



TIROS SPACE INFORMATION
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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...

The recent report by Asia Pacific Aerospace Consultants Pty. Ltd. (APAC), commissioned by the Australian Department of Industry, Innovation and Science (refer the May 2016 News Bulletin) attempts to paint a rosy picture of the Australian commercial space industry but has excluded the government and not-for-profit space activities as well as the research and academic sectors.

It is not clear why and on whose instructions, those sectors were excluded from the report but my guess is that, if included, the picture would not have been so rosy – but rather a bleak and dismal picture.

I base my suggestion of the findings of an OECD report on space related research & development that, using 2013 data, concluded that in Australia only 0.56% of all research & development funding by government is on civil space related projects – placing Australia amongst the lowest ranked countries.

I believe that if we expect the commercial space industry to continue in the rosy manner described by the APAC report, we should pay more attention to the research & development background as it is from this background that the next generation of 'space men and women' (and I do not mean those that travel into space) will come that will sustain the on-going development of that commercial space industry. Alternatively the Australian commercial space industry will gradually disappear into oblivion.

Jos Heyman

UNISEC Global

UNISEC Global has initiated a competition for a device that can be mounted on a 1U, 2U or 3U cubesat to allow the speedy and controlled re-entry of such cubesats and the end of their mission life. It is expected that the winning design will be used for the first time in October 2018. UNISEC is a consortium of local chapters that aim at facilitating university students' practical space projects such as building and launching satellites and rockets.

Antares

Orbital ATK expects the first flight of its re-engined Antares medium launch vehicle to take place in early July. The vehicle's first stage will now be powered by two Russian built Energiya RD-181 engines, replacing the AJ26 engines that had been based on Russian NK-33 engines left over from the N1 moon rocket programme of the 1970s.

The launch vehicle will carry the Cygnus OA-5 spacecraft to ISS.

CZ 7

The first flight of the Chinese CZ 7 launch vehicle took place on 25 June 2016 from the new Wenchang launch facility. The rocket carried a scale model of a re-entry capsule for a next-generation crewed spacecraft.

The CZ 7 launch vehicle is intended as a replacement for the CZ 2F and will be used for future crewed flights. It will be developed in several versions consisting of a K3-1 first stage, a K3-2 second stage and a two or four K2-1 boosters.

Intelsat-39

Intelsat has ordered a replacement for the Intelsat-902 satellite located at 62°East.

To be known as Intelsat-39, the satellite will be built by Space Systems Loral using the SSL-1300 platform. It will be fitted with C and Ku band transponders and will use electric as well as chemical propulsion for orbit raising whilst on-orbit it will be operated with all-electric propulsion.

CST-100

The first crewed flight of Boeing's CST-100 spacecraft has been delayed until February 2018 due to a number of technical issues and additional requirements. This follows an unscrewed orbital test flight scheduled for December 2017.

