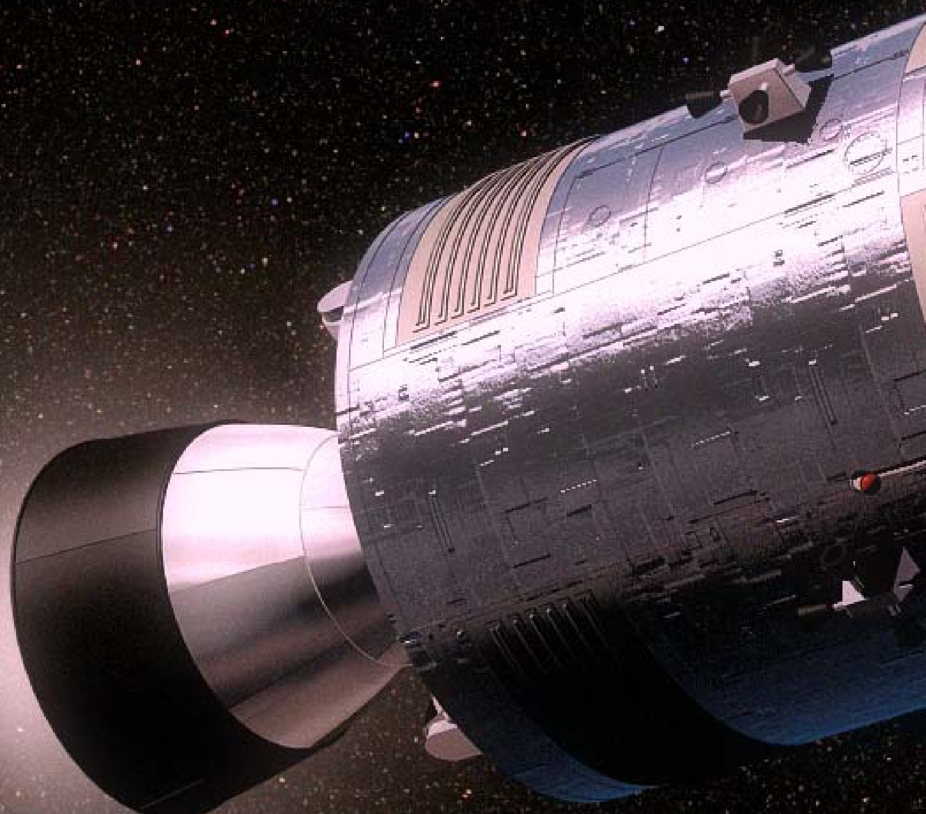
SpaceAlliance magazine



Issue 2 – February 2011

SPACE ALLIANCE

Ariane 5 rocket aproaches the end the 2010 with a new successful launch

Last launch of November 2010 was performed by the European rocket Ariane 5 with it's fifth out of six flights scheduled for 2010.

Lift off was on 26th of November at 18:39 GMT from Kourou space centre, French Guyana, ELA3 complex, under the flight indicative of V198. This has been again a dual launch configuration (ECA version), this time the satellites on board being Intelsat 17 and Hylas 1 .

Intelsat 17 or IS17 is the newest Intelsat geostationary platform that is to replace the old Intelsat702 satellite (launched 17 June 1994) at the orbital position of 66 degrees East (somewhere above the Indian Ocean), offering communications services to customers in Europe, Africa, Asia and Middle East.

The new satellite, weighting 5540 kg, built on the LS-1300 platform developped by Space Systems/Loral is a telecommunications satellite that will work for about 15 years, using 28 transponders in the C band as well as 46 in the Ku band.

The contract signed in August 2008 with the American company from Palo Alto, California, foresaw a delivery within 2 years; the satellite was built on time, without delays. The earlier Intelsat, IS16 –for which we had a dedicated article- has been built by another provider- the Orbital Sciences Corporation, on its Star2 platform. Currently, Intelsat has problems with one of the recent launched satellites- Galaxy15- the technical failures being related in an recent article.

Intelsat is one of the bigest companies and a pioneer in this domain (must be remembered that in 1965 Intelsat launched the first commercial telecommunications satellite), that is providing even since the foundation in 1964 satellite services, including telecommunications, media-video, data and voice services in about 200 countries for nearly 1800 clients.

Since then Intelsat wrote it's name in history with it's technical accomplishments: for example in 1969 transmitting the first global live tv transmission of the Apollo 11 Moon landing, or in 1974 when the first international digital communications satellite network started.

With a modern fleet numbering almost 50 satellites and 8 ground stations, with a personnel of 1100 and offices in Brazil, China, France, Germany, India, Singapore, South Africa, United Arab Emirates, England and United States, Intelsat recorded 2.4 billion dollars revenues by the end of 2008, consolidating it's position on the global telecommunications market.

By comparison, Hylas 1 is a more special project. It was supposed initially to be launched using a Falcon 9 rocket but in 2009 the intentions changed and a new launch contract was signed with ArianeSpace. On the basis of this new contract the flight was to be executed by the new launcher Soyuz2-1a but, as related in another article, ArianeSpace encountered some problems in the deployment of ground systems for the new rocket (which will finally fly in the beginning of 2011) so in this perspective, in order to be on schedule, the launch of the Hylas 1 satellite was assigned with the Ariane 5 rocket.

Hylas 1(or Highly Adaptable Satellite) is the first satellite in the Hylas constellation constructed by the british operator Avanti Screenmedia Group Plc with headquarters in London. It will work from the orbital position of 33.5 degrees West serving about 22 central and west-european countries (150.000-300.000 users) with the intention of providing broadband internet services and HDTV programs.

Weighting 2570 kg at the launch, the new satellite, built by EADS Astrium on a I-2000 platform initially developed by the ISRO Indian Space Agency, will operate for about 15 years, using 6 transponders in the Ka band and 2 on the Ku band.

It is a three axes stabilized satellite with 4.2 x 2.6 x 2.5m dimensions, having 2 mobile solar panels with GaAs technology, each measuring 2.54 x 1.53m and 2 batteries with 32Ah capacity each, composed of 20 cells.

On board we found a circular antenna with 1.6 m in diameter operating in the Ku band and 2 elliptical antennas 1.6 x 1.35m operating in the Ka band. The two antennas secure communication with Inmarsat East London Control Centre as well as with the two Goonhilly and Land's End ground stations.

But the main characteristics is the GFP technology (Generic Flexible Payload).

Hylas 1 is the first public-private partnership initiated by ESA that is completed with the construction of a satellite and will be followed up in the next 2 years by other similar partnerships with Inmarsat and Hispasat. Financially, the ESA’s contribution was of 34 million euro out of a total amount of 120 millions for the construction of the satellite.

It is in fact a build-up for the ARTES program (Advanced Research in Telecommunication Systems) initiated several years ago by ESA. The partners of this dialogue were BNSC (British National Space Centre) and the Avanti Communications commercial company.

The official guarantee offered by both public institutions and the lobby made by the Avanti company brought in eventually other investors, estimating that the final project investment (satellite and related services/applications) will be in the region of 500 million euro.

Avanti is a company founded in 2007, which itends to be a very dynamic player in the sector of satellite communications. After it recorded in 2008 a net loss of 1 million UK pounds, it had in 2009 a positive profit of 1 million UK pounds and finally the successful launch of the Hylas 1 satellite directly moved up the company's London stock exchange rate, so that it is worth now 604.86 million UK pounds.

Ariane 5 is today the preferred commercial launch vehicle because of it's proven fiability (since December 2002 when the ECA version was introduced and the first flight ended with the loss of the onboard loaded satellites Stentor and Hotbird 7, the rocket has an impressive record of 36 flights without errors).

