Industry Engagement Success Stories

from Australian Astrophysics

AAL aims to act as a catalyst for boosting the impact of innovation by strengthening the connections across astronomy research units, government and private sectors.

The far-reaching impact of WiFi technology is perhaps the best example of technology developed in astronomy and transferred to industry. WiFi technology was based upon radio astronomy techniques developed within CSIRO and went on to revolutionize modern communication. The story comes so quickly to mind that one might be forgiven for thinking it is the only example of successful engagement between astronomy and industry.

AAL has produced this document to proudly showcase some current examples of fruitful collaboration between the Astrophysics Research and Industry sectors.

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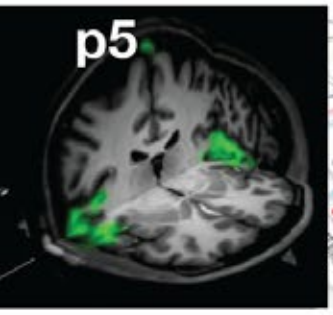
Featured Stories

Technology Transfer

Capacity Building

Skills Transfer

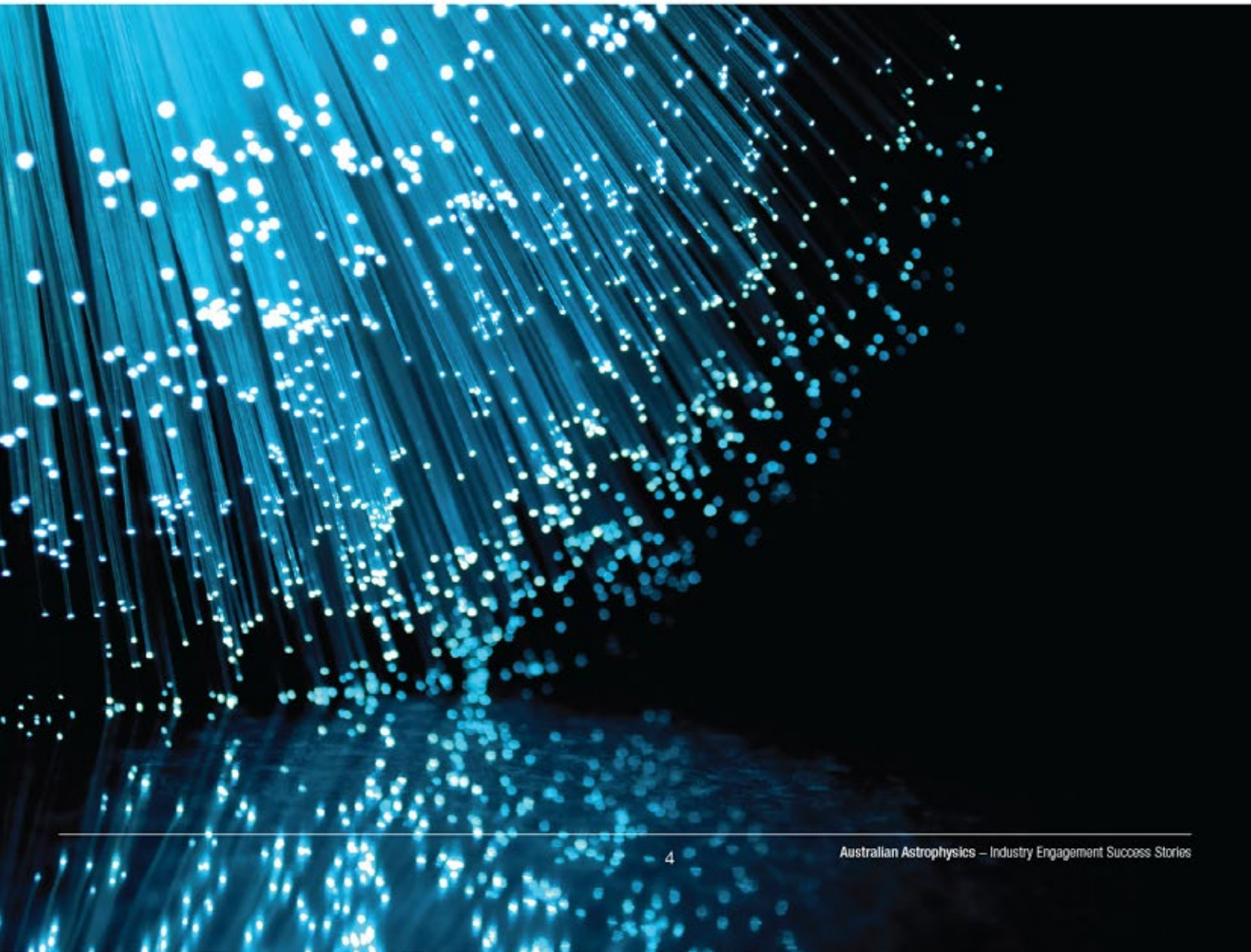


Photonic Lantern

The optical fibre technology like photonic lanterns developed by astronomers at the University of Sydney has already been adopted by telecommunications firms to increase the bandwidth (number of data channels) of a single fibre. Astronomers use lanterns when capturing light from the Universe and designed the fibres to filter some of the noise from the signal.

Besides use by companies such as Nokia, Phoenix Photonics and Optoscribe for bandwidth increase, photonic lanterns have the potential to increase the bandwidth on a submarine cable up to tenfold at no extra cost, setting the stage to become a multi-million dollar business in the next decade.

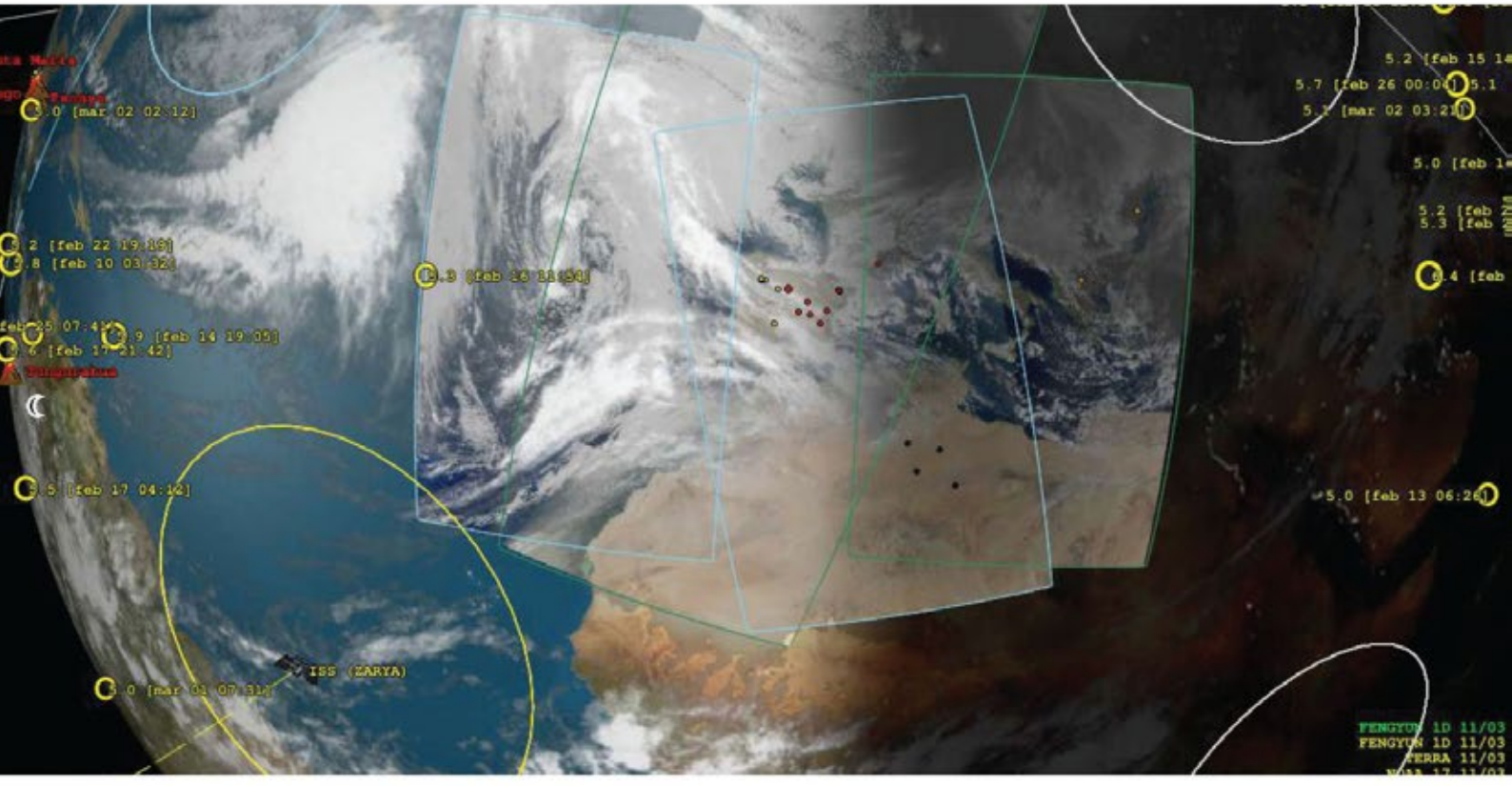
The photonic lantern allows a 'multimode' optical fibre to be connected to a 'singlemode' fibre, which is how such remarkable bandwidth increases are possible.



