VRI SPACE UPDATE

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Europe's strategy

- **ESA growing up as the official agency of the European Union (EU) for space science and global applications**. With the permanent installation and current utilization of its Columbus laboratory, along with the re-supply capability of its Automated Transfer Vehicle (ATV), ESA is able to act as the co-owner of the International Space Station that is the largest facility for manned spaceflights. 2008 represents for ESA a significantly busy year with up to seven major missions to be launched and operated: Columbus (in orbit since February) and ATV (since March), experimental navsat GIOVE-B (since April), Earth Explorer GOCE (planned for launch in September), Herschel & Planck observatories (in December ?), and the ultimate NASA maintenance of Hubble Space Telescope (in October).

This year will also be marked by the ESA Ministerial Council of The Hague, in the Netherlands (25-26 November). This high-level conference of the 17 ESA member States plus the Czech Republic (which will sign the ESA Convention in June), plus Norway, Switzerland and Canada (as Cooperative State), plus representatives of the European Commission, has to decide the new challenges, along with budgetary resources, of the space programme for the 2009-2011 timeframe.

Following recent statements, the ESA Council of The Hague will be a transitional one. It is expected to upgrade for completion many programmes which have been approved in December 2005 at Berlin (such as GMES/Copernicus? and ExoMars Plus), to clear the way towards more important decisions for the next Ministerial Conference in 2011: advanced systems for space transportation, technology development for international ventures in manned spaceflight, robotics of new missions for the exploration of the solar system, ... It will implement the facts that ESA is mainly linked to the EU policies (because of the Treaty of Europe) and that its members will increase from 18 to 22, even 24 States in the next three years. It will endorse the reforms ESA Executive proposes to make its management as intergovernmental organization more efficient: decision process without the unanimous consent, less complicated allocation of the financial resources, revision of the industrial policy for the contracts between member States.

ESA must be considered as the main direct link of the European Union with the European industry of space systems to manage the satellite elements for the Galileo constellation of civilian navigation, for the GMES products and services (Sentinel spacecraft), for the development (through PPP's/Public-Private Partnerships) of innovative satcom solutions to provide broadband and mobile communications. Priority is given to applications which have to serve the daily life of each European citizen at a global scale and to meet the society-oriented needs and worldwide policies of the European Union (sustainable development, climate change monitoring, defence and security, humanitarian missions …).

- **Europe, the strong global leader in space business**

Let's combine the high revenues from space, which are achieved by Europe-based operators of communications and broadcasting satellites in geosynchronous orbit: SES in Luxembourg (with SES Astra, SES Sirius and SES NSS), Eutelsat in Paris, Hispasat in Madrid, Inmarsat in London, Telenor Satellite in Oslo, Hellassat in Athens and Nicosia, and – from 2009 on – Avanti Communications in London, Solaris Mobile in Dublin. All together, these operators 'control' half of the world market in the field of space systems, dedicated to digital broadcasts and broadband links.

Also, in the field of earth observation, Europe is a key player with the greatest number of commercial remote sensing satellites: optical imagery with the SPOT satellites of CNES (Centre National d'Etudes Spatiales) and SPOT Image, the Disaster Monitoring Constellation (6 DMC micro-satellites) of Surrey Satellite Technology Ltd (SSTL), radar imagery with TerraSAR-X of German Infoterra, Cosmo-SkyMed (2 satellites) of Italian e-Geos. Within the next five years, some 18 operational remote sensing satellites for dual-use missions will be launched in Europe: 3 Sentinels of ESA for the GMES programme of the EU (Sentinel-1A for SAR observations, Sentinel-2A for multi-spectral imagery, Sentinel-3A for ocean and medium-resolution land monitoring), 5 mini-satellites forming the German RapidEye constellation, the Spanish DMC-Deimos, other 2 Cosmo-SkyMed (radar), 1 TanDEM-X (radar) for Infoterra, 2 Pleïades (optical sensors) of CNES, Ingenio/SEOsat of Spain, PROBA V(egetation) of Belgium … EO (Earth Observation) satellites,

equipped with high-accuracy radar, are developed for military purposes: 5 SAR-Lupe in Germany, Paz/SEOSAR in Spain …

ESA announced some opportunities to develop new PPP (Public-Private Partnership) contracts with the commercial operators of communications/broadcasting satellites and of remote sensing spacecraft, as well with the four manufacturers of satellites in Europe: EADS Astrium, OHB-System, SSTL and Thales Alenia Space. It is looking for a PPP structure to finance the EDRS (European Data Relay Satellite) system. Some PPP ventures are already in place to exploit EO (Earth Observation) satellites, such as TerraSAR and, later, TanDEM-X (Infoterra), SPOT (SPOT Image), RapidEye (with DLR)…

- **Regional space plan in France.** Toulouse Space Show'08, consisting of an international exhibition and three major conferences (European Navigation, Frequency & Time, Space Applications), took place from 22 to 25 April. Some 1,800 people attended this event and the announcement was made to renew it in March 2010. Two VRI members, Septentrio (navsat receivers) and Xenics (infrared sensors), participated to the exhibition focusing on the use of space systems for socio-economic and regional development throughout Europe.