Satellite Update

Launches in April and May 2016

Int.Des.	Name	Launch date	Launch vehicle	Country	Notes
sub-orbital	New Shepard Test-4	2-Apr-2016	New Shepard	USA	Test
2016 023A	SJ-10	5-Apr-2016	CZ 2D	China	Scientific
2016 024A	Dragon CRS-8	8-Apr-2016	Falcon 9 v.1.2	USA	Cargo
2016 025A	Sentinel-1B	25-Apr-2016	Soyuz 2-1b/Fregat MT	ESA	Earth observ.
2016 025B	MicroSCOPE	25-Apr-2016	Soyuz 2-1b/Fregat MT	France	Technology
2016 025C	OUFIT-1	25-Apr-2016	Soyuz 2-1b/Fregat MT	Belgium	Technology
2016 025D	e-St@r-2	25-Apr-2016	Soyuz 2-1b/Fregat MT	Italy	Technology
2016 025E	AAUSat-4	25-Apr-2016	Soyuz 2-1b/Fregat MT	Denmark	Technology
1998 067HT	Diwata-1	27-Apr-2016	ISS	Philipp.	Technology
2016 026A	MVL-300	28-Apr-2016	Soyuz 2-1A/Volga	Russia	Scientific
2016 026B	Aist-2D	28-Apr-2016	Soyuz 2-1A/Volga	Russia	Technology
2016 026C	SamSat 218	28-Apr-2016	Soyuz 2-1A/Volga	Russia	Technology
2016 027A	IRNSS-1G	28-Apr-2016	PSLV XL	India	Navigation
2016 028A	JC Sat-14	6-May-2016	Falcon 9 v.1.2	Japan	Communic.
2016 029A	YW-30	15-May-2016	CZ 2D	China	Surveillance
1998 067HU	MinXSS	16-May-2016	ISS	USA	Technology
1998 067HV	Cadre	16-May-2016	ISS	USA	Technology
1998 067HW	STMSat-1	16-May-2016	ISS	USA	Technology
1998 067HX	Nodes-1	16-May-2016	ISS	USA	Technology
1998 067HY	Nodes-2	16-May-2016	ISS	USA	Technology
1998 067HZ	Flock 2e-01	17-May-2016	ISS	USA	Earth observ.
1998 067JA	Flock 2e-03	17-May-2016	ISS	USA	Earth observ.
1998 067JB	Flock 2e-02	17-May-2016	ISS	USA	Earth observ.
1998 067JC	Flock 2e-04	17-May-2016	ISS	USA	Earth observ.
1998 067JD	Flock 2e-01	17-May-2016	ISS	USA	Earth observ.
1998 067JE	Flock 2e-02	17-May-2016	ISS	USA	Earth observ.
1998 067JF	Lemur 2-5	18-May-2016	ISS	USA	Earth observ.
1998 067JG	Flock 2e-03	18-May-2016	ISS	USA	Earth observ.
1998 067JH	Flock 2e-04	18-May-2016	ISS	USA	Earth observ.
1998 067JJ	Lemur 2-6	18-May-2016	ISS	USA	Shipping
1998 067JK	Lemur 2-7	18-May-2016	ISS	USA	Shipping
1998 067JL	Lemur 2-8	18-May-2016	ISS	USA	Shipping
sub-orbital	RTV-TD-1	23-May-2016	Rohini	India	Test
2016 030A	Galileo FOC-7	24-May-2016	Soyuz 2-1b/Fregat MT	ESA	Navigation
2016 030B	Galileo FOC-10	24-May-2016	Soyuz 2-1b/Fregat MT	ESA	Navigation
2016 031A	Thaicom-8	27-May-2016	Falcon 9 v.1.2	Thail.	Communic.
2016 032A	Kosmos-2516	29-May-2016	Soyuz 2-1b/Fregat M	Russia	Navigation
2016 033A	Zi Yuan 3-2	30-May-2016	CZ 4B	China	Earth observ
2016 033B	NuSat-1	30-May-2016	CZ 4B	Argent	Earth observ
2016 033C	NuSat-2	30-May-2016	CZ 4B	Argent	Earth observ
1998 067JM	Flock 2e-05	30-May-2016	ISS	USA	Earth observ
1998 067JN	Flock 2e-06	30-May-2016	ISS	USA	Earth observ
1998 067JP	Flock 2e-07	31-May-2016	ISS	USA	Earth observ
1998 067JQ	Flock 2e-08	31-May-2016	ISS	USA	Earth observ
1998 067JR	Flock 2e-05	31-May-2016	ISS	USA	Earth observ
1998 067JS	Flock 2e-06	31-May-2016	ISS	USA	Earth observ

1998 067JT	Flock 2e-07	31-May-2016	ISS	USA	Earth observ
1998 067JU	Flock 2e-08	31-May-2016	ISS	USA	Earth observ
1998 067JV	Flock 2e-09	31-May-2016	ISS	USA	Earth observ
1998 067JW	Flock 2e-10	31-May-2016	ISS	USA	Earth observ

Other updates

Int. Des.	Name	Notes
1998 067GF	Flock 1e-1	Re-entered 18 May 2016
1998 067GH	Flock 1e-3	Re-entered 29 May 2016
1998 067HJ	Flock 2b-8	Re-entered 22 May 2016
2004 005A	Molniya 1-93	Re-entered 16 April 2016
2005 014A	Dart	Re-entered 7 May 2016
2006 007A	Eutelsat 9-B	Relocated and re-named as Eutelsat Hot Bird 13-E
2013 064W	Trailblazer	Re-entered 22 May 2016
2015 055A	Progress M-29M	Re-entered 8 April 2016
2016 023A	SJ-10	Recovered 18 April 2016
2016 024A	Dragon CRS-8	Undocked and recovered 11 May 2016

ABS

Permira, the British company that acquired the Asia Broadcast Satellite communications satellite system in September 2010, has put the ABS system up for sale.

