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Committee Secretary
Standing Committee on Industry, Innovation, Science and Resources
PO Box 6021
Parliament House
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Via Email: iisr.reps@aph.gov.au

8th December 2020

Dear Sir/Madam

Submission by the Victorian Space Science Education Centre (VSSEC) to the House of Representatives Standing Committee on Industry, Science and Resources inquiry into the development of Australia's space industry.

The Victorian Space Science Education Centre (VSSEC) is pleased to provide this submission to the inquiry into the development of Australia's industry.

Our submission has six elements:

- A description of VSSEC's activities, credentials, and relevance to the inquiry
- Comment on educational aspects of international space collaboration
- Space education in Australia
- Comment on the relationship between education and workforce development
- Comment on Australia's space governance arrangements as they effect education
- Comment on Eligibility to apply for grants.

VSSEC's Activities and Credentials

VSSEC is one of six specialist maths/science centres established and funded by the Victorian Department of Education and Training (DET). The Centres were established by the State Government of Victoria to increase the number of students progressing to further education in the STEM disciplines to address forecast serious shortages in the technical workforce.

Each of the Centres offers programs in specified areas of science and technology, including the Earth, environmental and biological sciences. The Centres have their own budgets and

considerable independence. They are located on the campuses of Victorian secondary colleges in Melbourne, Geelong, Bacchus Marsh and Ballarat.

VSSEC is a purpose-built facility located on the grounds of Strathmore Secondary College in Melbourne. The Director of the Centre is responsible to the College Principal and provides a monthly report to the school's council. The Centre also has an advisory committee comprising industry and university representatives who assist the Director on questions of Centre strategy and priorities.



VSSEC occupies a purpose-built facility at Strathmore Secondary College in Melbourne. The building's shape represents the arms of a spiral galaxy.

VSSEC's signature program is an immersive "Mission to Mars" program where students perform designated roles within a simulated mission control centre and as astronauts exploring a simulated crater on Mars.

This and other programs offered by VSSEC are tied to the National curriculum and the Centre provides classroom teachers and students with preparatory and follow-up materials that cover specific curriculum objectives at particular year levels. VSSEC's staff are, above all, experts in pedagogy and, to quickly summarise, the Centre, in effect, applies the science of teaching to the teaching of science (and technology, engineering and mathematics). Space and the space sciences are the vectors through which the challenges and opportunities of the STEM disciplines are applied.

"VSSEC applies the science of teaching to the teaching of science."

Since opening its doors to students in 2006, more than 150,000 students have participated in VSSEC's programs either at the Centre or through outreach activities (*VSSEC Annual Report 2006-2020*). COVID-19 brought class visits to VSSEC to a halt in March 2020 and the Centre,

like many other educational institutions across Australia, has devoted considerable effort since then to strengthen its online programs. The Centre is now looking systematically into applying Virtual and Augmented Reality (VR and AR) to STEM learning in ways that support classroom teachers and facilitate learning in ways that are ethical and safe.

In the latter part of 2020, VSSEC installed a small radio telescope on a property north of Melbourne and is now offering an on-line radio astronomy program, initially catering to Year 9 students, and it is already well-subscribed.

VSSEC routinely hosts visits by VIPs including Royalty, Governors, Ambassadors, Federal and State Ministers, Astronauts and Senior officials often with policy responsibilities in science and technology. In 2020 the Governor of Victoria, The Hon. Linda Dessau AC, made a 'virtual visit' to VSSEC. The Centre is a *de facto*, national science education showcase.

More information about VSSEC may be found [here](#).

The intrinsic interest inherent in space science makes it successful vector of education. Evidence of the effectiveness of VSSEC's approach to education has been obtained through numerous research projects and VSSEC can point to success against several measures.

The situation remains, however, that the number of students studying the physical sciences, mathematics, and engineering at the secondary level and who continue these studies at university and TAFE is insufficient to meet the forecast demands of industry.

Whilst the thought of making a career in space appeals to many students who visit VSSEC, competition from other sectors of manufacturing industry, especially, is fierce. We consider that the relatively low number of students who indicate to us at VSSEC their definite intention to pursue tertiary studies in the STEM disciplines places in question the stated aim of the Government to have a space sector that employs more than 20,000 people and generates \$12 billion by 2030. Perhaps more seriously, this calls into question that more recently announced ambition of the Government to establish sovereign manufacturing capability in the six areas specified for particular attention, including space.

Properly resourced and structured primary and secondary STEM programs with, above all, teachers who are qualified, competent, and confident to teach the STEM disciplines will be essential to the realisation of these ambitions.

