

# SMARTSATNEWS

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# Contents

## CEO Welcome

## SmartSat CRC Conference 2022

- Day One: PhD Development
- Conference Dinner
- Day Two: Main Conference
- Defence Workshop

## Conference Poster Competition

## Research

## Node Updates

## Diversity & Inclusion

## Education & Training

## Kanyini Update

## Project Updates

## Other News

## Careers

## Awards

## Upcoming Events

## Past Events

Front image: attendees at the SmartSat CRC Conference 2022  
at the Sydney Masonic Centre in Sydney, NSW



## Message from the CEO



Dear colleagues,

Our first in-person SmartSat annual conference proved to be an enormous success, attracting over 150 attendees across academia, government and industry.

For almost the entire duration of the life of the SmartSat CRC we have battled against travel restrictions and COVID-19 regulations to stay connected and to find opportunities to collaborate with one another. This event provided a long-awaited and much appreciated opportunity for our stakeholders to connect in person, many for the first time, to share ideas and make new, meaningful connections.

One of the many highlights of the conference was the overarching message that to achieve success, we must bring together the many moving parts within the space sector and work as one "Team Australia". SmartSat, at its core, is about collaboration and catalysing innovation within the Australian space eco-system. This allows our partners to achieve more together than they would be able to individually, while streamlining access to government, Defence and civil end-users to the top science and technology capability that our country has to offer. This vision was echoed throughout the technical sessions presented at the conference, and I was thrilled to witness the young talent amongst our PhD students who will become the next generation of inventors and scientists in space.

I was delighted to announce during the conference that we have appointed our fifth Professorial Chair, Professor Kirk McKenzie from Australian National University, specialising in precision measurement in space. I would like to welcome Kirk to the SmartSat team and I look forward to working with him moving forward.

I was also pleased to formally announce our personal development scholarship of up to \$3,000 to assist current and future PhD students from diverse backgrounds to invest in themselves. This could be through professional development, soft skills training or study assistance to help overcome any hurdles that might prevent them from reaching their full potential.

I am incredibly proud of the outstanding research that is emerging from our community of academics and industry researchers. I look forward to many more future opportunities to bring together our SmartSat community to celebrate achievements and explore opportunities.

**Andy Koronios**  
Chief Executive Officer

**“SmartSat, at its core, is about collaboration and catalysing innovation within the Australian space eco-system.”**





# SmartSat CRC Conference 2022

In September, SmartSat held its first hybrid conference in Sydney NSW. SmartSat researcher, PhD students, industry partners and participants were invited to come together to share their project findings and network with colleagues at the Sydney Masonic Centre or online through our conference portal.

## Day One: PhD Development

The first day of the conference was dedicated to providing professional development and networking opportunities to our PhD students. The day was opened by Higher Degree Research Program Coordinator, Dr Wei Xiang, before moving into a panel hosted by Industry Director, Dr Sarah Cannard, on making the most of a PhD. On the panel were SmartSat Board Director, Professor Margaret Harding, and SmartSat Research Program Manager, Dr Andrew Barton, joined by Head of Australasia at Airbus Defence and Space, Sasha Hapke. The panel shared insights from their extensive careers either as PhD's who have found success in the space sector, or from working alongside researchers to create real-world impact.

This session was followed by a Diversity and Inclusion seminar, hosted by Roshni Sharma. Roshni is a Project Manager and Analyst with FrontierSI, as well as the CEO of her own coaching organisation, Vistaar Soft Skills Solutions. These sessions looked at the challenges and opportunities that exists for women pursuing careers in STEM and explored how individuals can champion diversity and inclusion in their research, their workplace and in their every day lives. The PhD students learned how to identify inequality in a range of settings and were empowered with the tools to address and combat it.



Kicker Communications Director, Ash Pritchard (right), in conversation with journalist Liam Mannix.

Ashford Pritchard, Director of public relations consultancy Kicker Communications facilitated an illuminating session educating the PhD students on how to communicate their research. The students heard from Liam Mannix, National Science Reporter for the Sydney Morning Herald and The Age on how to avoid the jargon and convey the key points of their research for maximum effectiveness, giving them the tools to share their work with the world.

Following a lunch break during which students were given the opportunity to network, Professor Xiang led the



Nermine Hendy presenting on her research into improving space-borne SAR performance.

students into the PhD presentations:

- **Compact Clock for Small Satellite Applications** by Emily Ahern
- **Attack-resilient CubeSat constellations** by Joshua Davis
- **Building damage estimation after natural disaster using multi satellite source data based on machine learning** by Chang Liu
- **Fabrication of 3-D wavelength-tuneable photonic crystals for space-based mm-wave, terahertz and infrared communications** by Vibor Thapliyal
- **Coherent Free-Space Optical Communications (Phase 2)** by Skevos Karpathakis
- **Data Fusion for improving the positional accuracy of wildfire detection using geostationary satellites** by Nur Fajar Trihantoro
- **Using Quantum Entanglement to Remotely Synchronise Clocks** by Sabrina Slimani
- **Using Satellite Data to Locate and Phenotype Plants from Space** by Brandon Victor
- **Interference modeling, detection, and mitigation for improving space-borne SAR performance** by Nermine Hendy
- **Advances in Long-term Water Quality Monitoring through Data Fusion** by Trung Dung (Alex) Nguyen
- **Deep Learning for Advanced Physical Layer Communications** by Kou Tian
- **Integration of ground- and satellite- based data to map the Urban Heat Island effect** by Robert Andriambololonaharisoamalala

The day provided an invaluable opportunity for our PhD students to share their research findings with the broader SmartSat community. These projects have the potential to result in world-changing technologies in Earth Observation, advanced communications and advanced satellite systems and sensors.



**1** Attendees at the SmartSat CRC Conference Dinner 2022 **2** Gamilaroi man Uncle Michael West performs the Welcome to Country **3** Professor Lisa Harvey-Smith discussing the secrets of the James Webb Telescope **4** SmartSat Chair Dr Peter Woodgate giving the opening address **5** Company Secretary Kris Trott and Chief Finance Officer Rosie Erasmus at the dinner

## Conference Dinner

The conference dinner was hosted at Doltone House, Jones Bay Wharf on the evening of day one. Guests were treated to stunning sunset views of the Sydney Harbour Bridge while enjoying drinks on the balcony of the heritage venue.

The event was opened by Uncle Michael West from the Metropolitan Local Aboriginal Land Council, who performed the Welcome to Country for the guests meeting on the lands of the Gamilaroi Nation.