Established in 1997 and headquartered in Hong Kong (but registered in Bermuda) ABS currently operated six satellites with a total of 348 transponders providing a coverage of 80% of the population in the Americas, Africa, Asia Pacific, Europe, the Middle East, Russia, and Commonwealth of Independent States with satellite-to-home and satellite-to-cable TV distribution, cellular services, and internet services.

These satellites are ABS-2 at 75°E, ABS-3 at 3°W, ABS-4 at 61°E, ABS-6 at 159°E, ABS-7 at 116.1°E and ABS-3A at 3°W.

On 15 June 2016 ABS-2A with an additional 48 transponders, was launched and located at 75°E whilst ABS-8, to be located at 116.1°E is scheduled for launch in 2017/18.

Falcon 9 re-use

SpaceX hopes re-use a recovered first stage of the Falcon 9 for a launch scheduled for September or October this year. The satellite(s) to be launched on this flight have not been disclosed as yet.

AEHF-5

The US Defense Department has ordered an Atlas 5 launch vehicle for the AEHF-5 communications satellite scheduled for 2018.

Australia's National Broadband Network

by Jos Heyman

Introduction

Following a report by the government's Broadband Advisory Group, released on 22 January 2003, the Australian government announced the establishment of a national broadband network (NBN) using fibre cables four years later, in 2007. Subsequently the National Broadband Network Corporation was established on 9 April 2009 as a fully government owned corporation.

Background

The fully understand this move it is necessary to delve briefly into some geographical/demographic facts about Australia as well as its history.

Australia is an island continent with an area of 7,692,024 km². It has currently a population of 24 million resulting into an average distribution of the population at 2.8 persons per km². However, 64% of the population lives in the capital cities meaning that the population distribution outside those capital cities is significantly lower. In other words: Australia has a lot of open space – the outback.

Based on information published by the Australian Bureau of Statistics, 86% of all households have internet access, a figure that compares favourably with the level of internet access in Europe and the United States.

Similar to many other countries, telecommunications in Australia were originally the responsibility of the government through the Postmaster's General Department. The means of telecommunications in those early days were telephones and telegrams. Radio, and later television have always been a mixture of government owned broadcasters and commercial broadcasters.

On 1 July 1975 the telecommunications operations of the Postmaster General's Department were split-off as Telecom Australia but it remained a government owned organization.

Separately, the government had established the Overseas Telecommunications Commission in 1946, to manage all international telecommunications services into, through and out of Australia. OTC was absorbed by Telecom Australia in 1992. In 1993 Telecom Australia was renamed as the Telstra Corporation Limited.

Privatised in stages commencing in 1997, Telstra is now Australia's largest telecommunications and media company, operating telecommunications networks with both landlines and mobile networks. The company markets voice, mobile and internet access whilst it is also involved in the Foxtel pay television and other entertainment products and services.

Since the early 1990's Telstra has faced competition. The major one of these is Optus whilst there are a large number (currently about 50) of smaller operators. Most of these smaller operators, but not Optus, make use of the Telstra fixed network to provide their services.

Optus Communications was formed 1994 by a consortium of telecommunications and investment companies to take over the assets of the Government-owned AUSSAT Pty Limited that had been established in 1981 to operate the AUSSAT series of communications satellites. Optus Communications spread its wings to other forms of telecommunications in Australia providing serious competition to Telstra.

To be somewhat independent of the Telstra infrastructure, Optus embarked on the establishment of an interstate Hybrid Fibre Coaxial (HFC) network and a series of exchanges between Optus' interstate network and Telstra's local network. In this manner it could provide local and long distance calls to residential customers connected to the Telstra's local phone network, following which calls were then transferred to the Optus network.

Optus also became active in laying fibre optics into major office buildings and industrial areas as well as mobile telephones and other associated communication products.

In 2001 Optus became a wholly owned subsidiary of Singapore's Singtel and the company is now known as Singtel Optus Pty Limited. Optus continues to operate its own communications satellites.

NBN

As originally conceived, the National Broadband Network (NBN) is a national wholesale-only, open-access data network using the Fibre-to-the-Home (FTTH), sometimes referred to as Fibre-to-the-Premises (FTTP) approach with the use of the network being sold to retail service providers who then sell internet access and other services to consumers. It was envisaged that this would provide a 97% coverage.