Ariane 5 has 3 flying versions: GS, ES and ECA. The major diferrence is that the GS version uses a Vulcain 1 propulsor for the first stage, while the rest of the versions use Vulcain 2.

The ECA version is the only commercial launcher capable of carrying a total of 9.6 tons load, composed of the two different platforms (satellites and the added protection and integration equipments).

50.5 m long and with a total mass of 780 tons at liftoff, the launcher uses 2 MPS Europropulsion solid fuel propulsors with a nominal force of 5060 kN (and a reaction time of 130s), a cryogenic main stage Vulcain 2 Snecma with a 1390 kN of thrust (540s burn-time) and a final cryogenic stage ESC-A Astrium Space Transportation using a HM-7B Snecma propulsor with 67 kN and a reaction time of 945s.

Finally, in the top section of the rocket is is integrated the SYLDA internal structure surrounding the two satellites and flight's thermal protection structure developped by Oerlikon Space company.

In 2009, Ariane 5 managed to perform 6 flights (5 in the ECA version and 1 in version 5GS) and the launch of 14 satellites: HotBird10/NSS-9/Spirale A/Spirale B (February), Herschel/Planck (May), TerrStar-1 (July), JC Sat 12/ Optus D3 (August), Amazonas 2/ COMSATBw-1 (October 1), NSS-12/Thor-6 (October 29) and Helios 2B (December 18). For more info please consult the SpaceAlliance related articles from 2009.

In 2010, all Ariane 5 flights were in the ECA version: Astra 3B and ComsatBw2 (March), Arabsat 5A and COMS1 (June), Nilesat 201 and RASCOM-QAF 1R (August), Eutelsat W3B and Bsat 3b (October), and finally Intelsat 17 and Hylas 1.

Next flight of the Ariane 5 rocket and also the last of 2010 will happen on the 26th of December with the Hispasat 1E and Koreasat 6 satellites.

The Glonass system hit by the loss of three satellites

On 5th of December 2010, at 10:25 GMT the Baikonur Cosmodrome hosted a new Proton launch having onboard three Glonass satellites: Kosmos 2470, 2471 and 2472.

The satellites built by JSC Information Satellite Systems/Reshetnev and NPO PM on an Uragan-M platform were three axes stabilized spacecrafts, 2.4 m x 3.7 m (solar wide span of 7.2 m), weighting 1415 kg and having a lifetime of 7 years.
The satellites were foreseen as an enforcement of the Russian satellite navigation system block M the one which is the basis of the Glonass before putting into operations the new block K (somewhere at the end of the month).
The flight, scheduled earlier 2010, has been delayed several times due to satellite problems and in the end has been carried out in December.

The Proton rocket entered the operation under the UR500 name on 16th of July 1965. Since then it has performed 362 flights with various scenarios: it has been used for Russian interplanetary missions to Moon, Mars, Venus or Haley comet, it flew to Mir and ISS stations, and last but not least it carried military or commercial spacecraft to orbit.

The Proton M version is 53 m long and weights 712 tons in nominal configuration. It is equipped with a booster system 42.3 m in length and a diameter varying between 4.1 and 7.4 m. Additionally we found on board the rocket special systems controlling the orbital injection –these ones different based on the mission's specifics. For this flight the Russians were using the Blok DM 3 equipped with a RD 58 M engine having a thrust force of 85 kN.
The first stage of the rocket is powered by 6 RD275 type engines developing a total thrust of 10.5 MN, the second stage is equipped with 4 RD210 engines 2.3 MN of thrust and the third stage has a RD212 engine capable of developing 0.6 MN.
In this configuration the rocket is able to liftoff a payload of up to 22 tons for a LEO mission or 6 tons for a GTO.

If for the previous Glonass flights it has been used a Proton M Blok DM2 configuration, this time, as mentioned before, the configuration has been switched to Blok DM3. According to the flight plan, after third stage separation, two consecutive Blok DM3 activations should bring the satellites into the desired orbit (19.100 km altitude and 64.8 degrees inclination).

The Russian company Energia, the one which builds the Proton rocket has invested recently a large amount of money for buying the most part of the shares in the SeaLaunch operator which went to bankruptcy. There is a strategic reason for the long term improvements of the Blok M assembly considering this configuration will be used for commercial flights. Finding a test case financed with public money is therefore a good opportunity which cannot be missed.

For the moment is not sure why the launch failed, some sources speaking about an error on the Blok DM3 others about an error in the flight control software. Apparently the telemetry was good until the separation of the third stage, when the trajectory deviated from the desired attitude course with 8 degrees. Soon the satellites reentered the atmosphere and felled down to Earth somewhere 1500 km in the North-West of the Hawaii.

The event retained the attention of the Russian authorities, the president Medvedev asking for an investigation on the possible causes of the accident which affects the strategic interests of the country and on a large perspective over the spending in the aerospace industry sector.

The last failure of a Proton rocket dated from September 2007 when the first stage failed to separate and ended in the loss of the Japanese JSAT Corporation's satellite JCSat 11.
In March 2008 another telecommunication satellite- AMC 14 part of the SES Americom fleet was left in a lower orbit than expected. However the geostationary transfer has been achieved using the onboard thrusters.

As mentioned previously, this has been the 362nd flight of the Russian launcher and the 43rd incident in its history (including the accidents and the sub-performed flights).

The Glonass system would have had, according to official information, 26 satellites in orbit. Theoretically the number is sufficient for a complete coverage of Russian territory (at least 18 satellites) and more for global expansion of services (24 satellites). However should be said that 4 satellites are in technical maintenance and 2 –more than 2 years old- are now kept as a back-up, so only 20 would be fully operational.

Glonass system ("Globalnaya Navigationnaya Sputnikovaya Sistema" or "Global Orbiting Navigation Satellite System") was put into operation for the first time in September 1993 with a group of 12 satellites and has reached the projected number of 24 for a global coverage in December 1995. However due to financial problems at that time and to the lack of new investment, some satellites have been retired without beeing replaced.

The system consists of three orbital planes, separated by 120 degrees with the satellites from the same orbital plane being separated by 45 degrees. Each satellite makes a circular orbit at a height of 19.100 km and an inclination of 64.8 degrees and has an orbital period of 11 hours and 15 minutes. Satellites are uniquely identified by the so-called "slot number"-the first orbital plane contains slots 1-8, second plane slots 9-16 and the third slots 17-24.

Each satellite transmits two types of signals, a standard one for commercial applications and a high-precision encoded one used by military applications. There are actually 25 channels separated by 0.5625 Mhz in the so-called L1 frequency bands:1602.5625-1615.5 Mhz and L2:1240-1260 Mhz.

According to official information, when the system will be complete, the maximum positioning error will be 70 m, both horizontally and vertically, and the speed error will stay at a value of 15cm/s (in the case of civil system), the error decreasing to 10-20 m in the case of military systems.

To keep pace with competing satellite navigation systems, the Glonass system will benefit from an investment of $ 2.6 billion hoping to reach a total of 30 operational satellites in 2011. This change of the system's conception is a result of studies from 2007, when it was decided to change the number of satellites from 24 to 30-meaning 8 operational satellites plus two spares will be reserved for each orbital plate.

The new generation of Glonass-K satellites to be launched starting 2011, benefit from an improved design that should increase their operating period (10 to 12 years), reliability, as well as smaller size and weight (750 kg) which would allow the replacement of the Proton-M launcher with the new Soyuz 2 (and almost a halving of the cost of launch).