The Perl Data Language

The computer programming language extension was created by Karl Glazebrook at the AAO in 1996 to assist in data analysis for the two-degree field (2dF) fibre commissioning. The Perl Data Language (PDL) gave standard Perl the ability to compactly store and speedily manipulate the large and multidimensional data arrays which are the bread and butter of astrophysical computing.

Other disciplines were attracted by the power of PDL and its use has extended to also include the detection of forest fires from space, brain science imaging, air pollution monitoring and genome research.



MOKU:Lab

The all-in-one professional test and measurement device, Moku:Lab, was designed and built by a team of gravitational wave researchers and is now revolutionising the workbenches of scientists and engineers across the globe. Professor Daniel Shaddock and his team, based at the Australian National University, created the device that can switch between an oscilloscope, spectrum analyzer, waveform generator, phase meter, data logger, or lock-in amplifier (and many more) from an iPad, to streamline their own laboratories while researching gravitational wave detection.

Moku:Lab is the flagship product of a company, called Liquid Instruments, that has been extremely successful in attracting venture capital and now employs 15 people in Canberra. Moku:Lab is now available in 27 countries, is translated into 5 languages and has realised more than $750,000 in revenue to date.

CloudCAM and Sodar

Two products originally developed by the former UNSW PhD student Colin Bonner, are being sold by a company called Fulcrum-3D to improve the efficiency of wind and solar farms. A team of astronomers from the University of New South Wales developed prototypes of CloudCAM and Sodar to remotely monitor conditions at the site in Antarctica where they were performing observations.

CloudCAM has been used to provide realtime forecasting for solar energy farms and shown 4-5% improvements in power output from the solar farms, with 90% reduction in battery usage, since it is able to predict when diesel backup needs to come online. Sodar is a portable wind monitoring system designed to measure wind speeds in three dimensions and up to 200m above ground level. This provides a better understanding of the wind profile at a wind farm site, and the unit is easy to relocate when required.

Balance Services Group

Balance Services Group has improved its capacity to deliver radio-quiet energy supply in remote areas as a direct result of collaboration with International Centre for Radio Astronomy (ICRAR) in Perth.

The company is based in Western Australia and provides sustainable energy supply and storage solutions. The astronomers at ICRAR contracted Balance Services Group to help them find a solution to the complex problem of powering extremely sensitive low frequency radio telescopes without jeopardising observations of radio waves from the Universe.

The collaboration between Balance Services Group and ICRAR is a crucial step towards building the Low-Frequency Aperture Array (LFAA) of the Square Kilometre Array (SKA) telescope which will bring international infrastructure development contracts to Australia. Through this contract, Balance Services Group is well placed to deliver on further contracts during the development and building of LFAA and SKA over the next decade.

GCo Electrical

A Geraldton electrical contractor is poised to take a slice of the SKA pie after years of working with ICRAR-Curtin University in the remote Murchison region. It's all part of ICRAR-Curtin University's commitment to preparing local industry to participate in the construction of the world's largest radio telescope.

GCo Electrical was selected by ICRAR-Curtin University as the lead contractor for the Murchison Widefield Array (MWA) telescope infrastructure, and has had a presence on the SKA site ever since. The company has been involved in maintenance, upgrades and related infrastructure for the MWA and fellow precursor telescope the Australian SKA Pathfinder (ASKAP). Most recently, GCo worked with ICRARCurtin University on SKA preconstruction plans, developing and costing a blueprint to deploy more than 130,000 antennas for the low-frequency part of the SKA.

