetry is studied to evaluate and validate the performances of Galileo navsat measurements.
- PROBA Inspector, with high agility for orbital maneuvers, will carry a miniaturized camera to inspect satellites or debris around the Earth.

“The real challenge for ESA is to develop 2 to 3 PROBA missions at the same time”, Courtois concluded.

3. Table showing Europe as the leading player in the world for the development and utilization of remote sensing satellites

Nowadays and mainly during this decade, Europe will reinforce its significant role as player in the availability of remote sensing satellites for a great variety of earth observations (optical and radar imagery, altimetry and laser measurements from space):

- ESA is developing the Earth Explorers for scientific purposes and the Sentinel spacecraft for operational services in the framework of the GMES programme, as well as the PROBA V(egétation) microsatellite to continue the Vegetation imagery mission for VITO in Belgium.
- Eumetsat is operating spacecraft for weather forecasts and climatic data (Meteosat in geosynchronous orbit, Metop/EPS in polar orbit) and for oceanography (Jason in cooperation with NOAA in USA).
- Commercial ventures are competing to provide the most accurate data to public users for geo-information systems, environment monitoring and security management purposes: Astrium Services through SPOT Image (optical sensors) and Infoterra (SAR observations) subsidiaries, e-Geos (Telespazio) with the Cosmo-SkyMed constellation of radar satellites, DMCII (Disaster Monitoring Constellation International Inc) with medium-resolution EO micro-satellites, RapidEye with its constellation of five optical observatories, ...
- National governments are giving a strong support to the industrial development of dual-use remote sensing satellites (Pleïades in France, Ingenio in Spain, Cosmo-SkyMed in Italy, Goktürk in Turkey) and of military very high-resolution “spy satellites” (Helios-2 in France, SAR-Lupe in Germany, Paz in Spain).

In italics: the non-European players for earth observations from space, with impact on the market of remote sensing satellite data in Europe.

COMPANY (Country) Address (Web site)	Main characteristics (situation as of 1 st January 2010)
ASTRIUM SERVICES (France/UK/Germany) 6, rue Laurent Pichat, F-75016 Paris, France (www.astrium.eads.net)	Owner of Infoterra and of SPOT Image, leader in Europe for optical and radar observations from space. Looking for governmental contract for geo-information system data (3 satellites in operation, 3 in construction)
DEIMOS IMAGING (Spain) Campus Miguel Delibes, Paseo de Belen, 1, E-47011 Valladolid, Spain (www.deimos-imaging.com)	Subsidiary of Deimos Space (part of Spanish Elecnor Group) to participate to the DMC (Disaster Monitoring Constellation) through contract with SSTL (1 remote sensing microsatellite in operation, 1 in preparation)

<p>DIGITALGLOBE (USA) 1601 Dry Creek One, Suite 260, Longmont, Colorado 80503, USA (www.digitalglobe.com)</p>	<p><i>Earth imaging and information company providing highest resolution (0.60 m) and multispectral (2.4 m) imagery with QuickBird satellite since October 2001. With the pair of more agile and fully operational WorldView satellites - WorldView-1 and WorldView-2 since September 2007 and October 2009 -, able to produce 0.50 m-resolution (panchromatic) imagery. ClearView contract with National Geospatial-Intelligence Agency (NGA). Distribution agreement with European Space Imaging (EUSI). (3 satellites in orbit)</i></p>
<p>DISASTER MONITORING CONSTELLATION INTERNATIONAL IMAGING (United Kingdom) Tycho House, Surrey Research Park, 20 Stephenson Road, Guildford, Surrey, GU2 7YE, United Kingdom (www.dmcii.com)</p>	<p>Constellation consisting of medium-resolution remote sensing micro-satellites designed and built by Surrey Satellite Technology Ltd (SSTL); individually owned and operated by Algeria, Nigeria, Turkey (no more operational), United Kingdom (2), China, Spain (Deimos Imaging) in 2009. (6 satellites in operation, 2 in construction, 1 in project for Sri Lanka, up to 8 with higher resolution sensors for projected 2nd generation system)</p>
<p>E-GEOS (Italy) Contrada Terlecchie, I-75100 Matera, Italy (www.e-geos.it)</p>	<p>Joint venture between ASI (Agenzia Spaziale Italiana) and Telespazio to promote and commercialize radar imagery of the Cosmo-SkyMed X-SAR satellites. Strategic alliance with 4C Satellite Images & Technologies. Contract with Lockheed Martin for US National Geospatial-Intelligence Agency (NSA) (3 satellites in orbit, 1 in construction for launch in 2010)</p>
<p>EUMETSAT (Germany) Am Kavalleriesand 31 D-64295 Darmstadt, Germany (www.eumetsat.int)</p>	<p>Intergovernmental organisation (18 member States and 12 cooperating States) to establish, maintain and exploit European systems of operational satellites for meteorology, climate monitoring, global change observations, oceanography. Cooperation with NOAA for exchange of meteorological images and data. Optional programme of Jason satellites for oceanography data with precise altimeter. Possible operator of Sentinel-3 satellites (6 satellites in orbit, 5 in construction for operations until 2015, 4 Imager satellites + 2 Sounder satellites in preparation for MTG/Meteosat Third Generation, 2-3 post-EPS in project)</p>
<p>EUROMAP (Germany) Kalkhorstweg 53, D-17235 Neustrelitz, Germany (www.euromap.de)</p>	<p>Euromap Satellitendaten-Vertriebsgesellschaft mbH, subsidiary of GAF AG to provide data covering Europe from the fleet of Indian Remote Sensing Satellites, following commercial agreement with Antrix Corp and through cooperation with DLR. (IRS-1C/1D, Resourcesat-1, Cartosat-1/-2A in orbit; up to 4 in construction for launches from 2010 until 2012)</p>