What happened with the Japanese Akatsuki probe

Recently, news about a Japanese attempt to insert the Akatsuki probe into an observation orbit around Venus spread around the globe. The attempt was a failure because the satellite escaped the gravitational field and remained on a large orbit around the Sun. We will try in this short article based on the little information released by the officials to see what could be the reasons for this anomaly.

First of all, we should give some basic details about the Japanese mission to Venus.
The satellite was sent on 20th of May 2010 from the Tanegashima space centre onto a 482 million kilometer flight to its destination, aboard a H II A rocket, on its 17th flight.
Five other platforms were sent with the same rocket, each of them designed to carry out different technological experiments: IKAROS, UNITEC 1, WASEDA-SAT2, KSAT and Negai.
The initial name (Planet-C or VCO “Venus Climate Experiment”) referred directly to the mission's scientific purpose, this being the 24th scientific platform built-up by Japan.
The prism shaped satellite, having the approximate dimensions 1.04 x 1.45 x 1.4 m, weights about 640 kilograms at launch (including 320 kilograms of fuel) and costs JAXA 25.2 billion yens (about 300 million Euros).
On board there are 6 scientific experiments: UVI (“Ultraviolet Imager”), LAC (“Lightening and airglow camera”), IR1(“1 µm infrared camera”), IR2 (“2 µm infrared camera”), LIR (“Long wave IR camera”) and USO (“Ultra stable oscillator”) which along with DE (Sensor Digital Electronics Unit) providing control and data processing- weight 37 kilograms out of the satellite's total mass.

The power system was designed to make use of an area of 2 x 1.4 m^2 and generates a nominal power of 1200W (with a minimum of 500W for the chosen orbit around Venus, calculated for the end of the mission taking into account the degradation of the solar cells). The satellite is equipped with two solar panels whose position can be adjusted on one axis, allowing them to follow sunlight even when the rest of the platform is directed towards a particular target (namely the surface of the planet).

The chosen orbit is an elliptical one with a high eccentricity, the satellite having to travel between 300 km for the perigee and 79.000 km (equivalent to 13 average Venusians rays) to apogee, with an orbital period of about 30 hours. Traveling in a westerly direction, the satellite has for 20 hours out of one period the same speed as the rotational speed of the atmosphere, allowing a better synchronization for observations of physical phenomena that take place there.
For comparison with the Venus orbital plane which is inclined at 3 degrees from the ecliptic, the Akatsuki probe should travel at an inclination of about 172 degrees.

The satellite command and control system, named by the Japanese AOCU (“attitude and orbit control subsystem with processor”) assures a three axes stabilization using an engine system (RCS or “reaction control system”), used in conjunction with the reaction wheels (RW). These momentum “storage devices”, four in total, are of two types: some bigger and able to develop 20Nms and some smaller, able to develop 4Nms.
The RCS system is composed of 12 monopropellant engines (N2H4) for attitude control, and one bipropellant engine (N2H4+NTO), or OME (“orbital maneuvering engine”) for orbital corrections.
Keeping a constant pressure in the two fuel tanks is provided by a compressor that pumps Helium from a special tank so that it compensates the loss and eliminates the compression and displacement effects induced from acceleration.

Normal engines are grouped in pairs and develop a traction force of 23N (8 of them) and respectively 3N (the remaining 4). As we mentioned earlier, these are the ones meant to do the small corrections necessary for attitude control and for the discharge of the momentum stored in the RW. OME is used only in two situations, but it plays a major role in the mission's success. Firstly, OME must pull the probe out of Earth's gravitational field and place it on a transfer orbit around Venus. Secondly, it must put the probe on an elliptical Venusian orbit.

The sensors consisted of IRU ("inertial reference unit with gyro"), two stellar cameras (STT-"star trackers"), solar sensors (TSAS and CSAS "sun aspect sensors") and accelerometers (ACM).

The thermal control system had to be specially designed for operating near Venus, where the solar radiation has a value twice as big as the one registered around Earth. Thus, despite the MLI ("multi layer isolation"), it is expected that 140 W/m2 of the solar energy will overcome the barrier and go inside the satellite. In addition to that, the electronics on-board dissipate about 500W and scientific instrumentation another 1000W, in nominal operating conditions.
Because of this, passive insulation was not enough and a number of dissipative panels were added. Another big problem to overcome was the internal temperature distribution which is not uniform, because in some areas a temperature of 20 degrees Celsius has to be maintained (board electronics) and in parallel there are regions where the temperature must remain at 0 degrees Celsius (the optical zone). Part of the thermal control system there is the possibility of heating (using a thermistor system with a maximum capacity of 300W) internal areas that are prone to low temperatures.

Communication with Earth is made in the X band, at a frequency of the transponders of 8 Ghz and a transmission power of 20W. Three types of antennas are installed on board: one HGA ("high gain antenna"), two MGA ("medium gain antenna") and two LGA ("low gain antenna").
HGA is circular, with a diameter of 1.6 m and has a gain of 37 dBi providing scientific data transmission to ground stations at a rate ranging from 4kbps at 1.5 AU, 8 kbps at 1.1 AU, 16kbps at 0.7 AU and 32kbps at 0.5 AU.
MGA is horn-type antenna, mounted on a panel that allows 180 degrees rotation, has a gain of 14 dBi and is used for "housekeeping" telemetry transmission (the one that includes essential data regarding on-board electronics) when the probe is performing observation missions and HGA is no longer oriented towards Earth. Transmission rates were calculated for values greater then 6bps (at a distance of 1.7 AU).
LGA is a wide coverage antenna and does not require precise positioning to aquire signal. The two antennas are mounted in tandem in the +x/-x directions, assuring in this way a spherical coverage. LGA is used for receiving remote commands sent from the ground station.
For nominal operation, two Japanese ground stations have been designated to communicate with the satellite – Uchinoure and Usuda, but the support of DSN ("deep space network") is also available through Goldstone, Canberra or Madrid in case of an emergency.

Some words about the scientific instruments onboard the spacecraft.
IR1 has been designed to study the cloud movement in the low atmosphere of Venus, the vapors distribution, the mineral composition of the soil or the existence of volcanic activity. Weighting 6.7 kg it has an optic system with a field of view of 12 degrees and a Si central sensor type CSD/CCD (charge sweeping device/charge coupled device) with 1024 x 1024 pixels. The instrument is able to scan Venus at three different wavelengths: 1.01 µm, 0.97 µm and 0.9 µm.

IR2 can go through the deep clouds of the planets and study the physics of it, the concentration and dimension of the component particles, the CO distribution and the phenomena which drive the circulation in the low atmosphere. A secondary role is played in studying (while traveling from Earth to Venus) the clouds of interplanetary dust based on the light emission passing them.
Weighting 18 kg the instrument –with a field of view of 12 degrees- is carrying a CSD/CCD detector of type PtSi and can scan at 4 different wavelengths: 1.735, 2.26, 2.32 and 1.65 µm.

LIR (long wave infrared camera) intends to study the movement and the convection current, the distribution and the speed of the wind above the clouds based on the images taken at the wavelength of 10 µm. It is actually a bolometer weighting 3.3 kg, with a field of view of 12 degrees and a 320 x 240 pixels sensor.

UVI (ultraviolet imager) captures the ultraviolet radiation and from its variation can measure the SO_2 level which is involved in the formation of the clouds or other substances from their composition and which absorb the radiation. Based on this it can be realized the diagram of the wind speed above those clouds. UVI, weighting 4.1 kg has an optic system with a 12 degrees field of view and a 1024 x 1024 pixels CCD sensor on Si technology, being able to scan at the wavelength of 283 and 365 nm.