SmartSat Chair, Dr Peter Woodgate, provided the opening address where he noted that together, the community is building something greater than the sum of its individual parts for the benefit of Australia's future. Dr Woodgate reiterated SmartSat's commitment to its role in building a collaborative national space ecosystem, supporting the visionary thinking that will be essential of meeting our country's needs and ensuring our sovereign capability.

The highlight of the evening was the keynote address provided by award winning astrophysicist, author and Australian Government Women in STEM Ambassador, Professor Lisa Harvey-Smith on the secrets of the James Webb Telescope.

Her presentation looked at how the telescope is a macramé of exceptional design, launched as a cylinder shape before slowly unfolding to its full 6.5 meter length. At 100 times more sensitive than the Hubble Telescope, it has unprecedented accuracy capable of measuring the chemical make up of space.

Professor Harvey-Smith explained that despite appearing to come straight out of a Hollywood movie, the images captured by the telescope are not only real but provide valuable information about the unknown corners of our universe. The James Webb Telescope is peering back to over 13 billion years ago to reveal the first galaxies and asteroids in space and is currently searching for bio-signatures so as to hone in on possible alien life.

Following the Professor's presentation, guests were afforded the opportunity to network over a three course meal. The evening was a triumph of connection following two years of disconnection due to the global pandemic, bringing together the brightest minds in the SmartSat community to share ideas and build relationships with an aim to furthering research and development into satellite and space technology.





*Attendees listening to SmartSat Chair Dr Peter Woodgate opening the conference in the Sydney Masonic Centre*

## Day Two: Main Conference

Day two of the SmartSat Conference brought together our ecosystem of project leaders, researchers, industry partners, government personnel and staff, along with our PhD students, for a full day of technical sessions.

The event was opened by the new Deputy Head of the Australian Space Agency, Dara Williams, who commended SmartSat's commitment to supporting the objectives of the agency to grow the space industry in Australia.

The Keynote Address was given by Shane Canney, Chief of Air and Space at DSTG. Canney provided an update on the Space Jeopardy and Response (S-JAR) Project, the Defence Science and Technology Strategy and Defence's commitment to collaboration for addressing strategic priorities while being guided by principal of 'more, together'.

The conference divided the project presentations into four technical sessions:

- **Advanced Systems and Sensors**
- **Earth Observation Analysis**
- **Onboard Processing and Earth Observation Instruments**
- **Communications and Platforms**

The **Advanced Systems and Sensors** session was facilitated by Dr Andrew Barton. Dr Hai-Tan Tran from DSTG presented on the Space Jeopardy and response (S-JAR) project, which investigates how to better identify the cause of satellite communication failures and the development of

cognitive satellites to combat the hazardous environment of space. The project is strongly aligned with DSTG's STaR Shot program and has participants from the Australian National University, RMIT University, the University of Adelaide and the University of Sydney.

QuantX's Dr Sebastian Ng gave an overview of the engineering model for the Compact Clock for Small Satellite Applications. This project, centered around the two-photon rubidium clock, come after QuantX's flagship product, the Cryoclock. The Compact Clock is a technology-simple product that has high-frequency stability and is based on telecommunication laser sources, all within an all-fibre design.

In a similar vein of research was Sabrina Slimani's project in using quantum entanglement to remotely synchronise clocks, a technology that has critical applications a cross a multitude of sectors. Current methods of clock synchronisation are unsafe and insecure, while the alternatives suggested in Slimani's research is more reliable and less able to be intercepted by foreign signals.

Dr Yasir Latif rounded out the session with a presentation on Ultra-fine Attitude Control via Event-based Star tracking and Piezoelectric Stabilisation. Many CubeSat-based applications require precise stabilisation in order to accurately capture small targets or fine-grain changes on the Earth's surface, however their size leaves them susceptible to jitter, which can be combatted by ultra-fine attitude determination technology.

The **Earth Observation Analysis** session, facilitated by Craig Williams, ran concurrently to attendees with an interest in remote sensing and EO data.

The first presentation came from Leonardo's George Coulloupas who gave an update on his project into Maritime Domain Awareness with synthetic aperture radar (SAR). This multi-phase project looks into the use of SAR data generated by the COSMO-SkyMed constellation in combination with satellite-based Automatic Identification Systems (AIS) to produce ship tracking data capable of predicting future vessel movements by up to 20 hours.

Continuing the theme of nautical applications was an overview of the OysterQual project, presented by Dr Kathryn Barker from Curtin University. With an industry valued at over \$90 million, having access to accurate information



*(L to R) Board Director Mikaela Jade, Chair Dr Peter Woodgate, Chief Finance Officer Rosie Erasmus and Industry Director Sarah Cannard enjoying afternoon tea*



*Scott Owens from Arlula presenting on his research into automated instant high resolution imagery procurement*

on Australia's vast coastline is critical for informing the location of oyster farms for peak production. Barker's project brings together various remote sensor data on coastal regions conducive to shellfish production, thus growing the aquaculture sector across Western Australia.

Following was an insight into automated instant high resolution imagery procurement and integration research conducted by space industry company Arlula, presented by Scott Owens. Arlula currently provides a single point of access to a global network of satellite imagery to industry. This research seeks to develop improved methods for accessing data rich, high-resolution EO data using a command line driven tool as opposed to a graphical user interface, supported by the CSIRO data cube.

The session was rounded out by Professor Linlin Ge from the University of New South Wales demonstrating how SAR technology can be used to map floodwater where traditional methods fail. While best results are gathered using a combination of mapping methods, SAR technology is capable of penetrating heavy cloud cover and significant weather events to provide real-time flood data for better managing natural disasters.

After lunch, the attendees again split up to take in one of two sessions. I-in-the-Sky Capability Demonstrator Leader, Dr Rebecca Allen, facilitated the session on **Onboard Processing and Earth Observation Instruments**.

Graduate Nova Systems engineer Nadia Sarunic kicked off the afternoon's presentations with an overview of the hyperspectral imaging camera, HyperScout 2 Flight Model instrument, and its integration into the South Australian state satellite Kanyini. The compact, earth observation payload has a spectral range enabling an extremely detailed analysis of land cover. This will support the mission's commitment to providing real-time data that can inform research into crop health, forestry, inland water levels and coastal monitoring.

Also looking at the capability of the HyperScout 2 was Dr Eriita Jones and Dr Sha Lu from the University of South Australia presenting on energy-efficient on-board AI processing of hyperspectral imagery for Early Fire-Smoke Detection. The project aims to develop an early detection model for identifying smoke that can operate in a range of conditions, empowering essential services to better manage bushfires and prevent them wreaking havoc.

