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Inquiry into job creation opportunities in Queensland arising from the establishment of an Australian space industry

Submission by: Rhonda O'Sullivan

Principal Research Fellow

Sustainable Minerals Institute

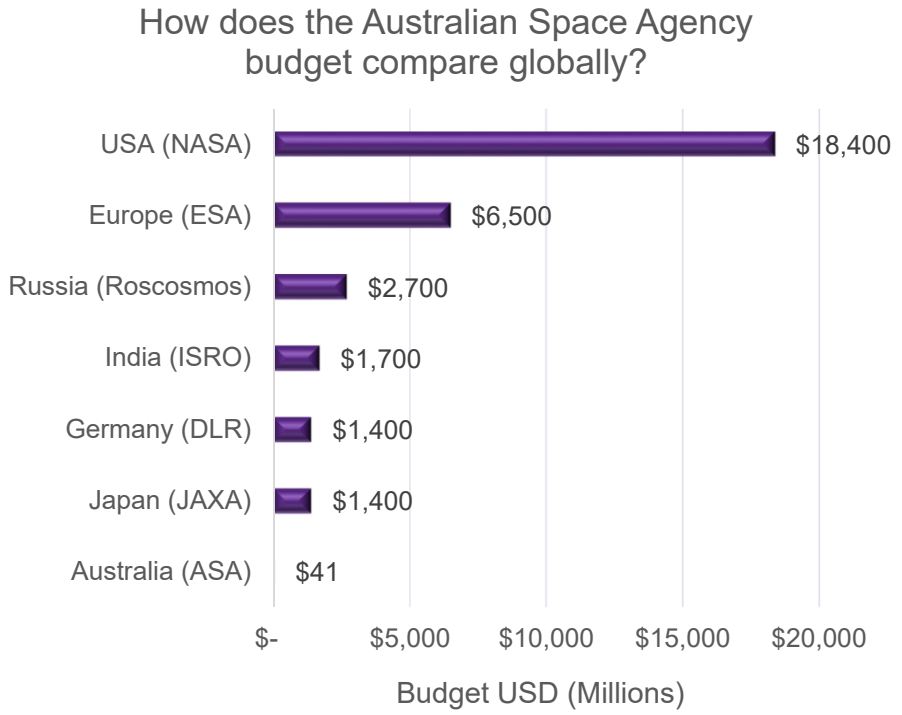
WH Bryan Geology and Mining Research Centre

Executive Summary

- Australia's space agency (ASA) budget is small on the global playing field.
- The priorities listed by the ASA are broad, unfocussed and budget constrained.
- It is recommended that space activities are focussed on what we are good at and internationally respected to gain momentum and attract further investment into the Australian space sector.
- Some of the largest mining companies are owned and operated in Australia. We have deep expertise in metals mining, oil and gas extraction, safety, exploration and remote sensing applications, airborne geophysics, environment, modelling, reporting and governance of the mining sector.
- There is ambiguity in the international law regarding the use of space resources. Where there is ambiguity, there is opportunity. Internationally, it is an opportunistic time to enter this arena with the USA and Luxembourg challenging property rights legislation by creating their own legal frameworks to support space resource activities. Given our expertise in mining, we do not want to miss this boat.
- It is proposed that we utilise resources to focus on entering this area as there will be reciprocal benefits for both space and terrestrial mining advancement. This aligns with the ASA's priority number 7, which states that "developing a strategy to position Australia as an international leader in specialised space capabilities". If we can demonstrate a reciprocal and beneficial relationship between space and terrestrial mining, this could lead to future investment in space by the mining industry.

Global context setting

- Australia needs to focus our limited resources on what we are good at to ensure impact, growth and sustainability.
- Timing - The USA and Luxembourg are challenging space ambiguity in space legislation to create a global platform for space opportunities.
- The space sector is in a transition phase. Commercialisation has been facilitated by reusable rocket technology which will continue to lower launch costs in future years.
- We are entering the “new space” era.



How will we spend our budget?