LAC (lightning and airglow camera) weights 2.3 kg, has a field of view of 16 degrees and works at 4 distinct wavelengths: 777.4, 480-650, 557.7 and 545 nm. It is designed for the study of the airglow phenomena (the light emission of the oxygen from the upper atmosphere) and for the study of the electrical discharges which take place on the planet.

USO (ultra stable oscillator), 2 kg in weight, will observe the radio transmission through the Venus atmosphere, the temperature distribution based on the altitude and the density of the electrons. By emitting the radio waves at 8.4 GHz, the ground stations will measure the change of frequency in the received waves and the modification of intensity in the radio signal after passing the Venus atmosphere.

What is so special at our neighbor Venus to attract the attention of the scientists?
Venus, the closest planet to us and similar in size (the medium radius being 0.949 of the Earth's radius) is a very good source to understand the process which produced the Earth formation and its natural conditions.
The atmosphere is an extremely dense one, with a pressure around the value of 93 bar, mainly containing CO_2 which induces a greenhouse effect with temperatures of 740 K and high altitudes H_2SO_4-H_2O clouds.
Venus is at a distance of 0.7 AU from the Sun and executes a complete orbit in 224.65 Earth days. The Venus rotation is the slowest from all the planets with values of 6.5 km/h at the equator (compared with 1670 km/h for the Earth) and with a period of 243 days. Despite this the upper atmosphere is moving at much faster speeds of 360 km/h inducing very powerful tornados. Previous observations have seen two major vortexes placed on the poles of the planet and moving on the local vertical with a periodicity of 3 days.
Despite the previous explorations the atmospheric circulation and the meteorological phenomena or the fluid dynamics which sustain these mechanisms are unknown meaning there is enough place for major discoveries in this field.
Another point of interest for the scientists is the exploration of the surface of the planet specially the composition of the soil and the volcanic activities which take place all over the places.

Until now several missions have searched on Venus: Venera, Mariner, Pioneer Venus, Vega, Magellan and Venus Express from ESA which is the only active satellite at this location. The big agencies have kept their interest for future Venus explorations- ESA with the BepiColombo which will be launched in 2014 and which in its way to Mercury will take the opportunity to observe Venus, NASA-through the New Frontiers program which intends to send a lander on the surface of the planet and Roscosmos-which will launch in 2016 a new Venera mission, the Venera D.

The first program has been started by USSR in February 1961 when the first Venera 1 mission was launched with the purpose of a direct collision with Venus. Some days later the satellite has been declared lost from the communication point of view and later measurements have shown it failed reaching the target passing at a distance of 100.000 km from Venus.
USSR did not stopped here and the exploration continued with the Venera 3 in 1966 (marking the first human object passing the atmosphere of a planet and hitting the surface), Venera 4 in October 1967, Venera 5 and 6 in 1969, Venera 7 in 1970 which survived the surface impact and successfully transmitted the first data from the planet, Venera 8, 9 and 10 which transmitted the first images, the Venera 11 and 12 which made measurements on the Venusian storms, Venera 13 and 14 which realized the first investigations on the soil and transmitted the first color images, Venera 15 and 16 which made use for the first time of the SAR (synthetic aperture radar) for mapping the planet.
The Venera missions continued in 1985 when two new satellites from the Vega program focused on the Venus atmosphere.

On the other side NASA started the exploration with the Mariner program and for a short time even an Apollo mission with human crew has been considered. After the loss of the first probe Mariner 1, the second one Mariner 2 succeeded to observe the physical conditions on Venus from a distance of 34.000 km, followed by the Mariner 5 in 1967 which approaches to 4000 km from Venus and the Mariner 10 in 1974.
Investigations continued with the Pioneer Venus – a complex project including the satellite itself (which orbited the planet between 1978 and 1992) and 4 special probes which collected information from atmosphere.
In 1989 NASA was sending the Magellan spacecraft which in the 4.5 years of operations around Venus and with the help of the onboard radar succeeded to scan 98% of the surface and to make the most complete map.

For short periods some other satellites have been performing Venus observations i.e. Galileo, Cassini or Messenger.

Still, currently, as mentioned before the only active satellite around Venus is the Venus Express of ESA. VEX has been launched in November 2005 and reached the desired orbit (89.99 degrees x 24 hours orbital period) in April 2006.
It is a 1270 kg satellite (of which 570 kg of fuel), equipped with the following scientific instruments: VMC (Venus monitoring camera), ASPERA (analyzer of space plasma and energetic atoms), PFS (planetary Fourier spectrometer), VIRTIS (visible/ultraviolet/near infrared mapping spectrometer), MAG (Venus Express magnetometer), VeRa (Venus radio science experiment), SPICAV/SOIR (ultraviolet and infrared atmospheric spectrometer). Theoretically, from the scientific point of view, VEX should be complementary to the Japanese solution meaning that the data collected by JAXA should complement the VEX observations.

So, what happened with the Japanese probe? On the 6th of December Akatsuki started the maneuvers for orbital injection around Venus. The satellite had loaded onboard the sequence of commands necessary for this autonomous maneuver (there was no possibility to control it from ground as the reentry did not occurred on the visible side of the planet).
In general, the entry in a dense atmosphere as the one from Venus and the orbital injection can be made in 2 ways: using a big maneuver or using a succession of small maneuvers, both techniques having advantages and disadvantages.
For the Akatsuki satellite the first solution has been considered, the principal engine OME being ignited at 23:49 GMT for a burn of 12 minutes, a communication blackout of 22 minutes (another 2 smaller maneuvers on 11 and 13 December intended to perform the latest orbital corrections).
Unfortunately the ground stations re-established the connection with the spacecraft lately after 90 minutes at 01:28 GMT when they have seen the failure of the orbital injection, the spacecraft being found in safe mode and with telemetry at low rate via LGA.
From the analysis of the data collected in the internal memory it has been found that the main engine functioned for only 152 seconds while the acceleration progressively decreased in parallel with the decrease of the pressure in the fuel tank. In the interval 152-158 s the acceleration dropped suddenly from 0.8 to 0.5 and the satellite lost its stabilization and rotated by 42 degrees. Almost immediately AOCS switched the stabilization from the RCS system (by commanding the closure of the fuel valves) to the RWL system.

However due to the high rotation previously induced and because of the limited momentum of the RWL, the spacecraft could not stabilize itself and went down autonomously to the safe mode at the moment 375s.

The engineers are still doing investigations. It appears that the uncontrolled rotation has been produced by a malfunction of the main engine. OME has a special ceramic expansion cone and from the first observation it is thought that this one has been somehow damaged. Initially it was taken into account the possibility of an impact with small space debris which could break the ceramic nozzle but this has a very low probability. Then the engineers made the connection between the decrease of the pressure in the tank and the OME. Thus, because of an inconstant fuel supply, the engine started to work intermittently and this added on top of the heat produced by the atmosphere re-entry could induce a thermal stress on the ceramic nozzle breaking it. When this thing finally happened the engine’s jet has been suddenly redirected to another vector, inducing a major perturbation and the loss of the stabilization. In the end the cause of this anomaly could be a defective valve of the Helium pressure installation or even worst a pipe that could be broken. Encountering this kind of anomaly is not new for JAXA which already has a negative score in the field of propulsion technology.

This is the second failure of the Japanese agency after the one of the Nozomi spacecraft which had as destination the planet Mars. The first orbital injection attempt in 1999 has failed due to a defective valve the spacecraft being left in a large orbit around the Sun. The second attempt was intended to take place in 2003 but in 2002 a solar flare hit the onboard equipments and canceled any possibility to run the maneuver.

