SMARTSAT
COOPERATIVE RESEARCH CENTRE

Kanyini: SA Space Services Mission

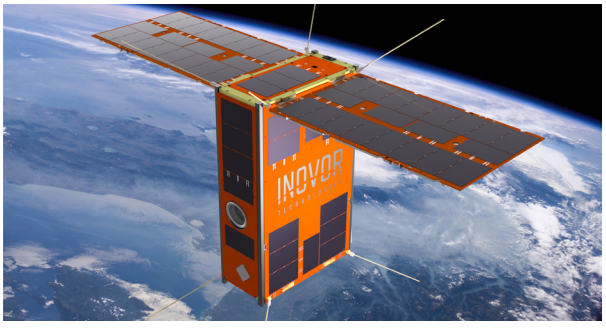
Building the South Australian Space Sector

Mission Goal: In partnership with industry, the mission will capitalise on NewSpace opportunities to contribute to a thriving and enduring South Australian space sector and support Australia's national space strategy.

The South Australian Government has invested $6.5m to deliver the SA Space Services Mission in partnership with South Australian companies Myriota and Inovor Technologies, lead by the SmartSat Cooperative Research Centre (CRC).

Myriota, born out of advanced technologies developed at the University of South Australia's Institute for Telecommunications Research, was founded to revolutionise the Internet of Things (IoT) by offering disruptively low-cost and long-battery-life global connectivity. Inovor Technologies, Australia's only sovereign commercial satellite manufacturer, was selected to design, build, test and operate the satellite bus that will be launched into LEO. Both companies highlight how South Australia's research institutions underpin growth in the state's commercial space sector.

The satellite, named Kanyini by local school students, is part of the South Australia Space Sector Strategy 2030 and is the first state-based satellite in Australia. The Space Sector Strategy is an important element of the South Australian Government's Growth State initiative aimed at ensuring our state's space industry journey continues its upward trajectory. One of the Missions' goals is to position South Australian industry to develop its capability for Cubesat production and increase participation of the associated supply chains required to sustain production. SmartSat CRC is managing the application prototyping as the project lead. Once launched, the planned three-year mission in Low Earth Orbit (LEO) will provide opportunities to test and develop capability and inform future missions.



Data collected from the satellite can be used for a variety of applications including informing decisions around water use, climate policy, mining and emergency management.

Kanyini will also have a key role in inspiring our next generation of space technologists in South Australia and across the country. Associated school engagement programs are underway; the first activity was a competition for all South Australian school students to name the satellite. Kanyini, submitted by Findon High School, is a Pitjantjatjara word describing the principle of connectedness through caring and responsibility for all things.

Payloads

Myriota will provide the IoT space services for the mission; sending data from IoT devices and sensors on Earth's surface to the satellite. The data will be securely transferred directly to the cloud and returned to Earth so it can be used to improve delivery of emergency services, and environmental monitoring. For example, data will be collected on weather events, including rainfall and bushfires, which have been impacted by climate change in recent years.

The hyperspectral imaging payload is the HyperScout 2 Flight Model Instrument, which is provided by COSINE. The imager features 45 spectral bands from 450-950nm covering the visual and near infra-red ranges of the electromagnetic spectrum. This spectral range

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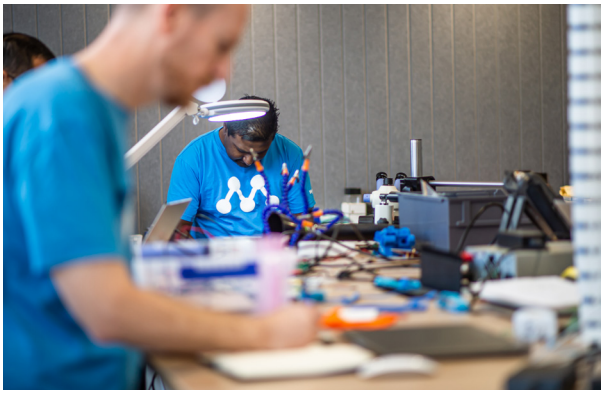
allows analysis of many characteristics of vegetation and soil that is not possible from a standard 3 band (red-green-blue) sensor.

The HyperScout 2 imager also includes a three-band thermal infrared sensor that will allow new types of research and analysis of heat generators in South Australia and have potential environmental monitoring and management applications. It also features an onboard processing capability which provides the opportunity for advanced Artificial Intelligence (AI) algorithms to conduct smart processing of the hyperspectral data directly on orbit, offering the potential to reduce the data transmission requirements or to support more rapid decision making for time-critical applications.



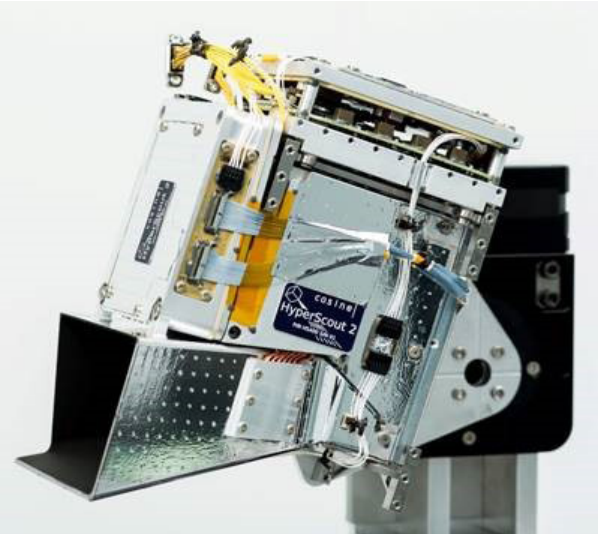
Timeline

Kanyini is on track to launch in 2024 following the development of the satellite bus, integration of the payloads, integration testing and delivery to the launch provider.

Kanyini is currently undergoing extensive functional testing at Inovor Technologies in Lot Fourteen using engineering models of the satellite bus and the IoT and earth observation payloads.

Myriota are currently assembling the flight model of the IoT payload and the flight model of the HyperScout 2 payload has been delivered to SmartSat CRC and is ready for integration.

The flight models of the satellite subsystems have been manufactured by Inovor Technologies and are currently undergoing unit-level testing, with system integration scheduled to commence in Q3 2023.



Research Projects

Three SmartSat CRC research projects directly linked to Kanyini are currently underway:

Onboard Hyperspectral AI: Cal, Panoptic segmentation, estimation

This project has completed its third milestone which saw the development of a panoptic segmentation network that was tested on the Intel Movidius Myriad 2 VPU. Previous work on the project included a lightweight atmospheric correction method that uses a generative adversarial network-based approach for the onboard correction of EO images impacted by atmospheric effects.

Small satellite energy-efficient on-board AI processing of hyperspectral imagery for early fire-smoke detection

The research, now largely complete, studied an operational concept for using the Kanyini satellite to do onboard detection of a fire and quickly transmit the warning during the next ground station pass. The research team has created an online video that summarises their work.

Robust Predictive AI: Advanced Satellite Hyperspectral Band Registration and Reliable Event Prediction

The research project commenced in mid 2023 , with them team currently reviewing existing literature on learning-based co-registration methods for single band and hyperspectral band imagery, temporal event forecasting methods, and multi-modal image fusion techniques.

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