

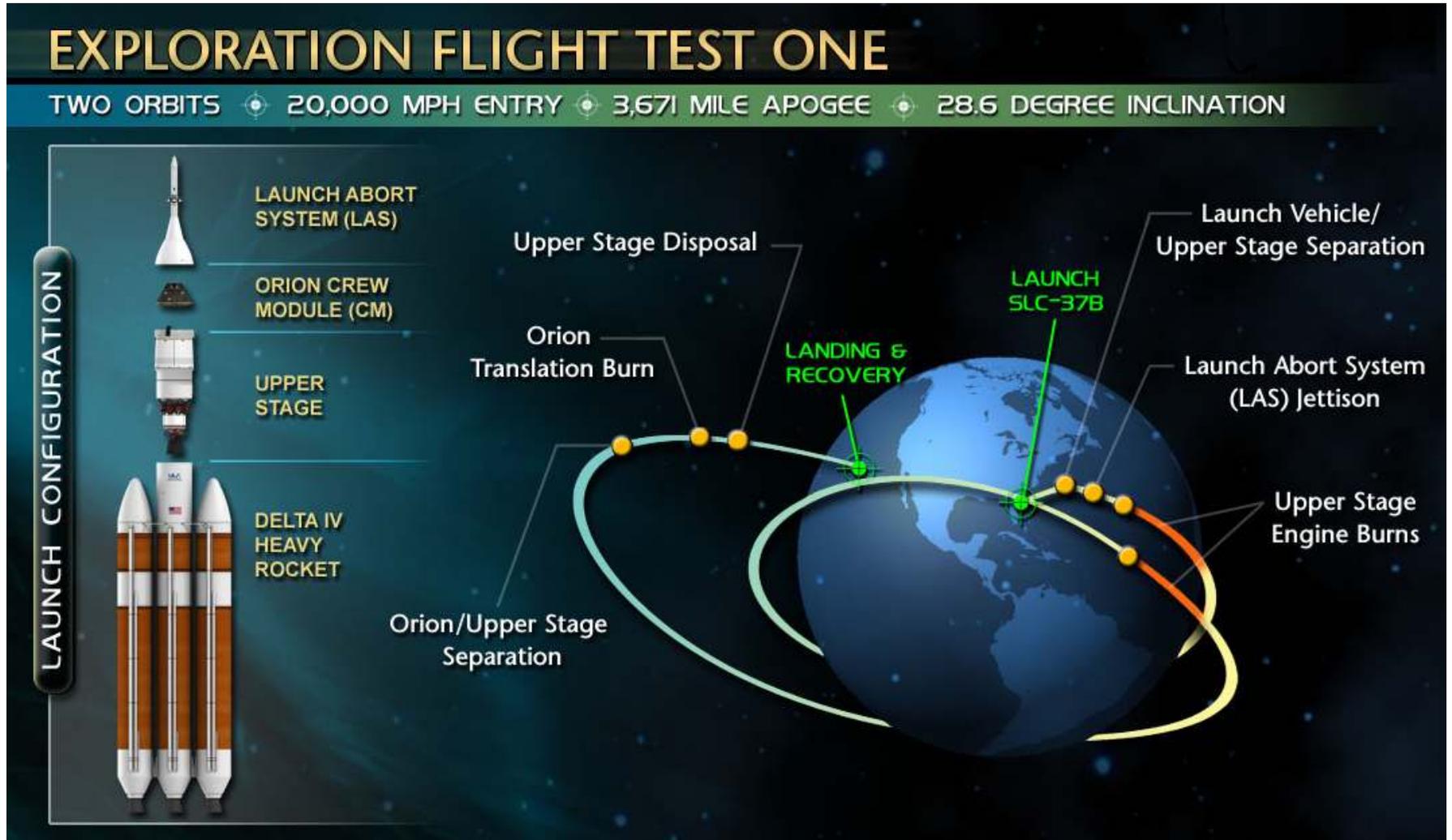


TIROS SPACE INFORMATION NEWS BULLETIN

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Orion EFT-1 flight

The *Tiros Space Information (TSI) - News Bulletin* is published to promote the scientific exploration and commercial application of space through the dissemination of current news and historical facts. In doing so, Tiros Space Information continues the traditions of the Western Australian Branch of the Astronautical Society of Australia (1973-1975) and the Astronautical Society of Western Australia (ASWA) (1975-2006).

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Calling card...

Recently there have been some problems with the Kosmos identification of Russian satellites. Some of these problems have now been resolved, as is clear from a paragraph in this News Bulletin, whereas others remain.

