Costs

Small players get set to rocket ahead

Budget buys and backyard builds are taking the space race to the masses.
Mark Eggleton *reports*

AUSTRALIA has always lagged behind in the space race even though we were one of the earliest nations to launch our own communications satellite. As the Australian Centre for Space Engineering Research (ACSER) director, Professor Andrew Dempster says, "There's not much commitment from government as there is a lack of appreciation of what space can provide the economy. We are the only OECD economy not to have a space agency."

The good news is, as the cost of satellite technology has come down, we're able to think seriously about getting back into the ballgame by default. In recent years there has been a bit of a changing dynamic in space, as satellites have become smaller and cheaper to make and launch.

In the United States, there are even books on building your own backyard satellite and a company offering to launch picosatellites into space for around $US80,000.

NASA have become strong advocates of picosatellites with a number of companies and research institutions now developing CubeSats which are small, cube-shaped satellites of around 10 centimetres in size and around a kilogram in weight. Once launched into space, they can unfurl antennas or a solar sail and carry out small missions. Earlier this year, NASA announced they would fly 33 smaller satellites as auxiliary payloads in 2014. A number of organisations have been approved to launch their satellites on this flight and the small CubeSats will undertake a range of technical demonstrations as well as scientific and educational missions.

Launched into lower earth orbit, CubeSats can have a shorter shelf life in space while they undergo short missions, before re-entering Earth's atmosphere and burning up on re-entry.

According to DSTO's Intelligence, Surveillance and Reconnaissance Division chief, Dr Tony Lindsay, small satellites represent great opportunities for Australia. In recent years, the DSTO has started up a small space program of its own to build up local skills in the sector.

A key project to come out of our renewed interest in the sector is the Biarri CubeSat program in collaboration with the US, the UK and Canada. It's the first-ever joint satellite project and involves the University of New South Wales (UNSW), which is building the different GPS payloads for the Biarri project.

Biarri, an Aboriginal word loosely translated to hunt or to track, will initially involve a series of precision flying experiments with three satellites flying in formation where they'll be tracked by GPS and a laser system developed by local defence company Electro Optic Systems (EOS).

As Biarri progresses, the idea is it will set the foundation for an international ground station network involving the four international partners.

Lindsay says Australia's niche lies in defence at the moment and we are taking a lead in the project: "It's a way for Australia to value-add to CubeSat technology and each country provides an important part of the project. For example, the US is providing the launch facilities and the satellite 'bus' or shell while the UK is providing communication links. Canada is providing ground station infrastructure, as are we, while also working with EOS, UNSW and the Australian National University. "There's terrific opportunity in Australia within the small satellite area, especially in collaboration with places like Canada, which has an excellent program. Both countries are vast, and while Canada reaches almost to the North Pole, we reach to Antarctica, so there's plenty of scope to establish ground stations over a wide area," Lindsay says.

Taking off: A Russian rocket carries a cluster of foreign satellites into orbit, including seven mini satellites

With Biarri, most of the heavy lifting is being done by the US, including the placing of micro-thrusters onboard that will allow the CubeSats to change direction and velocity in space.

What it does for Australia is it simply puts us back in the game. The next project, Bucaneer, is purely Australian. The 'bus' or satellite blank is being sourced from the US but it will be a fully Australian satellite. It's a collaboration between DSTO and BAE Systems and is a space-borne miniaturised high frequency radar.

Lindsay says the eventual goal would be to cross-calibrate between Australia's over-the-horizon radar system and the US.

"We will have to find a launch provider somewhere though," he says. "Importantly, to ensure the success of these programs and others moving forward, it has to be a whole of government initiative.

"With the technology access that everybody has these days, the barrier to entry is lowering rapidly. We will quickly fall behind unless the government embraces space technology. There are lots of space faring nations these days but unfortunately (at the moment) we're not one of them," Lindsay adds.

Professor Dempster, who leads the team at UNSW, hopes the new 'Space Utilisation Policy' coming from the Federal Government will lead somewhere: "We are one of the most obvious places on earth that should have a strong space policy, yet we continue to get our data from elsewhere. To get where we would like to be, smaller nanosatellites are the key".