Innovation Composites

Collaboration with the CSIRO on the ASKAP radio telescope project has given Innovation Composites the opportunity to develop capacity for future government projects. The precision composites and fibreglass manufacturer worked with CSIRO to develop and produce radio-wave shielded, high-strength, weather-proof and insulated casings for a new style of radio wave detector.

Astronomers at CSIRO turned to Innovation Composites because the housing for the delicate receivers must integrate a number of functional requirements into a single component, robust enough to endure the extreme climate and remote nature of Murchison Radio-astronomy Observatory, located in the Mid-West region of Western Australia.

Innovation Composites were delighted with the collaboration and stated that in the future they see "an increased focus on "whole life cost" project assessment and more targeted performance parameters leading to greater use of composites for infrastructure, technical and defence projects."

Horizon Power and EMC Solar Construction

EMC Solar Construction has grown from 12 to 52 employees while working with astronomers at a remote radio-wave observing site to build a solar power station. The Murchison Radio-astronomy Observatory (MRO) in outback Western Australia is more than 800km from Perth and needs a stable and sustainable power supply. The Perth based company has lengthy experience delivering offgrid renewable energy solutions, and the strict radio frequency interference (RFI) measures required by this project were something new.

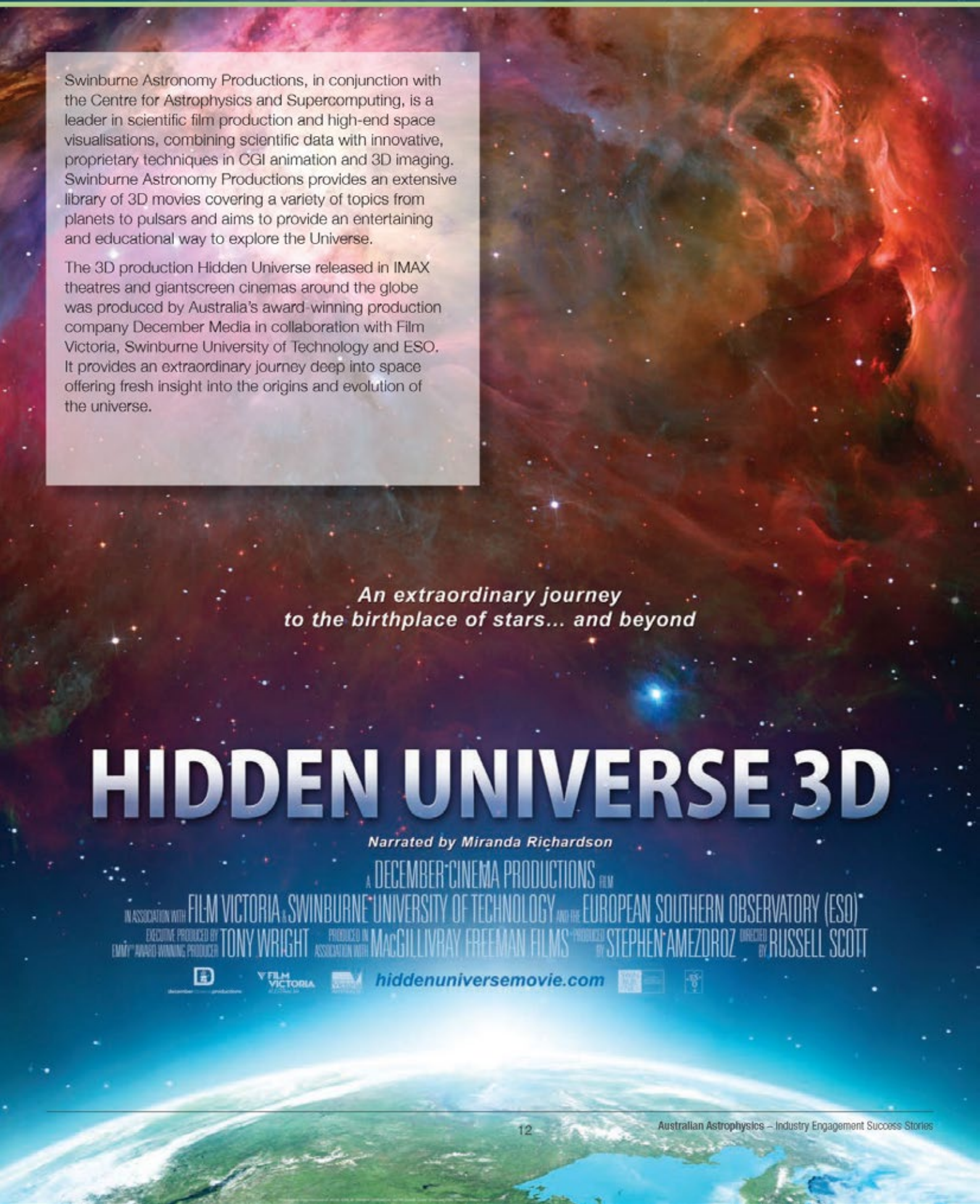
EMC Solar Construction's highly skilled staff worked with CSIRO's specialist engineers and Horizon Power to design and implement workable RFI shielding solutions. Since then, EMC Solar Construction has designed and built a 1.6 megawatt (MW) solar array of 5280 solar panels and a lithium ion battery system that will deliver power at a rate of 1 MW with a storage capacity of 2.5 MW hours – making it the largest lithium-ion storage battery in Australia (other than those in submarines and Tesla Powerpack in SA).

