



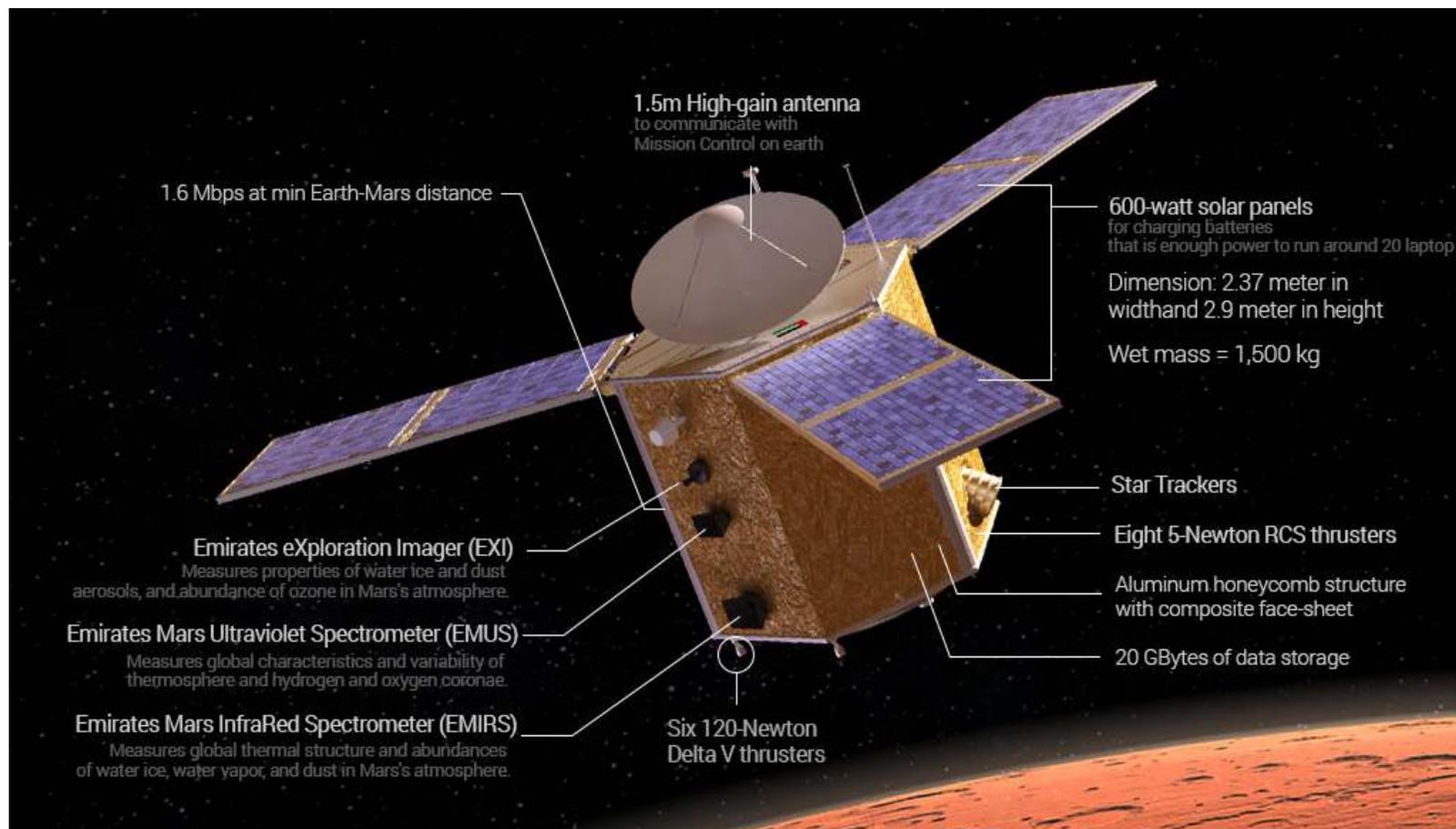
TIROS SPACE INFORMATION NEWS BULLETIN



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Editor: Jos Heyman FBIS

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Al-Amal

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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...

This is the 500th News Bulletin since, in September 1973 a one page News Bulletin containing just a few Society news items, was published. The first 24 issues were by the Astronautical Society of Australia (WA) Branch, that was followed by the Astronautical Society of Western Australia in November 1975, whereas Tiros Space Information took over the publication in March 2006.

Apart from myself, the News Bulletin has had another four editors: Geoff Davies, the initial editor who prepared a total of 137 issues over several periods, Scott Simms, 15 issues, Jane Lamm, 14 issues and Chris Nelson, 9 issues.

The earliest News Bulletin were printed on a stencil machine. Later the printing facilities of a (no longer existing) mining company and a public utility were used, be it without the knowledge of these institutions. After that a home printer was used.