Following this was a presentation on using calibration and panoptic segmentation as a solution to providing onboard hyperspectral artificial intelligence (AI) presented by the Queensland University of Technology's Dr Harshala Gammulle and Dr Tharindu Fernando. With their research still in its early stages, the pair gave an overview of how they propose to achieve their goal by using light-weight, deep learning based atmospheric correction networks, as well as joint-learning between satellite and ground based sensors.

Finally, Dr Nicholas Younes from the Australian National University on the OzFuel project on Australian fuel monitoring from space. Similarly to the previous presentations, this project focuses on combatting the threat of bushfires using satellite technology. Dr Younes explained how the resolution of current spectral and radiometric data is insufficient for monitoring Australia's unique fuel conditions, and how his research would result in earth observation technology capable of determining the biochemical properties of fuel loads from space.



*Graduate Engineer Nadia Sarunic presents on Kanyini's Earth Observation capabilities.*

In the parallel session, Indo-Pacific Capability Demonstrator Leader Peter Kerr led the technical session on **Communications and Platforms**.

The session kicked off with a presentation from Dr Luis Lorenzin from DSTG and Ian Partis from Fleet on on-board processing for advanced tactical communications. His research looks at developing and implementing advanced waveforms that operate on a higher frequency band, allowing increased capacity and resulting in more resilient satellite communications in a Defence context, such as to tactical war fighters.

This was followed by an overview of DSTG's Dr Gerald Bolding's work into hybrid optical and e-band correlated channel model, presented by Siu-Wai Ho. The work looks at combatting the challenges presented to long outdoor communication links by poor weather conditions by studying its impact on e-band radio frequency and free space optical channels. The project characterises the properties of both systems using empirical data sourced from a communication system operated in six cities to ensure diversity of weather.

Professor Gretchen Benedix stepped in to present on Curtin University Binar space program and the value of learning from mistakes and failures. The program was built on



developing an autonomous software system to analyse space imagery to identify fireballs in the night sky and has evolved into building next generation small satellites, consolidating all the critical spacecraft subsystems onto a single board, to help advance understanding of the solar system and improve access to the space.

The session was rounded up with a presentation by Dr Mitra Savafi-Naeini from Australia's Nuclear Science and Technology Organisation (ANSTO) on robust, resilient attitude measurement and control systems for high-altitude pseudo satellites (HAPS). The project is developing a distributed payload attitude sensing and control system for HAPS constellations, known as Panoptes. These Panoptes-equipped HAPS will compliment satellite constellations with their accurate and resilient payload targeting capability.

The conference was closed out by Chief Research Officer, Dr Carl Seubert and Industry Director, Dr Sarah Cannard,



*Dr Carl Seubert provides his closing remarks at the end of the conference*

who summarised the events of the past two days and highlighted the dedication and commitment in the room.

Dr Cannard raised SmartSat's commitment to championing diversity and inclusion through the personal development scholarship, available to assist PhDs from diverse backgrounds to overcome any systematic challenges they may face.

Dr Seubert expressed how impressed he was with the quality of the research presented throughout the conference and announced that SmartSat has been working with NASA Jet Propulsion Laboratory (JPL) to establish an internship program for Australian students to gain valuable collaborative networks and industry experience.



*Dr Khoa Nguyen presenting at the Defence Workshop*

## Defence Workshop

Adjacent to the first day of the SmartSat Conference, over 40 representatives from Defence, industry, academia and government came together for a Defence Workshop, hosted by Indo-Pacific Capability Director, Peter Kerr, and Defence Science & Technology Group (DTSG) Liaison Officer Dr Jolanta Cuik.

The workshop highlighted four SmartSat projects approaching completion that are addressing key needs of Defence - Resilient Emergency Search and Rescue Communications; Compact Hybrid Optical/RF User Segment (CHORUS); On-Board Processing for Advanced Tactical Communications; and MIMO and Cooperative Communications for New Space. Additionally, attendees were given a preview of three exciting new projects in development that have potential to support future tactical communications capabilities.

The workshop concluded with an activity designed to develop scope and objectives for new defence capabilities using satellite technology. This event provided a valuable opportunity for SmartSat to fortify its strong relationship with Defence and cement our commitment to developing new technologies with applications in national security.

**[Click here to watch all the sessions from Day Two of the SmartSat CRC Conference 2022 on our YouTube Channel.](#)**



# Poster Competition

Prior to the conference, all SmartSat PhD students and/or Project leaders were asked to submit a poster outlining the objectives of their research and their findings so far. These posters were displayed throughout the conference for attendees to view. Each poster was judged by a selective panel of staff to identify the best posters submitted by a PhD student and project team.



**1** Professor Andy Koronios presents Assoc. Professor Karin Rienke and Alvaro Valenzuela Quinteros with their award for best Project Team poster **2** Professor Andy Koronios presents PhD student Chang Lui with their award for best poster

## Winner Best Project Team Poster

### Project P3-04: Real Time Fire Analytics

*Presented by Professor Simon Jones, Associate Professor Karin Reinke, Dr Mariela Soto-Berelov, Dr Chermelle Engel, Dr Sam Hislop, Alvaro Valenzuela Quinteros, Kostas Chatzopoulos Vouzoglakis, Nur Fajar Trihantoro and Simon Ramsey.*

With natural disasters increasing in intensity, frequency, and distribution across the country, it is essential that Australia equips itself with verified, high-quality, real-time bushfire information.

Continental monitoring and surveillance of bushfires through Earth Observation is invaluable to protecting built and natural assets by providing timely information to land managers and emergency services before, during and after wildfire events, particularly in instances of extreme weather and smoke. This project incorporates two elements:

- 1) Design and implementation of a data platform ecosystem to enable fire surveillance in real-time from geostationary, polar-orbiting and aerial platformed sensors.
- 2) Development of autonomous surveillance AI algorithms.

The researchers propose using a satellite system encompassing geostationary, polar orbiting and aerial based sensors for real-time fire landscape attribution. Currently, fire detection in Australia relies on Suomi Visible Infrared Imaging Radiometer Suite (VIIRS), Terra and Aqua Moderate Resolution Imaging Spectroradiometer (MODIS). As the Terra MODIS approaches the end of its lifecycle and

the and VIIRS placed in safe mode with no data acquired from it since July 2022, there is significant demand for new algorithms to optimise operational sensors.

The desired outcome is to provide automated disaster intelligence that is timely, reliable, repeatable and fit-for-purpose, with detection hardware that is resilient to complex weather conditions (including cloud and smoke cover) and attribution algorithms capable of improving theoretical models for image signal processing and fire characterisation.