<p>EUROPEAN SPACE IMAGING (USA/Germany/Turkey) European Space Imaging (EUSI): Arnulfstrasse 197 80634 Munich, Germany (www.euspaceimaging.co)</p>	<p>Global supplier of Earth information derived from space imagery (Ikonos imagery archives, WorldView and QuickBird) and aerial photography. WorldView Global Alliance with DigitalGlobe to market WorldView images of 0.46-m resolution/panchromatic and of 1.84 m/multispectral (see DigitalGlobe: 3 in orbit)</p>
<p>GEOEYE (USA) <i>Orbimage/Space Imaging. 21700 Atlantic Boulevard Dulles, VA 20166, USA (www.geoeye.com)</i></p>	<p><i>Result of Space Imaging merged with Orbimage: the world's largest commercial satellite imagery company, to operate a current constellation of three remote sensing satellites. Global provider of geospatial imagery products and services with digital remote sensing satellites, complemented by data from other optical, aerial and radar sources. GeoEye-1 launched in September 2008 for 0.41 m-resolution imagery. (OrbView-2, Ikonos and GeoEye-1 in orbit, GeoEye-2 in construction for 2012-2013)</i></p>
<p>IMAGESAT INTERNATIONAL (Israel) 2 Kaufman Street, 17th Floor, Tel Aviv 61500, Israel - Imagesat Cyprus : 45 Ayias Paraskevis, Office 1A, Yermasoyia, Limassol 4044 Cyprus (www.imagesatintl.com)</p>	<p><i>Commercial provider of high-resolution, satellite earth-imagery collected by its family of Earth Remote Observation Satellites (EROS). Exploitation of EROS-A in orbit since December 2000 and collecting 1.9-m resolution images. EROS-B launched in April 2006 for 0.70-m resolution images. (2 satellites in orbit, 1 in construction)</i></p>
<p>INFOTERRA (Germany/United Kingdom/France) - InfoTerra GmbH, D-88090 Immenstaad, Germany - InfoTerra Ltd, Atlas House, 41 Wembley Road, Leicester, Leicestershire, LE3 1UT, United Kingdom -InfoTerra SAS, 15, avenue de l'Europe, F-31522 Ramonville Saint-Agne, France (www.infoterra-global.com)</p>	<p>Remote sensing companies of Astrium (managed through Astrium Services) to provide geographical information solutions – in digital form and for dual use - by acquiring and processing of airborne and satellite data. Developing the TerraSAR system of commercial radar satellites to enhance earth observations. (1 optical micro-satellite [Topsat] and 1 radar satellite [TerraSAR] in operation, 1 radar satellite [Tandem-X] in construction for launch in May 2010)</p>
<p>NOAA (USA) 14th Street & Constitution Avenue, NW, Room 5128 Washington, DC 20230, USA (www.noaa.gov)</p>	<p><i>National Oceanic and Atmospheric Administration of USA, conducting research and gathering data about global situation of oceans, atmosphere, environment, managing the National Weather Service, the National Environmental Service Data and Information Service, the National Ocean Service. Partnership with Eumetsat for exchange of images and data, for the oceanography programme of Jason satellites. (4 satellites in geostationary orbit + 5 in polar orbit + Metop of Eumetsat; in construction: 3 + 2 for geostationary orbit, 3 + 2 ? for polar orbit)</i></p>

