VRI SPACE UPDATE

N°7 – May/June 2009

Note that the next rendez-vous of Flanders with space applications has been postponed to 2010: the Third International Workshop "The Future of Remote Sensing", organized by VITO, is planned to take place in Antwerp during autumn 2010. This event is considered as a useful opportunity for information and contacts about the Vegetation program and the Belgian contribution to the GMES (Global Monitoring for Environment & Security) program of the EU (with operational products and services associated to the Sentinel missions of ESA).

1. Space transportation systems: towards a decade of new and planned launch vehicles

A changing world for the access to space: modularity, flexibility, competitiveness through innovating but not revolutionary solutions

- **Modular family of launch vehicles: the next key for low-cost access to space**

During the 2010s, space transportation business for governmental and commercial missions in orbit will know some changes and choices affecting the evolution of launch services in the world.

- NASA plans to stop the flights of the Space Shuttle - with three reusable Orbiters – during the first quarter of 2011, because of their very high costs and because of new priorities related to the Constellation program of space exploration. The problem of USA is the gap for astronauts to guarantee their independent access to the International Space Station (ISS) from 2011 to 2015: Russia will have the key by providing the Soyuz TMA spaceflights. In a report issued April 16, the NASA-chartered Aerospace Safety Advisory Panel (ASAP) said flying the space shuttle beyond 2010 would expose NASA to increased safety risks and siphon money away from the shuttle's successor, the Orion Crew Exploration Vehicle and Ares 1 launcher of the Constellation program, further delaying its planned debut. The panel also concluded that a cash infusion would do little to speed up completion of Ares and Orion and expressed doubt that any of the proposed private-sector alternatives could eliminate the looming five-year gap between the shuttle's retirement and Ares and Orion's planned 2015 debut.

- NASA and the US industry are involved in the development of the Ares 1 (to put in low orbit the Orion spaceship for 4 astronauts) and Ares 5 (to go to the Moon with the Altaïr lunar module, after docking with Orion) launch vehicles for the Constellation program. Both Ares 1 and Ares 5 will combine propulsion systems of the Space Shuttle (reusable ATK solid booster), the Saturn V (Pratt & Whitney/Rocketdyne J-2X) and Delta 4 (Pratt & Whitney/Rocketdyne RS-68B). DOD is continuing to exploit in parallel the Delta 4 family (using cryogenic engines) and Atlas 5 launchers (with Russian rocket engines). The future of Ares 1, because of seriously dramatic vibrations of the booster at launch, is discussed by the Committee of Norman Augustine for the report of *"Review of US Human Space Flight Plans"* whose publication for the White House is expected in mid-August. It is not yet well established how USA will keep autonomy for the manned flights of NASA to ISS and how NASA will obtain enough budgetary resources for a return to the Moon in 2020. The ambitions of the US program in space exploration - requiring an investment estimated around some 100 billion € during the next 10 years - remain unclear under the Obama Administration: this latter is hesitating to go ahead with the vision President Bush Jr. defined for NASA on 14 January 2004, more than 5 years ago! Two scenarios for some 70 billion € to be invested in USA could be evaluated and proposed. It is expected that an international plan of joint cooperation, as the step forward, would be initiated. It will be interesting to know in which matter the private offers with commercial servicing systems - Space-X with Dragon and Orbital Sciences with Cygnus - will get the green light to go ahead.

- Roscosmos (Russian Space Agency) initiated design work on the successor of the Soyuz spaceship and on the modular family of Rus-M launch vehicles (to be used during the second half of the next decade from the new cosmodrome of Vostochny in Eastern Siberia): in early April, a pair of study contracts for a total of 28 million € - from March 2009 to June 2010 - were allocated to RKK Energia in Korolev (preliminary design of the reusable Rus spacecraft with up to 6 people for flights around the Earth and to the Moon) and to TsSK Progress in Samara (preliminary design of Rus-M launchers). A decision with governmental funding is expected by late 2010. However, at Paris Air Show 2009 (Le Bourget), Vitaly Lopota, Director General of RKK Energia, admitted the need for further money to complete a great deal of tests. The Russian Military Forces will operate, from Plesetsk cosmodrome (North of European Russia), its own family of modular launch vehicles, named Angara: they are developed by Khrunichev Space Center in Moscow. Note that, in the framework of Euro-Russian cooperation, the first Soyuz ST (with KSE/Kit Sauvegarde Européen equipment of Thales Alenia Space ETCA) launcher is planned to fly from French Guyana in February 2010.