International Collaboration in Space Education

Some years before the Australian Space Agency was established, VSSEC was accepted as a member of the International Space Education Board (ISEB). VSSEC was and remains the only Australian organisation represented on this body which is the peak body for space education globally. The ISEB sits within the structure of the International Astronautical Federation (IAF) and most of its members are the heads of education of the world's space agencies.

In pre-COVID-19 times, VSSEC provided in-service programs for teachers at the annual International Astronautical Congress (IAC), such as was held in Adelaide in 2017. How VSSEC will maintain its presence and influence in future, at least until the pandemic is brought under control remains to be seen. The Charter of the Australian Space Agency makes no specific

mention of education – a point for discussion in the forthcoming review of the Charter. Meanwhile, VSSEC has been encouraged by the Agency to continue its international engagement activities through ISEB on both the Centre's and Australia's behalf.

VSSEC has established, on a bilateral basis, a collaboration with the Wallingford Schools District in Connecticut USA. VSSEC has gifted its programs to Wallingford where a Mission to Mars simulator, drawing on VSSEC's experience, has been established. COVID-19 prevented a planned student exchange from occurring early in 2020, which, we hope, will be resurrected when international travel resumes.

Space Education in Australia

VSSEC occupies a unique place in Australia's space education landscape. There is no other Centre like it anywhere else in the country. There is a smaller centre in Adelaide that is modelled on VSSEC and that makes use of Mission to Mars software and other materials that were gifted by VSSEC.

Several small companies, some operating as sole traders, offer short programs on space topics to schools for a fee. The aim of these programs seems primarily to be to inspire students about the mysteries of outer space.

Volunteer groups, including specialists with deep space knowledge, have arranged space camps for secondary school students for many years during terms breaks in South Australia and Queensland. These activities are well-subscribed and those selected to participate almost universally report about their experience with great enthusiasm.

Finally, several museums and national institutions including Questacon, CSIRO and the Space Agency have or are developing space exhibits and places for space discovery. Several of these centres have been closed or access severely restricted due to COVID-19.



Research conducted by Dr Isabel Kingsley has revealed several important points about the impact of these activities (Kingsley and others, 2019). In broad terms, short duration activities and occasional or casual visits to specialist centres speak to those who are already interested; they serve to reinforce interest, but their overall impact from a pedagogic perspective is limited. The data collected by Kingsley from students who participated in VSSEC's Mission to Mars Program indicated considerably higher impact and longer-term influence, especially in affecting many students' interest in and attitude towards science and technology.

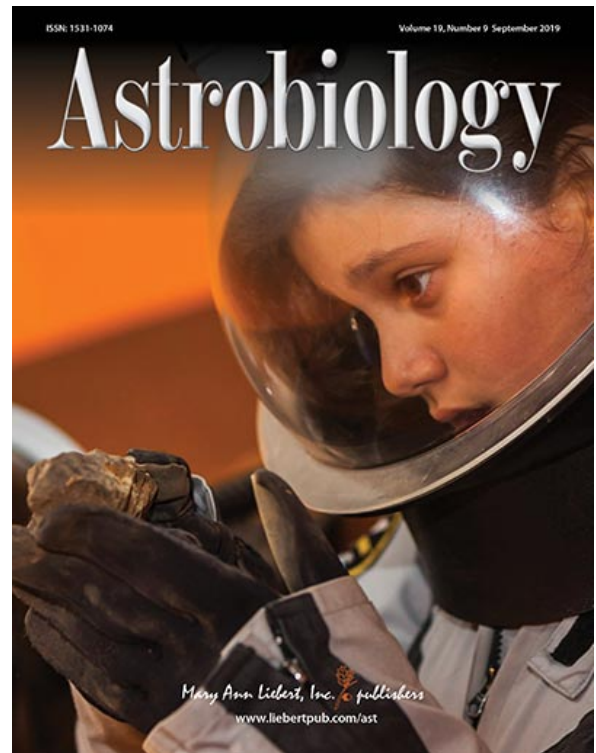
Kingsley also found that students who had participated in the Mission to Mars program reported being somewhat confused by the experience because, their previous exposure to science in the classroom had been presented as a discipline of certainty; the answers were in the back of the textbook. However, VSSEC made them aware that science was uncertain and experimental. Data was imprecise and sometimes difficult to understand and interpret. They experienced science as a journey of discovery through observation, measurement, recording, interpretation, and analysis, leading to a finding or a conclusion. They were exposed to the importance of critical thinking in evaluating their results.

From VSSEC's point of view, Kingsley's findings provide persuasive evidence of the effectiveness of VSSEC's immersive and experiential approach to education.

