

# CAREERS WITH STEM<sup>TM</sup> SPACE

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ISSUE  
FLIP FOR  
SCIENCE  
CAREERS

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# WATCH THIS SPACE

Australia's space sector is set for lift off – and there's a whole galaxy of jobs to fit your passions

**ANTHONY MURFETT**  
DEPUTY HEAD,  
AUSTRALIAN  
SPACE AGENCY

A job in the space sector may seem out of reach, or only available to a select few who want to be an astronaut.

But the good news is, there are many space jobs that draw on STEM skills and areas like software development, industrial design, and metal fabricating.

Space jobs are a part of our everyday lives and make life easier here on Earth. The Australian Space Agency aims to triple the size of the Australian space sector and create 20,000 more space jobs in Australia in the next 10 years. But we're going to need people like you – the next generation of the space workforce – to make it happen.

Jobs in the space sector are incredibly varied. Some people

work in space law, or space medicine, while others have expertise in manufacturing or coding, research or communication. If you have an interest or curiosity in space, there could be a job out there for you in the near future.

I encourage you to think about what your passions are, what kinds of things interest you, and what sorts of jobs might use those skills. Do you like teaching, working with your hands, or being outdoors? Do you want to work with data, design things, or make scientific discoveries? There are space jobs that fit all of those interests, and many more. The great thing about space is that it's a brilliantly diverse field, and it's only getting bigger.

When it comes to your space career, not even the sky's the limit!

**Anthony Murfett,**  
Deputy Head of the  
Australian Space Agency

**IF YOU HAVE AN INTEREST  
OR CURIOSITY IN SPACE, THERE  
COULD BE A JOB OUT THERE FOR  
YOU IN THE NEAR FUTURE"**

## Experience STEM@Griffith

Wherever your interest lies, Griffith University has a STEM degree that's right for you. Our degrees across science, technology, engineering and the environment are built around hands-on, project-based learning so you can take advantage of the exciting opportunities in STEM, now and into the future.

[griffith.edu.au/stem](http://griffith.edu.au/stem)



# OUT OF THIS WORLD

Meet two people who've launched inspiring space careers into the cosmos

## #1

## NEUTRONS IN SPACE

### INSTRUMENT SCIENTIST DR HELEN MAYNARD-CASELY'S OBSESSION WITH ICY MOONS HAS LED TO A FASCINATING CAREER

"One of the reasons I went into science is because it looked like I'd have a lot of fun," says Helen. And she's certainly had plenty of fun in her career – she's done everything from hunting down hedgehog fleas for Britain's first televised flea circus, to helping set the Guinness World Record for the longest glow-in-the-dark necklace.

Now, Helen is a senior instrument scientist at the Australian Centre for Neutron Scattering (ACNS) at ANSTO, where she works with a piece of equipment called WOMBAT. (It has a cute nickname because its real name, the high-intensity neutron diffractometer, is such a mouthful.)

Most of Helen's job involves helping other scientists – from biologists and chemists to engineers – use WOMBAT to experiment with different materials, subjecting them to extreme conditions like pressure, temperature or a vacuum, and revealing what happens to the material as a result.

But Helen also uses WOMBAT for her own research, which is all about icy planets and moons. For example, on Titan (the largest of

### DR HELEN MAYNARD-CASELY INSTRUMENT SCIENTIST

Saturn's 82 moons) there are dunes, volcanoes and oceans, but they're not made of the same materials as on Earth. Helen uses instruments like WOMBAT to recreate the conditions on moons like Titan to try and find out how these geological features are formed. "The big question that drives me is: how do all these materials, which are nothing like rocks, act a bit like rocks?" she says.

During her undergraduate degree, Helen spent a day at the UK's equivalent to the ACNS and was instantly inspired. "There were gangplanks, things chugging away, things that go whoosh. I thought, this is cool, this is not equipment you can have in the lab."

She pursued a PhD that would let her spend more time investigating moons and experimenting with neutron scattering, and then spent some time working as a researcher, then as a science communicator for a few months (hence the fleas and glow sticks). She then moved to Australia to work at the Australian Synchrotron, and now the ACNS.

"The best thing about my job is working with people from all sorts of backgrounds. I'm a people person!" she says. – *Chloe Walker*

### HOW DO ALL THESE MATERIALS, WHICH ARE NOTHING LIKE ROCKS, ACT A BIT LIKE ROCKS?"

MASTER'S IN SCIENCE  
(PLANETARY SCIENCE),  
UNIVERSITY COLLEGE LONDON

PHD IN HIGH PRESSURE  
PHYSICS, UNIVERSITY  
OF EDINBURGH

RESEARCH FELLOW,  
AUSTRALIAN SYNCHROTRON

INSTRUMENT  
SCIENTIST, ANSTO



#2

## LIFE ON MARS

ENGINEER TURNED ASTROBIOLOGIST  
JAMES BEVINGTON'S STEM CAREER  
IS OUT OF THIS WORLDJAMES BEVINGTON  
ASTROBIOLOGIST

**J**ames Bevington has firsthand experience living on the Red Planet... sort of.

James had just arrived from the US to Australia to kick off his PhD at UNSW Sydney when he applied to NASA to take part in a mock mission to Mars – spending eight months living on the side of a remote volcano in Hawaii, at 2500m above sea level – and he got in!

James deferred his PhD, and took up the post of commander of HI-SEAS Mission V to help NASA understand how team dynamics and human psychology fare in an extreme environment.

## Career launch path

James says he's always followed his interests, which meant signing up for a degree in biosystems engineering. Then, during a Master's in Environmental Engineering at the University of Georgia, he became increasingly interested in synthetic biology. "Basically engineering microbes to become little chemical factories", he explains, which meant studying "life at the extremes". And it doesn't get much more extreme than life outside of Earth.