- ILS (International Launch Services) and Sea Launch (from a mobile platform in the Pacific Ocean), the Russo-American commercial ventures in space transportation, have to take into account the growing cost of life conditions in Russia and in Ukraine. The Proton rocket, produced by Khrunichev Space Center in Moscow and marketed by ILS, represents the only competitor of Arianespace, but there is a crucial question: will this powerful launcher be still available after 2015, when the Angara system will become operational for governmental missions? In the case of Zenit 3, with first 2 stages made by Ukrainian Youchnoye and 3rd stage of Russian RKK Energia, the marketing is affected by the bankruptcy status of Sea Launch Company (which filed for Chapter 11 protection on 22 June in Delaware Court) and the future is really clouded.

- CALT (China Academy of Launch Vehicle Technology) currently is developing the Long March 5 family of modular launchers to be operated, starting in 2014 and until 2035, from Wenchang Satellite Launch Center (a complex which will have three launch pads) on Hainan Island (South of China). This family consists of a combination of propulsion modules using environmentally clean propellant (kerosene, liquid oxygen, liquid hydrogen).The heaviest version would be able to place 25 t in low-orbit and to inject 14 t in GTO (geostationary transfer orbit). There are pressures of US satellite industry - especially Space Systems Loral - on the Obama Administration to make the Department of State more flexible with ITAR (International Traffic in Arms Regulations) in order to allow commercial launches with Chinese Long March and Indian PSLV/GSLV rockets.

- ISRO (Indian Space Research Organisation), with the Indian aerospace industry, is developing indigenous launch capacity to GTO for satellites between 2 to 4 t as well as to LEO with recoverable spacecraft and for manned spaceflights. The maiden flight of the GSLV MkII (with “made in India” cryogenic engine) is expected during this autumn. The demonstration launch of the powerful GSLV MkIII is announced for 2010, but would take place in 2011. Antrix Corp., its commercial arm, already is successful with the international marketing of the PSLV (Polar Satellite Launch Vehicle) versions to place mini-, micro- and nano-satellites in orbit between 500 and 1.000 km. Don’t forget that the first “made in Belgium” small satellite - Proba-1 - is in orbit thanks to a PSLV launch from Sriharikota! India is looking for ITAR revision process to launch commercial and governmental spacecraft with US components.

- JAXA (Japan Aerospace Exploration Agency) and MHI (Mitsubishi Heavy Industries) are developing and marketing the H-IIA launch services: the Japanese rocket uses cryogenic propulsion systems with various solid strap-on boosters. The most powerful H-IIA version is capable of placing up to 4,15 t in

GTO. The main problem is the availability of Tanegashima Space Center (TNSC) restricted by fisheries to launch periods during the year. The H-IIB variant, with two cryogenic LE-7A engines - instead of one single LE-7A - on the first stage, will be able to launch up to 16,5 t in low orbit (with the HTV/H-II Transfer Vehicle for ISS resupply services) or up to 8 t in GTO.

- SpaceX (Space Exploration Technologies Corporation), a private enterprise which was founded in June 2002 and is headquartered in California, has the goal to reduce the cost by a factor of ten of space transportation services by developing the Falcon 2-stage launchers. Falcon 1 (with 1 Merlin 1C engine), after three failures, was successful in 2008 and 2009 to put small satellites in low orbit from Kwajalein Island. Before the end of this year, Falcon 9 (with 9 Merlin engines) will be tested from Cape Canaveral (Complex 40) with 10-ton payload in low orbit. It will be used in 2010 to achieve Commercial Resupply Services (CRS) of the ISS with the recoverable Dragon spacecraft. Space X, if it is successful, will represent the major step in the challenge of privately funded access to space.

- ESA, with French CNES and for Arianespace service & solutions, envisions to upgrade the current Ariane 5-ECA launch vehicle (9.5 t in GTO) into Ariane 5-ME (Mid-life Evolution, 11 t in GTO) by using the restartable Vinci engine for the cryogenic upper stage. The ESA Ministerial Council at The Hague in November decided to go ahead with pre-development work of Vinci technologies (with a budget of 357 million € for technological activities during the period 2009-2011). Belgian SABCA (electro-mechanical actuators), Thales Alenia Space ETCA (power conditioner) and Techspace Aero (through Safran/Snecma) are concerned by the preparatory studies on the next upper stage of Ariane 5-ME. The development program will be decided in 2011-2012, with an investment of some 1.2 billion €, by the next ESA Ministerial Council in an Italian city. The demonstration flight of Ariane 5-ME version is planned for 2016-2017. To its European partners, France is proposing Ariane-6 reference concept for first flight in 2025 (see information below).