I have been advised that officially the Kosmos names are assigned by Russia and they report these to the United Nations OOSA office in Vienna. However, it appears that no Russian entity has a responsibility to publish these in a timely manner.

The current arrangement now seem to be that Roscosmos sends official information to the Russian foreign ministry, something that occurs many weeks after the launch.

In due course, the foreign ministry sends this information to Vienna, and UN OOSA publishes this information a few month later via their website.

In the meantime USSPACECOM assigns a designation independently, based on their best judgement.

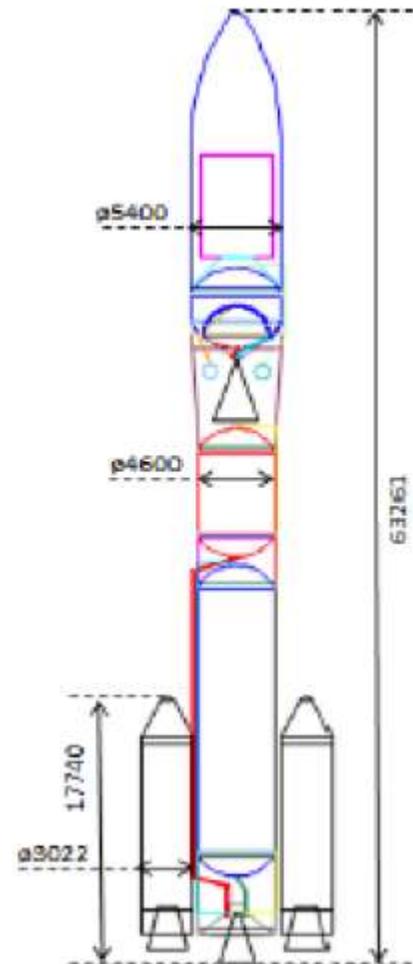
On top of all that it has been suggested that all other Russian publications should be regarded as preliminary and prone to corrections. UN notes are amendable too.

This is, of course, nothing new. A totally random check of a UN OOSA reports indicates that Kosmos-1127, launched on 5 September 1979 was not reported by Russia until 23 January 1980. And that is not something typical Russian, Australia did not report Aussat-3, launched on 15 September 1987, until 3 May 1989 and Optus D-1, launched on 13 October 2006 was not reported until 22 December 2008.

Part of the problem is, perhaps, that these days we have sufficient advanced information to know that, for instance, the satellite launched by Russia on 30 November 2014 is a Glonass K satellite. This is in contrast to 'the olden days' when a Kosmos satellite was launched without any notice and careful analysis by western observers would conclude its purpose after a while.

Well, after the Navstar identification problem that I highlighted last month, all I can say, life is not meant to be easy....

Jos Heyman



Ariane 6

At its December 2014 meeting the ESA Council agreed on the development of the Ariane 6 launch vehicle. Intended to replace the Ariane 5, the first launch is expected to take place in 2020.

The phasing out of the Ariane 5 is the result of competition, where cheaper launch vehicles can now orbit satellites that have become lighter due to improved technology.

The decision came after disagreement between Germany, that wanted to develop the Ariane 5ME (Midlife Evolution), and France that wanted the Ariane 6. And indeed the current agreement appears to be a compromise between the two.

The Ariane 6 will come in two versions, the Ariane 62, that will have two P120 solid boosters, and the Ariane 64, which will have 4 P120 solid boosters.

The first stage will be powered by a Vulcain engine with liquid oxygen and hydrogen fuel whilst the second stage will be a LOX/LH2 fuelled Vinci engine. The total length of the launch vehicle will be about 63 m whilst the main stage will have a diameter of 4.6 m.

Amazonas-5

Hispasat has ordered its Amazonas-5 communications satellite from Space Systems Loral (SSL). Using the 1300 platform, the satellite will be fitted with 22 Ku band transponders and 35 Ka band transponders to serve the Latin American market.

The satellite will combine the capacities of the Amazonas-4A and -4B satellites. The former was launched on 22 March 2014 but has problems with its power supply. Amazonas-4B, which was to be

launched in 2015, has been cancelled.

The launch of Amazonas-5 will take place in 2017.

CST-100

Whilst working on the CST-100 contract for NASA's crewed spacecraft, Boeing is proposing to also develop a cargo transport version. This version will have the typical crewed mission requirements, such as the launch abort system, deleted providing more cargo space. The cargo transport version will also have the capability to return cargo to Earth, landing in the western United States like the crewed version.