The MRO is home to two next-generation radio telescopes; the Australian Square Kilometre Array Pathfinder (ASKAP) and the Murchison Wide-field Array (MWA).

Swinburne Astronomy Productions

Swinburne Astronomy Productions, in conjunction with the Centre for Astrophysics and Supercomputing, is a leader in scientific film production and high-end space visualisations, combining scientific data with innovative, proprietary techniques in CGI animation and 3D imaging. Swinburne Astronomy Productions provides an extensive library of 3D movies covering a variety of topics from planets to pulsars and aims to provide an entertaining and educational way to explore the Universe.

The 3D production Hidden Universe released in IMAX theatres and giantscreen cinemas around the globe was produced by Australia's award-winning production company December Media in collaboration with Film Victoria, Swinburne University of Technology and ESO. It provides an extraordinary journey deep into space offering fresh insight into the origins and evolution of the universe.



Electro Optic Systems

Space debris management

Ground-based space situational awareness is a growing priority for government and commercial organizations around the world that need to protect their investments in space. Electro Optic Systems (EOS) announced a strategic partnership with global defence giant Lockheed Martin for the development of a space debris tracking centre in Western Australia. Through this agreement, customers will see a clearer picture of the objects that could endanger satellites, and do so with greater precision.

The collaboration will help both organizations establish a global network of space sensors, while simultaneously increasing the market reach of the partners' data and services.

The site will use a combination of lasers and sensitive optical systems like those found in telescopes to detect, track and characterize man-made debris objects. Electro-optical technologies that can zoom in on specific objects form a strong complement to radar-based systems that will sweep the sky and track 200,000 objects.

CISCO

Internet of Everything Innovation Centre

This centre was created to improve the oil and gas, agriculture, health and city planning industries using the expertise of radio-astronomers. The gains, in cloud computing, analytics, cyber security and ICT solutions, of having astronomers involved in the Square Kilometre Array (SKA) activities working with startup companies, industry experts and developers attracted a ~$30M investment from Curtin University, Woodside, and CISCO.

In 2016, Cisco Internet of Everything Innovation Centre (CIIC) successfully commissioned a 100 Gb per second data link between the remote telescope in rural Western Australia, the Murchison Widefield Array (MWA), and the Curtin campus in Perth located 1000 km away. This is a major milestone on the path to developing ICT solutions for the SKA. CIIC is now working on developing next-generation software signal processing solutions for the MWA and, ultimately, the SKA.

Dr Ilana Feain

Founder of Nano X

Trained as an astronomer, Dr Dr Ilana Feain uses her knowlegde of radio wave physics to provide radiotherapy at about 10% of the cost of current best practice treatment machines. She is the CEO of a company called Nano X, that has its roots at the University of Sydney and is developing a very different type of radiotherapy machine. Conventional radiotherapy machines require a patient to lie motionless on their back while a 3000 kg X-Ray system revolves around them. The Nano-X solution does away with the revolving gantry, and instead rotates the patient inside the machine.

However, because organs move while the body is rotated, an ability to track the organs while the body rotates is needed. The expertise desperately needed for the success of Nano-X and their life-saving low cost radiotherapy machine are exactly those that Dr Ilana Feain developed during her Astrophysics PhD at the University of Sydney and extended as a Research and Project Scientist at CSIRO Astronomy and Space Science Division.

NCRIS
National Research Infrastructure for Australia

Part of the NCRIS network

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