- Arianespace, during the next decade, will operate three different launch vehicles (for a wide range of satellites, from 100 kg to 20 t) from three separate facilities at Europe's spaceport: Ariane 5-ECA built by Astrium Space Transportation (EADS), Russian Soyouz ST produced by TsSKB Progress in Samara, European Vega (with strong Italian support) manufactured by ELV. While the maiden flight of Soyuz ST from French Guyana is announced for the first quarter of 2010, the demonstration flight of Vega (carrying an Italian passive micro-satellite and many Cubesats from Europe) is postponed until autumn 2010.

- New national entrants to launch micro-satellites (around 100 kg in low orbit) are increasing for political prestige and for military purposes. The Iranian Safir IRILV (1 success) and the North Korean Unha-2 (1 failure) achieved demonstration flights during the first half of this year. The South Korean KSLV 1 (Naro 1) is developed on the basis of the Angara first stage (Russian liquid engine) with the technical assistance of Khrunichev Space Center: the first launch with South Korean small satellite is scheduled around 11 August. Brazilian VLS launch from Alcantara has an unclear status, while Taiwan (with TSLV in 2012) and Indonesia (with Lapan SLV in 2014) are facing the technological challenges to develop their own launchers based on solid boosters.

France proposing Ariane 6 for 2025 or earlier: a modular launcher for up to 6 t in GTO to replace Ariane 5-ECA and Soyuz rockets

During the first half of 2009, Arianespace signed 10 new contracts for geosynchronous communications and broadcasting: Hispasat-1E (Spanish operator), Arabsat-5C & Badr-7 (Arabsat), Yamal-401 & -402 (Russian Gazprom), Intelsat New Dawn (Intelsat), JCsat-13 (Japanese operator), Alphasat I-XL (ESa/Inmarsat), ABS-2/ST-3 (Hong Kong), ST-2 (Singapore/Taïwan). In negotiation was the 11th contract for Hylas with British operator Avanti Communications). However, at the beginning of the year, Arianespace had to solve the urgent problem of the PB batch contract for 35 Ariane 5-ECA, for launch services from late 2010 to 2015.

During 2008, the negotiations between Arianespace and its industrial contractors (also its major shareholders) came to a dramatic turn, because there was no agreement about the required reduction of the manufacturing prices ... Without this agreement, the successful business of Arianespace could be in jeopardy. The conclusion of the recent French book *"La naissance d'Ariane"* describing the epic birth of the Ariane launch vehicle in the 1970's stated that Jean-Yves Le Gall, CEO of Arianespace, put the ultimatum to stop Ariane 5 flights in mid-2010, if no contract will be finalized for the PB batch! Finally, on 30 January, due to the pressure of the French government, Arianespace and Astrium Space Transportation signed the contract of "more than 4 billion €" to produce 35 Ariane 5-ECA launchers for flights until 2015. At the same time, the government of Prime Minister François Fillon tasked a small group of 3 personalities from the French administration - Bernard Bigot (CEA), Yannick d'Escatha (CNES), Laurent Collet-Billon (DGA) – to review the situation of the launcher sector in France and Europe.

On 18 May - one month before Paris Air Show - this review was transmitted to the Prime Minister and released to the media under the name of "Report Fillon".

The exact title is: *"L'enjeu d'une politique européenne de lanceurs: assurer durablement à l'Europe un accès autonome à l'espace"* (The challenge of a European strategy of launch vehicles: the sustainable guarantee of an autonomous access to space for Europe). The main result of this 3-month review is the vision of France and a proposal - presented as Ariane 6 concept - to its European partners in space concerning the long-term development of the Ariane space transportation system in Europe. The report advocates for more transparency and continued efforts on efficiency and cost control at all levels of the launcher development and production chain (including Arianespace). It recommends for more efficiency to merge CNES/DLA (Direction Lanceurs) with ESA Launchers Directorate. It invites France to prepare for ESA Ministerial Council in 2011 a proposal of program for the development of a new European launch system which will replace Ariane 5 and Soyuz rockets in 2020-2025.

The concept of the new launcher, so called Ariane 6, will offer a high modularity, the reliable capacity to launch 3 to 6 t (single payload) into GTO, a great competitiveness at all levels - from development to operations - and a flexible upper stage with cryogenic restartable engine (similar to Vinci). ESA sources said the logic behind Ariane 6 - a 2-stage cryogenic rocket (Vulcain-X on the 1st stage, Vinci on the 2nd stage) with 2 to 6 solid strap-on boosters, following the performances to be achieved - was a cheaper, more-often launched rocket that allowed spaceport fixed costs to be spread over more flights to reduce prices. The higher frequency of launches would meet commercial customers' preferences for having their own launch when they wanted it. For Astrium Space Transportation, the Ariane 5-ME for heavy payload and the modular Ariane 6 variants would co-exist during the 2020's.