In March 2001 an electronic (pdf) version was introduced as an option to a printed copy until we stopped printing in March 2006 after which only electronic copies were made.

There are 5273 pages of archived News Bulletin and the summary index lists 10,062 items to help you find your way through it all.

Except for News Bulletin #1, of September 1973, I do not have any hardcopies. I can ill afford the bookshelf space that this would require. All issues are stored electronically in my computer with appropriate back-ups. However, I would guess that the Western Australian State Library has a full set of hardcopies (until we stopped them) as part of their statutory collection.

So, now we are aiming at the 1000th issue, something that will take another 40 odd years. Statistically I will not be there to celebrate that but hopefully Tiros Space Information will still continue to exist, wherever that may be in this world.

Jos Heyman

Looking back in Space

On the 500th Edition of the News Bulletin, June, 2015.

I am honoured to add my enthusiastic congratulations to the editors and readers of Tiros Space Information News Bulletin. How much "Space" has influenced global change over these 500 Bulletins. A few years before the first edition in September 1973, Apollo photographs of this unique blue and white Planet Earth in black space caused a massive and enduring change in community recognition that we are all riding on Spaceship Earth. And the word "Environment" became common as laws were made to help protect and sustain our common and unique heritage and values. Instead of a Professor of Space Science at Rice University in Houston Texas I became the first Chairman and Director of the Environmental Protection Authority (EPA) in Western Australia. And Jos Heyman, the present Editor, became the first EPA Records Officer. A physicist colleague, Gordon McDonald, became the first Chairman of the Council of Environmental Quality in the USA. Yet Apollo with all its magnificence, was only about 20 years before I first helped my 85-year-old grandma Hoban to see the moving star of Sputnik 1 from our Strathfield backyard. Nana, a country girl who learned to read by a candle, shook her head and murmured to me only "It's not right. It's not right."

Now, in 2015 I shake my head and mutter, "It's not right" because in the years while I have grown almost to Nana's age, no other astronauts have walked on the Moon, yet. The Chinese, I think, will be next. Yet there is strong continuity in the "Space" world. I met up with Buzz Aldrin again in Washington, D.C., in June 2012, the first time we had talked extensively since I lectured his Astronaut Class of 1964 about what I thought they might encounter and discover in space. This time I could show him a model of my matchbox-sized Apollo Dust Detector Experiment he put on the Moon on that gloriously-unique day, and we could discuss what our partnership discovered about extraterrestrial dust on the Moon. Yet there is much magnificent other space activity. A few weeks ago, another former student, Jim Burch who won his PhD with the little Aurora 1 satellite in 1967, saw his decades of work as a distinguished Professor, achieve success with four satellites stacked on one another at launch, as the NASA Magnetospheric Multiscale Mission, which were launched on 13 March 2015 to provide access to predictive knowledge of a universal process that is the final governor of space weather. It copied and massively improved upon a little trick we first tried with firing the Twins rocket payloads into auroras above Fort Churchill, Canada, over three winters in the late 1960s, when society was so very different. These are only two personal experiences out of many awesome and beautiful discoveries by unmanned robotic missions by many researchers and many countries and agencies. Who cannot but delight in the European Space Agency saga of Rosetta pursuing a comet, having a 3-year nap on the way. An exquisite fairy tale that is true. Space services in communications, weather forecasts and many other fields are now routine.

The magic of the Tiros Space Information News Bulletins is that their five editors have succeeded, 500 times, over these long and changing times, in being part of this global continuity, bringing, these days, to over 180 readers world-wide a sense of personal continuity throughout these epochs. Long may this continue, with your help and support. We must keep the magic and joy and services of Space alive and real. The EPA celebrated its 1000th meeting a while back, so I strongly recommend you help the News Bulletins also reach their millennia. "To Eternity and beyond"...

Prof. Brian J. O'Brien FTSE
(Inaugural Hon. President, Astronautical Society of Australia, WA Branch)

Satellite Update

Launches in April 2015

| Int.Des. | Name | Launch date | Launch vehicle | Country | Notes |
|-----------|----------------------|-------------|----------------|--------------|-------------------------|
| 2015 021A | Dragon CRS-6 | 14-Apr-2015 | Falcon 9 v.1.1 | USA | Docked with ISS |
| 2015 022A | Thor-7 | 26-Apr-2025 | Ariane 5ECA | Norway | Communications |
| 2015 022B | Sicral-2/Syracuse-3C | 26-Apr-2015 | Ariane 5ECA | Italy/France | Military communications |
| 2015 023A | Turkmen Alem 52E | 27-Apr-2015 | Falcon 9 v.1.1 | Turkmst | Communications |
| 2015 024A | Progress M-27M | 28-Apr-2015 | Soyuz 2.1a | RUS | Cargo transfer |
| --- | ??? | 29-Apr-2015 | New Shepard | USA | Suborbital test |

