Submission to “Developing Australia’s Space Industry,” 10 January 2021.

Summary of Recommendations

1) The Australian Space Agency (ASA) should be funded to have an eventual budget equal to 0.1% of the Federal Budget.
2) Initial low cost space development projects should include programs similar to NASA’s Educational Launch of Nanosatellites (ELaNa), Small Business Innovation Research (SBIR) and Venture Class Launch Services (VCLS) programs.
3) Funding for Australian Space Centres focussing on satellite applications such as satellite communications, remote sensing and geospatial positioning should be established based on a collaborative university/industry model.
4) The space program should be balanced and not exclusively focus on one area at the expense of others. These areas include satellite applications, space technology, space science, space exploration, astronauts and space education.
5) Join the European Space Agency so that Australian industry can have access to European space technology and participation in European space projects.

1) Australian Space Office Budget.

In order for the ASA to have an effective program, it must be properly funded. Previous efforts by the Australian Space Office, CRC for Satellite Systems and the Australian Space Research Program were only funded at $5M to $10M a year, equivalent to only 0.001% to 0.002% of the Federal Budget, with the indignity of then having the organisations terminated, despite achieving a number of successes.

Other countries that have space agencies typically spend around 0.1% of their government budgets on their space programs. For example, Canada has a space agency budget of CA$356M ($361M) [1] or 0.12% [2] of their government budget. Japan has a budget of ¥157B ($1.96B) [3] or 0.15% [4]. The exceptions are the US (US$23.3B, $29.9B [5] or 0.5% [6]) and Russia (R176B, $3.06B [7] or 1.0% [8]) which spend considerably more as a percentage of their government budgets.

The ASA budget is currently about $50M a year or about 0.01% of the Federal Budget. The recommended amount of 0.1% or $500M per year can not of course be achieved overnight. It will take time, but it should not take longer than five years, so that the benefits obtained to Australia are achieved in a timely manner. I am sure that the ASA will be able to easily fund a number of useful and productive programs that help both Australia and its space industry.

2) Initial Space Development Projects.

With the current limited funding, the ASA should focus on programs that are low cost and as cost effective as possible. We can look no further than NASA for ideas on how this can be achieved. Despite having the world’s largest space budget and high visibility and extremely expensive programs such as the International Space Station and Artemis Moon landing programs, NASA also has much smaller programs that have the same aim as the ASA. That is, to develop the country’s space industry and capability. Summaries of three such programs are given below. Links to the programs are also provided, where further information on how these programs are run can be obtained.

Educational Launch of Nanosatellites (ELaNa).

https://www.nasa.gov/mission_pages/smallsats/elana/index.html

This program aims to help high schools, universities and non–profit organisations get their small cubesats into orbit. NASA does not fund the cubesats, but it does help out with advice and especially in getting the cubesats tested for the space environment and in getting the cubesats launched. Since it only costs about $100,000 to launch a cubesat, the ASA could easily afford to have several Australian built cubesats launched into orbit each year as well as providing space environment testing. It would be up to the organisations to obtain funding to build the satellite themselves.

Small Business Innovation Research (SBIR). https://sbir.nasa.gov/

This NASA program aims to help small companies develop new technologies and products that could be of future benefit to NASA. This is normally done in several stages and a cost shared basis. Phase I provides up to US$125,000 for six months to help fund the initial ideas for the project. Winners of Phase I are provided with up to US$750,000 for two years or more for prototype development in Phase II. In Phase III, the technology is commercialised, but NASA does not provide funding. The ASA could do something similar, say providing $100,000 for Phase I and $600,000 for Phase II projects. The smaller amounts reflects the lower costs in Australia compared to the US, and would allow more projects to be funded.

Venture Class Launch Services (VCLS)

https://www.nasa.gov/press–release/nasa–awards–venture–class–launch–services–demonstration–2–contract

This program is part of NASA's Launch Services Program (LSP) which obtains launch services from the US commercial launch industry to launch NASA's satellites into orbit and deep space. For VCLS, LSP buys services from upcoming small launch vehicle providers. As these providers are in the initial stages of flying their vehicles, NASA acts a key customer, helping these companies get initial launch contracts. The payloads that NASA provides are typically from the ELaNa program, which can tolerate the high risk associated with these vehicles. The ASA could do the same for Australia's fledgling launch industry, providing help to these companies when they need it most and in a way that is useful to the ASA's aims.

3) Australian Space Centres.

One of the successful outcomes of the Australian Space Office (ASO) during the 1990's was its Space Industry Development Centre (SIDC) program [9,10]. These centres were based at various universities in collaboration with industry. These included the Australian Space Centre for Signal Processing (satellite communications), the Space Microwave Centre (satellite communication components) and SATNAV (satellite navigation). Yearly funding was only $2.1M [11]. I would not be here today in a successful Australian space business if I had not been employed at one of these centres. These centres provided a key pool of talented engineers and technology that is vital for the Australian space industry to survive and thrive. Unfortunately, when the ASO was terminated in 1996, so did funding for the SIDCs causing significant harm to Australia's space capability.

The previous CRC for Satellite Systems and current Smartsat CRC are similar to the SIDCs, but are more expensive ($55M for the Smartsat CRC [12]) and are limited to seven year terms. An Australian Space Centre program will provide a low cost and long term program that overcomes these limitations where each centre can focus on its particular area of expertise. This can initially be in the area of satellite communications, remote sensing and satellite navigation, the key areas of satellite applications.