Some observers are suspecting the Ariane 6 initiative of "Report Fillon" to kill the program for the powerful Ariane 5-ME version, without compromising the European industrial efforts to develop the new and advanced Vinci engine. How will it possibly be able, at the next ESA Ministerial Council, to convince the member States to invest 1.2 billion € in Ariane 5-ME and to start another investment for the Ariane 6 program? The CEO of Arianespace is not frankly in favour of a more powerful version than the current and reliable Ariane 5-ECA launch vehicle. For him, the dual launch system, considered as a commercial asset, penalizes the business of Arianespace and the performances of Ariane 5-ECA, because of the difficulty to combine two suitable spacecraft in an efficient mode and at the right time.

2. New opportunities for an enlarged Europe in space: to meet the needs of the global society: information & security

Because of the national delays for the pan-European approval of the new Treaty of the Union (Lisbon), ESA is still waiting the official reconnaissance of its technical role, as architect and prime contractor, to develop space systems for the missions of the European Union (EU) in the world. Well known are the Galileo constellation of civilian satellites for global navigation and the GMES (Global Monitoring for Environment & Security) "system of systems": both initiatives of the European Commission, while their development is progressing at ESA with the European industry, are still looking for efficient governance and sustainable funding to go ahead on a long way and at global scale. Along with Galileo (navsat) and GMES (eosats), the European Union is concerned by satellite systems for its broadband infrastructure in rural areas and isolated parts: an initiative concerning broadband infrastructure in Europe was proposed as part of the EU recovery plan which was endorsed by the European Council in December 2008.

There are, under the management of European Commission Directorates, two other programs involving space systems: Mobile Satellite Services (MSS) and Air Traffic Management (ATM) in Europe. Four Directorates of the Commission are directly concerned by the development of space systems: Enterprise & Industry (G. Verheugen/Germany) for GMES and space exploration policy, Transport (A. Tajani/Italy) for Galileo and air traffic management, Information Society & Media (V. Reding/Luxemburg) for mobile satellite services and broadband systems, Science & Research (J. Potocnik/Slovenia) for FP7 projects and activities. Note that the European Commission will consist of another team with a revised organisation on 1st November: new people will propose new ideas and new initiatives.

Paving the way for European mobile satellite services (MSS)

European consumers and businesses, particularly in rural areas, can expect to benefit from innovative wireless communication services after the European Commission selected two operators, Inmarsat Ventures Limited and Solaris Mobile Limited, to provide mobile satellite services across Europe. The services, such as high-speed internet access, mobile television and radio or emergency communications, will be provided over a specifically reserved S-band spectrum. Both satellite operators demonstrated an advanced level of technical and commercial ability to provide these services.

On 22 August 2007 the European Commission proposed an EU decision for the selection procedure for MSS to be organized at the European level . Adopted by the European Parliament and the Council on 30 June 2008, the decision established a single selection and authorization process to ensure a coordinated introduction of MSS in the EU. The single selection procedure was launched by the European Commission on 7 August 2008. Four companies - 2 European and 2 American proposals - had submitted an application by 7 October 2008. All the four candidates were admitted to the first selection phase in December 2008. With the assistance of independent experts, the Commission analyzed the technical and commercial development of these mobile satellite systems in close cooperation with national authorities.

EU Telecoms Commissioner Viviane Reding insisted on *"the first pan-European selection procedure, developed in close cooperation with the European Parliament and the Member States."* She added: *"A Europe-wide market for mobile satellite services is now becoming a reality. I call on the Member States to take without any delay all the required follow up steps in order to allow a timely and proper launch of mobile satellite services."* Mobile satellite services (MSS) will offer innovative wireless communications to millions of EU consumers and businesses all over Europe thanks to portable terminals carried by a person or mounted on a car or a ship. They can also help bridge the digital divide in the availability of high-speed internet coverage in Europe by reaching rural and less populated regions.

On 14 May, two mobile satellite operators were selected for the EU by the Commission: Inmarsat Ventures Limited (London, United Kingdom) and Solaris Mobile Limited (Dublin, Ireland) demonstrated the required level of technical and commercial development of their satellite systems. No second selection phase was required as the two candidates could be accommodated in the available S-band spectrum. The two selected proposals for pan-European MSS showed high upfront investment of over hundreds of millions €. Commercial service should start within 24 months from this selection decision at the latest - by May 2011 -, subject to commitments to an earlier launch made by operators in their application. The member States of EU now have to ensure that Inmarsat (Europasat project) and Solaris (S-Mobile system) have the right to use the specific radio frequencies identified in the Commission's decision and the right to operate their respective mobile satellite systems. These providers have to be authorized to use their satellite systems all over Europe for 18 years from the selection decision.