Initial priorities listed by the Australian Space Agency:

1. Communications technologies
   - Australia ranks 14th in the information and communication technology development index 2017 (https://www.itu.int/en/ITU-D/Statistics/Documents/publications/misr2017/MISR2017_Volume2.pdf).
2. Space situational awareness (SSA) and debris monitoring
   - Motivation to help USA and low number of publications in comparison with the USA.
3. Positioning, navigation and timing (PNT) infrastructure
   - Australia has access to six high visibility GNSS – USA, Russia, Japan, EU, China, and India, but can improve of accuracy from 5-10m to within 3cm with improved ground stations.
4. Earth observation (EO) services
   - Important for defense, urban development, agriculture, water, coastal, marine, forest and climate management.
5. Research and development
   - Very broad, unsure of focus.
6. Remote asset management
   - Remote asset management market estimated to be worth $26.99 Billion USD by 2021 (https://markets.businessinsider.com/news/stocks/remote-asset-management-market-worth-26-99-billion-usd-by-2021-1001874168).
7. Developing a strategy to position Australia as an international leader in specialised space capabilities
   - Open to interpretation.

"Developing a strategy to position Australia as an international leader in specialised space capabilities"

Australian Space Agency Commitment

(https://www.industry.gov.au/strategies-for-the-future/australian-space-agency)

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Where are resources on the list?

We are not global leaders in the listed priorities.

We are global leaders in mining – why not build on this strength to differentiate ourselves?

Top mining companies are owed and operating in Australia:

- OWNED: Dual listed BHP and RIO are the top two ranked mining companies by market capitalisation globally (ranked 2 and 3 by revenue).
- OPERATING: Glencore (ranked 4 by market capitalisation) in Qld and NSW. Anglo American (ranked 7 by market capitalisation) also in Qld.
- Significant number of mid-tiers; e.g. South32 Ltd, Fortescue Metal Group, Newcrest Mining, MMG.

Mining expertise in numerous commodities (metals, energy) and mining methods (open pit, stoping, caving, *in situ* recovery)

Resources gives us a unique opportunity to differentiate our skill set in the space sector.

There are two types of space resources activities:

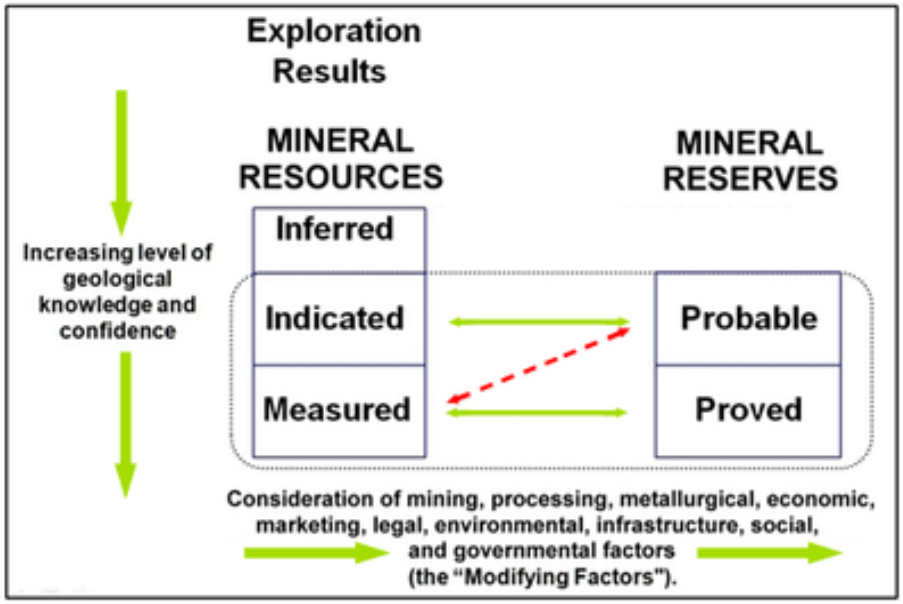
1. *In situ* resource utilisation – general international consensus and work progressing moon based activities, mars will likely be the next step.
2. Asteroid mining – long term strategy to support space activities.

Source: S&P Global Market Intelligence 31/08/2018

Top 25 metals & mining companies ranked by Aug. 31 market cap

Ranking					Market	Market cap change from (%)	
Current	End-July 2018	End-Aug 2017	Institution name	Trading symbol & exchange	cap (US$B)	End-July 2018	End-Aug 2017
1	1	1	BHP Billiton Group	BHP-ASX	121.91	-7.52	11.02
2	2	2	Rio Tinto	RIO-LON	83.50	-13.91	-5.70
3	3	4	Vale SA	VALE3-BSP	71.47	-11.13	27.60
4	4	3	Glencore PLC	GLEN-LON	57.33	-7.97	-13.18
5	6	NA	Nutrien Ltd.	NTR-TSX	34.48	3.36	NA

Resource and reserve risk is not well understood in the context of space……



Source: The Joint Ore Reserves Committee. The JORC Code, 2012 (http://www.jorc.org/ accessed 10/10/2018).