Other updates

| Int. Des. | Name | Notes |
|------------|----------------|---|
| 1998 067FY | TechEdSat-4 | Re-entered 3 April 2015 |
| 2004 030A | Messenger | Impacted on Mercury on 30 April 2015 |
| 2013 064S | ORS Tech-2 | Re-entered 3 April 2015 |
| 2014 067A | Progress M-25M | Undocked on 25 April 2015 and re-entered on 26 April 2015 |
| 2014 067B | Shin'en-2 | Also known as Oscar-82 (FO-82) |
| 2014 067C | DESPATCH | Also known as Oscar-81 (FO-81) |

Progress M-27M

Launched on 28 April 2015, the Progress M-27M cargo spacecraft was intended to dock with the International Space Station later that day. Problems with communications with the spacecraft initially forced a fall back to a 34-orbit rendezvous scenario. Following this, on-board television showed that the spacecraft was rapidly spinning. Attempts to gain control were unsuccessful and it was decided to abandon the spacecraft and it re-entered on 8 May 2015 over the Pacific Ocean.

Progress M 27M would have docked at the Pirs nadir port of ISS and would have remained there until October 2015.

The cause was traced to the third stage of the launch vehicle with a partial failure in the last phase of operation and a bad separation of the spacecraft causing the spacecraft to tumble out of control.

As an immediate consequence the Soyuz TMA-17M mission with cosmonauts O. Kononenko, K. Lindgren and K. Yui, has been rescheduled from 26 May 2015 to, tentatively, 24 July 2015.

To minimise the period of the space station having a crew of three, Soyuz TMA-15M, with crew members Shkaplerov, Cristoforetti and Virts will now undocked on 11 June 2015, rather than the planned 12 May 2015.

This will still have the space station crewed by three (Padalka, Kornienko and Kelly) for about six weeks.

To provide additional supplies, Progress M-28M is expected to be launched on 3 July 2015, using a Soyuz U launch vehicle.

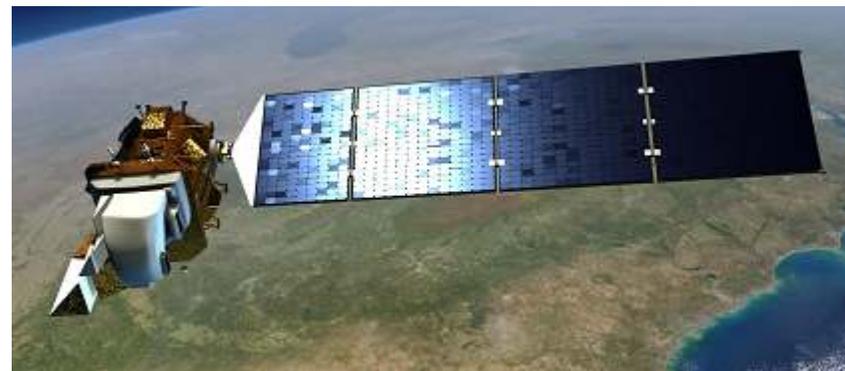
The reduction in crew is also expected to delay the launch of the US Dragon CRS-7 mission which was scheduled for 19 June 2015, as its docking requires two astronauts, one to capture the spacecraft with the robotic arm, the other to monitor and command the operation from the ISS's Cupola.

There are sufficient consumable on board of ISS to last until mid-September 2015, in case no supplies can be sent to ISS.

Eros-C

Israel has commenced the development of the Eros-C Earth observation satellite. The satellite, owned by ImageSat International, an Israeli company, will be built by Israel Aerospace Industries (IAI). The satellite is to be launched in 2017.

Landsat-9



NASA and the US Geological Survey (USGS) have started work on the Landsat-9 Earth observation satellite.

To be launched in 2023, Landsat-9 will continue the objectives of Landsat-8 and, like Landsat-8, will carry two instruments, one that operates in the visible, near infrared and shortwave-infrared light, and the other to record thermal infrared radiation, or the heat of Earth's surfaces.

Russian super heavy carrier rocket/Angara 5B

Russia has abandoned the development of a super-heavy carrier rocket from scratch as mentioned in the News Bulletin of September 2014. Instead the Angara 5 launch vehicle will be further developed to carry such heavy payloads, by the addition of an extra booster stage. This version will be known as Angara 5B.

Cancelled Projects: Orbital Sciences X-34

by Jos Heyman

On 28 August 1996 NASA signed a contract with Orbital Sciences for the development of an experimental sub-orbital spaceplane to test the technologies associated with low cost re-usable launch vehicles.

At that time two versions were envisaged. The X-34A was to be air dropped from the OSC's Trident launch aircraft that had also been used for the Pegasus launch vehicle, whilst the X-34B was to be launched from atop a NASA Boeing 747 carrier aircraft. Both versions were to land on a conventional runway.