Solaris Mobile Ltd, with a geostationary payload which was successfully launched on 3rd April onboard Eutelsat W2A satellite, was largely ahead of Inmarsat Ventures to start S-band broadcasts for MSS. However, during in-orbit

tests, the deployable mesh antenna of 12 m was affected by anomalies, so that the requirements for efficient services were not achievable. On 1st July, Solaris Mobile and its shareholders (Eutelsat Communications and SES Astra) confirmed *"significant non-compliance from its original specifications"*. *"These non-compliances meet criteria to file a claim for the full insured value of the payload."* In which matter S-band broadcasts can be tested in the next months? Until now, no announcement was made about the solution of Solaris to deploy another S-band payload before May 2011 which, in the selection of the European Commission, is the target date to start operations.

Facing air traffic management over Europe, Middle East and Africa

Since the 1970s, Europe is pushing ahead the use of satellites for aeronautical services. The defunct Aerosat program with USA was dedicated to the management of air travel over the Atlantic Ocean. Now, ESA is proposing the deployment of geostationary satellites to deliver ATM communications for the European Civil Aviation Conference area that spans from Iceland to Azerbaijan. With the support of the European space industry and Eurocontrol, air navigation service providers and national space agencies, ESA, through the Iris project - approved at ESA Ministerial Council in The Hague - , is studying satellite communications in its collaboration with the European Union's Single European Sky (SESAR) program.

Iris, named after the mythological personification of the rainbow and messenger of the Greek gods, is the European Space Agency's program for air traffic management via satellite. It is an ESA telecommunications department project under its Advanced Research in Telecommunications Systems (ARTES) program, known as ARTES 10. Iris Phase A saw two trade studies, one led by Thales Alenia Space, and the other by Astrium Satellites. Issued to ESA in the first quarter, Thales's preliminary definition begins with the 2014 small GEO satellite deployment for technology demonstration purposes. It is to be followed by 2020 by at least two larger geostationary orbit spacecraft, for redundancy and to deliver the service. Astrium had a similar system that employed GEO spacecraft with on-orbit spares. Iris spacecraft would provide L-band mobile communications between satellites in geosynchronous orbit and aircraft in flight, as well as Ku-band fixed links between satellites and ground stations.

Phase B is expected to start by July. It will investigate L-band antenna designs, beam forming networks and scheduling co-operation with SESAR to provide what aviation wants. By 2011, Iris will have a defined system, so that ESA can move on to phase C/D. The challenge for air traffic satellite communications is that ATM data links have entirely different requirements to the telephony and

internet connectivity that has previously characterised air-to-ground via space aviation communication.

The concept of Small GEO-type spacecraft, based on the platform developed by German OHB-System could be used for Iris. In 2014 a small geostationary orbit satellite could be launched to help modernise air traffic management in Europe. The satellite is described as the first step for the deployment of a constellation that will deliver ATM communications for the whole world. The players of the European space industry had until 4th May to submit tenders for phase B of Iris, the European Space Agency's air traffic management via satellite project. While aircraft satellite communications have been used for many years, they have mostly addressed non-safety-critical communications such as passenger telephone calls and internet connectivity.

Funded with €35 million ($45.4 million) up to 2011, the final cost of Iris will not be known, until the number of satellites and their capability is decided. Phase C is planned to start in 2012 and, if approved by ESA Ministerial Council in 2011, will support in-orbit verification and certification of the pre-operational system and technical support for deployment of the full system. Whatever is decided, a first Iris satellite will be needed in orbit by 2014 at the latest to enable aircraft-based Iris terminals to be certificated and for the airline companies to roll out the technology across their fleets to ensure the system is fully operational in 2020. ESA is already talking to Canadian Space Agency and Roscosmos about possible compatibility between Iris satellites and the spacecraft of Canada and Russia that would be in highly elliptical orbits, providing the same service to aircraft in extreme northern latitudes. Because Iris spacecraft are in geostationary equatorial orbit, they are very close to the horizon for the purposes of serving aircraft flying over northern Sweden.

By 2020 global air travel is expected to double, resulting in increasing congestion in the air and on the ground and a new requirement for an independent safety-critical air-to-ground link. The European Commission has already set targets for such a satellite system. ATM/SESAR must be 50% less expensive than current services, it must be able to handle a threefold increase in communication capacity, help improve safety by a factor of 10 and reduce the environmental cost by at least 10%. *"When coupled with navigation systems like [the European Union's] Galileo, satellite communication can even contribute to optimising aircraft trajectories,"* says ESA. For safety and cost, ESA says that future avionics on aircraft could be integrated and standardised with Iris.