Later on major propulsion problems affected the Hayabusa satellite, the success of the maneuvers performed above the Itokawa asteroid being a subject of debate until the last moment when, after returning to Earth, the specialists analyzed the probes collected by the onboard capsule.

JAXA has no other choice and as with the satellites mentioned earlier it will go further and try to recover the mission. The Akatsuki spacecraft, despite the failure of the orbital injection, could be used for some other experiments and for gaining experience which in the end could prove vital for the future, as with the lesson learned from the Nozomi and which helped operating the Hayabusa spacecraft in its way back to Earth.

Still a question stays in place- how difficult if not impossible it will be to perform a future orbital injection around Venus. Despite of the more than enough onboard reserve of fuel, even if the defective valve will be isolated, there is still a suspicion over the functionality of the OME engine and which should be clarified in the following days by performing small activations of the thruster and by monitoring the performances of the propulsion. If indeed the nozzle is broken JAXA will have a very difficult mission to calculate the next orbital injection when a very precise direction for thruster firing is requested. A good chance would be if the hole in the ceramic nozzle has increased in the past days, something that should cause its complete cease and detach from the engine. If this is the case- with no nozzle left, even if the thrust force decreases at least will be easier to keep the direction.

On long term, considering the current orbit which will bring the satellite back to Venus somewhere in December 2016 or January 2017 it will be interesting to see if the batteries, the solar panels and the rest of the electronics will last until then, taking into account that they have been designed for a 2 years lifetime and for a different kind of orbit.

China establishes a new record for the number of launches in 2010

Friday 17th of December China realized the 15th and last launch of the year 2010, establishing an absolute record in the space history of the country (compared with the previous record- 11 launches in 2008). Launched at 20:20 GMT aboard the Long March 3A rocket from the Xichang space centre, a new Beidou satellite come to sustain the other 4 platforms launched this year.

The new satellite is part of the Chinese navigation system Beidou (in English “Big Dipper”) called also CNSS or Compass Navigation Satellite System. More precisely we speak about the second generation of the Beidou 2 which intends to assure the country independence from the equivalent systems of the concurrence: the American GPS, the European Galileo, the Russian Glonass and the Indian IRNSS-Indian Regional Navigational Satellite System.

The Chinese interest for the satellite navigation and positioning technique appeared for the first time in the late 60s. Following the GPS example, in the middle 80s China succeeded to develop a new regional navigation concept called “Twin Star” and which has been tested practically in flight on two telecommunication platforms DHF-2A in the year 1989.

The test has shown that the precision of the system was reaching the one of the public GPS service and this convinced the Chinese authorities to invest more money for research and development.

The first Beidou generation comprised the Beidou 1A launched on October 30 2000, the Beidou 1B launched on December 20 2000, the Beidou 1C launched on May 24 2003 and the Beidou 1D launched on 2nd of February 2007. After the launch of the third satellite the system became operational at the beginning of 2004, China being the third country with its own satellite navigation system. The reference system used was Beijing 1954 one aligned with the Beijing’s time.

The first two satellites have been placed at the orbital positions 80 degrees East and respectively 140 degrees east. The third and the fourth which were considered backup have been sent to 110.5 degrees East respectively 58.7 degrees East (the last one being recovered from a major problem- after the launch the solar panels could not be unfolded easily and it took some time until the engineers managed to do it).

In this configuration Beidou 1 was able to cover the area between 70 and 140 degrees East longitude and 5 to 55 degrees North longitude and had a precision of 100 m when 2 satellites were used, precision which could increase to 20 m when the full capacity (4 satellites and all the ground stations) was used. In total up to 150 users could be served simultaneously.

The technique behind the system was called “dual way transmission” and was a complicate solution: the ground terminals receive the signal from one of the two satellites then an answer wass sent back to both the satellites. This signal was sent further to a ground station and by comparing the time shift between the two signals one could calculate the plane position of the terminal. By comparing this position with a three-dimensional database incorporating detailed maps of the Chinese regions it can be found the spatial position of the terminal. Finally this position was sent by the ground station back to the satellite and from here the encrypted signal goes back to the terminal and the operator could read the spatial coordinates. In parallel the users can transmit encrypted text messages to the ground station.

As it can be seen, the system was quite primitive and had some deficiencies: the limitation in the number of simultaneously users, the necessity of using big and powerful antennas for transmitting the signal to the satellite and last but not least the risk involved by the use of the ground stations (this being exposed in the case of a military conflict).

The second generation includes the Beidou2 M1 launched on 13th of April 2007, the Beidou I1 launched on 31st of July 2010, Beidou G1 launched on 16th of January 2010, Beidou G2 launched on 14th of April 2009, Beidou G3 launched on 2nd of June 2010 and Beidou G4 launched on 31st of October 2010.

The Compass constellation will comprise finally in 2020 a number of 35 satellites in a unique architecture which combines 5 geostationary satellites and 30 satellites orbiting the Earth in MEO and grouped in 3 orbital planes.
For instance the first MEO satellite the BD2 M1 has been placed in an almost circular orbit 21545 km x 21519 km x 55.26 degrees. The IGSO (inclined geostationary orbit) satellites have a 35652 km x 35959 km x 55 degrees while the simple geostationary satellites (under the indicative G) have a null orbital inclination

The signals are transmitted at 4 distinct frequencies: 1195.14-1219.14 MHz, 1256.52-1280.52 MHz, 1559.05-1563.15 MHz and 1587.69-1591.79 MHz, some overlaping the frequencies of GPS or Galileo. As the ITU (International Telecommunication Union) law says the first operator which emits in a specific band will have priority, it will be interesting to see if the Chinese will succeed to occupy the frequencies before the European system Galileo will do it. Anyway, for sure it will be necessary to perform supplementary tests in order to prove the three systems functioning in parallel will not interfere.

The Beidou2 are based on the DFH3 (Dong Fang Hong), have the dimensions 2.2 x 1.72 x 2.0 m, with a wide-span of 18.1 m and weighting 2200 kg (1100 kg of fuel). The lifetime – 5 years in the case of the commercial satellites has been extended to 8 years for the military variant.

DFH3 is a platform derived from the American variant GE Astro Space 5000 (specially the attitude control system), supplementary technology coming from the Daimler Benz Aerospace AG (for the communication components and for the mechanism which unfolds the solar panels).
BD2 is three axis stabilized with the help of a propulsion system using a FY 25 liquid fuel engine which performs orbital maneuvers and orients the spacecraft toward the ground station. This technology has been initially imported from the German company MBB through a commercial contract and later extended by the Chinese specialists.
The power system gives up to 1700 W DC. The platform could integrate instruments weighting up to 170 kg and having a power consumption of up to 900 W.

In the first phase the coverage will be limited to the Chinese territory and the neighbor countries but later on it will be extended worldwide. As with the rest of the satellite navigation systems Compass will have two components: a civil one with an accuracy of 10 m (position), 0.2 m/s (speed) and 50 ns (time) and a more precise military component.

How the spatial year 2010 ended-Part One

On December 25th 2010, India with its space agency ISRO has tried to put a new geostationary satellite into orbit. GSAT-5P was planned to enter operation (for about 14 years) in May 2011 joining in orbit the older GSAT-3E (which was launched in February 2003) at 55 degrees East orbital position. The flight was extremely short and eventually ended with the payload and rocket loss.