## Winner PhD Project Poster

### Project P2-30s: Building damage estimation after natural disaster using multi-satellite source data based on machine learning

*Presented by Chang Lui.*

Assessing the damage caused to buildings and civil infrastructure after natural disasters is a critical for disaster management. Lui's project will result in being able to provide detailed levels of building damage through the development and evaluation of deep learning models to estimate building damage by classifying damage into four levels using 2D and 3D data from pre- and post-event collections.

This task is challenging due to the limited public availability of imagery data containing damaged buildings, and most existing research only seeks to determine whether a building has collapsed or not. Moreover, most deep learning models are designed for segmentation of intact buildings, which might not be suitable for damaged building segmentation.

The multi satellite source data collected based on machine learning includes 2D and 3D labeled building outlines pulled from satellite imagery, segmented into four post-event building damage levels: no damage, minor damage, major damage and collapsed. This proposed 2D building damage classification model performs better than damage classification, in particular in building localisation.

The findings from this project could support government agencies, emergency services and rescue teams in their disaster response and decision making by providing near real-time information for disaster management.

# Research



**Dr Carl Seubert**  
Chief Research Officer

SmartSat is actively developing focused and collaborative projects to align research and technology toward enabling the capability demonstrators. A key part of this approach is the early engagement of our industry partners and having them drive the shape of work. Large and strategically important projects that were recently approved include SCARLET-α, Cognitive Satellite Communications, and mm-wave intersatellite-links.

SCARLET (SpaceCraft Autonomy Research Laboratory) is a SmartSat created initiative which aims to develop practical, applied and innovative capabilities in autonomy to enable Australia's pursuits in space missions. Currently, this is a virtual laboratory with an objective of bringing together researchers and industry to focus and coalesce efforts for tangible outcomes. SCARLET-α is the first project and is led by newly appointed SmartSat Professorial Chair in AI, Ryszard Kowalczyk from UniSA and involves four SmartSat industry partners.



*The preliminary branding for project SCARLET (SpaceCraft Autonomy Research Laboratory)*

SmartSat recently celebrated its annual conference that was held in person in Sydney, which was a great success in sharing technical knowledge of current research projects and showcasing our partner's and their contributions to the Australian ecosystem. I also welcome our latest SmartSat Professorial Chair in precision measurement in space, Dr Kirk McKenzie from the Australian National University.

Progress continues with the Indo-Pacific Connector (IPC) Capability Demonstrator architecture and our strategic research contributions to DSTG's RMS STaR Shot. SmartSat and some of its partners presented at this year's ADSTAR conference during a dedicated session with a theme spacecraft resilience, including a SmartSat presentation



*Dr Carl Seubert presenting at the UK Australia Space Bridge presentation at Cicada Innovations, Sydney*

around the use of autonomy as a mechanism to enhance resilience. We recently held a workshop with DST, Space Command, industry, and academic partners focusing on integrated tactical communications project as an agile access layer for "IPC Cloud." This involved highlighting the utility of small satellite constellations for Defence as well as a more formal review of a handful of relevant projects and on integrating and transitioning partner technologies into Defence programs.

Work continues with technologies toward our other capability demonstrators. For I-in-the-sky there is ongoing engagement with the emergency management ecosystem and sharpening the needs and applications for space technologies. NASA representatives that are collaborating on the LunaSAR project will be visiting Australia to engage with the Safety from Space team and advance the work. CSIRO continues with program development of AquaWatch, collaborator engagement and projects. SmartSat recently awarded a research project to LTU to demonstrate at the pilot sites an innovative machine learning approach to estimate water quality parameters in complex coastal waters.

We recently held the wrap-up of our five Space Bridge projects. These were great collaborative teams across the countries that achieved some meaningful industry-driven research. This was intended as seeding projects (supported financially by SmartSat, UK Government and SA Catapult) and we continue to seek additional funding opportunities to continue this great initiative.

I recently had the privilege of presenting to the New South Wales Chief Scientist at the Science & Research Breakfast Seminar Series. Being science week, I focused on how space technology is vital to continue pushing our pursuits of science, exploration and discovery. It was a great opportunity to talk about our great portfolio of research and technology developments and our future prospects.

# Node Updates



## NSW Node

### Dr Tim Parsons

Chair, Aurora Space Cluster  
NSW Node Coordinator

Anyone following Australian space-related LinkedIn accounts can't have missed the recent spike of stories from this September's International Astronomical Congress 2022 in Paris. Alongside a team of SmartSat staff and PhD students, we were pleased to have a significant delegation from Aurora in attendance, including HEO Robotics, Leo Labs Australia, Mawson Rovers, Raytracer, Quasar Sat Technologies, Space Machines Company and Valiant Space.

All reported packed schedules of meetings with potential international partners and customers, alongside R&D presentations. With a record post-Covid attendance reported for this Paris edition of the congress, with strong exhibits from Asian, European, UK, Canada and Middle-East participants.

The highlight of the conference was undoubtedly the successful bid to host IAC 2025 in Sydney – led by the Space Industry Association of Australia, NSW Government, Business Events Sydney and the Australian Space Agency – pipping other contenders at the post after a nail-biting selection process in the General Assembly.

The three key learnings from the week were:

- The global space community is actually not that massive, and Australian companies are well-regarded
- Turning up in person at international conferences is critical to building the professional and personal relationships that underpin commercial partnerships



Adjunct Profesor Nicola Sasanelli (left) Dr Peter Woodgate (third from right) Elizabeth Weeks (second from right) and Peter Nikoloff (right) meeting with Deputy Director for Technology and Research Investments at NASA Goddard Chrystal Johnson (center) and representatives from NASA at the IAC 2022 in Paris, France

- Quite a lot of RFPs globally are being responded to by consortia of national and international partners, and we expect upstream Australian companies - including Aurora members - to begin to appear in more of these as they knock off planned flight heritage milestones over the next 18 months.

In July, the NSW Node also received six applications for the demonstrator grants, with three of them successful in their first pass.

#### For more information contact:

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[smartsatcrc.com/key-initiatives/new-south-wales-node](https://smartsatcrc.com/key-initiatives/new-south-wales-node)



## Vic Node

### Milica Symul

Vic Node Coordinator

Recently the Vic Node issued an open call for Expressions of Interest (EOIs) for projects that foster the creation and commercialisation of space-related research and innovation in Victoria. Applications for Round 1 of these Demonstrator Grants, which aim to empower researchers and companies within the Victorian space ecosystem and create state-based opportunities for industry-led R&D, closed on 26 September 2022. We received a good number of applications, three of which are now under contract in a positive move for the Node.