3. Space exploration: at the crossroads for international ventures with systems to return to the Moon as first step to Mars, asteroids

The 40th anniversary of the first Moon landing with Apollo 11 and its' astronauts was celebrated by NASA and Obama Administration with a great simplicity … The media in Europe showed a great interest to remember the pioneering odyssey of the 1960's with the epical competition in space, during the Cold War, between USA and USSR (Russia with Ukraine and Kazakhstan). Four decades later, the return of men (and the arrival of women) on the Moon is intensively discussed in Washington.D.C., but this enterprise is not seen as a real priority. The result of these discussions in NASA, industrial players and federal authorities is that the Constellation program is criticized for its technical choices. The partners of USA in the International Space Station (ISS) are invited to join this program which has an unclear future.

CBO report casts serious doubt on Orion-Ares schedule and budget

In a report released on 16th April with the title *"The Budgetary Implications of NASA's Current Plans for Space Exploration"*, the Congressional Budget Office (CBO) made a severe review about NASA's plans to replace the Space Shuttle and return astronauts to the Moon, stating that there is a high probability that NASA will face significant cost overruns on its Shuttle replacement and lunar exploration programs. It warned that the plans will fall behind schedule under the current funding outlook, even if the agency dramatically scales back its program of robotic science missions and aeronautics research.

The Constellation program includes the Orion crew capsule and its Ares 1 launcher as well as the Ares 5 heavy-lift rocket and Altair lunar lander. Orion and Ares 1 are expected to replace the Space Shuttle in 2015, while the Ares 5 and Altair are necessary for a planned return of astronauts to the Moon by 2020. The report estimated the total cost of the Constellation program at $92 billion and warned that the price tag could climb as high as $ 110 billion. In September 2004, the CBO estimated Constellation's cost at between $ 44 billion and $ 57 billion.

The CBO report examined four scenarios, two of which assume NASA's total annual budget will average $ 18.2 billion through 2013, followed by increases to at least $ 19.1 billion annually from 2013 to 2025. This scenario most closely resembles NASA's current budgetary outlook. Keeping Orion-Ares 1 and the lunar return on their current schedules under that budget profile would require delaying 35 of 79 planned robotic missions planned through 2025 and ending

U.S. participation in the Space Station in 2015! Alternatively, NASA could delay just 15 of those robotic missions, in which case either Orion-Ares 1 would slip to 2016 and the lunar return would slip to 2023, or NASA would require an annual budget of $19.3 billion from 2010 to 2013 and more than $20 billion through 2025, the report said. NASA would require an annual budget of $23.8 billion through 2025 to keep Constellation on its current schedule, extend space shuttle operations to 2015 and continue U.S. participation in the international space station to 2020.

Augustine Committee review of US plans for Human Space Flight: Directors General of Roscosmos and ESA expressing views to NASA

Hopefully in mid-August, USA and its partners in the ISS venture will know more and better about the American strategy to go back to the Moon as the first chapter of an ambitious odyssey to explore the solar system. On 17th June, from ESA Headquarters, via an audio link, Anatoly Perminov, Director general of Roscosmos, and Jean-Jacques Dordain, Director General of ESA, transmitted their statements to the member of Augustine Committee.

- A. Perminov considered as *"reasonable to prolong station life until 2020 at least"*. He insisted on the opportunity to proceed to a more grandiose and significant project *"in particular, development of the transport systems for expedition to the Moon and Mars."* He added: *"Russia would accept the project with equal involvement of the parties, which implies partner's share of results, as well as Russian involvement in development of critical elements (launch vehicles, propulsion system, technology and experience in support of the long-term space crew missions). Regarding this, it would be reasonable to establish an international expert group for overall analysis of the integration capabilities in space exploration."*

- J.J. Dordain noted the limited amount of resources in ESA for manned space flight (maximum 15 % of the total ESA activities): *"Member States have never decided to increase their contribution to human space flight activities to the detriment of science and services to the citizens."* About the lessons learned from ISS cooperation, he called for these improvements: redundancy in key functions, in particular transportation; full standardisation of interfaces and interdependency; balancing utilisation, assembly and maintenance activities from the start of the program; milestones to attract the attention and the interest of governments and public.