Confidence: The Concept of Reserves

Reserve Classification	Earth Application	Mars ISRU Application	Confidence
Proven	Use as collateral for a bank loan	Astronaut lives can depend on it	99%
	MAKE COMMITMENTS		
Probable	*SPECIFIC DEFINITIONS EXIST*	*UNDEFINED*	90%
Possible		*UNDEFINED*	50%
Potential	*THE EXPLORATION ARENA*		<50%

Source: Abbud-Madrid *et al*. 2016. Mars Water In-Situ Resource Utilization (ISRU) Planning (M-WIP) Study. Internal NASA report.

What can Australia actually do?

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Theme	Space Mining	Terrestrial Mining	Economic Relevance and Job Potential
Exploration	Celestial body exploration. Remote sensing technology. Japanese Space agency recent Hayabusa2 Mission and successful landing on asteroid (162173 Ryugu).	Improving exploration capabilities under cover: - remote sensing - geochemistry - geophysics - drilling This expertise applied to space exploration will drive competition to improve terrestrial technology and ultimately increase the probability of success.	If pooling resources and technologies to exploration and discovery under cover ultimately increases our chances of discovering an orebody in the NW Queensland mineral province. Discoveries lead to infrastructure and jobs. This is becoming increasingly important with the copper grade declining at Mount Isa which is a regional hub of outback Queensland and pays significant government royalties and taxes.
Attracting Business **Legal**	The USA and Luxembourg are challenging space resource property rights and legal frameworks to attract business. *"Luxembourg is the first European country and the second country worldwide after the United States to offer a legal framework to secure property rights for space resources".*		If we also set up favorable legislation within our nation state to encourage business, we would be the first country in the southern hemisphere to do this and would attract business particularly from large space agencies like India and Japan. Japan has openly quoted a strong relationship with Australia because of its mining expertise.
Governance	Space resource governance is now a topic gaining momentum e.g. The Hague International Space Resources Governance Working Group.	Australia (JORC) and Canada (NI43-101) have the best regulation on resource reporting in the world and is adopted internationally. I argue JORC is more applicable internationally as it is principals based. This allows nation states to derive their own legislation from a non-prescriptive base.	Both the JORC code and NI43-101 were developed as a response to fraudulent reporting from companies respective stock exchanges which impacted shareholders. If we learn from this, we do not need to repeat the mistake. Australia had their first Space related business register on the ASX in July, 2018 (Luxembourg-based Kleos Space). We need to be ready when the first space exploration company is listed to mitigate risk to investors. Governance related jobs would increase and professional organisations would gain more memberships e.g. Australasian Institute of Mining and Metallurgy.
Technology **Asset Management**	Remote asset management including automation. Terrestrial mining can benefit from space robotics and miniaturisation (e.g. sensors, cube sat technologies).	Some of the larger Australian mining companies are moving towards full automation. Space mining can benefit from this expertise and utilisation of a analogous testing environment for new equipment trials e.g. dusty (moon), uneven ground, limited communication options under cover etc..	Technology gains leading to cost reductions to current operations. This would ultimately lead to more company profits which in turn would result more economic contribution (social investment, royalties and taxes, employees, pay debt back quicker or reinvestment opportunities sooner). Improving mining operations will have a knock on effect to the mining supply chain.
Research	Proposed relevant research topics: In situ resource utilisation Asteroid extraction research Helium-3 abundant on the moon (non radioactive form of energy	Utilising our exploration, geology, engineering, blasting and processing and economic expertise. We are a global leader in mining optimisation (e.g. Whittle Consulting an Australian owed company with one of the only patented software that assesses the entire value chain).	Within mining, it is well known that the industry is behind in relation to global technological advances. This creates a huge opportunities. Research related jobs with practical applications to improve economics of current mining operations combined with the leading technology that space provides will further advance our domestic businesses.

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Lets shine the light on Queensland's resource and space partnership potential!

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Thank you

Rhonda O'Sullivan | Principal Research Fellow
Sustainable Minerals Institute
University of Queensland

[redacted]

Qualifications:

- BSc (Hons) Earth Sciences
- MSc (Mineral Economics)
- MBA
- Space Studies Program 2018.
  International Space University