The vehicle had a span of 8.44 m and a length of 17.76 m. It was to be fitted with a Fastrac rocket engine fuelled by liquid oxygen and kerosene generating a thrust of about 267,000 Newtons. It would have been able to fly eight times the speed of sound and reach altitudes of about 80 km.

Two X-34As vehicles were built. The first, identified as A1, was initially a hybrid of flight hardware and structural test hardware without the rocket engine and was to be used in this configuration, to certify the use of the Tristar aircraft.

The second vehicle was identified as A2 and was to be the first actual flight article whilst the designation A3 was given to the A1 vehicle after the installation of the remaining flight hardware, including the rocket engine. Some reference sources have suggested that A3 was to be another vehicle.

It was intended to conduct a total of 27 unpowered and powered test flights at Edwards Air Force Base in California beginning in early 2000. These flights would have used the A1 vehicle.

After the completion of the tests at Edwards AFB, the A2 vehicle was to be used for further tests at the Kennedy Space Center that would demonstrate the X-34A's capability to reach Mach 4.6, whilst it was also to demonstrate the rapid turnaround flight operations envisaged for reusable launch vehicles of the future. It was envisaged that most flight would have a turnaround time of two weeks but one test with a 24 hour turnaround time was also scheduled.

The refurbished A1, then known as A3, was to be used to expand the performance by reaching speeds of Mach 8 whilst the use of carry-on experiments was to be explored. These tests were to be performed at Edwards AFB again.

Apart from demonstrating a cost goal of \$500,000 per flight, the X-34A was to be used to test lightweight composite airframe structures that required little inspection; reusable composite propellant tanks, tank insulation and other propulsion components; advanced thermal protection systems capable of surviving subsonic flights through rain and fog; integrated (built-in) low-cost avionics, including differential Global Positioning System and Inertial Navigation System; integrated automated vehicle health monitoring and checkout; and a conformal air data system for flight control inputs that would replace traditional blade-like air data probes, unable to survive reentry temperatures.

The first captive flight of the A1, mated to the Tristar launch aircraft, took place on 29 June 1999. This was followed by two more captive flights, the last one on 24 September 1999, when it was decided to suspend a further six captive flights to 2000. The first glide flight was scheduled for later that year whilst the first powered flight was intended to take place in 2001.



Although illustrations show the X-34 deploying a satellite, it is not clear from reference sources if it was intended to deploy satellites during this test programme or in a post-test programme.

During the development of the X-34A, NASA demanded major design changes but without providing additional funding, instead expecting Orbital Sciences to fund this. Orbital Sciences refused to make these changes without NASA funding and the programme was formally cancelled by NASA on 1 March 2001.

The A1 and A2 airframes remained in storage at Edwards Air Force Base until 16 November 2010 when they were taken to the National test Pilot School at Mojave, California to investigate the possibility of restoring them to flight status. Obviously, this did not happen.

Construction of the X-34B version, which probably would have been heavier, was never commenced.

WISE

Analysis of mid-infrared emissions by 100,000 galaxies from the Great Galaxy in Andromeda, as seen by NASA's WISE telescope, failed to indicate any signs of highly advanced extraterrestrial life in those galaxies.

The analysis was based on the theory that if an entire galaxy had been colonized by an advanced spacefaring civilization, the energy produced by that civilization's technologies would be detectable in mid-infrared wavelengths. This theory was advanced in the 1960s by theoretical physicist Freeman Dyson and the analysis was undertaken by the Center for Exoplanets and Habitable Worlds at Penn State University.

The findings do not necessarily exclude extraterrestrial life and the researchers intend to have a second look at about fifty galaxies that have higher levels of mid-infrared radiation than was expected. Furthermore, it is possible that those galaxies have forms of life that are not yet that advanced that they emit large amounts of the mid-infrared radiation.

Arabsat-6A, HellasSat-4/SaudiGeoSat-1

Lockheed Martin has received an order for the Arabsat-6A and the Hellas-Sat-4/SaudiGeoSat-1 communications satellites to be based on the A2100 satellite platform.

To be launched in 2018, Arabsat-6A will be located at 30.5°E whilst the other satellite will be located at 39°E. No launch service provider has been announced for Arabsat-6A but Hellas-Sat-4/SaudiGeoSat-1 will be launched with an Ariane 5.

The contract includes a partnership with Taqnia Space Co. a subsidiary of Saudi Technology Investment and Development Co., to explore future manufacture, assembly and integration of satellites in Saudi Arabia in order to develop space technology in that country.

Merlin

Methane Remote Sensing Lidar Mission (Merlin) is a proposed methane monitoring satellite for France and Germany.

The satellite will be based on the Airbus Astrobuss S platform, a development of the Myriade platform.

Launch is expected to take place in 2019.