About the ISS program, he clearly explained two basic reasons to continue it:

1. *"To reap the benefits of the investments made, by utilising the resources on board. The ISS is a unique laboratory offering resources which cannot be found on Earth. As for any laboratory, significant results will come from a repetition of experiments which require years rather than months."*
2. *"To be part of the human exploration program. The ISS is the place for testing hardware and operations before they are used for lunar exploration and even more for Mars exploration which is the end objective of human exploration. There should not be any gap between ISS operations and lunar operations, since any discontinuity would lead to a low of expertise, because expertise is with the people who operate."*

Concerning the preparation of a potential contribution of ESA to a human lunar exploration program, he notified: *"Europe is dependent upon other partners, in particular USA, and cannot take decisions on its own. Europe needs a high-level political decision, because any significant contribution of Europe to human exploration requires significant additional budget, since human exploration should not be developed to the detriment of science and applications for, the citizens."* Mr Dordain concluded his statement by addressing this important question: *"shall we invite other partners, China, India, South Korea to join our current partnership, under 'terms and conditions' that we could jointly agree?"*

EU organizing high-level space exploration conference at Prague, on 22-23 October, about a first vision of long-term program

Since late 2008, Gunter Verheugen, EC Director Enterprise & Industry, is pressing EU-ESA Member States to define a long-term vision of space exploration during a high-level political, scientific and industrial conference. The Czech presidency of the EU proposed to organize it at Prague during the first half of 2009. Finally, this EU-ESA conference has been delayed until 22-23 October. G. Verheugen hopes that the European Commission in place until 1st November will conclude 5-year mandate with a promising view of the future in Europe. The European vision of space exploration with automated and manned spacecraft will depend on which option will be selected in September by the Obama Administration with taking into account the recommendations of Augustine Committee report.

Annex 1

Europe's big move to become worldwide leader for earth observations satellites during the next decade

In the next ten years, Europe will operate a total of 40 remote sensing satellites for operational products and services in earth observations related to monitoring for environment and security. These satellites are part of governmental/public missions (European Commission/GMES, Eumetsat, Defense…) or developed as commercial/private initiatives (SPOT Image, Infoterra, DMCII, e-Geos,).

The table below summarizes the satellites in preparation (construction practically decided) for launches between 2009 and 2020. It does not take into account the satellites for science and technology demonstration: ESA Earth Explorers, DLR TET (TechnologieErprobungsTräger) and EnMap (Environmental Mapping & Analysis Program) missions, Miosat and PRISMA spacecraft of ASI (Agenzia Spaziale Italiana), CNES small missions with Myriade micro-platforms and in cooperation with Israel (Venμs)… Nano- and micro-satellites developed by universities and technical institutes, especially in Germany, are not mentioned.

Operational earth observation satellites to be launched in Europe (2009-2020)

Satellite (launch)	Operator (prime contractor)	Main characteristics (system/type of investment)
Deimos-1 (July 2009)	Deimos Space (SSTL)	Optical microsatellite (DMC/private)
UK DMC-2 (July 2009)	DMCII (SSTL)	Optical microsatellite (DMC/private)
Helios-2B (late 2009)	DGA (Astrium)	Optical spy-satellite (Defense/public)
Tandem-X (late 2009)	Infoterra (Astrium)	Radar satellite (Infoterra - DLR/ public-private)
Cosmo-4 (early 2010)	e-geos/Telespazio - Defense (Thales Alenia Space)	Radar satellite for dual use (Cosmo-SkyMed/public)
Pleïades HR-1 (2010)	SPOT-Image - DGA (Astrium)	High-resolution optical satellite for dual use (SPOT-Defense /public)
MSG-3 (2011)	Eumetsat (Thales Alenia Space)	Geostationary meteo satellite (Meteosat/public)
METOP-B (2011)	Eumetsat (Astrium)	Polar meteo satellite (Metop-EPS/public)
Pleïades HR-2 (2011)	SPOT-Image - DGA (Astrium)	High-resolution optical satellite for dual use (SPOT-Defense /public)
Sentinel-1A (2012)	ESA (Thales Alenia Space)	Radar satellite (GMES/public)
Jason-3 (2012)	Eumetsat (Thales Alenia Space)	Oceanography satellite (Jason/public)
Sentinel-2A (2012)	ESA (Astrium)	Medium-resolution optical satellite GMES/public)
PROBA-Vegetation (2012)	ESA + VITO (Verhaert Space)	Optical microsatellite (Vegetation-GMES/public)
Ingenio-SEOsat (2012)	CDTI + ESA (Sener)	High-resolution optical satellite (Spain/public)
TerraSAR X-2 (2012)	Infoterra (Astrium)	Radar satellite (Infoterra - DLR/ public-private)
SPOT-6	SPOT Image/Infoterra (Astrium)	2.5-m resolution optical satellite (Infoterra/private)