During Toulouse Space Show, the Region of Midi-Pyrénées endorsed a space plan. Described itself as the first space expertise pole in Europe with some 9000 jobs (directly concerned by astronautics) and two major industrial sites (EADS Astrium for the development, integration and testing - within Intespace - of satellites for communications, broadcasts, observations, science…, Thales Alenia Space for the design and manufacture of payload for spacecraft which are assembled and tested in Cannes). This plan was signed by the French Minister for higher education and research, by CNES (French space agency), some 50 enterprises, institutions and associations. It aims at harmonizing the actions of all the economic players involved in the development of the space sector in the South-Eastern part of France, at facilitating the development of the regional economy, notably in the field of space applications, at preserving its rank of pole number one for Europe in space.

Launch services

- **Which long-term future of heavy Ariane 5 booster?** A group of European pioneers of the Ariane programme in the 70's and 80's has

sent a letter regretting the uncertain future of Ariane launch services to the General Director of ESA, the Chairman of CNES and the CEO of Arianespace. Among them: French Frédéric d'Allest (founder of Arianespace), Yves Sillard and Roger Vignelles; Belgian Raymond Orye (who was, at ESA, the head of the Ariane programme during 25 years); Swiss Peter Creola; Swedish Fredrik Engström; Italian Giuseppe Grande; German Hans Hoffmann, Horst Rauck and Hanspeter Schneiter. They asked ESA's Ministerial Council of the Hague for funding a strong programme to upgrade the existing Ariane 5-ECA - less than 10 tons in GTO (Geosynchronous Transfer Orbit) - with an improved avionics and with a new cryogenic upper stage using the restart able Vinci engine. This improvement will allow Ariane 5 to inject in GTO up to 12 tons or two spacecraft of 5.5 tons.

Manned spaceflight

- **Frank De Winne opening in 2009 the activities of 6-people crew in the International Space Station.** In late May, ISS partners - NASA (USA), Roscosmos (Russia), ESA (Europe), JAXA (Japan), CSA (Canada) have to agree the arrangement for the use of two "made by RKK Energia" Soyuz spaceships in order to guarantee the transport and emergency return of the station's crew when it doubles in size to six from May on next year. Annually, Soyuz spacecraft will transport two crews of three to the station, one launching in April and then one in May (the first one with Frank De Winne, who will work during six months in the ISS modules).

The April crew will return to Earth in October, reducing the ISS complement to three, but two weeks after their landing the launch of a third three-person crew will take place, bringing the station team back to full strength. Then, in November, the second team of three, launched in May, will depart, leaving the October team behind and again reducing the ISS to three members. But two weeks later, a fourth Soyuz with a 3-people crew will be launched to return the ISS to full strength again. This cycle will continue until the advent of the new Orion spacecraft, with a capacity of 4 to 6 astronauts, around 2015.

- **European project of manned spaceship to be promoted by EADS Astrium at Berlin Aerospace Show ILA 2008** (from 27 May 27 to 1st June). EADS Astrium Bremen is the manufacturer of the ATV (Automated Transfer Vehicle) spacecraft. The first unit, named "Jules Verne", achieved an important technological milestone with the

first fully automated docking – with laser beams – to the Russian Zvezda module of the International Space Station. Up to 4 further units will be produced for re-supply and maintenance flights, each to be launched every two years.

EADS Astrium, with some support of German Aerospace Center DLR, has designed a variant of its space station freighter, in order to accommodate a capsule, with heat shield, for 3 astronauts instead of the pressurized module. A mock-up of concept will be exhibited at ILA 2008, Berlin. Until now, Europe does not possess its own manned space transportation system and is reliant on the Americans and the Russians to get its people into orbit. If its development is decided in November by ESA Ministers at The Hague, the recoverable – but not re-usable – spaceship for human missions could be tested in 2013. It would fly with crew as early as 2017. This European CSTS (Crew Space Transportation System) will be carried into space by Ariane 5-ES from French Guyana.