The 2310 kg weighting satellite, of which 1335 kg of fuel, built on a I-2K platform was equipped with 24 transponders for nominal configuration and another 12 additional transponders, all working in the C band. The satellite was served by two solar panels generating a minimum power of 2600 W more than enough for the transponders' consumption estimated at 1700 W.

If for INSAT-3E's launch ISRO used the services of Ariane 5 rocket, this time they wanted to launch aboard a GSLV rocket of indigenous origin that would have had to leave the satellite in a geostationary transfer orbit GTO from where the orbital corection engine which develops a traction force of 440 N would have took over the task of trajectory circularization and the decrease of the orbital plane inclination.

According to the committee that investigated the causes of the accident, 10 of the connectors that ensured the transmission of commands from the on-board computer located in the upper part of the rocket's body and the electronics that control the four rocket boosters broke down due to the vibration or acceleration induced by the dynamic pressure, most likely this being the result of manufacturing defects. The flight went normally until T0 +47.5 s, but at the time T0 +47.8 the onboard telemetry showed the first error. Shortly, the booster system which ensures the lift-off for the first 2.5 minutes, with no orientation commands and with no stability- ended up putting the rocket in an undesired attack angle and consequently induced to the structure a dynamic stress above the permissible values. At T0+53.8 s, the rocket body broke because of the pressure which has been subjected to, ending up in a ball of fire that caught the attention of TV cameras present at the event. To avoid any problems at T0+64s the Indian flight engineers ordered a controlled explosion which destroyed the rocket. The final conclusions of the official invetigation remains to be seen, and what recomandations will be made to avoid repeating the inccident, but ISRO is now under pressure,being the second accident the Indian Agency encounters in 2010.

GSLV of Geosynchronous Satellite Lauch Vehicle is a rocket with a mass of 402 tons, having a 3-stages construction that combines solid and liquid fuel. It is in service since 2001, with seven launches (6 under Mark 1 indicative and 1 as Mark 2) of which 4 were successful. Of the Mark 1 launches, one failed due to a manufacturing defect of a component (a complete failure in July 2007 when the satellite Insat 4C was lost), and another was a semi-failure (in September 2007 a defection of the last stage of the rocket caused the Insat 2CR satellite to be placed in an orbit lower than desired, but later it has been moved through it's own engines on the desired geostationary orbit). Also on April 15th 2010, the test flight of the new version Mark 2, launched from the Satish Dhawan Space Center in Sriharikota has failed after the third stage of the rocket deviated from the desired trajectory as a result of a faulty fuel pump.

GSLV Mark 1 has a lift off capacity of 5000 kg for a low orbit (LEO) and respectively 2200 kg for geostationary transfer orbit (GTO). The successor of this series is the Mark 2 rocket, which was expected to enter in operation for comercial flights somewhere in 2011 but in the end got some delays due to technical problems encountered.

This is a completely new generation that, beside the technical improvement of the existing GSLV, will also provide a halving of the launch cost. In addition, if the results will be good, the Mark 3 version-the mature product of the series- will provide a technical support for the manned space flight program, which India will try to put in place starting 2015, the new rocket being the basis of the future launches. It should be noted that this program began in 2007 with the flight of so-called Space Capsule Recovery, a 550kg capsule from which will be derived the next generation orbital vehicle that will be able to carry 2 astronauts on a LEO orbit with an altitude of 400 km.The entire program will cost India around 2.2 bilion dollars.

So what's new to this version of GSLV? India has signed a partnership with Russia that would have to assure support for its future space programs specially in the sensitive area of sending astronauts into space. The agreement was signed with Roskosmos in December 2008 during the visit of Medvedev to India and continues the tradition of bilateral cooperation started in 1984 with the first flight of an Indian astronaut on board the Salyut space capsule. Besides the logistical support that it hopes to obtain from this agreement, another training flight of an Indian astronaut will be held aboard a Soyuz in 2013. Collaboration does not stop here but has materialized so far through technical support to Indian rocket engines- we're talking mostly about the third stage of GSLV rocket. This KVD-1M type engine, supplied so far by Russia from the Proton rocket, will be replaced by building an own Indian cryogenic engine (CS).

The old Russian engines runing on liquid hydrogen and oxygen were sold in the early '90's, right after the collapse of the USSR. In total India has purchased 7 pieces of which 6 have already flown (and only one remained on stock until the entry into operation of the new Indian engine). After 1990, due to technology transfer regulations, India was not able to buy anymore Russian components and instead forced to develop an indigenous engine. But its development in laboratories lasted more than 18 years.

Cryogenic engines are more efficient than conventional solutions but on the other hand it asumes complex design and construction solutions because they involve low temperatures which implies thermal and structural stress on components. Apart from replacing the third stage engine, it is likely to appear small structural changes at the lower stages to improve their performance.

At the same time with the development of the Mark 2 version, will continue the efforts for the Mark 3 version-which should come into operation in 2012 and which will replace the four start boosters with other 2 larger, will introduce a new engine based on liquid fuel for the first stage, a restarting engine for the second one and will improve the performance of the cryogenic engine tested on Mark 2.

Beside GSLV India currently owns the PSLV launcher or Polar Satellite Launch Vehicle- a 294 tons rocket with four stages that combines solid and liquid fuel and is able to launch a payload of 3200 kg in a low orbit (LEO) or 1600kg in a Sun-synchronous orbit (SSO). Since April 2008 it also holds the record for the number of satellites launched at a time –with 10 satellites launched simultaneously.

How the spatial year 2010 ended-part 2

The ILS (International Launch Services) company based in Virginia, USA, and whose main shareholder is the Russian company Krunichev Space Center, manufacturer of the Russian Proton rocket and the one who has the exclusive rights to sell the transport services to all commercial satellite operators worldwide-has made its last flight in the late December 2010.

The launch took place from Baikonur Cosmodrome on Sunday December 26th 2010 at 21:51 GMT. Separation from the carrier rocket occurred 9 hours later at 07:03 GMT when the ground stations have received the first signal of the satellite located in an intermediary orbit (35888 km x 3712 km x 24.6 degrees).

The satellite will correct its orbit with the help of onboard engines i.e. to reduce the orbital plane inclination and increase the height of the perigee until obtaining a circular trajectory. Then will be placed at 9 degrees East orbital slot and will be subject to further testing until May 2011 (when is expected to enter the effective operation).

This was the 12th launch of a Proton rocket in 2010 and 64th use by ILS. Previous commercial releases have been made on October 14 and November 14 with the XM 5 and SkyTerra 1 satellites. The launch was postponed by one week to expect the first results of the official investigation after the December 5th accident when a military version of the Proton rocket used by the Russian space agency Roscosmos failed to send into orbit a payload consisting of three Glonass satellites.

The Proton rocket which came in operation under UR500 indicative made its debut in a flight on 16 July 1965. Since then, it has managed to carry over 360 flights with most complex scenarios: was used to launch Russian interplanetary missions to the Moon, Mars, Venus and Comet Halley, transported cargos for the Mir stations and now for the ISS and finally transported military and commercial satellites intro orbit.

The Proton rocket is 58.2 meters long and weights 705 tons in normal configuration. It is equipped with three engines and a system of boosters, with a length of 42.3 m and a diameter ranging between 4.1 and 7.4 m. Also there is the additional Breeze M system which develops an additional force of 20 kN and is equipped with a three axes stabilization system, a navigation system and an onboard computer that is responsabile for the quality of orbital injection. In this case, the amount of loaded fuel depends on the mission and is variable to optimize the flight performance. The first stage of the rocket is powered by 6 RD 276 type engines that provide a total of 11 MN. The second stage is powered by three RD 210 engines, plus a type RD 211 engine providing a total force of 2.4 MN. The third stage is powered by a type RD 213 with 583 kN traction. The flight control is made with triple redundant avionics system which commands a 31 kN motor with four nozzles. In this configuration, the rocket is capable of carying a mass of up to 6360 kg in a geostationary transfer orbit.