<p>RADARSAT INTERNATIONAL /MDA's GEOSPATIAL SERVICES (Canada) MDA, 13800 Commerce Parkway MacDonald Dettwiler Building, Richmond, British Columbia V6V 2J3, Canada (www.rsi.ca)</p>	<p><i>Provider of information solutions combining earth observation data from optical remote sensing satellites and from its Radarsat system which offers all-weather, day-and-night C-band SAR (Synthetic Aperture Radar) monitoring. Radarsat-2 launched in December 2007. (2 in orbit, Radarsat Constellation of 3 mini-satellites in construction for launch in 2012-2014)</i></p>
<p>RAPIDEYE (Germany) Molkenmarkt 30, D-14776 Brandenburg an der Havel, Germany (www.rapideye.de)</p>	<p>Satellite-based Geo-Information System, combining daily revisit and multispectral observations, thanks to an operational constellation of remote sensing mini-satellites for 6.5-m resolution images. Cooperation with MDA in Canada (payload) and SSTL (platform & integration) in the United Kingdom. (5 identical satellites in orbit, launched in August 2008 by the same Dnepr rocket)</p>
<p>SPOT IMAGE (France) 5, rue des Satellites, BP 14 359 F-31030 Toulouse Cedex 4, France (www.spotimage.com)</p>	<p>Worldwide supplier of geographic information products and services derived from the multispectral imagery of French SPOT earth observation satellites. Owned by EADS Astrium and operated by Astrium Services. Distribution agreements with KARI in South Korea for Kompsat-2 data, with NSPO in Taiwan for Formosat-2 data. (2 satellites in operation, 2 Pleiades in construction for launch in 2011-2012, SPOT-6 & SPOT-7 in construction for launch in 2013-2014)</p>
<p>TELESPAZIO (Italy) Via Tiburtina, 965, I-00156 Roma, Italy (www.telespazio.it)</p>	<p>Subsidiary of the Italian-French Group Finmeccanica-Alcatel, specialized in satellite applications, including earth observations from space. Offering a complete range of solutions from acquiring and processing space data to the distribution of specific products and services (via Eurimage). Operating company for the Cosmo-SkyMed constellation of radar satellites, with e-Geos subsidiary. Agreement with GeoEye to market Ikonos and GeoEye imagery. Contract with Lockheed Martin to provide radar images to US National Geospatial-Intelligence Agency (NSA) (3 satellites in orbit, 1 in construction for launch in 2010)</p>
<p>TUBITAK UZAY (Turkey) Space Research Technologies Institute, ODTU Yerleskesi, 06531 Ankara, Turkey. (www.uzay.tubitak.gov.tr)</p>	<p>Member of the DMCII constellation as operator of the Bilsat-1 remote sensing satellite (mission completed in 2006). Indigenous development of the Rasat research mini-satellite for earth observations. (1 in orbit but decommissioned, 1 in construction for launch in 2010, 1 Goktürk in preparation for 2013)</p>

<p>VITO/PEGASUS (Belgium) VITO-TAS (Teledetectie en aardobservatieprocessen) Boeretang 200 B-2400 Mol, Belgium (www.vito.be)</p>	<p>International center for Vegetation data processing and archiving. Developing the ultra-light Mercator UAV (Unmanned Aerial Vehicle) for long-duration remote sensing missions. Operator of “made in Belgium” PROBA-V(egétation) mini-satellite to continue Vegetation observations. (1 in construction for launch in 2012)</p>
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(c) Space Information Center/Belgium

Annex 1: ESA Budgets for 2010 [2009]