On 26 November 2008, Telstra made a submission to the government to build the National Broadband Network with a network that would cover between 80 to 90% of the Australian population in major cities. The submission was refused by the government following which Telstra announced its intention to increase speeds on its existing networks.

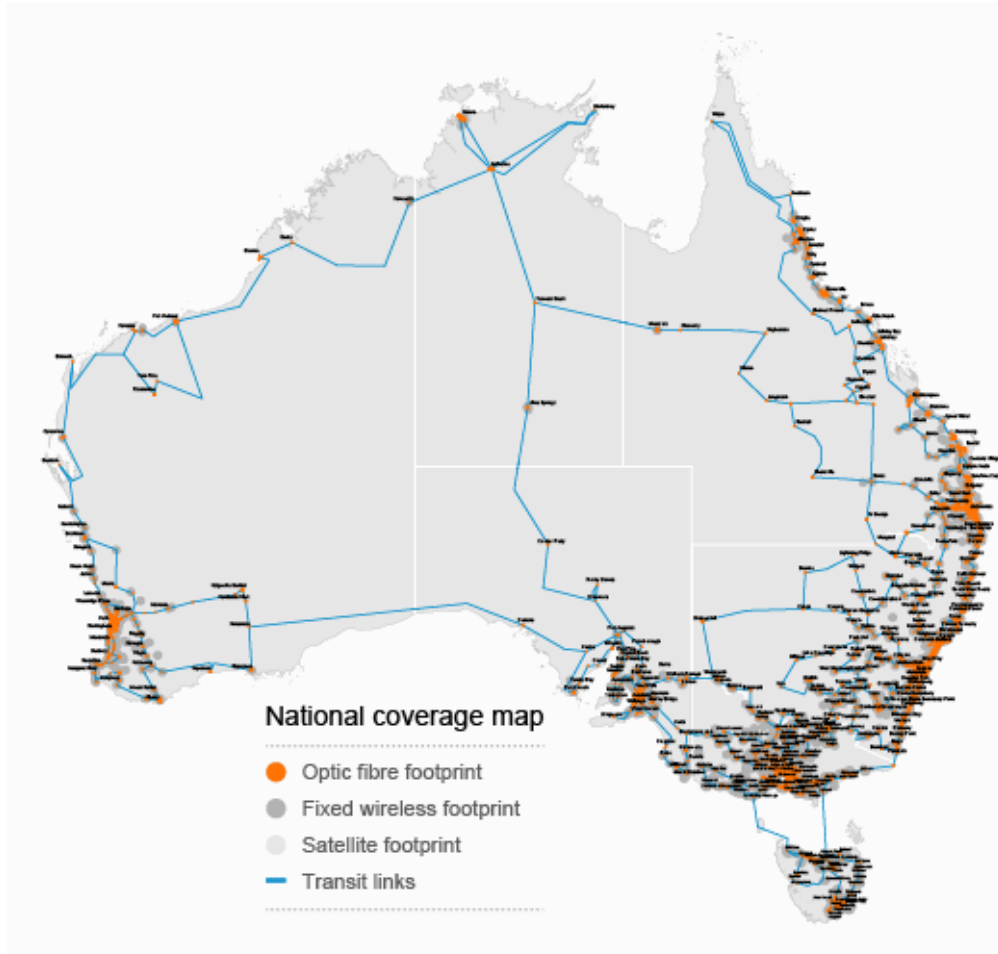
On 23 June 2011 the government, now represented by NBN, signed an agreement with Telstra whereby Telstra agreed – against payment by the government - to switch its internet customers from the existing copper and hybrid fibre-coaxial networks to FTTH, in areas where this was installed.

After a change in government in 2013, the new (Liberal/National) government commissioned a strategic review to determine the ideal infrastructure mix to deliver fast broadband across the country as quickly as possible, whilst also reducing costs. This resulted in a technology mix comprising 20% by optical Fibre-to-the-Home (FTTH), 38% by existing Fibre-to-the-Node (FTTN), 34% by Hybrid Fibre/Coaxial (HFC) cable already deployed by pay-TV companies, and 5% Fixed Wireless (FW). The remaining 3% will be reached by satellite.