Satellite Update

Launches in November 2014

Int.Des.	Name	Launch date	Launch vehicle	Country	Notes
2014 070A	ASNARO	6-Nov-2014	Dnepr 1	Japan	Scientific
2014 070B	Hodoyoshi-1	6-Nov-2014	Dnepr 1	Japan	Technology
2014 070C	ChubuSat-1	6-Nov-2014	Dnepr 1	Japan	Technology
2014 070D	QSAT-EOS	6-Nov-2014	Dnepr 1	Japan	Technology
2014 070E	Tsubame	6-Nov-2014	Dnepr 1	Japan	Technology
---	Philae	12-Nov-2014	---	ESA	Comet lander
2014 071A	YW-23	14-Nov-2014	CZ 2C	China	Earth observation
2014 072A	YW-24	20-Nov-2014	CZ 2D	China	Earth observation
2014 073A	Kuaizhou-2	21-Nov-2014	Kuaizhou	China	Technology
2014 074A	Soyuz TMA-15M	23-Nov-2014	Soyuz FG	Russia	Crewed; docked with ISS
1998 067FL	Spinsat	28-Nov-2014	Via ISS	USA	Technology
2014 075A	Kosmos-2501	30-Nov-2014	Soyuz 2-1b/Fregat	Russia	Navigational

Other updates

Int. Des.	Name	Notes
1983 010A	Kosmos-1441	Re-entered 8 November 2014
1998 067EL	Ardusat-2	Re-entered 8 November 2014
2012 021B	Tiantuo-1	Re-entered 3 November 2014
2014 009A	Shindaisat	Re-entered 24 November 2014
2014 031A	Soyuz TMA-13M	Undocked and landed on 10 November 2014
2014 042A	Progress M-24M	Undocked on 27 October 2014 and re-entered 20 November 2014

Kosmos-2491/2494, 2501 and 2502

Further to the last month's report on Kosmos-2499, it now seems that object 2013 076E, that at the time was thought to be debris, is now probably a similar satellite as Kosmos-2499. It was reported by Russia on 5 May 2014 and has been named as Kosmos-2491. This means that the Glonass satellite launched as 2014 012A is now named Kosmos-2492, in spite of the fact that earlier Russian reports identified it as Kosmos-2491 as well as Kosmos-2494.

It is now also clear that the SKRL 756-1 and 756-2 satellites launched as 2013 078A and B, are known as Kosmos-2493 and -2494.

In the meantime Kosmos-2491 and -2499 have activated on-board amateur radio transponders as Radio-46 and -47 respectively.

The Glonass K-1 navigational satellite that was launched on 30 November 2014 was originally named Kosmos-2502. This meant that – until properly identified – there was no Kosmos-2501. It was suggested that the Olimp K satellite that was launched on 28 September 2014, may be the Kosmos-2501. Since then the Glonass K satellite has been identified as Kosmos-2501.

EDRS-3

ESA's proposed European Data Relay System (EDRS)-3 laser relay satellite will be launched with a Space X Falcon 9 in late 2016.

The satellite will be built by Airbus and will commercialize laser communications links worldwide. It will make use of OHB's SmallGeo platform. To be placed at 22.5°E, it will be part of a constellation of two geostationary satellites with a possible two to follow at a later date.

The first EDRS payload, identified as EDRS-A, will be a laser terminal fitted on Eutelsat-9B, to be launched in 2015.

No reference has been made so far to EDRS-B (or -2) but this may refer to another payload to be placed on a commercial communications satellite.

CZ 9

China has begun the research to lead towards the development of a large rocket that is to be used for crewed missions to the Moon. Designated as CZ 9, it will be able to carry a payload of up to 130 tonnes, almost twice as large as the 70 tonnes for NASA's SLS.

The first launch might take place in 2028.

New Horizons

Ground control has re-established contact with the New Horizons spacecraft that is on its way to Pluto and its moon Charon. The spacecraft is now 5 billion km from Earth and a radio signal takes 4 hours, 26 minutes to reach the spacecraft.

Launched on 19 January 2006, the spacecraft was 'put to sleep' for most of the journey although periodically it was 'woken up' for tests. It is now being prepared for its encounter with Pluto on 14 July 2015, at a distance of about 10,000 km and over the next three months it will take photos of Pluto to ensure that it is on track for this fly-by.

Cygnus

Orbital Sciences has selected an Atlas 5 for the launch of the next Cygnus cargo transfer spacecraft in 2015 with an option for a second such launch vehicle for the 2016 mission.