The Node is also preparing to host a panel discussion on Future Trends in Spatially Enabled Digital Twins on Tuesday, 18 October 2022. Digital twins are essential for organising and visualising masses of data in a digital environment for the purposes of testing and modelling. This event will feature an expert panel moderated by Associate Dean of Geospatial Science at RMIT University, Professor Monica Wachowicz. We hope this event will not only open a discussion on the importance of digital twins, but provide an opportunity for our community to network and make valuable connections.

#### For more information contact:

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## QLD Node

### Professor Stuart Phinn

Program Leader EO Analytics

In June 2022, the Queensland Earth Observation Hub kicked off with an Industry and Research design thinking workshop in Brisbane. The workshop brought together potential Industry partners who have current earth observation opportunities underway in Queensland, along with researchers from many local universities, including Griffith University, The University of Queensland, University of the Sunshine Coast and Queensland University of Technology. A core goal of the workshop was the initiation and socialisation of a number of program opportunities related to earth observation. These include a partnerships program, a calibration and validation program and a mobility scheme.

In August 2022, Brisbane was also lucky enough to host the biannual Advancing Earth Observation forum. The QLD Earth Observation Hub was able to engage and learn from current earth observation opportunities at this dedicated event which brought together over 300 research, government and industry representatives from around the country.

The Queensland Earth Observation Hub is a joint initiative supported by SmartSat, whose activities are funded by the Australian Government's CRC Program, and the Queensland Government, via the Department of State Development, Infrastructure, Local Government and Planning. The hubs core goal is to grow Queensland's Earth observation industry by enabling product and service development or expansion through knowledge transfer between Australian research organisations and Earth observation businesses.

As we near the end of September 2022, the Queensland Earth Observation Hub has had the privilege of accepting a number of applications, that are currently helping to build capability for Queensland businesses by matching research and development opportunities. This is a first and strong step forward to helping support knowledge transfer and increasing the capacity of Queensland businesses to undertake, and utilise the outcomes of earth observation, research and development opportunities.

#### For more information contact:

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## Diversity & Inclusion



### Dr Sarah Cannard

Industry Director

#### SmartSat CRC Diversity and Inclusion Initiative Female PhD Personal Development Grant

SmartSat is delighted to announce a new Diversity, Equity and Inclusion initiative to support our female PhD students with personal development.

The Personal Development Grant is an additional \$3,000 (incl. GST) for SmartSat female PhD students over and above their base PhD Scholarship and Operational Funds (if applicable) already allocated to their PhD.

The aim of the grant is to attract more female students into higher degree research programs to improve the gender diversity of Australian STEM PhD's by supporting female students to participate in personal development activities.

This may include activities such as mentoring programs, leadership training, attendance at women in STEM events, presentation and communications skills, personal branding, public speaking, diversity and inclusion training, etc.

Each PhD candidate receiving the funds is encouraged to consider what activity is best for their personal career journey.

# Education & Training



**Dr Ady James**

Education and Training  
Director, Industry Training

The second Phase of the Skills Gap Analysis, completed by La Trobe University, undertook additional qualitative work to triangulate the results of the first study to provide industry validation, test the skills gap findings with the lived experience of the space industry and training providers, and capture more qualitative information about skills needs pressure points. This project has also developed a Space Skills Database that has commenced the mapping of skills to courses, occupations, and education providers. It will support greater insights into the skills gaps in different industry domains, and the identification of capability and capacity of training providers and available courses.

It is recognised that many roles within the industry require multi-year qualifications and thus have long lead times. This means employers need to be proactively planning ahead for future workforce needs. In a nascent industry, many of the offerings do not currently exist and there are barriers facing course development in terms of time, human capacity, and financial resources.

SmartSat is working with its partner network to look at innovative and collaborative programs as a means to reduce the barriers for training providers to develop courses and bring greater clarity on training and education market demands.

SmartSat, in collaboration with its national and international networks has also commenced its efforts to fill some of the knowledge and skills gaps identified through the skills gap studies. SmartSat has commenced the development and roll-out of various Master Classes and Short Courses that directly align to gaps identified, including in the areas of Space Law, Radiation Protection for Space, Designing Space Missions and Systems, and Applied Space Systems Engineering.

In order to fill skill gaps in the space industry identified by the Skills Gap Analysis, SmartSat is offering a range of Master Classes space law, applied engineering and mission design to be across Adelaide and Sydney.



## **Space law applicable to mission planning (Adelaide)**

Hosted by Emeritus Professor Steven Freeland and Donna Lawler from Azimuth Advisory, this course will cover specific issues relating to the legal and regulatory

framework relating to designing and building the space and ground segments to support mission planning.



## **Radiation Protection for Space (Adelaide)**

Radiation is a major hazard in spaceflight, causing progressive performance degradation and/or can lead mission-ending failures. Critical or sensitive electronics must have been already

radiation hard assessed or need to be radiation tested before the mission to guarantee the required tolerance against radiation damage for the mission life.



## **Applied Space Systems Engineering Course (Adelaide)**

This workshop examines the practical application of space systems engineering processes throughout the mission life cycle. Hosted by Dr Bruce Chesley from Teaching Science and

Technology Inc in the US, the course is aimed at developing the relevant knowledge and skills needed to apply systems engineering tools and techniques within a project environment to produce effective space systems.



## **Designing Space Missions and Systems (Sydney)**

Hosted by Dr Bruce Chesley from Teaching Science and Technology Inc in the US, Designing Space Missions and Systems examines the real-world application of

the entire space systems engineering discipline. Using a process-oriented approach, the course starts with basic mission objectives and examines the principles and practical methods for mission design and operations in depth.

To find out more about the Master Classes or to register, visit [smartsatcrc.com/education/training-master-classes](https://smartsatcrc.com/education/training-master-classes)

## **South Australian Premier's Reading Challenge**

Finally, SmartSat sponsored a space-themed challenge in the South Australian Premier's Reading Challenge. The Premier's Reading Challenge is a literacy engagement program that was introduced by the Premier in 2004 to encourage students to read more books and enjoy reading and improve literacy levels. The space themed category received 463 entries from Reception to Year 9, with winners receiving a merchandise pack, book voucher and a space related book as a prize.

- **Reception – Year Two**  
Griffin Greyson  
Open Access College
- **Year Three – Year Five**  
Lailani Coffey  
St Brigid's Catholic school
- **Year Six – Year Nine**  
Madison Masters  
Klemzig Primary School

# Kanyini Update



(L to R) Education and Training Director Dr Ady James, Graduate Engineer Nadia Sarunic and Satellite Systems Engineer Nick Manser gather at Inovor Technologies for the Test Readiness Review and EOP FlatSat integration

## HyperScout 2 Flight Model ready for integration into Kanyini

Kanyini has reached its integration phase, with SmartSat and cosine announcing that the hyperspectral imaging camera, HyperScout 2 Flight Model instrument, will be onboard the South Australia state satellite.