History

Fiction to science

John Stanton, *chief executive of the Communications Alliance, traces the progress of satellites from the wild imaginings of literary greats into the utilities we rely on every day*

OPINIONS vary on who first dreamed up the idea of space-based satellite communications.

A short story by American clergyman Edward Everett Hale, published in 1869, described a man-made "Brick Moon", launched into space to help mariners navigate.

French science fiction writer Jules Verne, in his 1879 novel *The Begum's Fortune*, describes a fictional cannon which shoots a large projectile that misses its target – and, indeed, misses the Earth – sending the shell into a geocentric orbit in space, endowing the Earth with a "second satellite" (the moon being the first).

But most commentators credit another science fiction writer, Arthur C Clarke, whose 1945 article describes how artificial satellites could be positioned in geosynchronous orbits to provide international communications for Earthlings.

Twelve years later, Russia launched Sputnik I, the first man-made satellite, giving birth to the "space race" and to the era of satellite communications.

Then, in 1962, NASA launched Telstar I; the first satellite capable of two-way communications.

Australia played no part in the early Russian and NASA space efforts, but was deeply involved in the development of the world's first commercial satellite network, developed by the International Satellite Telecommunications Organisation (Intelsat).

Australia was one of 11 founding signatories to the agreement to establish Intelsat as a global consortium charged with providing satellite communications capability available to all nations of the Earth. Several years later, Australia was equally influential in the creation of Inmarsat, which provides a global network of satellites tailored to maritime users.

Intelsat launched the first commercial communications satellite, nicknamed "Early Bird" in April 1965. Australian representatives played key roles on the board and on the technical and operational committees of Intelsat as it built a strong global network of satellites. This endures to the present day, with more than 50 spacecraft in orbit.

Australian earth station facilities, most notably at Gnangara, north of Perth, play a vital role in the tracking, telemetry control and monitoring (that is, the process of 'flying' the satellite) – for a host of satellites operators around the world.

Today, the global communications industry is served by more than 400 geostationary communications satellites, positioned almost 36,000km above the Earth's equator, along with numerous satellites operating from lower orbits.

2012 marks the 27th anniversary of Australian communications satellites, which began when Aussat (now part of Singtel Optus) launched its first satellite, A1, aboard the Space Shuttle Discovery. It was the first of nine successful Optus satellite launches, which have provided voice, video and data services ubiquitously across Australia ever since.