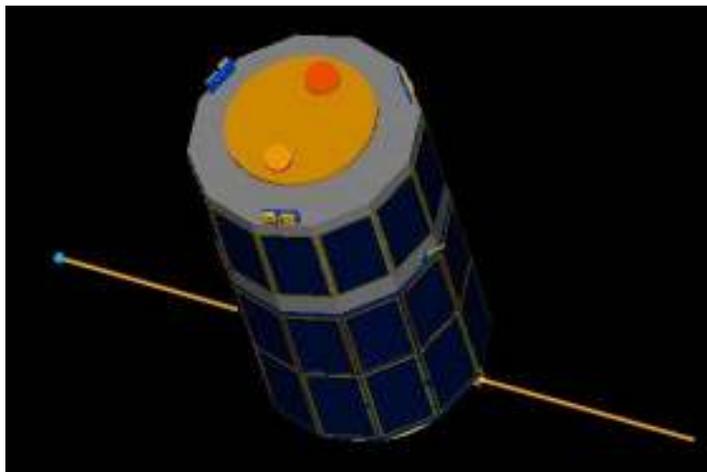
TESS

NASA has selected a Falcon 9 v1.1 for the launch of the Transiting Exoplanet Survey Satellite (TESS) in August 2017 from Cape Canaveral.

The objective of TESS is to detect transiting exoplanets orbiting nearby bright stars over a period of three years.

It was originally intended to use a Pegasus XL.

Cancelled Projects: NPSat-1



The Naval Postgraduate School Satellite (NPSat)-1 was a low-cost, technology demonstration satellite with a mass of about 80 kg, intended as an educational tool and to demonstrate the use of a COTS architecture.

It was intended to be launched for a two year mission as a secondary payload and be placed in an approximate 550 x 800 km orbit with an inclination between 30° and 80°.

The payload included two experiments by the Naval Research Laboratory (NRL):

1. the coherent electromagnetic radio tomography (CERTO) experiment which was to measure total-electron-content (TEC) in the ionosphere; and
2. a Langmuir probe to augment CERTO data by providing on-orbit measurements.

It also carried four experiments designed by the Naval Postgraduate School:

1. a Visible wavelength Imager (VISIM);
2. several micro-electromechanical systems (MEMS)-based rate sensors.
3. a novel design for a configurable, fault-tolerant spacecraft computer board, and
4. Solar Cell Measurement System (SMS),

NPSat-1 was originally scheduled to be launched on 9 March 2007 as part of the STP-1 flight, along with ASTRO, NEXTSat/CSC, STPSat-1, CFESat, MidSTAR-1, FalconSat-3 but was not ready in time. A new suggested date of 7 December 2009 was not met either.

Of all the experiment, the SMS experiment was later moved to a dedicated cubesat mission, NPS-SCAT, launched on 20 November 2013.

One reference has suggested that the satellite may be launched on a military Falcon Heavy launch in 2016 but, in absence of any further data on the experiments, it may be assumed that the satellite, fitted with the experiments designed in the first half of the previous decade as described in this article, has been cancelled.

Orion EFT-1

On 4 December 2014 a Delta Heavy launch vehicle launched the Orion Exploration Test Flight (EFT)-1. Previously referred to as Orion Flight Test (OFT)-1, it was an uncrewed test flight of the Orion spacecraft.

The flight tested various Orion systems such as separation events, avionics, heat shielding, parachute deployment and recovery. The flight also evaluated the Crew Module (CM), the Service Module (SM), the Launch Abort System (LAS), and the Orion-to-Stage Adapter, be it that the SM was only a structural representation.

From a sentimental perspective, the spacecraft carried a small lunar soil sample along with a part from an Apollo lunar suit and a variety of other mementos, including a "Star Trek" Captain Kirk action figure as well as an assortment of flags, medallions, patches and pins.

The spacecraft remained attached to the launch vehicle's upper stage and was placed in a transfer orbit of 185 by 888 kilometers. After completing one orbit, the upper stage fired its engine again and placed the spacecraft in an elliptical trajectory (no a full orbit) of 5795 km from where it dived back into the atmosphere at a speed of 32,000 km/h, providing data on how the spacecraft responds to re-entry speeds that will be encountered on deep space missions. The upper stage of the launch vehicle was used for course corrections before being jettisoned prior to re-entry.

Following re-entry Orion deployed parachutes and splashed down in the Pacific Ocean off California, about 440 km off the coast of Baja California and 1015 km south of San Diego, where two US Navy vessels were position to recover the spacecraft. The flight lasted 4 hours, 24 minutes.

The flight was declared successful with all test objectives having been achieved.

It is intended to use the recovered Orion EFT-1 in a launch abort test scheduled for 2015 or 2016. For this test the spacecraft will be mounted on a Peacekeeper missile.

A second orbital test flight, designated Exploration Mission (EM)-1, will be conducted towards the end of 2018 using NASA's new SLS heavy launch system whereas the first crewed mission is scheduled for 2021,

Orion Service Module

Airbus Defence and Space has been awarded the contract to develop and construct the Orion service module for ESA. The service module will provide propulsion, power supply, thermal control and the central elements of the life support system of the Orion spacecraft.