Based on this, Telstra transferred the ownership of its copper and HFC networks to NBN in December 2014, allowing NBN to use these networks for its multi-technology rollout.

As such the NBN network will now consist of

- new development areas that will be serviced by FTTH technology outright;
- established areas where the existing copper lines have been severely affected by groundwater and other factors and that will now be serviced by FTTH technology replacing the copper lines;
- established areas where the existing copper or HFC networks are still efficient and that will be serviced by FTTN technology;
- a satellite system to reach consumers outside the main population areas.



National coverage map (the grey area represents the 3% referred to in the text)

The redesigned network is expected to be fully operational by 2019.

Long term, NBN is planning to provide educational services, health services, emergency services and applications for agriculture, business, and communities to the remote areas using

the satellite facilities. Consideration is also being given to In-Flight Connectivity (IFC), a service that is being sought by airline operators.

NBN Satellites

In the original NBN plan it was intended that the network would connect 97% of Australian homes, schools and workplaces through the fibre network. To cover the remaining 3%, comprising some of the most remote places in Australia, as well as its coastal islands and external territories including Norfolk Island, Cocos Island, Christmas Island and Macquarie Island in the Antarctic, the NBN ordered two high-throughput communications satellites from Space Systems/Loral (SS/L) in February 2012.

In the interim NBN purchased satellite capacity from Optus and Thailand's IPStar to commence interim satellite services on 1 July 2011. These services were limited to customers that were not able to access alternative services.

The first of the two NBN communications satellites was launched on 30 September 2015 and was positioned in a geostationary orbit over 140°East.



Sky Muster-1A

The 6440 kg satellite uses the L/S 1300 platform and is fitted with 110 Ka band transponders offering 80 gigabits per second of bandwidth, compared to four to six gigabits per second capacity available from current satellites servicing Australia.

The satellite sends/receives signals to/from a satellite dish at an Earth station, from where it is distributed to a local network. Earth stations have been established at Wolumia (New South

Wales), Kalgoorlie (Western Australian), Bourke (New South Wales), Geraldton (Western Australia) and Roma (Queensland)

The satellite was initially known as NBN-1A but has since been renamed as Sky Muster-1A. In Australian slang a 'muster' refers to the gathering of livestock in the outback.

The second satellite (NBN-1B) is scheduled for launch in December 2016.



Kalgoorlie Earth station (NBN)

NROL-76

The National Reconnaissance Office (NRO) has booked a Falcon 9 launch vehicle for the March 2017 launch of the NROL-76 satellite. The launch will take place from Cape Canaveral.

M3MSat

The Canadian Maritime Monitoring and Messaging Microsatellite (M3MSat), which was originally to be placed in orbit by the Russian Soyuz-2-1b/Fregat-M that was launched on 8 July 2014 but the deployment was cancelled due to the crisis in the Ukraine.

It was now launched as a payload on the 20 June 2016 launch of the Indian PSLV XL rocket. It had been earlier scheduled for the PSLV XL launch of 28 September 2015 but that was delayed.

Red Dragon



SpaceX has proposed to send an unpiloted Dragon 2 spacecraft to Mars in 2018 as a demonstration of the technologies required for transporting large payloads to the planet and effectively landing them there.

Designated as Red Dragon, it will be launched with a Falcon Heavy launch vehicle and make a propulsive landing on Mars using its own propulsion system based on four pods with two SuperDraco rocket engines each.

Subsequently SpaceX is expected to fly further unpiloted missions every 26 months, when the windows for Mars missions are open, culminating in a crewed mission in 2024/25.

It is expected that NASA will cooperate with this programme.

The Dragon 2 spacecraft is expected to fly for the first time to ISS in 2017.

US Military Launches

To overcome launch gaps during the transition by United Launch Alliance from the Atlas 5 to the new Vulcan launch vehicle, the US Air Force may give consideration to launching some of its military satellites on an Ariane 5 launch vehicle. However, such a move would require significant changes in the national space policy. This policy currently required US government payloads to be launched on rockets built in the USA unless:

- there is a no-exchange-of-funds agreement involving international scientific programs;
- launches involve secondary technology demonstrator or scientific payloads for which no US launch service is available; or
- it involves hosted payload arrangements on spacecraft not owned by the US government.

