STANDING COMMITTEE ON INDUSTRY, INNOVATION, SCIENCE AND RESOURCES
Inquiry into Developing Australia's Space Industry
PUBLIC HEARING
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Transcript from Proof Hansard:

Ms BIRD: Excellent. Thank you. With each of those projects, is there a component of that that is looking at skills and knowledge analysis and identifying workforce for the future as well?
Dr Clayfield: The projects themselves are technology research and development projects, but each project does have a component regarding education, outreach and knowledge transfer. Obviously, part of our role as the national science agency is to develop the capability of our future workforce—for example, by bringing in postdoctoral fellows in those areas and supporting work experience students and so on.
Ms BIRD: Okay. I don't need you to do it right now, because quite a few of my colleagues will have questions, but are you able to maybe provide to the secretariat a few really good examples of some of those—I'm talking about the development of a PhD student or a schools outreach program or something like that—that you're actually involved with in your particular platform?
Dr Clayfield: I can. I might just add on that, though, that CSIRO does have some separate space related education and outreach activities specifically in this area.
Ms BIRD: So would it perhaps be better, Dr Williams, for the agency in general to provide that?
Dr Williams: I think that can really be for Kimberley.
Ms BIRD: Okay. Dr Clayfield, just a few from your specific area would be fine. It's just that as we do a report, if we're describing something, it's good for the general public to have a picture of a few real-life examples, so that would be of great value. Thank you.
Dr Clayfield: Sure. One very nice example is our PULSE@Parkes program, which enables school students to operate the Parkes radio telescope.
Ms BIRD: Ooh!
Dr Clayfield: Each year we get somewhere between 150 and 200 students taking up that program, reaching about 25 schools every year.
Ms BIRD: Excellent. A few like that would be great—just two or three really exciting examples that we could include.

RESPONSE TO QUESTION ON NOTICE

Below are a few examples of space education programs and activities undertaken by CSIRO with A. schools and B. at undergraduate and PhD level. Further examples can be supplied if required.

A. School programs

CSIRO operates two national space-related school education and outreach programs:

- **PULSE@Parkes (expanded detail with respect to hearing response)**

  CSIRO's educational program PULSE@Parkes is designed to give school students the opportunity to observe with the Parkes radio telescope. The students control the Dish, select pulsars to observe, gather then analyse their data. During the program they meet with our scientists and PhD students and discuss study options and career paths in astronomy and space. They learn about observational science and are introduced to our innovative technology and handling big data sets. In 2019-20 more than 160 students and 25 teachers from 19 schools took part in this program.

  With COVID, all PULSE@Parkes sessions from March 2020 were moved to online remote mode, reaching more schools (~25) and over 200 students in locations across Australia including the Snowy Mountains, Darwin and Townsville. Special sessions were also held for groups including CSIRO's Young Indigenous Women's STEM Academy, for BHP Foundation Science and Engineering Award finalists and for a large public session at Perth Astrofest.

- **NASA Global Learning and Observations to Benefit the Environment (GLOBE) Program**

  GLOBE, the Global Learning and Observations to benefit the Environment Program, is a worldwide NASA sponsored international science and education program that provides students and the public worldwide with the opportunity to participate in data collection and the scientific process, and contribute meaningfully to our understanding of the Earth system and global environment.

  GLOBE is delivered in Australia through a partnership between CSIRO and the Australian Space Agency. Program participants engage in local investigations that cover five core fields: atmosphere, biosphere, hydrosphere, soil (pedosphere), and Earth as a system. Participants, including school students, can make local scientific observations relating to these fields (for example, surface and air temperature, land cover classification and water transparency) and submit these to the GLOBE data and information system. These measurements are combined with readings at automated stations to create a worldwide resource for use by working scientists, other students and teachers and a community of citizen scientists; some measurements serve as ground truth for NASA satellite data products (e.g., clouds, soil moisture). Since 2019, 111 Australian primary and secondary teachers have already registered with CSIRO to deliver GLOBE activities through their classrooms.

B. Undergraduate internships and PhD projects in space-related areas of activity

CSIRO accepts numerous students for undergraduate vacation/internship scholarships and co-supervision of PhDs each year, some of which are focused on space-related projects, including in the areas of lunar resource exploration and utilisation, Earth observation applications, space life sciences, satellite technologies, materials and space communications. Examples from 2020-21 include:

- **Lunar resource exploration and utilisation**

  With NASA's plan to return humans to the Moon and establish a permanent presence on the Moon, which is supported by the Australian Space Agency's Moon to Mars initiative, the CSIRO Space Technology Future Science Platform (Space FSP) is undertaking several projects relating to In Situ Resource Utilisation (ISRU) on the Moon. Several university students have been engaged on projects in this area, including:
  - A student completing a Bachelor of Engineering (Materials) (Honours) and Bachelor of Science (Physics) undertook a project exploring the concept of a miniature X-ray sensor that could be used for measuring metal content over larger areas of the Moon more efficiently than is currently possible.
  - Two Electronics and Computing Engineering and Mechatronics Engineering students worked on a project to develop robotics and sensing software systems to support the demonstration of an autonomous survey rover capability for resource mapping on the Moon.
  - A PhD student in Mechanical Engineering/Material Science and Engineering is looking to develop enhanced methods for producing metal and oxygen in a space environment (for example, on the Moon) through electrolysis of silicates. These methods are also of great value for terrestrial processing applications, producing "green steel" without the need for coking coal, thus massively reducing the carbon footprint of such operations.
  - A PhD student in Geological and Earth Sciences is investigating controlling factors on geomechanical characteristics of icy lunar and Martian regolith simulants, and how the properties change with controlling factors such as water content, temperature, pressure and mineralogy of the regolith, which may influence extraction and processing of the material.

- **OptoCubes**

  The Space FSP's OptoCube project is developing a novel experimental device that can operate independently in microgravity onboard the International Space Station for the purpose of gaining real time information on what happens to human cells in space. This will provide critical information about the safety of astronauts spending increased time in space and can be used to help develop prophylactic treatments for future astronauts. This device is unique because it uses light to both carry out and measure multiple simultaneous experiments and can be remotely operated. Using a microgravity simulator, two Bachelor of Science (Hons) students undertook projects investigating the effects of microgravity on bone cells, and how the response of bone cells might be modified to prevent the loss of bone density seen in any space traveller. These investigations are critical steps in refining the design of the OptoCube and provide model comparisons to compare to eventual experiments in space. The final OptoCube will be an incredibly versatile tool for space research—from monitoring bone cells (or any other human cell type) to fish life cycles to plant growth.