NROL-71

It is expected that the first in a series of replacements for the KH 11 series of optical space surveillance satellites will be launched from Vandenberg in 2018 with a Delta 4 Heavy rocket. It has been identified as NROL-71 and it is expected that the satellites will be bigger to take full advantage of the payload capacity of the Delta 4 Heavy.

NorStar

NorStar Space Data, a Canadian company, has proposed to establish the NorStar constellation of 40 satellites to monitor Earth and space. The satellites would be fitted with downward and upwards looking hyperspectral and infra-red sensors.

For the downward looking sensors a market in agriculture, mining, fishing and fossil-fuel energy has been identified.

Soyuz TMA-18M



Sarah Brightman, who was in training to fly to ISS on Soyuz TMA-18M, along with Sergey Volkov and ESA astronaut Andreas Mogensen, has withdrawn from the training for 'personal family reasons'.

It is understood she may resume the training at a later date and may then be scheduled for a future flight.

Brightman and Mogensen would have stayed on ISS for 10 days and would have returned on Soyuz TMA-16M along with Gennady Padalka, Brightman's place will probably be taken by Japanese entrepreneur Satoshi Takamatsu, who trained as Brightman's backup.

Soyuz TMA-18M was scheduled for launch in September 2015 although this launch date may change as a result of the Progress M-17M investigation.

Göktürk-1



After a delay of two years Turkey's Göktürk -1 satellite high resolution (80 cm) optical reconnaissance satellite will now be readied for launch in 2016 by a Vega launch vehicle. The satellite was built by Thales Alenia of France and Telespazio of Italy with the final assembly being undertaken by Turkey's AIT.

The delay was the result of problems with an export licence for a satellite with a ground resolution sharper than 1 meter and the partially completed satellite was put in storage. Recent developments with other sub-metric observation satellites, has allowed an export licence to be granted.

Earlier Turkey had the GökTürk-2 satellite launched on 18 December 2012 but this satellite had an optical multispectral imager with a resolution of 2 m.

Long term Turkey hopes to develop a GökTürk-3 reconnaissance satellite fitted with a synthetic-aperture radar, entirely in Turkey.

Centennial-1

One of the 16 cubesats that was carried to ISS by Dragon CRS-6 for deployment in due course, was the Centennial-1 1U cubesat built by Booz Allen Hamilton, a management consulting firm better known for pushing paper than building hardware.

It carries an Air Force designed photon detector that will track a sodium guide star laser beamed to it in space. This will help to calibrate the adaptive optics of a 3.5-meter-diameter ground telescope located at the service's Starfire Optical Range.

Centennial-1 was originally scheduled to fly on the Cygnus Orb-3 mission that failed to orbit on 28 October 2014.

New Shepard



On 29 April 2014 Blue Origin successfully conducted the first flight of the New Shepard sub-orbital spacecraft.

The New Shepard re-usable launch vehicle was being developed by the Blue Origin Corporation with funds from NASA's Commercial Orbital Transportation Services (COTS) programme.

In August 2012 the company was denied further funds by NASA and further work was cancelled although a launch abort test was completed on 19 October 2012. New Shepard consists of a Propulsion Module (PM) and a Crew Capsule (CC) and the current tests are for the use of the spacecraft for sub-orbital flights.

Launched from Van Horn in Texas, the rocket rose to an altitude of 93.5 km after which a dummy Crew Capsule separated and descended back to Earth on a parachute.

The recovery of the Propulsion Module failed as a consequence of the loss of pressure in the hydraulic system on descent.

Avanti

In spite of a low level of utilization the Avanti Communications Group which operates the Hylas-1 and -2 communications satellites, intends to have the Avanti-3 and -4 satellites launched as soon as possible in order to service new customers in Europe, the Middle East and Africa without undue delays.

Avanti-3 will be a Ka band payload on the German EDRS-C satellite scheduled for launch in 2017 whereas Avanti-4 is being built by Orbital ATK for launch in 2017.

Russian space developments

In what seems to be a return to centralised control by the government, Russia is in the process of establishing a single rocket engine manufacturing holding company that will merge at least seven companies, including NPO Energomash and Keldysh Rocket Research Center into a single organisation.

This is part of the structural reform of Russia's space industry that was initiated in 2010 and will see the merging of numerous enterprises into five or six large holdings. It is expected that other branches in the industry, such as orbital spacecraft development, in-orbit operation, guidance systems, scientific research, testing and strategic rocketry, will have similar holding companies.

In a separate move, Russia has invited to China to become a major partner in a proposed Russian lunar station. China has also been informed about Russia's plans to create a Russian national orbiting space station.

In mid-April President Putin stated that Russia will launch its own space station by 2023. It will serve as a base for Russia's lunar program from where spacecraft will fly to the Moon, with a first orbiting manned mission scheduled for 2025 and a landing in 2029.