The service module is based on ESA's Automated Transfer Vehicle (ATV) that was also developed and constructed by Airbus Defence and Space and was used as a cargo spacecraft for ISS.

SMAP

The Soil Moisture Active Passive (SMAP) spacecraft was designed to provide global measurements of soil moisture in order to enhance the understanding of the processes that link Earth's water, energy and carbon cycles. The measurements also aid in predictions of plant growth and agricultural productivity, improve weather and climate forecasts, and enhance our ability to predict the extent and severity of droughts and where floods may occur.

The satellite carries a radiometer and a synthetic aperture radar operating at L-band designed to make coincident measurements of surface emission and backscatter. The measurement swath width is 1000 km, providing global coverage within 3 days at the equator.

In addition the satellite carries a 6 m diameter antenna that will be used by both the radar and the radiometer.

The satellite will be launched on 29 January 2015 with a Delta 7320-10C rocket from Vandenberg. It will be placed in a 685 km polar orbit.

SMAP was based on the Earth System Science Pathfinder-7 (Hydro) mission that was cancelled in December 2005.

Eutelsat Quantum

Eutelsat has ordered the first Eutelsat Quantum satellite from SSTL. The GMP-T platform will be fitted with an analog on-board signal processor and a phased-array antenna design designed by Airbus. Launch is planned for 2018.

The on-board signal processor will enable the pairing of any part of the Ku-band frequency with any other part, making the satellite easily compatible with the different regulatory requirements in the different regulatory regions of the International Telecommunication Union (ITU).

The satellite will be the first in the communications industry that will enable the complete electronic synthesis of 'receive' and 'transmit' coverages in the Ku-band, including on-board jamming detection and mitigation. It gives customers access to premium capacity through footprint shaping and steering, power (Mbps) and frequency band pairing.

Through this the satellites will be able to serve in any region and will be able to complement another satellite anywhere in geostationary orbit. This level of flexibility is expected to transform fleet management and will enable more efficient use of resources.

CERES and Comsat NG

France has awarded a contract to Airbus Defence and Space for the development of the CERES electronics intercept series of satellites. The first of three satellites will be placed in a low-Earth orbit in 2020. However, funding may be limited as France also has an urgent need to replace the current Syracuse 3 military communications satellite, known as Comsat NG.

IXV

The launch of the Intermediate Experimental Vehicle, IXV, scheduled for mid-November was cancelled in late October after the French space agency, CNES, and ESA determined that the flight trajectory of the Vega rocket carrying the IXV would have posed unacceptable risks to people in French Guiana. This cancellation came after the IXV recovery ship had been sent to the intended recovery area in the Pacific Ocean.

Although the intended flight path had been known for years, the ESA IXV team and CNES had failed to assess the potential risk.

The flight has now been rescheduled for mid-February 2015 after an alternative trajectory had been decided. To achieve this flight path the lift-off will be modified by 3° to the north after which the Vega rocket will have to perform a dogleg maneuver to get back to the original intended flight path at an altitude of 320 km, when the IXV will be released to climb to 450 km altitude before descending and re-entering the atmosphere over the Pacific Ocean.

The IXV is a lifting-body re-entry experiment to validate re-entry technologies for future European reusable launchers. Built by Thales Alenia, the 480 kg empty mass vehicle will use its aerodynamic shape, thrusters and two tail flaps during the descend, leading towards a splash down suspended from parachutes into the Pacific Ocean after a flight of 1 hour, 40 min. During the descent it will make measurements that will be used in the development of future re-entry vehicles.

Cube Quest Challenge

NASA has started a competition for the developments of cubesats to fly to the Moon and beyond on the first Orion flight to be launched by the SLS rocket in 2018.

Known as the Cube Quest Challenge the competition is open to teams that will develop new technologies that will advance the state of the art of cubesats and demonstrate their capabilities as viable deep space explorers. The competition will involve the designing, building and delivering flight qualified small satellites.

The first stage, known as 'Ground Tournaments' will involve four events in which all teams can participate in order to demonstrate their proposed cubesat's ability. From this the teams that will receive funds to further develop their proposals, will be selected.

The actual hardware stages are referred to as 'Lunar Derby', to demonstrate the ability to place a cubesat into a stable lunar orbit and demonstrate communication and durability near the moon; and 'Deep Space Derby', to demonstrate communication and cubesat durability at a distance greater than 4,000,000 km, ten times the distance from the Earth to the Moon.