Last info: on May 13th, Roscosmos, the Russian space agency, announced the signing with ESA of a technical agreement for the Euro-Russian development of a new manned spaceship for a crew of 6 people. Tests of this joint 20-ton vehicle, designed for missions to the ISS and around the Moon, are expected to begin in 2015. First manned flight with the most powerful Angara booster is planned in 2018 from the cosmodrome of Vostochny to be built in the Far East. No indication is given about the participation of the European space industry.

Navigation systems

- **Galileo going ahead with European Parliament legislative resolution of 23 April 2008 for the further implementation of the European satellite radio navigation programmes (EGNOS and Galileo)**. This vote of the Euro-deputies (607 "yes", 36 "no", 8 without advice) gives the political green light to the European GNSS (Global Navigation Satellite System) by defining the legal framework for contracts and efforts to the operational deployment in 2013.

The document specifies the financial envelope: "(20) The European Parliament and the Council have decided that the total estimated amount of the operating costs for the Galileo and EGNOS systems for the period 2007-2013 is 3.405 million Euro at current prices. 1.005 million Euro has already been foreseen in the existing financial

programming (2007-2013). This amount has been increased by an additional 2.000 million Euro as decided by the budgetary authority through a review of the current financial framework (2007-2013). Furthermore, a sum of 400 million Euro is made available through the Seventh Framework Programme for research, technological development and demonstration activities, bringing the total available budget to 3.405 million Euro for the programmes for the period 2007-2013."

The EP resolution clearly states: "(26) As the programmes will be financed by the European Community, public procurement under the programmes should comply with Community's rules on public contracts and should aim, first and foremost, to attain value for money, control costs, mitigate risks and improve efficiency and decrease dependencies on single sourcing. Open access and fair competition throughout the industrial supply chain, offering a balanced chance to participation of industry at all levels, including in particular SME, should be pursued across the Member States. Possible abuse of dominance or long-term dependence on single suppliers should be avoided. In order to mitigate programme risks, to avoid single source dependence and to ensure better overall control of programme, cost and schedule, dual sourcing should be pursued, wherever appropriate. European industries should have the possibility to rely on non-European sources for certain components and services in case of demonstrated substantial advantages in terms of quality and costs, taking account of the strategic nature of the programmes and of the EU security and export control requirements. Advantage should be taken of investments and industrial experiences and competences, including those acquired during the definition and development phases of the programmes, while ensuring that competitive tendering shall not be prejudiced."

For the procurement of the activities of the deployment phase of Galileo, it insists on applying the following principles:
a) "split of the procurement of the infrastructure into a set of six main work packages (system engineering support, ground mission infrastructure completion, ground control infrastructure completion, satellites, launchers and operations) as well as a number of additional work packages, through a comprehensive overall procurement break-down; this does not rule out the prospect of multiple simultaneous procurement strands for individual work packages, including of satellites;

b) competitive tendering of all packages and, for the six main work packages, the use of a single procedure whereby any one independent legal entity, or a group represented for this purpose by a legal entity part of a group, may bid for the role of prime contractor for a maximum of two of the six main work packages;
c) at least 40 % of the aggregated value of the activities to be subcontracted by competitive tendering at various levels to companies other than those belonging to the groups of which entities will be prime contractors of any of the main work packages; […]
d) dual sourcing wherever appropriate in order to ensure better overall control of programme, cost and schedule."

Speaking on April 23rd at Toulouse Space Show'08, Paul Verhoef, Head of Galileo Unit DG-TREN (Transport & Energy), highlighted this key condition: the Galileo procurement will be based upon a balanced participation of industry at all levels, including SME's, across Member states of the EU. He also described short-term milestones:

- launch of the Invitation To Tender for all the elements of the infrastructure; "the signatures of the procurement contract are scheduled to take place in late 2008/early 2009)";
- EC-ESA agreement to be concluded in June in order to allow ESA to act as procurement agency;
- EGNOS agreement in 2008 (including on transfer of ownership) to start operational services in spring 2009 with ESSP (European Satellite Services Provider) which will move from Brussels to Toulouse.
- Establishment of European GNSS Programmes Committee to allow the EU/ESA Member States to be closely associated with the essential elements of the EGNOS-Galileo management.