Expanding NASA goals

US Congress member Dana Rohrabacher has announced his intention to introduce legislation in the US Congress that directs NASA to support efforts for permanent human settlement beyond Earth orbit. The Space Exploration, Development, and Settlement Act of 2015 would amend the National Aeronautics and Space Act that established NASA in 1958 by adding an additional goal to a list of existing national space activities.

India's space programme.

It has been announced that during 2015/2016 India will launch the GSAT-6 and GSAT-15 communications satellites, the IRNSS-1E, IRNSS-1F and IRNSS-1G navigational satellites and one space science satellite named ASTROSAT. The latter is expected to be launched in October 2015 by a PSLV Launch vehicle.

Jason-CS/Sentinel-6A

Airbus has received an order to build the Jason-CS/Sentinel-6A ocean topography which is to be launched in 2020. The 1400 kg satellite is the latest in the series that was started with the Topex-Poseidon satellite of 10 August 1992, Jason-1 and Jason-2 of 7 December 2001 and 20 June 2008 and Jason-3 which is to be launched in July 2015.

The contract includes an option for a further satellite, scheduled for around 2025.

Al-Amal

Although the United Arab Emirate's Space Agency was only established about a year ago, it has now announced plans for a mission to Mars. Known as Al-Amal (meaning Hope) or Emirates Mars Mission, it is hoped to launch the spacecraft in July 2020, reaching Mars in 2021 to coincide with the 50th anniversary of the UAE's independence from Britain. Its orbit around Mars will be 22000 km × 44000 km.

The mission's objectives will concentrate on the Martian atmosphere and climate and will study how the lower and upper layers of the atmosphere interact with each other. It will also investigate the possible connection between today's Martian weather and the ancient climate on that planet.

The spacecraft will measure 2.37 m x 2.90 m and will have a mass of app. 1500 kg.

It will carry three experiments

- EXI (Emirates eXploration Imager), a digital camera that will send back high-resolution colour images;
- EMIRS (Emirates Mars InfaRed Spectrometer), an infra-red spectrometer to examine temperature patterns, ice, water vapour and dust in the atmosphere; and
- EMUS (Emirates Mars Ultraviolet Spectrometer), an ultraviolet spectrometer to study the upper atmosphere and traces of oxygen and hydrogen further out into space.

Proba V

The European Space Agency's Proba V satellite has successfully demonstrated the use of an experimental Automatic Dependent Surveillance – Broadcast (ADS-B) receiver to monitor the movements of aircraft in European air space.

Launched on 7 May 2013, the primary mission was to measure vegetation growth and the ADS-B was only a secondary experiment developed by the German DLR space agency.

The ADS-B signals include GPS data on the aircraft's position, speed and altitude, and the signals are designed to be detected by ground stations and nearby airplanes.

The 1500 x 750 km footprint of the single satellite is relatively small and a fully world-wide operational system would require a constellation of satellites. Several commercial operators have indicated interest in establishing such a system.

XCOR

XCOR Aerospace, the developer of the Lynx sub-orbital crewed vehicle intended for the space tourist market, is considering the development of an orbital vehicle based on the Lynx.

It will involve a two stage re-usable vehicle that will be air launched from and aircraft. The first stage would return to its launch site after separation from the upper stage. The upper stage would enter into orbit and would eventually also land again on the launch site.

The proposed vehicle would be able to carry up to 500 kg of cargo or two people.

VAMP



Northrop Grumman has proposed to develop the Venus Atmospheric Maneuverable Platform (VAMP) as a contender in the next NASA New Frontiers planetary science competition. The competition is expected to begin in 2016.

VAMP is an inflatable propeller plane that could cruise Earth's super-heated sister planet for years, sampling the acidic alien atmosphere directly and safely observing the venusian surface from 50 km up. At this altitude the density of the venusian atmosphere is just about the same as on Earth a sea level, ie 1 Atmosphere, whilst the temperature at that altitude is a comfortable 15°C.

The plane may be powered by solar but a final decisions is still to be made.

If proceeded with, VAMP would be launched in 2021 and would be inflated once it would be in an orbit around Venus. It would then descend into the planetary atmosphere for the flight.

VAMP could also be used on other planets that have an atmosphere that can sustain aerodynamic lift, such as Saturn's moon Titan.

Xephyr

Masten Space Systems, a US company is currently working on DARPA's Experimental Spaceplane (XS)-1, intends to develop a reusable orbital vehicle concept called Xephyr. Using the XS-1 as the re-usable first stage, Xephyr would have a second stage for placing satellites in orbit.

PROCYON

On-going problems with the PROCYON ion engine (refer last month's News Bulletin) have led to the cancellation of the planned asteroid rendez-vous.

Sentinel 2

On 11 June 2015 a Vega launch vehicle will place the first of two Sentinel 2 satellites in a polar orbit with an altitude of 785 km.