Google Lunar X

The X Prize Foundation has announced that the deadline in the Google Lunar X competition has been extended to the end of 2016.

The competition provides staged prizes to land a commercial spacecraft on the Moon and have it travel at least 500 m across the surface of the Moon. Currently there are 18 teams involved.

Hayabusa-2

On 3 December a Japanese H 2A-202 launch vehicle placed the Hayabusa-2 spacecraft into orbit.

Hayabusa-2 is an asteroid mission that will study near-Earth asteroid 1999 JU3, a roughly spherical asteroid with a diameter of about 1 km, and collect rock samples of the asteroid using four landers.

In particular the mission is to establish what original organic matters exist in the solar system and how they are related to life.

After a swing-by of Earth in late 2015, the spacecraft will reach the asteroid in June 2018 when it will be placed in an orbit around the asteroid for an 18 months observation programme during which it will make three close approaches.

The 600 kg spacecraft is fitted with an array of instruments, including imagers, a spectrometer and a terrain-mapping altimeter.

After reaching the asteroid, Hayabusa-2 will drop the Small Carry-on Impactor (SCI) at 300 m from the surface. The impactor includes 4.5 kg of plasticized HMX and a 2.5 kg copper liner that will explode to form a copper penetrator hitting the asteroid with a velocity of 2 km/s, creating a crater. Before the explosion Hayabusa-2 will maneuver to the opposite side of the asteroid whilst the explosion and impact will be observed by the DCAM-3 deployable camera subsatellite.

After the crater has been formed Hayabusa-2 will observe the asteroid using the onboard instruments of Hayabusa-2. It will also approach the impact site and collect rocks with a horn leading into a sample holding chamber.

The spacecraft will also deploy four landers:

1. three Micro/Nano Experimental Robot Vehicle for Asteroid (MINERVA) landers, designated as MINERVA 2-1A, -2-1B and 2-2, developed by Japan that will hop across the surface of the asteroid. Each has a mass of 0.5 kg; and
2. the Mobile Asteroid Surface Scout (MASCOT) lander developed by DLR, the German space agency and CNES, the French space agency. The 10 kg lander will study the asteroid's magnetic field, surface temperature, rock composition, and take pictures during descent and after landing. The instruments carried by MASCOT are a Wide Angle Camera, a Radiometer, a Magnetometer and an Infrared Microscope. It is also fitted with an internal hopping mechanism that allows the lander to move. Two hops are envisaged to take place within the expected 16 hours of operation. These operations will be fully automated, without intervention by ground control.



MASCOT,
Minerva-2

Following the collection of three surface samples, Hayabusa-2 will begin the return flight to Earth in December 2019 with a landing of the sample bearing re-entry capsule towards December 2020.

The launch vehicle also carried three other spacecraft.

The Proximate Object Close flyby with Optical Navigation (PROCYON) is a 59 kg spacecraft to demonstrate the use of optical navigation during an asteroid fly-by as well as demonstrate a number of technologies associated with the spacecraft. It was developed by the University of Tokyo and JAXA/ISAS (Japan Aerospace Exploration Agency/Institute of Space and Astronautical Science)

The spacecraft was initially placed in an orbit that allows it to come back to Earth by solar electric propulsion. After the demonstration of the spacecraft technologies, the spacecraft will use its miniature ion propulsion system to place itself into a deep space orbit which includes an Earth swing-by towards the end of 2015 during which it is intended to change the direction of the spacecraft towards a 50 km fly-by of the asteroid. During the fly by the spacecraft will conduct observations using a camera with a scan mirror and onboard image feedback control.

The spacecraft is fitted with an Ion thruster and COld-gas thruster Unified Propulsion System (I-COUPS), a unified propulsion system of ion thrusters and cold-gas thrusters by sharing the same gas system. I-COUPS consists five units: an Ion-Thruster Unit (ITU), a Cold-gas Thruster Unit (CTU), a Power Processing Unit (PPU), a Gas Management Unit (GMU), and an I-COUPS Control Unit (ICU).



DESPATCH

The second spacecraft was Shin'en-2. It is a 15 kg interplanetary spacecraft built at Kagoshima University and fitted with a transponder to establish long-range communications technologies.

It was placed in a 0.7 to 1.3 AU solar orbit between Venus and Mars with an inclination that will keep it in the Earth equatorial plane.

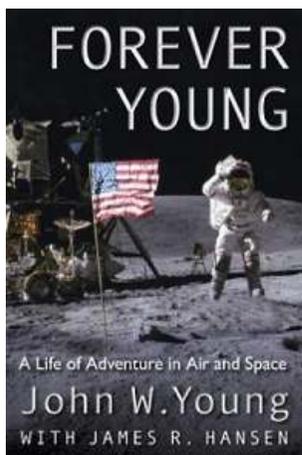
The final spacecraft was the Deep Space Amateur Troubadour's Challenge (DESPATCH) space probe, an art project of the Tama Art University also referred to as ARTSAT-2. The 30 kg sculpture carried a CW beacon and was built using a 3D printer.