HyperScout 2 will be launched into space on board the 6U CubeSat as part of the SA Space Services Mission and will provide critical data to government and non-government agencies.

The HyperScout 2 is a three-in-one instrument that combines hyperspectral and thermal imaging with high level data processing and Artificial Intelligence (AI) capabilities. It provides hyperspectral imaging in the visible and near infrared to analyze the composition of the Earth, along with three thermal infrared bands to retrieve the temperature distribution, boosting and improving the number of Earth Observation applications cosine's customers can benefit from.

SmartSat is leading the mission and application prototyping, with Adelaide-based satellite manufacturing company Inovor Technologies designing and building the satellite and South Australian space company Myriota contracted for the IoT space services. Data collected from the project is intended to support informed decision making in the areas of water usage, climate policy and disaster management.

Kanyini Mission Director Peter Nikoloff confirmed that the project needed a compact imaging payload that could provide a nuanced Earth view. The spectral range of HyperScout 2 enables an extremely detailed analysis of land cover, supporting research into crop health, forests, inland water and coasts, while the thermal infrared imager will provide vital information on heat generators in South Australia.

In parallel with the development phase, SmartSat is formulating a research program with our partners to make optimal use of the systems once in orbit.

cosine made several design changes to HyperScout 2 at the beginning of the project, in order to adapt the instrument to the reduced dimensions and volume available on the Kanyini satellite. The efforts of the team of experts at cosine made it possible to perform all the necessary design changes, as well as to assemble the instrument, characterize its performance and test its resistance to environmental conditions in just 8 months.

cosine delivered the Engineering Model to SmartSat within 3 months of project kick-off. Now the Proto-Flight Model is ready for the final integration at spacecraft level. SmartSat has investigated the feasibility of utilizing Kanyini's hyperspectral data for crop classification as part of the UK/Australia Space Bridge collaboration for the research project Advancing remote sensing benefits to agriculture through hyperspectral processing. Other research groups are considering applications of the AI module of the HyperScout 2 onboard Kanyini for bushfire smoke detection, monitoring water quality and advanced analytics for Defence and security.

Follow Kanyini's journey at [saspacemission.com.au](https://saspacemission.com.au)



cosine Research Scientist Nathan Vercruyssen (left) and Managing Directors Marco Beijersbergen (second from left) and Marco Esposito (second from right) with SmartSat Chair Dr Peter Woodgate, Kanyini Mission Director Peter Nikoloff (center) and Communications and Outreach Director Nicola Sasanelli (right) at IAC 2022 in Paris with the HyperScout 2.



# Project Updates

## Queensland Government and SmartSat invest AU\$1.5M each to deliver the Queensland Earth Observation Hub

The Queensland Earth Observation Hub was officially launched this month with the announcement of two new earth observation research projects.

The establishment of the EO Hub aims to accelerate the growth of local and national Earth observation industry by supporting commercialisation of research, and EO product and service development. The Queensland Government and SmartSat are investing AU\$1.5million each to deliver the EO Hub.

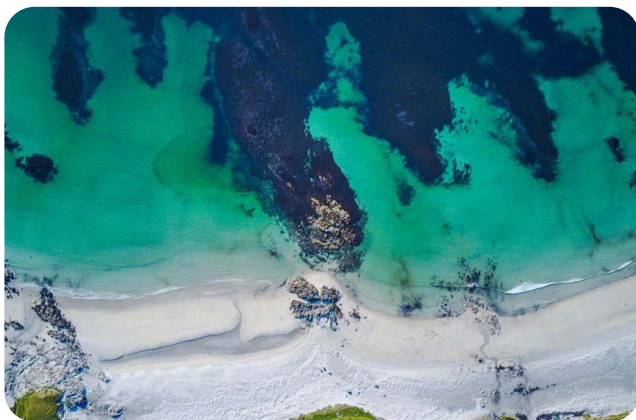
Queensland Deputy Premier and Minister for State Development Steven Miles said cooperation with SmartSat was bringing new industries and jobs to Queensland.

"We have lift off with the Earth Observation Hub launching in Queensland, creating more jobs and ensuring Queenslanders are at the forefront of the space industry," Mr Miles said.

"The two new projects are both about keeping Queenslanders safe, with one of them combining satellites, local networks and edge computing to demonstrate how we could monitor remote geohazards such as flood water levels or landslides in real time, the other will use satellite and drone imagery and analytics to monitor Queensland's extensive coasts for hazards and conditions.

"With a space industry based here in Queensland we can safely say, this is one small step for Queensland and one giant leap for Queensland jobs."

The two successful Queensland based projects represent a near AU\$900,000 investment from the Queensland EO Hub and industry. The grant program is fostering the creation and commercialisation of space-related research and innovation in Queensland. The aim is to empower the space-related industry ecosystem of Queensland, creating State-based opportunities for industry-led R&D with SmartSat's current partner base and beyond.



Earth Observation imagery of an Australian coast



The Kurloo, a Global Navigation Satellite System (GNSS)

### PROJECT 1

#### Localised GNSS IoT networks and satellite broadband communications for remote geohazard and structure monitoring

Global navigation satellite system observations are critical for monitoring geohazards and safety of natural and artificial structures and assets, such as tailing dams, landslides, bridges, and flood water levels.

This project will demonstrate the technological feasibility of combining local area Internet of Things networks, edge computing and satellite broadband communications for earth observation.

Conducted by Queensland University of Technology in collaboration and Queensland-based Monitum Pty Ltd, the project's expected outcomes include the design of a new satellite-IoT system, and prototypes of an GNSS IoT platform end-devices, and a baseline processing engine.

### PROJECT 2

#### COASTS: Coastal Change Observation and Analytics (multi-) Scale (multi-) Technology System

Understanding complex coastal processes and interactions between land, sea and human communities is a primary concern for both government and industry. Frequent, high-quality spatial information across Queensland's coastal zone is required to monitor, manage, and predict coastal change and its associated hazards, but is seldom available.

The Coastal Change Observation and Analytics (multi-) Scale (multi-) Technology System, COASTS, will directly address the issues of lack of coastal monitoring data using of satellite imagery, drones, numerical modeling, artificial intelligence-based analytics, and cloud-based technology.

This collaboration between the University of the Sunshine Coast, Queensland University and EOMAP Pty Ltd will cost-effectively derive and deliver information and tools that fill the gaps in our understanding of coastal processes, coastal hazards, and beach safety.