KA-SAT is the first Eutelsat satellite exclusively equipped with Ka-band transponders (a total of 82) and will join the HotBird satellite fleet which operates in the Ku band serving the European, North African and Middle East areas. It is the 17th satellite built by EADS Astrium for the Eutelsat operator, as part of an agreement signed in January 2008.

Built on a Eurostar 3000 platform, the 6150 kg satellite has a life expectancy of 15 years. It's equipped with two solar panels that generate a minimum of 15 kW, enough for the usage of the transporders (11 kW) and is able to handle a 70 Gbits/s bidirectional traffic- 35 times more than standard Ku satellites and 5 times more than any other satellites in the Ka band. It is estimated that this capability will soon allow to drop the satellite internet prices to values comparable to those of terrestrial operators.

The previous launch of an Eutelsat satellite was on October 28th 2010 when an Ariane 5 rocket put into orbit the W3B platform.
The next commercial release of ILS will be made sometime in 2011 when the satellites Luch 5A and Amos 5 will be on board.

How the spatial year 2010 ended-Part 3

Wednesday, December 29 2010 the hangar ELA 3 of the Kourou space base in French Guiana was the scene of the last year's launch, when an Ariane 5 rocket was launched at 21:27 GMT to transfer on a GTO orbit a payload of two telecommunication satellites.

This was the 55th flight for an Ariane 5 rocket and the flight number 199 since 1979 when Ariane series went into operation.

Hispasat 1E satellite is the second in a series of five designed to bring a major improvement in the working capacity for the Spanish operator. Built by Space Systems/Loral on a LS-1300 platform under an agreement signed in July 2008, the satellite weighting 5270 kg, will be joining the orbital position 30 degree West and share the position with two older platforms: Hispasat 1C and 1D launched in 2000 and 2002 respectively. From there it will operate for a period between 15 and 18 years, 53 Ku-band transponders providing services such as Fixed Satellite Services (FSS) and Broadcast Satellite Services (BSS) with coverage in Europe, North America and North Africa.

KOREASAT 6 is the 6^{th} satellite of South Korea's KT Corporation. It's a 2622 kg satellite built in partnership by Thales Alenia Space and Orbital Sciences Corporation on a Star 2 platform. It will operate for a minimum of 15 years, from the 16 degrees East orbital slot, 30 Ku-band transponders with the stated purpose of providing HD-TV and 3D-TV mainly for the Korean peninsula.

Ariane 5 is the favorite candidate for commercial launches today because of proven reliability over time (since December 2002 when the ECA version has been introduced in use and when its inaugural flight also ended with the loss of the loaded satellites-Stentor and Hot Bird 7-the rocket has an impressive record of 36 flights without fail).

Ariane 5 has three constructive versions: GS, ES and ECA. The major difference is that the GS version uses a Vulcan 1 engine type for the first stage while the other two use the Vulcan 2 type engine. ECA is the only commercial launcher version capable of rising a total payload of 9.6 tons composed of two different platforms (satellites, together with the integration and protection equipment).

In length of 50.5m and with a total mass of 780 tons, the launcher makes use of two MPS Europropulsion engines using solid fuel with a thrust force of 5060kN (and a reaction time of 1300s), a cryogenic main stage Vulcan2 Snecma with the force of 1390kN (combustion time of 540s) and a final cryogenic stage ESC-A Astrium Space Transportation powered by a Snecma HM-7B engine with a force of 67kN and a reaction time of 945s.

Finally, the top of the rocket houses the SYLDA internal structure surrounding the two satellites and the flight thermal protection structure developed by Oerilikon Space.

In 2009 Ariane 5 managed 6 flights (5 in ECA version and 1 in GS) and the launch of 14 satellites: Hot Bird 10/NSS-9/Spirale A/Spirale B in February 2009, Heschel/Planck in May 2009, TerreStar-1 in July, JCSat 12 / Optus D3 in August, Amazonas 2/ COMSATbw-1 on 1 October, NSS-12/ Thor-6 on 29 October and finally Helios 2B on 18 December. About these missions, Space Alliance reported in separate articles from 2009.

In 2010 all the six Ariane flights were made in ECA version: Astra 3B and ComsatBw 2 in March, Arabsat 5 A and COMS 1 in June, Nilesat 201 and RASCOM-QAF 1R in August, Eutelsat W3B and BSat 3b in October, Intelsat 17 and Hylas 1 on 26 November and finally the flight on which we have given details in this article.

How the spatial year 2010 ended-Part 4

In an article from April we mentioned an incident that affected one satellite of the Intelsat fleet- the Galaxy 15. Then , apparently following an intensification of solar activity on April 3 to 5, Intelsat completely lost control of the satellite -more precisely its transponders continued to function but any attempt of controlling it was unsuccessful.

Galaxy 15, built by Orbital Sciences Corporation Company-the same that provided another 5 satellites to Intelsat-was sent into orbit in October 2005 and had an estimated flight resource until 2022.

It's built like its predecessors on a STAR 2 platform that is considered by its manufacturer as cheaper, more compact and lighter than those offered by other competing companies and last but lot least- it's capable of hosting most of today's existing communication configurations.

The satellite weights 1892 kg, taking benefit of the two solar panels located on both sides, each consisting of four elements based on Ga-As technology. The energy generated is stored in two Li-ion battery systems with a capacity of 4840 Wh.

Three axes stabilization is achieved using a monopropellant propulsion system based on hydrazine and for orbital maneuvering a bi-propellant system is used.

Equipped with 24 transponders in the C band and 1 in the L band, the satellite provides media services for operators in North America and respectively for the American Aviation Authority.

In April Intelsat announced that in order to prevent possible network disruptions, it was decided to temporarily move an older Galaxy 12 platform, launched in April 2003 and equipped almost identically with 24 transponders in the C band (without the L band transponder used for commercial aviation)- from the 123 degrees West orbital slot at 133 degree West where the Galaxy 15 was operating.

Installed in the new position since April 14, the satellite took up duties of the defected platform until the investigations of the technical issue will provide a solution.

The failure of the Galaxy 15 is coming on top of the one of IS 4 in February and led to company financial results below expectations for the fist months of the year but still increased by 2 percent over the same period of the last year. With a number of 2025 active transponders before the appearance of the problems at Galaxy 15 (of which 82% were used at maximum) Intelsat executives hope to see better results in the next period and thus to reassure shareholders about the company's future.

Returning to the initial technical problem, it has to be recalled that after intense testing and after sending of nearly 200,000 commands Intelsat failed to take control, then in a desperate attempt to resolve the situation, on May 3 the company decided to send powerful radio pulses to force the satellite's power system to break and to close the active transponders- unfortunately also without success.

Without having all the details, we speculated on possible damage and technical solutions that engineers have to overcome, so we said that the fault could be located either in the antenna's decoder or in the board processor that under the influence of a high energy flow could have corrupted the software (damage which can be solved by a classic software 'update' after the current board image is downloaded and compared with the right one).

To reach that point, engineers needed to take control of the satellite by forcing the satellite's computer to execute commands sent by the ground. Because these situations happened many times in the spatial history, designers take care ever since the designing phase of a platform to provide a minimum of functionality, namely as we mentioned, command execution can be achieved either classical via software or in exceptional cases when the latter does not respond (as is the case here) via hardware interfaces that can directly reset the onboard circuits. These last-mentioned commands also called "high-priority" are executed quickly, along with their reception, and as we said do not have to follow the logic of the onboard algorithms.