Giuseppe Viriglio, ESA Director of EU and industrial programmes (until 1st July - he will be replaced by Belgian René Oosterlinck for the Galileo programme until 30 December 2010 -, described the situation of Galileosat with the main contractors for the IOV (In-Orbit Validation) phase of 4 satellites (currently in construction) to be merged with the FOC (Full Operational Capability) phase of 26 satellites (still to be contracted):

- system activities : Thales Alenia Space (Italy)
- space system : EADS Astrium (Germany)
- Galileo mission segment : Thales Alenia Space (France)
- Galileo control segment : EADS Astrium (United Kingdom)
- Operator : DLR (Germany)

- Launch services: Arianespace (France).

Note that, in 2013, up to four operational navsat constellations for global positioning and synchronisation will exploit some 120 satellites in MEO (Medium Earth Orbit, between 20 000 and 24 000 km, of 11-hour to 12-hour duration): some 36 for the American GPS (Global Positioning System), 24 for the Russian GLONASS (Global Navigation Satellite System), 30 for the Chinese Compass/Beidu, 30 for the European Galileo!

Military missions

- **The French presidency of the EU considering military space activities as priorities for Europe's defence and security.** Visiting the Centre Spatial Guyanais of Kourou on 11 February 2008, French President Nicolas Sarkozy referred to new space development to be part of EU presidency of France during the second half of 2008. He insisted on the start of the GMES (Global Monitoring for Environment & Security) programme by establishing the required governance for this multi-purpose venture. He also encouraged pushing ahead the establishment of a joint and co-ordinated infrastructure in Europe – through the European Defence Agency (EDA) - for the military use of space.

In his speech of Kourou, President Sarkozy made a specific statement about military space systems in Europe developed and operated with € 1 billion of budgetary resources: 1/20 of the military effort USA is achieving in space! He had this question about the independence of the Union for its defence and protection from space: *"Do we prefer to become progressively more dependent on others to guarantee the security and secrecy of our communications, supervise our military operations and to decide on our positions on how major geo-political crises are managed?"* During EU Presidency, France will take some initiatives for the pan European coordination of military space efforts: in the form of integrated 'metasystem' (system of systems) or through an interoperable 'lego' of national programmes?

The EDA shows some interest to stimulate the efforts towards a common infrastructure for the military use of space, but it has not the financial resources to go beyond the right intent. France is proposing the MUSIS (Multinational Space-based Imaging System for Surveillance, reconnaissance & observation) initiative to be developed by Germany, Belgium, Greece, Italy and Spain; later, this group will

be joined by Sweden. MUSIS, for which first industrial studies have been made by industrial teams of EADS Astrium and of Thales Alenia Space, calls for a joint system which combines high-resolution and dual-use radar and optical satellites, along with data relay and intelligence satellites. The MUSIS plan has to be defined now, in order to supersede the national systems from 2015. The Eurospace group estimates that the European budgets for military space activities have to amount to € 1 to 2 billion annually.

New technologies

- **Luxspace initiative to develop materials for solar sails in space.** An international team led by Luxspace company (subsidiary of OHB System in the Grand Duchy) and involving nine partners in technological research, was selected by ESA to study, design and produce the materials of solar sails. This 2-year project is named Solar Sail Materials (SSM). Solar sailing is undergoing a regain of interest from the space agencies, because of new mature technologies to manufacture large light structures. Caravels of space require sails of thousands square meters in order to use the radiation pressure of sunlight as wind for travel in the solar system. In Belgium, CSL (Centre Spatial de Liege) and Samtech are contributing to the SSM project which aims at designing and thinning film materials for sails, at defining the most reflective coating and at selecting the assembly technology resistant to the space environment.

- **WSLlux establishing a high-tech incubator close to Euro Space Center.** By the end of the year, modular facilities in a modern infrastructure - linked by optical fiber to ESA Redu station - will be built in Transinne/Libin (Province of Luxemburg), near E411 highway at mid-way between Brussels and Luxemburg in order to welcome entrepreneurs mainly in the sector of space applications. WSLlux is a joint venture of Wallonia Space Logistics in Liege and of provincial business developer Idelux in Arlon. The activities within the new incubator will be promoted by WASA (Walloon Association for Space Applications), representing active players for applications by satellites in Wallonia.

Communications & broadcasts

- **S-band ventures in Europe competing to acquire satellite capacity from the European Commission.** Up to five candidates are

known to operate geosynchronous satellites for mobile broadcasts in S-band frequencies to cover Europe. Three of them are European, while other two are from USA. The license to operate S-band from space will be given to one operator or can be divided between two.