## Other News



Professor Andy Koronios (right) with EOS Space Systems CEO Glen Tindall.

### EOS Space Systems joins SmartSat as core partner

SmartSat has welcomed EOS Space Systems aboard as a core partner, joining universities and global corporations such as Airbus, BAE Systems and Nova Systems.

As a core partner, EOS Space Systems will have priority to select and lead strategic research projects, and can nominate candidates for the SmartSat Board and Industry Advisory Board.

SmartSat CEO Professor Andy Koronios said EOS Space Systems becoming a core partner was the culmination of one of the organisations most exciting space ventures, Project CHORUS.

"SmartSat CRC brought together a cross-disciplinary team of industry and universities under the leadership of the Defence Science and Technology Group (DSTG) and facilitated the requirements-gathering from end-users, developed system designs and the research components."

"What began as a \$1.2 million dollar Phase 1 project has already moved to the next phase, with a further \$2.8 million investment in the rapid development of this innovative technology."

Project CHORUS aims to build on existing world leading Australian technology in compact RF tactical terminals and optical communication to develop "leap-frogging" technology that exploits bearer diversity through a highly integrated hybrid Optical-RF tactical terminal with applications for the commercial and national security markets.

Phase 1 of CHORUS (Apr 2019-Apr 2020) was a research activity to develop concepts for, and explore the feasibility of, a highly integrated, tactical satellite communications terminal combining radio frequency and optical frequency capabilities into a single compact terminal. Phase 2 is on track to deliver a working terrestrial demonstration with a terminal in early 2023.

CEO of EOS Space System, Glen Tindall said the commercial potential of Project CHORUS was significant

with the technology dovetailing neatly with our existing globally-recognised capabilities of EM Solutions.

"Project CHORUS has been an exercise in the best-practice commercialisation of a new technology driven by collaboration between government, industry, and academics. The success of this venture to date demonstrates the value of having an independent platform like SmartSat CRC to bring the various parties together and accelerate the emergence of Australia's space sector."

DSTG's Chief Technology Officer, Strategic Research and Innovation, Professor Michelle Gee said that Defence's investment in the SmartSat through the Next Generation Technologies Fund was clearly paying dividends.

"We are seeing the development of potentially breakthrough technologies that could be a game changer for military satellite communications. Those are exactly the sorts of results we want and expect to see from the Next Generation Technologies Fund."



(L to R) Chair of the Aurora Space Cluster Dr Tim Parsons and Antares Inc co-founder Shankar Sivaprakasam with Quasar Satellite Technologies CEO Phil Ridley, Head of Product Rashmi Karanth, Head of Engineering Michael Boers and Cicada Innovations' Head of Space Technology Julie Autuly.

### Innovative space start-ups team up to create a software-defined space to ground capability

Space start-ups Antares Inc and Quasar Satellite Technologies have announced a partnership to bring a breakthrough innovation in satellite constellation management to market.

Under the agreement, Quasar's digital multi-beam Phased Array technology, which enables customers to manage spacecraft constellations through a single ground station connection, will be integrated into Antares Inc's software-defined Open Satellite Platform.

Antares Inc Co-founder, Shankar Sivaprakasam said they were hugely excited to be partnering with Quasar to help mission owners and satellite operators significantly reduce the cost of managing constellations.

“Quasar’s digital multi-beam Phased Array ground station is a game-changer. Rather than having to establish links to satellite constellations using multiple ground stations and providers, Quasar’s connectivity from a single station vastly simplifies and creates a cost-effective earth-spacecraft communication. Being able to offer Quasar connectivity-as-a-service via the Antaris software-defined satellite platform for our SaaS customers will give us a significant advantage as we start to roll out our platform to clients across the world.”

Under the agreement, Antaris will be one of Quasar’s first demonstration users once the company’s multibeam service launches in early 2023. Antaris plans to make ground contact from its demonstrator satellite (launching late 2022) via an API service with the company’s S band antenna, and other bands into future.



*Antaris Inc co-founder Shankar Sivaprakasam with Quasar Satellite Technologies CEO Phil Ridley*

Antaris will then offer Quasar connectivity via its marketplace to customer base, which is expected to include satcomms providers, space agencies, Defence and intelligence entities and contractors, and space start-ups.

Quasar Satellite Technologies CEO, Phil Ridley, said they were looking forward to working with Antaris on building an end-to-end software defined satellite platform for delivering capability to space.

“The Antaris SaaS marketplace solution for orbiting mission design and management is a perfect match for our flexible ground station solution, and together they offer satellite mission designers a range of choices for developing their satellite capabilities for launch and then communicating with them in a cost-efficient way when in orbit.”

## Careers

### Principal Scientist in Earth Observation & Remote Sensing



The Principal Scientist in Remote Sensing will provide specialist scientific advice on space mission design related to Earth Observation and Remote Sensing applications particularly in areas such as environmental monitoring, water quality monitoring and agricultural intelligence from space.

The role will lead the design of relevant missions and the formulation and development of relevant research and innovation projects that will be delivered by our partners.

#### Role Responsibilities

- Provide specialist scientific advice on Earth Observation and Remote Sensing applications with an emphasis on environmental monitoring and disaster resilience, water quality monitoring and agricultural intelligence using in-situ and space-based assets;
- Lead the scientific design and development of space missions;
- Provide guidance on mission architectural concepts against end-user requirements;
- Participate in the scientific review of SmartSat projects for the relevant area of expertise so as to ensure that these projects are scientifically and methodologically robust.

#### Essential Criteria

- A PhD in a relevant scientific and/or technical field;
- Experience in research project design for earth observation and remote sensing applications;
- Experience or familiar in space mission requirements, design and development;
- Demonstrated ability to collaborate with research leaders and researchers and to engage with a variety of key business stakeholders;
- Demonstrated ability to prioritise tasks and work under pressure to meet deadlines with minimal supervision.

Applications close 14 October 2022. For more information and a full Position Description, please contact the CEO at [CEO.confidential@smartsatcrc.com](mailto:CEO.confidential@smartsatcrc.com).



# Awards



*SmartSat AI Theme Leader Clinton Fookes accepting the award for Scientist of the Year at the Australian Defence Industry Awards*

## **SmartSat AI Theme Leader, Clinton Fookes named Australian Defence Industry Awards' Scientist of the Year**

SmartSat AI Theme Leader, Clinton Fookes has been named Scientist of the Year at the Australian Defence Industry Awards 2022.

The Australian Defence Industry Awards universally acknowledges all defence industry stakeholders — from primes, SMEs, academic institutions and associations through to high-performing individuals such as Defence executives, Indigenous and female leaders, students, scientists, technicians and academics.