At least theoretically, these commands should solve the classical satellite communication issues but it seems that in this case there was a more complex problem because after extensive testing and deployment of nearly 200,000 Intelsat commands, Intelsat failed to take control.

Without the reception of orders from the ground, the so-called "station keeping commands", the satellite has put itself into motion and began to move eastward. In nine months of uncontrolled flight, the satellite has crossed a geostationary satellites zone active in TV services for the American continent, satellites belonging to several operators: Intelsat, SES, Telesat of Canada and Satmex of Mexico.

At 131 degrees West orbital position, has met first on May 23 the SES Astra satellite AMC-11 which for some television programs uses the same frequency range. To avoid possible interferences, it has been decided to move AMC 11 from Galaxy 15's influence area.

Then Galaxy 15 came in the influence area of other Intelsat satellites-first time around Galaxy 13 in mid-July, then around Galaxy 14 and 18 in August.

Galaxy 23 (affected in late August) then Anik-F3 belonging to Telesat operator has also performed maneuvers to avoid the radio interference.

Problems caused by Galaxy 15 were supposed to come to an end in August because the command and attitude control system constantly degrades, and without the commands for maintaining attitude it was expected to lose the alignment towards the Sun-case in which the satellite would remain without power. Intelsat engineers' predictions proved to be inaccurate because it had to wait until December for automatically reset of the board computer. More precisely, on December 23, the satellite has started to work again and was able to send telemetry and accept commands from ground operators. At least for the moment all the problems seem solved and Intelsat said in an official press release that the satellite is no longer a threat for the rest of the commercial operators and in short time it intends to put the satellite again in usage in its commercial fleet. A few weeks will be required for detailed investigation to understand what caused this anomaly and how such situations can be avoided in the future, to finally stabilize its orbit and move it in an operational slot.

Until then, the satellite is kept in safe-mode position in the so-called 'sun-pointing'; that is aligned with the solar panels toward the Sun with the batteries charged at maximum. Current orbital position is 121 degrees west. Transponders are switched off completely to avoid further complications and a mini-update of the software has already been done to improve the unit decoders that allow changing the antenna. A major SW update will come in place as soon as the satellite will be stabilized to the 'Earth-pointing' position.

SPACE ALLIANCE

How the spatial year 2010 ended-Part 5

Recently, on December 5, we reported about the launch of the Proton rocket from the Baikonour Cosmodrome, when on board were 3 new satellites from the Glonass constellation: Kosmos 2470, 2471 si 2472. If the previous flights serving the Glonass network used the Proton M-Blok DM2 configuration that time was preferred the new Blok DM3 configuration.

Russian company Energia, which builds the Proton rocket, has recently invested a large sum of money and managed to take, as reported in another Space Alliance article, the majority of the SeaLaunch's shares, the operator who went to bankruptcy recently. There is therefore a long-term strategic reason for improving the performance of the Blok DM system as it will be used for some future commercial flights, and this testing opportunity, financed with government money, could not be ignored.

Unfortunately, the launch was a total failure, resulting in the loss of all three satellites in an accident serious enough to affect the strategic interests of the country, and Russian authorities reacted immediately, president Medvedev ordering an official investigation. Furthermore, the investigation had a direct impact on the commercial launch of ILS (International Launch Services)- though this uses the Breeze M version, its satellite Ka-Sat's launch being postponed from December 20 to December 26.

The Glonass system would have had, according to official information, 26 satellites in orbit. Theoretically the number is sufficient for a complete coverage of Russian territory (at least 18 satellites) and more for global expansion of services (24 satellites). However should be said that 4 satellites are in technical maintenance and 2 –more than 2 years old- are now kept as a back-up, so only 20 would be fully operational.

Glonass system ("Globalnaya Navigationnaya Sputnikovaya Sistema" or "Global Orbiting Navigation Satellite System") was put into operation for the first time in September 1993 with a group of 12 satellites and has reached the projected number of 24 for a global coverage in December 1995. However, due to financial problems at that time and to the lack of new investment, some satellites have been retired without beeing replaced.

The system consists of three orbital planes, separated by 120 degrees with the satellites from the same orbital plane separated by 45 degrees. Each satellite makes a circular orbit at a height of 19.100 km and an inclination of 64.8 degrees and has an orbital period of 11 hours and 15 minutes. Satellites are uniquely identified by the so-called "slot number"-the first orbital plane contains slots 1-8, second plane slots 9-16 and the third slots 17-24.

Each satellite transmits two types of signals, a standard one for commercial applications and a high-precision encoded one used by military applications. There are actually 25 channels separated by 0.5625 Mhz in the so-called L1 frequency bands :1602.5625-1615.5 Mhz and L2:1240-1260 Mhz.

According to official information, when the system will be complete, the maximum positioning error will be 70m, both horizontally and vertically, and the speed error will stay at a value of 15cm/s (in the case of civil system), the error decreasing to 10-20m in the case of military systems.

Returning to the initial thread, the committee instituted on December 5 by President Medvelev to investigate the causes of the accident has recently made public its findings. While the Proton rocket configuration was tested many times in space flights, the Block DM3 upper stage is new and was initially suspected as being the cause for the fault. This track was abandoned because it was proven that both the rocket and the auxiliary module worked perfectly.

Instead, it was found that Energia misjudged the amount of oxidizer necessary for Block DM-03, exceeding the indicated weight with 1-1.5 tons which has put the rocket into the wrong path and lead to the loss of three satellites. Both Roskosmos and Energia overlooked this simple calculation error as the commission ends up finding serious flaws in space flight preparation procedures.

Although the investigation was purely technical in the viewfinder, directions were extended so that we can easily talk about political issues and corruption.

Since 2001, the Glonass navigation system costs Russia 4.7 billion dollars and as mentioned is still not at full capacity although, despite the fact of being a key element for the Russian government.

To keep pace with competing satellite navigation systems, the Glonass system will benefit from an investment of $ 2.6 billion hoping to reach a total of 30 operational satellites in 2011. This change of the system's conception is a result of studies from 2007, when it was decided to change the number of satellites from 24 to 30-meaning 8 operational satellites plus 2 spares will be reserved for each orbital plate.

The new generation of Glonass-K satellites to be launched starting 2011, benefit from an improved design that should increase their operating period (10 to 12 years), reliability, as well as smaller size and weight (750 kg) which would allow the replacement of the Proton-M launcher with the new Soyuz 2 (and almost a halving of the cost of launch).

But until the release of this investment, the Russian leaderships want to see how the money is spent.

Satellites have been assured by the Sputnik Insurance Center Company, in whose administration board is found sons of current and former head of Russian space agency Roskosmos. To avoid the accuses, and probably put under pressure, the insurance company has promised that there will be no problems in the payment of the insurance, but as with many other similar situations in the past there are a lot of legal issues that can be raised and potentially slow down the process. The investigation also revealed more serious problems. Nearly 50 years after Gagarin's flight, the Russian space program still suffers major management deficiencies: the Angara rocket is still at the design stage, Svbodnyy Cosmodrome is still not functional, already started projects suffer major delays and very little money are invested in new tehnology.

In a global market for navigation solutions estimated at 60-70 billion a year, Russia was aiming for a niche of 15% (9-10 billion dollars and more than the earnings coming from the weapon sales) but only managed to stay at 1% well below its expectations.