VSSEC is aware that a new Field of Research (FoR) code has recently been added to specifically cater for research in the space sciences, as distinct from astronomy. If Australian science in general, and space science in particular, is to benefit from this newly introduced FoR code, the quality of science education from Years K to 12 must be given renewed priority by Commonwealth, State and Territory education authorities.

Education and Workforce Development

As noted above, the aims of Government to grow the space sector (however defined) and the manufacturing sector of the economy more generally assume that there will be a suitably educated, trained and experienced workforce to meet the stipulated growth targets. Aware of the challenge, The Commonwealth has reduced the fees of science and engineering course and increased the fees for arts and social courses at universities to entice more students to obtain science, engineering and technical qualifications. Work integrated learning is also being promoted.



The Cover of Astrobiology, in which Kingsley's paper was published

Whether these inducements will be successful remains to be seen, especially given the evidence that later educational and early career trajectories are heavily influenced by peers and parents well before students complete their secondary education.

VSSEC's experience indicates that the tertiary level interventions proposed by Government may come too late to make a substantial difference to the growth sought in Australia's scientific, engineering and technical workforce. Redoubled emphasis on recruiting, training and retaining teachers who are competent and confident to teach STEM subjects in primary and secondary schools will be essential if the Government's ambitions to strengthen sovereign capability including in the space sector is to be realised. This comment is based on evidence independent of VSSEC as well as VSSEC's direct experience.

Space Governance

VSSEC welcomed the announcement at the IAC in September 2017 that an Australian Space Agency would be established in 2018. Dr Clark and a number of Agency officials have visited VSSEC, but the Agency seems unsure in how to value, engage with or support VSSEC. We think there are two reasons for this:

- VSSEC is a State funded organisation and the Space Agency does not wish to be seen to be favouring one State over another, and
- The Space Agency's Charter speaks of inspiration but makes no explicit mention of education.

VSSEC is aware that the Agency is due for a mid-term review in 2021 and we will be advocating in that review that the Agency's Charter be expanded to include an educational responsibility with an appropriate adjustment to resourcing and funding.

Eligibility to Apply for Grants

The Commonwealth offers a series of grants through the Space Agency, the Department of Industry, Science, Energy and Resources (DISER) and the Department of Education, Skills and Employment (DESE) several of which VSSEC would like to have applied for.

Unfortunately, applicants must be for-profit companies or universities and other specified research organisations.

VSSEC would like to see the capacity for some discretion to be applied to the current eligibility criteria in order that it might be eligible to apply for future grant funding administered by the Agency.

VSSEC has been operating at capacity for some years and, from the point of view of the State Department of Education and Training, is meeting its objectives that are measured crudely by the number of students through the door. The Centre is funded on these numbers essentially as a *status quo* activity.

Certainly, inputs are much easier to measure than outputs. VSSEC's interest, however, is to measure the Centre's impact in quantitative and qualitative terms. These are the measures that we value and that we seek to strengthen with data.

The social and educational impacts of COVID-19 are combining with rapid advances in understanding how people learn, and rapid advances in technology to compel VSSEC to re-visit its program offerings in a fundamental way. This is cutting edge, applied educational research with impacts for teaching and learning across all ages and subject areas. VSSEC's university partners are willing to assist but they lack the time and money to invest in the review, tests, and trials that we envisage. We anticipate that the results of this work will allow VSSEC to proceed confidently into the third decade of the 21st Century and will provide an evidence base for broader reforms to educational practice in Victoria and elsewhere.

Conclusion

VSSEC is a unique space educational facility in Australia that has achieved global recognition and acceptance through its international activities. The Centre is at an inflection point and, with appropriate support, is positioned to make a significant contribution to the development of future educational practice, notably in the STEM disciplines in Australia.

We have sought to inform the Committee's deliberations about:

- The educational element of Australia's space capability that is not especially well-known and is often overlooked.
- The critical importance of education from years K-12 in terms of the Government's aspirations to grow a sustainable sovereign manufacturing workforce, including, as a sub-set, the space workforce.
- Current constraints on eligibility for grant funding that are hampering VSSEC's ability to contribute further to the national space enterprise.

We would welcome the opportunity to appear before the Committee in person to answer any specific questions that Committee members may have. We also extend an invitation to the Committee to visit VSSEC to assist the Committee's understanding and deliberations.

[REDACTED]

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Reference:

Kingsley, I., *et al*, 2019; *Hidden in the Figures: What Students Are Telling Us About the Effectiveness of Astrobiology Outreach*, *Astrobiology*, Vol 19, No 9.
<https://www.liebertpub.com/doi/10.1089/ast.2019.2048>. Accessed 6 December 2020.