4) A Balanced Space Program.

The various aspects of space is as varied as the sciences and engineering required to launch a rocket (mechanical, electronic, electrical, chemical, structural, aerodynamic, weather, safety, regulation, etc.). These include satellite applications, space technology, space science, space exploration, astronauts and space education. For satellite applications we have communications, remote sensing and navigation. For science we have space telescopes and sensors that observe the sun, the space environment, stars, extra solar planets, galaxies and the beginning of the universe. For space technology we have the materials and knowledge required to build satellites, launch vehicles and ground facilities. For space exploration we have planetary flybys, orbiters, landers and rovers. For astronauts we have spacecraft, space stations and bases on the Moon and Mars to explore our solar system. For education we have the obligation of passing on the knowledge we have learned about and from space to inspire the next generation to be part of this great enterprise.

A balanced space program should try to do all these things in proportion to the amount of resources that one has. At the current low budget level, the ASA needs to focus on areas where it can be most cost effective for the largest impact on the space industry. This has traditionally been satellite applications for

the obvious reason that it provides the greatest economic benefit. However, the other areas should not be ignored. A low cost way is have have studies performed on what Australia could do in the future, when more funds will be available. Small missions can also be funded. When increased funding does become available, more substantial programs can be implemented.

For example, an astronaut program need not cost billions of dollars. It can be achieved for a few hundred million dollars similar to Canada. The Canadian Space Agency has provided robotic arms to the Space Shuttle and International Space Station and plans to provide an arm for the Lunar Gateway. In exchange, NASA provides seats on its spacecraft and space station for Canadian astronauts. The money to build the arm is all spent in Canada as the Canadian space industry is used for this task. Australia can easily afford to do the same, although we need to find something that can be built in Australia and that NASA needs for its future plans either on low Earth orbit, the Moon or Mars. I'm sure the Australian space industry can think of something. We just need to ask (via those low cost studies).

5) Join the European Space Agency

The European Space Agency (ESA) has a long open invitation for Australia to join its organisation since the late 1970s. Unlike the US, which restricts access to its space technologies via its laws, Europe is much more open. Joining ESA would allow Australia to have access to those technologies, providing great benefit to Australian space industry, as well as being allowed to participate in European space projects. An example of a non–European country that is part of ESA is Canada.

The way that ESA works is that funding is provided by its member countries to ESA. The organisation then allocates various projects and development work back to the country in proportion to the amount of funding that is provided. This does not mean that Australia would lose control of which projects are funded, since funding is provided in two ways. There is mandatory funding, which is a fixed percentage of the countries gross domestic product (GDP). This is mainly spent on science projects. Then there are optional programs, which is where ESA gets the majority of its funding. Australia can then choose which programs to participate with Australian industry then participating in those programs.

This could be a good way for Australia to have an astronaut program. For example, the UK decided to participate in the European Service Module program, which is part of the US Artemis program. In return, a UK astronaut was chosen to be launched to the International Space Station for a six month mission. Australia could also participate in other areas of space as described above, as ESA has programs in all the main aspects of space, thus helping Australia achieve a balanced space program. As all the money effectively comes back to Australia, unlike in some other programs that Australia has participated in the past which send wheelbarrows full of money overseas with none coming back, this is win–win situation for Australia and its space industry.

References

[1] Canadian Space Agency 2020–21 Departmental Plan
https://www.asc–csa.gc.ca/eng/publications/dp–2020–2021.asp

[2] Government of Canada 2020–21 Estimates
https://www.canada.ca/en/treasury–board–secretariat/services/planned–government–spending/government–expenditure–plan–main–estimates/2020–21–estimates.html

[3] Annual budget of the Japan Aerospace Exploration Agency (JAXA) from fiscal year 2011 to 2020
https://www.statista.com/statistics/1049184/japan–budget–annual–jaxa/

[4] Japan's Cabinet approves record ¥106.61 trillion budget for fiscal 2021
https://www.japantimes.co.jp/news/2020/12/21/business/economy–business/japan–record–high–budget/

[5] NASA's FY 2021 Budget
https://www.planetary.org/space–policy/nasas–fy–2021–budget

[6] U.S. Federal Budget Breakdown
https://www.thebalance.com/u–s–federal–budget–breakdown–3305789

[7] Roscosmos compared its budget to NASA
https://tass.ru/ekonomika/7734535

[8] Russia Government Spending
https://tradingeconomics.com/russia/government–spending

[9] Australia in Orbit: Space Policy and Programs
https://www.aph.gov.au/About_Parliament/Parliamentary_Departments/Parliamentary_Library/Publications_Archive/CIB/CIB9798/98cib12

[10] Spaceport Plan Gets New Chance
https://www.afr.com/companies/spaceport–plan–gets–new–chance–19930219–kaqtt

[11] Estimates Committee – Supplementary Information to Additional Information Received from Estimates Committee E, October 1993 – Volume 7.
https://parlinfo.aph.gov.au/parlInfo/search/display/display.w3p;query=Id%3A%22publications%2Ftabledpapers%2FHSTP02100_1993–95%22;src1=sm1

[12] Space Research Centre Wins Federal Funding
https://www.australiandefence.com.au/defence/cyber–space/space–research–centre–wins–federal–funding

[13] ESA, an Intergovernmental Customer
https://www.esa.int/About_Us/Business_with_ESA/Business_Opportunities/ESA_an_intergovernmental_customer