Orbital ATK NGL

Orbital ATK intends to develop a new launch vehicle in order to compete with SpaceX and United Launch Alliance for the lucrative military launches.

The new rocket, labelled as Next Generation Launcher (NGL) would combine two Orbital ATK Castor 600 solid rocket motors as first stage, with a second stage powered by a Castor 300 solid fuelled rocket motor. As a third stage it would use the BE-3U, provided by Blue Origin and as currently used for the New Shepard sub-orbital rocket. Through the use of additional Castor engines as strap-ons the launch capability could be improved.

Development would be subject to US Air Force funding.

ORS-1 follow-on

The US Strategic Command is considering a follow-on satellite as a replacement for the ORS-1 tactical surveillance satellite that is expected to reach the end of its operational life by 2017.

ORS-1, launched on 30 June 2011 provides visible and infrared imagery to US forces operating in the Middle East and Southwest Asia.

XCOR

XCOR, the company that attempted to build the Lynx reusable sub-orbital spaceplane seems to have put that development on hold and is now focussing on the development of a liquid hydrogen rocket engine for United Launch Alliance.

New Shepard

NASA has contracted with Blue Origin for the use of the New Shepard vehicle to place research payloads into sub-orbital flights. These flights will go to an altitude of 100 km providing approximately four minutes of microgravity.

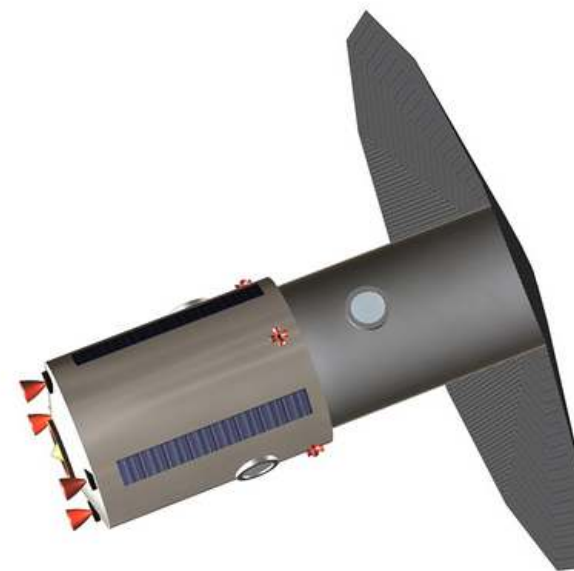
Blue Origin now joins Masten Space Systems, UP Aerospace and Virgin Galactic in providing this service.

Asteroid mining

Luxembourg intends to prepare legislation to facilitate mining on asteroids. The legislation, expected to take effect in 2017; would "guarantee operators the right to resources harvested in outer space in accordance with international law," whilst "Space resources-dedicated licences will be issued under the new law, and government supervision of the activities of operators and regulating their rights and obligations will be ensured by Luxembourg in accordance with the Outer Space Treaty."

The law will not only apply to local companies but also to foreign companies that are registered in Luxembourg.

Ryvok



At a recent conference a representative of Energiya presented the concept of a piloted lunar vehicle designated as Ryvok. The vehicle would fly from the International Space Station to the Moon carrying a crew and cargo delivered to ISS by Soyuz and Progress vehicles. The flight is expected to last up to 5 days and eventually Ryvok would land on Earth after depolying a 55m² umbrella shaped structure to allow re-entry.

Ryvok would have a mass of 11.4 tons and would be fitted with a Block DM upper stage to propel it towards the Moon. There was no reference as to how Ryvok would get to ISS but it has been suggested that it would be capable of operating with current launch vehicles.

ARM

The proposed Asteroid Redirect Mission (ARM) is doomed for cancellation after Congress failed to provide funds for this project. In doing so it was stated that whilst the technologies being developed for ARM could have some future benefits, "the Committee believes that neither a robotic nor a crewed mission to an asteroid appreciably contribute to the overarching mission to Mars," It further stated: "Further, the long-term costs of launching a robotic craft to the asteroid, followed by a crewed mission, are unknown and will divert scarce resources away from developing technology and equipment necessary for missions to Mars." "Toward that end, no funds are included in this bill for NASA to continue planning efforts to conduct either robotic or crewed missions to an asteroid," "Instead, NASA is encouraged to develop plans to return to the Moon to test capabilities that will be needed for Mars."