Sentinel-2 is a series on multispectral imaging satellites within the GMES (Global Monitoring for Environment and Security) or Copernicus programme, a joint European Commission and ESA programme for global land observation and collection of data on vegetation, soil and water cover for land, inland waterways and coastal areas as well as atmospheric absorption and distortion data corrections.

The 1100 kg satellites have been built by Astrium and are fitted with a Multi Spectral Imager (MSI) with 13 spectral channels in the visible/near infrared (VNIR) and short wave infrared spectral range (SWIR). The MSI has a swath width of 290 km and a resolution ranging from 60 to 10 m.

The second satellite in the series will be launched in 2016.

Sentinel 2 is part of a series of satellites that carry a range of technologies, such as radar and multi-spectral imaging instruments for land, ocean and atmospheric monitoring:

- Sentinel-1, a polar-orbiting, all-weather, day-and-night radar imaging mission for land and ocean services;
- Sentinel-2, as described above;
- Sentinel-3, a multi-instrument mission to measure sea-surface topography, sea- and land-surface temperature, ocean colour and land colour with high-end accuracy and reliability;
- Sentinel-4, a payload devoted to atmospheric monitoring that will be embarked upon a Meteosat Third Generation-Sounder (MTG-S) satellite in geostationary orbit;
- Sentinel-5, a payload that will monitor the atmosphere from polar orbit aboard a MetOp Second Generation satellite; and
- Sentinel-6, a payload that carries a radar altimeter to measure global sea-surface height, primarily for operational oceanography and for climate studies.

Each of the above missions consists of two satellites. In addition a Sentinel-5 Precursor satellite mission is being developed to reduce the atmospheric monitoring data gap between Envisat and the launch of Sentinel-5.

To date only Sentinel-1A has been launched (on 3 April 2014).

VCLS

The Venture Class Launch Services (VCLS) is the latest NASA requests for industry proposals to launch 60 kg of cubesats at the same time at a fixed price. It is expected that a contract will be granted by 30 September 2015 and that the launch will take place before 15 April 2018.

3-DPHab

As part of its Centennial Challenges programme, NASA, in cooperation with National Additive Manufacturing Innovation Institute, known as America Makes, has opened the 3-D Printed Habitat (3-DPHab) Challenge competition to build a 3-D printed habitat for deep space exploration, including Mars.

The competition will run in several phases and the first phase is a design competition that is expected to close on 27 September 2015.

The second phase is divided into a Structural Member Competition, to focus on the fabrication technologies needed to manufacture structural components from a combination of indigenous materials and recyclables, or indigenous materials alone. The On-Site Habitat Competition level challenges competitors to fabricate full-scale habitats using indigenous materials or indigenous materials combined with recyclables.

Winning concepts and products will help NASA build the technical expertise to send habitat-manufacturing machines to distant destinations, such as Mars, to build shelters for the human explorers who follow.

Mexsat-1

Also known as Centenario and Morelos-3, Mexsat-1 failed to reach orbit on 16 May 2015 after the Briz M stage of the launch vehicle failed and the launch vehicle and satellite crashed in Siberia.

The satellite was owned by the Mexican Secretary of Communication and Transportation (SCT) and was to provide secure communications for Mexico's national security needs, as well as enhanced coverage for the country's civil telecommunications. To have been placed in a geostationary orbit at 113°W, the 5325 kg satellite was built by Boeing using the 702HP platform. It was fitted with L and Ku band transponders.

| Launch vehicle | Success | Failed |
|-------------------------|---------|--------|
| Atlas (all versions) | 78 | 0 |
| Delta (all versions) | 96 | 0 |
| Ariane 5 (all versions) | 73 | 1 |
| Soyuz (all versions) | 185 | 3 |
| Proton ((all versions) | 124 | 4 |

The accompanying table provides an overview of the success/failure of the main launch vehicles since 2000.

HTV

Japan intends to make improvements to the HTV or Kounotori unmanned cargo spacecraft to make it cheaper to construct. The use of new high technology, such as those adopted by the car industry, may reduce the cost by 50%. To date four HTV missions have been flown and another three are scheduled over the next five years. The last of these, planned for 2020, may make use of the improved spacecraft.

AFSPC-5

Launched on 20 May 2015 from Vandenberg, the Air Force Space Command (AFSPC)-5 mission carried, apart from the X-37B or OTV-4 spacecraft as described in the May 2015 issue of the News Bulletin, a total of 10 cubesats.

These were collectively known as the Ultra Lightweight Technology and Research Auxiliary Satellite (ULTRASat) and were contained in eight Poly-Pico Orbital Deployers (P-PODs) which had been integrated into a structure built by the Naval Postgraduate School (NPS). The ULTRASat was positioned at the aft end of the upper stage of the launch vehicle.