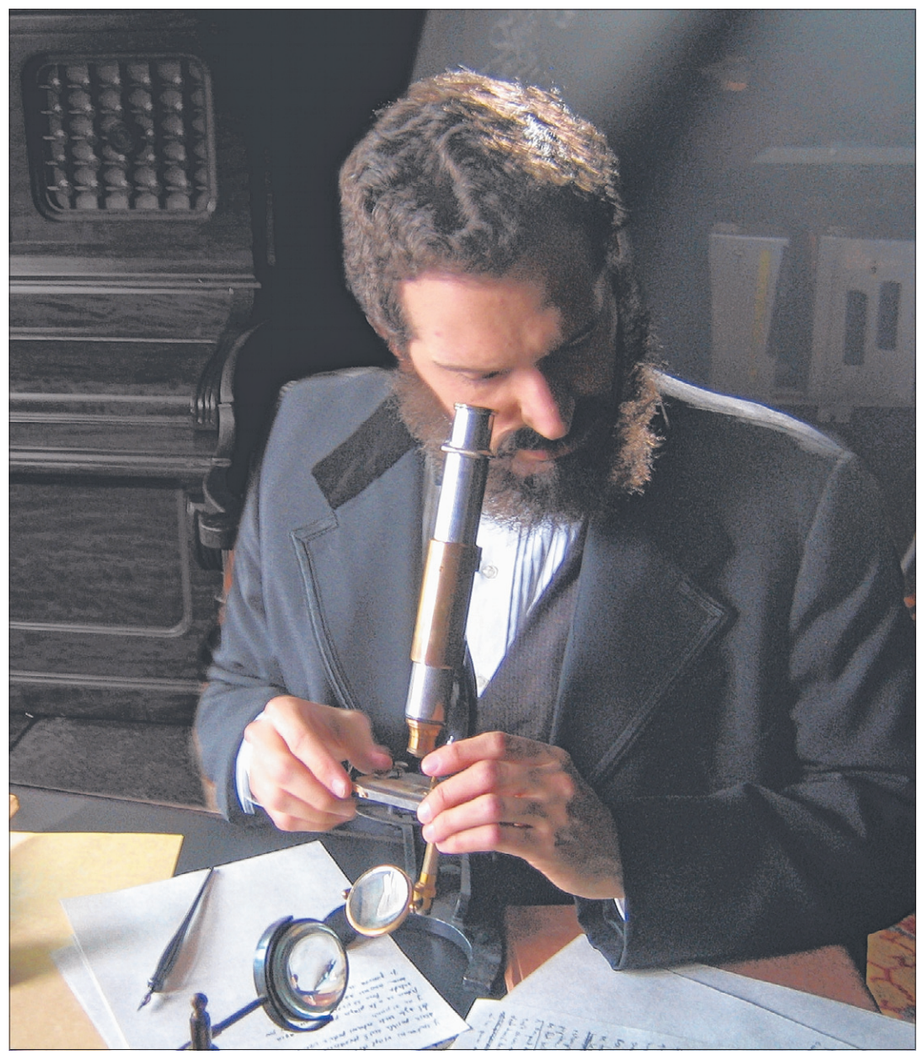
Ground-breaking work carried out for Optus by CSIRO during the 80s produced another of Australia's important contributions to the industry.

CSIRO scientists devised computer-based methods to massively accelerate the time-cycle for developing the antennae that satellites use to receive and re-transmit voice, data and video signals. Within a couple of years, aerospace companies around the world adopted the new methods, and antenna development times more than halved, saving the global industry billions of dollars.

Today, Optus provides a premium broadband service on one of its existing satellites, offering download speeds of up to 6Mbps. This is being used by NBN Co as its interim satellite broadband service.

NBN Co has signed contracts with US-based satellite builder Space System Loral to provide two state-of-the-art Ka-Band satellites that, from 2015, will provide a 12Mbps broadband service to remote areas as part of the National Broadband Network.

Ka-band is a part of the radiofrequency spectrum that covers the frequencies from 26.5GHz to 40GHZ. It has only recently begun to be used for satellite communications, but has long been used for high-resolution targeting radars in fighter jets, and also for radar speed guns used by police.



Making history: An actor plays science fiction writer Jules Verne, whose writings foreshadowed the development of satellite

> "French science fiction writer Jules Verne, in his 1879 novel *The Begum's Fortune*, describes a fictional cannon which shoots a large projectile that misses its target – and, indeed, misses the Earth – sending the shell into a geocentric orbit in space, endowing the Earth with a 'second satellite'."

The advantage of Ka-band is that it offers much higher throughput than lower-range frequencies, making it ideal for broadband data communications.

Through the Australian Communications and Media Authority (ACMA), Australian companies and regulators contribute strongly to the work of the International Telecommunications Union (ITU) which creates and maintains the 'rules of the road' for global satellite communications – ensuring that orbital slots, transmission frequencies and regulations are properly coordinated in an increasingly crowded space environment.

Australia has a wealth of other satellite players, including service providers of all types, earth station operators, network builders, software and hardware developers, system integrators and academics.

One operator – Perth-based NewSat – has won recent international awards for its operational performance and is gearing up to become Australia's second satellite operator via an advanced Ka-band spacecraft dubbed Jabiru-1. The satellite is under construction in the US by Lockheed Martin Space Systems, and will deliver high-powered services across Australia, the Middle East, Asia and Africa.

As the evolution of satellite broadband and other services continues apace, it's worth remembering Australia's role in the development and provision of satellite communications and the advantages the technology offers.