Breakdown by Programmes

In order of financial importance	in €millions [thousands]
<i>Scientific programme (mandatory activities)</i>	409.5 [434,449]
<i>Human Spaceflight (ISS construction and exploitation)</i>	330.4 [386,958]
<i>Launchers (Ariane 5 ECA, Vega, ARTA, Ariane Infrastructure, CSG)</i>	566.6 [659,103]
Earth Observation Programmes (Envisat utilization, Earth Explorers, GMES/Sentinel, Eumetsat MTG)	708.4* [586,151]
<i>General Budget (ESA Headquarters, ESTEC, ESOC, ESRIN, network)</i>	211.4 [239,479]
Associated to General Budget	196.7 [196,760]
Telecommunications Programmes (ARTES, Alphasat, Small GEO...)	325.9 [319,459]
Navigation Programmes (EGNOS, Galileo/GNSS)	714*[387,249]
Part financed by Third Parties outside EU (Eumetsat, Arianespace,...)	206.1 [47,641]
<i>Technology GSTP & Prodex (PROBA, R & D in new technologies)</i>	84.8 [112,505]
<i>Microgravity (experiments, instrumentation, missions)</i>	79.9 [93,696]
<i>Exploration (ExoMars...)</i>	102 [115,505]
SSA (Space Situational Awareness) initiative	9.9 [9,000]
ECSA (ESA Cooperating States Agreement with Hungary, Romania, Poland, Estonia, Latvia, Cyprus)	5.2 [3,206]
TOTAL	3,744.7 [3,591,781]

in heavy characters: the main increases for funding in 2010 (earth observation, navigation, telecommunications, space situation awareness)

In italics: the main decreases for funding in 2010 (launchers, human spaceflight, scientific programme, microgravity, exploration, technology GSTP & Prodex)

*** Includes Third Parties, mainly the European Union: navigation with Galileo, earth observation with GMES/Sentinel, telecommunications with PPP, especially Alphasat with Inmarsat, SmallGEO with Hispasat, ...**

Annex 2. 2010 income from participating States

(member and associated members) [compared to 2009]

In order of financial importance	% [2009]	in €millions [thousands 2009]
<i>France (through CNES)</i>	<i>18.2 [25.41]</i>	<i>681.4 [716,285]</i>
<i>Germany (through DLR)</i>	<i>16.67 [23]</i>	<i>625.8 [648,330]</i>
Italy (through ASI)	9.9 [13.11]	370 [369,527]
United Kingdom (through BNSC)	6.8 [9.56]	254.7 [269,401]
Spain (through CDTI)	5.2 [6.53]	195.2 [184,000]
Belgium (through Belspo/OSTC)	4.3 [5.71]	160 [161,000]
Netherlands (through NSO)	2.5 [3.51]	95.2 [99,000]
Switzerland (through CFAS)	2.4 [3.35]	91 [94,400]
Norway (through Norsk Romsenter)	1.6 [1.58]	60.2 [44,607]
Sweden (through SSC)	1.4 [1.99]	53 [56,031]
Austria (through FFG)	1.4 [1.54]	50.6 [43,355]
Denmark (through DTU)	0.8 [0.99]	30.7 [27,807]
Canada (through CSA)	0.6 [0.78]	20.8 [22,133]
Finland (through TEKES)	0.5 [0.71]	18.8 [20,000]
Portugal	0.5 [0.56]	18.8 [15,671]
Greece	0.4 [0.51]	16.2 [14,500]
Ireland	0.4 [0.47]	15.1 [13,280]
<i>Luxembourg</i>	<i>0.3 [0.45]</i>	<i>10.9 [12,800]</i>
Czech Republic	0.3 [0.24]	10.2 [6,871]
<i>Subtotal</i>	<i>74.2 [78.48]</i>	<i>2,778.6 [2,818,998]</i>
Income from European Union	20.2 [NA]	754.8 [NA]
Income from ECSA (Hungary, Romania, Poland, Estonia, Latvia, Cyprus)	0.1 [NA]	5.2 [NA]
Other Income (Arianespace, Eumetsat...)	5.5 [NA]	206.1 [NA]
TOTAL	100 %	3,744.7 [3,591,781]

In heavy characters: the main increases for funding en 2010 (Spain, Finland, Portugal, Czech Republic)

In italics: the main decreases for funding in 2010 (France, Germany)