The satellites were:

- LightSail-1, a 3U cubesat developed for the Planetary Society. The 4.5 kg satellite was fitted with two cameras, on-board accelerometers, radio telemetry, an attitude control system, and six solar arrays for battery charging. After four weeks in orbit the satellite will deploy a 5.5x5.5 m solar sail made of 4.6 micron Mylar to demonstrate controlled solar sail flight with no force other than sunlight pressure propelling the spacecraft. Because the satellite was placed in a low orbit, the sail will not be able to generate sufficient thrust to overcome the atmospheric drag. The satellite was launched as part of NASA's Educational Launch of Nanosatellites programme;
- Unix-Space-Server Langley (USS Langley), a 3U cubesat built at the US Naval Academy. Its primary objective is to demonstrate the ability the Unix-Space-Server (USS) global internet web server utilizing common TCP/IP internet protocol accessible to any internet user. A secondary objective is to demonstrate the PSK-31 multi-user transponder experiment;
- Ballistically Reinforced Communication Satellite – Propulsion Test Unit (BRICSat-P), a 1.5U cubesat developed by the US Naval Academy and the George Washington University to demonstrate the performance of the Micro-Cathode Arc Thruster (μ CAT) electric propulsion plasma thrusters, developed by the George Washington University. In addition it carried two amateur communication payloads;
- ParkinsonSat (PSat), a 1.5U cubesat developed at the US Naval Academy that carried a communications payload with two transponders. One served the Ocean Data Telemetry Microsat Link (ODTML) mission for DOD whilst the other operated in the amateur radio bands. The satellite was named after Dr Parkinson of GPS fame;
- Globalstar Experiment And Risk Reduction Satellite (GEARRSAT), a 3U cubesat built by NearSpace Launch to investigate the feasibility of using the Globalstar satellite communications network for the command and control of a small satellite;
- Aerocube-8A and -8B, also known as IMPACT-A and -B, two 1.5U cubesats by the Aerospace Corporation of El Segundo to demonstrate the Scalable ion-electrospray Propulsion (SiEPro) system. They also carried additional experiments to measure IV curves for 4-junction IMM solar cells and 5-junction SBT cells, demonstrated the Carbon Nanotube (CNT) harness and use of CNT/PEEK material and evaluated CNT radiation-shielding material; and
- OptiCube-1, -2 and -3 also referred to as O/C or Optical Cube, three 3U cubesats developed by California Polytechnic State University to provide on-orbit targets for ground assets to calibrate sensors for orbital debris studies and small-object tracking improvement. The satellites were sponsored by NRO.

ISS

On 27 May 2015 the Permanent Multipurpose Module (PMM) of ISS was moved from its location on the Earth facing port of the Unity module to the forward port of the Tranquility module. This move is the first step towards the usage of the Unity port as the primary docking port for the US cargo spacecraft and the preparation of the Harmony docking modules for future crewed spacecraft. This will involve the attachment of the International Docking Adapters (IDA) to the two Harmony module's docking ports. These will be delivered later this year. The PMM move was executed using the robotic arm. PMM was originally the Leonardo cargo module and, since it attached itself to ISS on 29 February 2011, it has been used as a storage place.



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THE ASTRONAUTICAL SOCIETY OF AUSTRALIA LIMITED WESTERN AUSTRALIAN BRANCH

BOX W2011 G.P.O., PERTH 8001. TELEPHONE 41 1449

News Bulletin no.1

September 1973

Formation of Branch

The Western Australian Branch of the Society was formally established at a meeting of members, which took place on 31st August 1973, in Perth.

Dr. Brian J. O'Brien, Director of Environmental Protection, accepted the position of Honorary President of the State Branch.

A Branch Council was elected, and the officers are:

| | |
|----------------|--------------|
| Chairman | A. Moore |
| Vice-President | M.A. Borgelt |
| Secretary | G.D. Davies |
| Treasurer | L.P. Costa |
| Editor | R.J. Bailey |

Aims of the Society

To assist in developing astronautics and the space sciences.
To promote the growth of the Australian aerospace industry.
To provide meetings for the dissemination of knowledge concerning astronautics and the space sciences.

National and International Activities

The Society holds an Aerospace Congress each year, at which papers are presented by speakers from Australia and overseas.

The Society is Australia's representative on the International Astronautical Federation, and sends a delegate to meetings of this body.

Branch Interests and Activities

The interests of members cover a wide range of topics, including:

rocket and satellite technology
space research
meteorology and mapping of earth resources
space medicine and space engineering

Meetings are held at regular intervals, featuring lectures, films and talks. A display of publications and photographic material will shortly go on exhibition at public libraries, and at the Festival of Fremantle.

Membership of the Society

Membership is open to all persons who are interested in any aspect of astronautics and the space sciences. There are various grades of membership, for technically qualified people and others, and a reduced subscription rate for students.

Information about the Society

All enquiries should be directed to the Secretary, at the above address, or telephone 25 0101 extension 2089.

G.D. Davies (Secretary)