Goktürk-1 (2012)	Turkish Defense (Telespazio)	High-resolution optical satellite (Turkey/public)
Sentinel-3A (2013)	ESA-Eumetsat (Thales Alenia Space)	Multispectral optical satellite (GMES/public)
Paz-SEOSAR (2013)	Hisdesat (Astrium Espana)	Military radar satellite (INTA/public)
MSG-4 (2013)	Eumetsat (Thales Alenia Space)	Geostationary meteo satellite (Meteosat/public)
SPOT-7	SPOT Image/Infoterra (Astrium)	2.5-m resolution optical satellite (Infoterra/private)
Sentinel-5 Precursor (2014)	ESA-TNO (?)	Multispectral optical satellite (GMES/public)
MUSIS CSG-1 ? (2015 ?)	Difesa (Thales Alenia Space)	Radar satellite for dual use (Cosmo-SkyMed/public)
MUSIS CSO-1 (2015)	DGA-EDA (Astrium + TAS)	Optical spy-satellite (MUSIS/public)
MUSIS SARah-1 (2015)	Bundeswehr (?)	Radar spy-satellite (MUSIS/public)
Sentinel-1B (2015)	ESA (Thales Alenia Space)	Radar satellite (GMES/public)
Jason-4/Cryosat (2015)	Eumetsat (Astrium ?)	Oceanography satellite (Jason-Cryosat/public)
MTG Imager-1 (2015)	ESA-Eumetsat (?)	Geostationary meteo satellite (Meteosat/public)
METOP-C (2016)	Eumetsat (Astrium)	Polar meteo satellite (Metop-EPS/public)
Sentinel-2B (2016)	ESA (Astrium)	Medium-resolution optical satellite GMES/public)
MUSIS CSO-2 (2016)	DGA-EDA (Astrium + TAS)	Optical spy-satellite (MUSIS/public)
MUSIS SARah-2 (2016)	Bundeswehr (?)	Radar spy-satellite (MUSIS/public)
MUSIS CSG-2 (2016)	Difesa (Thales Alenia Space)	Radar satellite for dual use (Cosmo-SkyMed/public)
Sentinel-3B (2016)	ESA-Eumetsat (Thales Alenia Space)	Multispectral optical satellite (GMES/public)
MUSIS SARah-3 (2016)	Bundeswehr (?)	Radar spy-satellite (MUSIS/public)
MUSIS CSO-3 (2017)	DGA-EDA (Astrium + TAS)	Optical spy-satellite (MUSIS/public)
MUSIS SARah-4 (2017)	Bundeswehr (?)	Radar spy-satellite (MUSIS/public)
MTG Sounder-1 (2017)	ESA-Eumetsat (?)	Geostationary meteo satellite (Meteosat/public)
Sentinel-1C (2018)	ESA (Thales Alenia Space)	Radar satellite (GMES/public)
Sentinel-2C (2019)	ESA (Astrium)	Medium-resolution optical satellite GMES/public)
Post-EPS-1 (2019)	Eumetsat (?)	Polar meteo satellite (Metop-EPS/public)
MTG Imager-2 (2020)	ESA-Eumetsat (?)	Geostationary meteo satellite (Meteosat/public)

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Abréviations :
CSG : Cosmo-SkyMed Seconda Generazione
CSO : Composante Spatiale Optique
DMC : Disaster Monitoring Constellation
EPS : Eumetsat Polar System
MTG : Meteosat Third Generation
MUSIS : Multinational Space-based Imaging System
SEOsat : Spanish Earth Observation Satellite
SSTL : Surrey Satellite Technology Ltd
TNO : Technologische Nederlandse Organisatie
VITO : Vlaamse Instelling voor Technologisch Onderzoek

Note:

26 June 2009: green light of Belgium to France for a participation to the MUSIS program of optical satellites for military observations

On 26 June, Minister Peter De Crem (Defense) and Minister Sabine Laruelle (Science Policy) sent a joint letter to French Minister of Defense Hervé Morin to confirm the Belgian desire of participating to the development of the military MUSIS/CSO (Mutinational Space-based Imaging System/Composante Spatiale Optique) program. The required investment, ensuring the continuity in the use of Helios-2 spy satellite imagery, would be defined by late July 2009.

The amount of around 140 million € - 90 from Defense budget, 50 from Science Policy money – was regularly mentioned. Would it be fully invested in the development, with Belgian industries as partners of Astrium, of MUSIS/CSO? In which matter could it be used to finance a "made in Belgium" complementary system using a Proba-type satellite with military payload for classified high-resolution hyper spectral observations?

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