- Solaris Mobile Ltd, located in Dublin, is a joint venture of Eutelsat and SES to exploit the S-band payload (with large dish antenna) aboard the W2A satellite of Eutelsat. This payload represents an investment of 130 million €, but still needs approval of frequencies before W2A launch in 2009.
- Inmarsat based in London is the global operator of mobile satellite services with L-band communications satellites. It looks for expanding them in S-band.
- Ondas Media, headquartered in Madrid, plans to have in 2011-2012 powerful broadcasting satellites for digital radio programmes. Initially, it considered the use of three L-band spacecraft in high-inclined elliptical orbits to be received by mobiles in the high-latitude areas of Europe. Recently, it signed an agreement with the Radio Communications Agency of the Netherlands for the construction, launch and operate two geosynchronous S-band satellites (at 10.2° West and 29.6° East).
- ICO Global, which starts operations in North America with first S-band ICO-G1 using 12 m dish antenna - launched on 14 April -, looks for expansion in Europe and the Middle East.
- Terrestar Global, which envisions having its first high-power satellite in geosynchronous orbit before the end of this year, is cooperating with Telekom Austria and EADS Astrium to enter the European market.

Earth observations

• **GMES to be renamed Copernicus.** EU Commission vice-president Gunter Verheugen, in charge of the GMES (Global Monitoring for Environment & Security) programme is proposing to give it a more attractively popular name: Copernicus. This new name will be officialised by the end of the year. Let's imagine: Galileo and Copernicus, the two key space activities of the European Union, serving global needs. Some 2.2 billion € are being invested by ESA with the support of the European Commission in the GMES programme.

• **Jason-2 launch to start an operational oceanography service from space.** Launched in August 1992, the French-American Topex-Poseidon spacecraft demonstrated the high value of getting

continuously radar altimetry data about the topography of the oceans and of the seas. This mission developed by CNES and NASA revolutionizes the science of oceanography. Jason-1 with Poseidon-2 altimeter was put into orbit at an altitude of 1,300-km to insure continuity of service, convincing operators of meteorological satellites - Eumetsat in Europe, NOAA in USA - to go ahead with an operational system. Satellite altimetry showed that the sea level was growing up by 3 cm at a global scale and 20 cm in some areas during the last ten years! This is an strong indication of the dramatic climatic warming.

On June 15th, from Vandenberg AFB in California, a Delta 2 rocket will launch Jason-2/Poseidon-3, built by Thales Alenia Space (France). It is an operational satellite still developed by CNES and NASA, but jointly operated by Eumetsat (optional programme) and NOAA. It is crucial for operational services of oceanography from space to fund the construction of the next altimetry satellite. Eumetsat and NOAA, together with CNES, are preparing Jason-3/Poseidon-4 – the copy of Jason-2/Poseidon-3 with the last Proteus platform - for a launch in 2013. However, there is a lack of funding: 46 million € or 1/5 of the total budget - are still missing. The European Commission is interested by the operational continuity in the framework of the GMES programme. ESA prefers to develop the fully new Cryosat-3 spacecraft proposed by EADS Astrium (Germany) with a more complicated payload of radar altimeters. Its development will be more expensive and will take longer: the launch will not take place before 2014-2015.

Science & exploration

- **Revised ExoMars mission presented at Thales Alenia Space in Torino.** ESA and the European industry are preparing an ambitious probe to explore the surface of the Red Planet. Planned for launch in November-December 2013 with an Ariane 5-ECA booster, the "ExoMars Plus" spacecraft will consist of:
  - a large carrier also equipped to relay communications in Mars orbit,
  - a lander carrying the 8.5 kg Humboldt payload (the previous GEP/Geophysical and Environmental Package, to which the Royal Observatory of Belgium is contributing),
  - a 6-wheel rover with 16.5 kg Pasteur payload to search life elements in the soil and the underground of Mars.

The main industrial partners of ExoMars are already known. Thales Alenia Space (Italy) is the overall prime contractor for ExoMars. Thales Alenia Space (France) will build the Carrier Module System, while EADS Astrium Ltd (United Kingdom) will lead the rover vehicle development. EADS Astrium SAS (France) and EADS Astrium GmbH (Germany) will be responsible respectively and for the EDS (Entry & Descent System) and for the landing platform. Galileo Avionica will provide the drill and the SPDS (Sample Preparation and Distribution System). ALTEC (part of Thales Alenia Space Italia) in Torino will host the Rover operation control centre.

An extra funding of some 600 million € - is required to increase the already approved budget of 600 million €, but it has still to be approved by the ESA Ministerial Council at The Hague on 25-26 November. The baseline mission is planned for departure to Mars in late 2013. Because of its more sophisticated concept, it is expected that "Exomars Plus" launch could slip to early 2016.

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