Dragon CRS-5/Falcon 9

The launch of the Dragon CRS-5 mission has been delayed until at least 6 January 2015 after pre-flight tests associated with a launch scheduled for 19 December 2014, discovered some technical problems.

Originally scheduled for 12 September 2014, the launch has been delayed several times.

In the meantime, the US Air Force Space Command is expected to certify the Falcon 9 for military launches very soon.



Book review: John W. Young, Forever Young

Sometime last year I received an announcement about the above book and finally bought it for myself as a Christmas present. One of the reasons for buying it (no, I did not get a review copy) was that John Young remains my 'favourite' astronaut whom I had the pleasure to meet sometime in 1981. John Young was involved in the Gemini, Apollo and Space Shuttle programs as an astronaut. He walked on the Moon during the Apollo-15 mission and flew the first Space Shuttle. After being an active astronaut he became involved in the management of NASA as the Chief of the Astronaut Office. . What makes this book so interesting, and the reasons for mentioning it here, is that it gives a great insight in the level of astronaut involvement in the various crewed space programmes, in particular the earlier Gemini and Apollo ones.

It also demonstrates the on-going interaction between the astronauts' interests, as pursued by John, and the NASA bureaucracy. Many of the suggestions made by Young appear to have been ignored by the bureaucracy for budgetary and whatever other reason.

It also seems that during the Space Shuttle programme these suggestions were ignored at a higher rate. And it is, in particular Young's comments on the Space Shuttle programme and the apparent deficiencies in this programme, that makes one astonished that not more fatal accidents occurred with the Space Shuttle.

The book, issued by the University Press of Florida, does not appear to be available in Australia so an on-line order is required.

Venus Express

ESA's Venus Express was closed down in December 2014 because the spacecraft has run out of fuel and is now expected to burn up in the Venus atmosphere in January 2015. This was after attempts to boost the spacecraft into a higher orbit from 23 to 30 November 2014, failed. Venus Express was launched on 9 November 2005 and entered into an orbit around Venus on 11 April 2006 with a typical orbit being 200 x 66000 km. The initial mission was to last 500 days but was subsequently extended.

Spot-7 = Azersky

Airbus, the operator of the Spot Earth observation satellites, has sold the Spot-7 Earth observation satellite to Azerbaijan's space agency Azercosmos. The satellite has now been renamed as Azersky and Azercosmos will be marketing the imagery of the South Asian region whilst Airbus will continue to market the imagery for other regions.

GSLV Mark III and CARE



On 18 December 2014 India launched the first GSLV Mark III launch vehicle on a sub-orbital test flight that was labelled X1.

Although the primary objective was to test the launch vehicle's performance, it also carried the Crew Module Atmospheric Re-entry Experiment (CARE), a 3635 kg experimental test vehicle for ISRO's future crewed Orbital Vehicle. It had a diameter of 3.10 m and a length of 2.68 m and was fitted with six liquid propellant thrusters. The purpose of the flight was to test orbital injection, separation and re-entry procedures and systems for the Orbital Vehicle's crew capsules.

Following separation from the launch vehicle at an altitude of 126 km it performed a three axis control using the thrusters to place it into a zero degree angle of attack at re-entry.

The re-entry started at an altitude of 80 km at which point the propulsion was shut down.

This was followed by a descent and landing aided by a total six parachutes, two with a diameter of 2.5 m, two with a diameter 6.5 m. The main parachutes, with a diameter of 31 m each were deployed at an altitude of 5 km. Splash down occurred in the Bay of Bengal and the spacecraft was recovered with the Indian Coast Guard ship ICGS Samudra Paheredar.

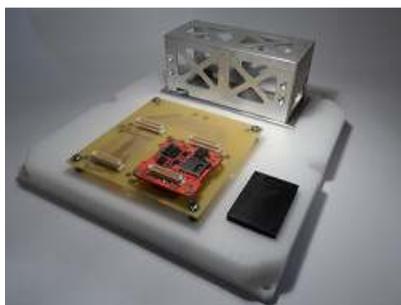
The launch vehicle has two S-200 solid motors, each of which has a length of 25 m and a diameter of 3.2 m. The booster provides a thrust of 5,150 kN.

The core stage, designated L-110, has two improved Vika engines fuelled by UH 25 (75%UDMH, 25% hydrazine) and N2O4. It has a length of 17 m and a diameter of 4 m.