Clinton Fookes is a Professor in Vision & Signal Processing within the School of Electrical Engineering & Robotics of the Science and Engineering Faculty at the Queensland University of Technology. He holds a BEng (Aerospace/Avionics), an MBA with a focus on technology innovation/management, and a PhD in the field of computer vision. Clinton actively researches in the fields of computer vision, machine learning and artificial intelligence. He has developed technology and solutions for a range of applications with end-user benefits across video analytics, biometrics, national security, human-computer interaction, medical signal processing, digital agriculture, infrastructure monitoring, aviation security & screening, and other pattern recognition areas.

In accepting the award, Clinton said it was an incredible and humbling honour to be recognised and acknowledged for delivering outstanding computer vision and AI outcomes for Defence.

## **SIG Water project wins Environment and Sustainability Award at Asia-Pacific Spatial Excellence Awards**

The SatCom IoT-enabled Automatic Ground Water Collection and Aggregation Pilot (or SIG Water project) is a collaboration between SmartSat, FrontierSI, Myriota, University of South Australia, NGIS and the South Australian Department for Environment and Water. The project developed a pilot direct-to-orbit satellite telecommunications solution to transmit and aggregate information collected from ground water bores in rural and regional areas.

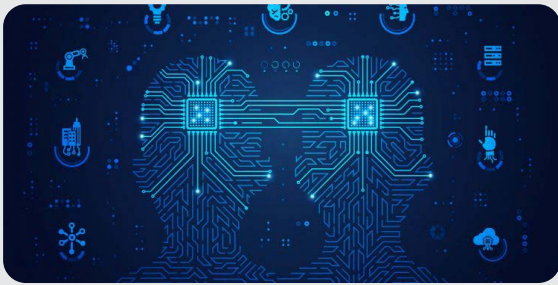
The project developed a pilot direct-to-orbit satellite telecommunications solution, integrated with an online spatial platform, as an end-to-end cost-effective means to transmit and aggregate, in near real time, automatically collected information from ground water bores in rural and regional areas, with a focus on environmental water monitoring. This improved groundwater readings from yearly to 6 hourly, and improved safety for groundwater monitoring staff. The project successfully deployed 70 groundwater bores with direct to space IoT communication, dramatically increasing our understanding of groundwater as a resource.

The Asia-Pacific Spatial Excellence Awards, hosted by Surveying & Spatial Sciences Institute and Spatial Industries Business Association, celebrate rising stars in the spatial industry.



*The SIG Water project sensor out in the field*

## Future Events



### Future Trends in Spatially Enabled Digital Twins

**Date:** 18 October 2022

**Location:** The Oxford Scholar, Melbourne

Join an expert panel to discover how the digital twin program uses spatial data, digital innovation and artificial intelligence to model and visualise places to help plan for our sustainable and resilient future.

Digital twins organise and visualise masses of data in one virtual place to create a 3D, digital version of the world. The vision for Victoria is to model and digitise places across the state virtually so that government, industry and the community can collaborate through shared open data, technology and algorithms to enhance real-world outcomes.

[Registration now open](#)



### 14th Australian Space Forum

**Date:** 25 October 2022

**Location:** Adelaide Convention Centre, Adelaide

The space forum provides an opportunity for the space community to share information and network with influential space sector leaders and the broader community.

The program includes a session on The National Space Mission for Earth Observation facilitated by SmartSat Chief Research Officer, Dr Carl Seubert.

[Registration now open](#)

## Past Events

### Distinguished Speaker Series: Professor Marco Martorello

As an Associate Professor in the Department of Information Engineering at the University of Pisa and the Director of National Radar and Surveillance Systems (RaSS) National Laboratory at CNIT, Marco Martorella provided an overview of space-related research activities at CNIT. With a relatively large portion of the research activities carried out within the RaSS Lab relating to Space, the event showcased developments into micro-satellite SAR clusters for EO and military applications, stratospheric balloon-borne SAR and Space Situational Awareness by means of radar systems.

### Industry Webinar with Airbus: Harnessing Market & Competitor Intelligence for Growth

Hosted by Airbus Defence and Space's Head of Strategy and Market Intelligence Steve Rooney, this webinar explored the value of market and competitor intelligence, how to understand data and stakeholder ecosystems, the best practice of intelligent organisations and a range of analyses techniques for maximising growth. The session was aimed at an audience of start-ups, SMEs and entrepreneurs to address the challenges of today's fast moving, digital world.



*Dr Tim Parsons presenting at the Queensland Earth Observation Hub Space Partnership Workshop*

### Queensland Earth Observation Hub Space Partnership Workshop & Networking Event

To mark the establishment of the new SmartSat node, the Queensland Earth Observation Hub hosted a workshop to provide the local space community with a comprehensive overview of its upcoming programs. Attendees also received an update on the first round of Demonstrator Grants, which closed 26 September 2022.

### Distinguished Speaker Series: Alessio Del Bue

Alessio Del Bue, Head of PAVIS (Pattern Analysis and computer Vision) Italian Institute of Technology (IIT) gave a technical presentation on the physical and social human-robot-AI interaction for health and space applications currently in development at IIT. The development of such AI and robotics is also being applied in the space sector through autonomous non-wheeled all-terrain rovers and intelligent systems for observation and automated detection of subsoil from satellite imagery.

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### **Vic Node Space Demonstrators R&D Workshop & Networking Event**

Following the launch of its first round of Demonstrator Grants, the Vic Node hosted an R&D workshop for prospective applicants. The event gave an opportunity to match industry challenges to research expertise that will ultimately lead to successful grant applications. The workshop was followed by a networking event enabling the conversations and collaboration to continue between the industry and research sectors.



*(L to R) Lead of ISS Columbus Program at Airbus Defence and Space Matthias Seifert, Dr Carl Seubert, Head of AustralAsia at Airbus Defence and Space Sascha Hapke, Professor Andy Koronios and Peter Kerr at the ADSTAR Summit 2022*

### **Australia Defence Science, Technology and Research Summit 2022 (ADSTAR)**

In July, SmartSat sent a delegation to attend the biennial ADSTAR Summit, Australia's principal forum for sharing and showcasing Defence-related research and innovation. The event, hosted by DSTG and Australia's Chief Defence Scientist Tanya Monro, brought together innovators, entrepreneurs, businesses, industry, government and academia to network, share ideas and foster collaboration. SmartSat Chief Research Officer, Dr Carl Seubert, presented as part of the session on Resilience in Contested Environments, speaking about smarter satellite technologies for combating hostile space conditions.





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