The upper stage, designated as C-25, has a CE-20 engine fuelled by LOX/LH2 although this stage is not included in the X1 launch. It has a length of 8.2 m and a diameter of 4 m.

The first full configuration launch is designated as E1 and will take place in 2017, with the launch of GSAT-19E.

PocketQube Kit



UK based Alba Orbital now markets the PocketQube Kit. The kit consists of

- the Alba Orbital Skeletonized structure that comes in 1p, 2p or 3p sizes. The 1p version is 5 x 5 x 5 cm and has a structural mass of 0.069 kg;
- the Radiobro MiniSatCom a transceiver designed to operate in the 420-450MHz or 902-928MHz;
- the Alba Orbital Labsat, test and development board that contains a microprocessor and, along with additional hardware, can monitor and interact with the other boards on the satellite that carry user experiments; and
- the Alba Orbital On Board Computer (OBC), which utilises a TI MSP430 microcontroller for low power consumption and flexibility. The board is readily programmable to fit the user's projects as required and comes with drivers for reading on board sensor data. The OBC includes temperature, RTC, accelerometer, gyrometer and magnetometer sensor capabilities for on board diagnostics and experimentation as well as a NOR Flash memory to store critical parameters for system operation.

The price starts at US\$6000 for a 1p version.

Kondor E-2

The Kondor E-2 Russian built radar imaging satellite, is subject to some controversy. Allegedly built for South Africa, and acknowledged as such by the Sattrack website, the South African government has refused to confirm or deny their ownership.

This has caused questions by the government's opposition, demanding that the public be informed "if there were irregularities in procurement, if it worked, and if it was money well spent". Some other sources in South Africa have suggested that "This satellite is a flying turkey!" and that South African support for this satellite was at the cost of South Africa's own satellite programme.

This use of the word 'turkey' is a subtle hint to a statement made by a South African politician in September 2010, who called South Africa's own experimental observation satellite SumbandilaSat, a 'flying turkey' and then suggested that South Africa's own satellite project should be shut down, in order to buy satellites from elsewhere. This suggestion was based on the perception that it would be cheaper to buy satellites from abroad. The South African Sunsat company was subsequently closed down.

NASA Earth Science Missions

NASA plans to deploy 13 Earth science missions over the next seven years. Some of these are payloads to be sent to ISS whereas others are independent satellites.

These are:

1. Pre-Aerosol Clouds and ocean Ecosystem (PACE), a satellite to observe ocean color and other indicators of global climate change;
2. Stratospheric Aerosol and Gas Experiment (SAGE)-3, an ozone-monitoring instrument to be taken to the ISS in mid-2016;
3. Cyclone Global Navigation Satellite System (CYGNSS), designed to use GPS signals. The mission consists of eight small satellites to be launched in October 2016;
4. A follow-on to the Gravity Recovery and Climate Experiment mission, a joint mission with Germany to map the Earth's gravity field. This mission is scheduled for 2017;
5. Ice, Cloud, and land Elevation Satellite-2 scheduled for 2018;
6. Tropospheric Emissions: Monitoring of Pollution, or TEMPO, to be placed on a commercial satellite to be launched in 2018;
7. Surface Water and Ocean Topography altimetry satellite in cooperation with France;
8. the Global Ecosystem Dynamics Investigation, an Earth venture instrument for the ISS;
9. the Ecosystem Spaceborne Thermal Radiometer Experiment, another Earth venture instrument for ISS;
10. a lightning imaging sensor to be sent to ISS;
11. a synthetic aperture radar satellite being developed by NASA and Indian Space Research Organisation;
12. Radiation, Ozone, Atmospheric Measurements satellite; and
13. Landsat-9, a follow-on of Landsat-8.

Angara 5

On 23 December 2014 Russia's Khrunichev launched the first Angara 5 launch vehicle from Plesetsk. It was placed in a geostationary transfer orbit and was fitted with a 2040 kg simulated communications satellite that was not deployed but remained attached to the Briz M upper stage instead.

The Angara 5 consists of a cluster of five kerosene fuelled RD-191 main engines. After about three to four minutes into the flight the four outboard boosters fall away and the core RD-191 engine, operated at a partial thrust during the first phase of the flight, continues at full throttle. The second stage is fitted with the RD-0124A engine whilst the third stage is the Briz M. The launch vehicle can place 24.500 kg into a 200 km orbit and 5400 kg into a geostationary transfer orbit. Eventually the Angara 5, which is part of a family of launch vehicles designed for light, medium-class and heavy satellites, will replace the Proton M launch vehicle.