James then switched to astrobiology. "I describe it as studying life at the edges and trying to understand where the boundaries are," he says.

**I DESCRIBE IT AS STUDYING  
LIFE AT THE EDGES AND  
TRYING TO UNDERSTAND WHERE  
THE BOUNDARIES ARE"**



With engineering undergrad and Master's degrees under his belt, James completed a Master of Science (Space Studies) at the International Space University in 2015 – two years later he was living in cramped quarters, commanding a crew of five and conducting experiments 'on Mars'.

James says he and his crew all agreed it was one of the most important experiences of their career. The work James was doing on the simulated Mars mission slightly shifted his research focus at UNSW when he returned to Australia.

James' PhD – which he's almost finished – involves conducting experiments on the International Space Station (ISS) to study life at the edges and the plausibility of life on Mars.

For example, he recently sent a plant to the ISS that had been engineered to have a controllable circuit in it. "We could flick a switch in the plant and it would turn from green to white," he explains.

Experiments like these could help humans on real-life missions to Mars in the future – like enabling us to use engineered plants to synthesise medicines, 56 million km away from Earth.

## To the future and beyond...

James dreams of going into space for real and is working on a space startup to send mini satellites on exploration missions.

Sending satellites to space is currently the domain of big agencies like NASA, but "that's not how science is done," says James. "Science is done with different labs across the world, reproducing each other's experiments and adding knowledge incrementally. I'm trying to make planetary exploration a bit more like that, so anybody can send a mission to Mars." – Gemma Chilton

PHD, SPACE LIFE  
SCIENCES, UNSWCOMMANDER,  
MISSION V,  
HI-SEASMASTER OF SCIENCE (SPACE  
STUDIES), INTERNATIONAL  
SPACE UNIVERSITYMASTER OF ENVIRONMENTAL  
ENGINEERING, THE  
UNIVERSITY OF GEORGIABACHELOR OF BIOSYSTEMS  
ENGINEERING, UNIVERSITY  
OF TENNESSEE-KNOXVILLE



**DR DAVID  
FLANNERY**  
ADJUNCT PROFESSOR

# Rockstar scientist on a mission to Mars

**QUT RESEARCHER DR DAVID FLANNERY IS LIVING HIS DREAM CAREER – HELPING NASA ON ITS NEXT MARS ROVER MISSION**

**D**r David Flannery's STEM career rocks, literally. An Adjunct Professor at QUT in Brisbane – he is also a key member of NASA's science team working on the Mars 2020 Perseverance Rover mission. The rover is more than halfway along its seven-month, 480-million-km journey to Mars and is due to land in February 2021.

David is using his geology, palaeobiology and astrobiology expertise to decide which Red Planet rocks the rover will collect and analyse. He is also mapping out the path that the rover will take across the Martian surface to get to those rocks. The rover needs to get the most useful scientific knowledge it can during its time on Mars, so choosing the right rocks to study is crucial.

"What's also exciting is that some of the rocks this mission samples will be the first to be transported to Earth," says David. "We will find them and collect them on this mission, then future missions will transport them here. The rovers can already do amazing in-situ science on Mars itself but if we want to really understand the planet's past and present, we need to analyse those rocks here on Earth."

**DO SOMETHING YOU ARE  
GENUINELY INTERESTED IN, AND BE  
PREPARED TO TAKE SOME RISKS"**

## DO WHAT YOU LOVE

David also helps work on one of the instruments on the Perseverance Rover's arm: the planetary instrument for X-ray lithochemistry, or PIXL for short. PIXL is an X-ray fluorescence spectrometer and high-resolution imager which maps elements to help tell us what Mars is made of. PIXL is led by QUT alumnus Dr Abigail Allwood, who is based at NASA's Jet Propulsion Laboratory in Pasadena, California.

"QUT has a very exciting role to play in the mission," David says. "We hope to participate in NASA operations and contribute to the science because that's what we really have to offer."

Not only is David flying high with his career, he's also doing what he's passionate about! "What I do is a huge amount of fun and if it wasn't fun I wouldn't do it," he says. "It might sound cheesy but if you follow your interests you'll be good at it and you'll apply yourself well."

David also says the pathway to the right career may not be straightforward. "To be honest, I had no master plan when I was younger but I studied things that interested me. I had a bit of a meandering journey through a variety of fields to where I am now."

"So, my advice is: do something you are genuinely interested in, don't expect riches – at least not immediately – and be prepared to take some risks." – Matthew Brace

BACHELOR OF SCIENCE (GEOLOGY),  
MACQUARIE UNIVERSITY

VISITING RESEARCH SCHOLAR, MIT'S DEPARTMENT  
OF EARTH, ATMOSPHERIC AND PLANETARY SCIENCES

PHD IN ASTROBIOLOGY,  
UNSW

CALTECH POSTDOCTORAL SCHOLAR / FULL-TIME  
RESEARCH SCIENTIST, NASA'S JET PROPULSION LABORATORY (JPL)

ADJUNCT PROFESSOR /  
RESEARCH FELLOW, QUT



## 5

## JOBS YOU COULD LAND WITH A SPACE SCIENCE DEGREE

**RMIT UNIVERSITY'S BRAND-NEW BACHELOR OF SPACE SCIENCE WILL HAVE YOU READY TO LAUNCH INTO ANY ONE OF THESE AWESOME SPACE JOBS**



If you're one of those people who's had your head in the stars since you were a kid and always knew a space career was on the radar – then a specific degree like RMIT's new Bachelor of Space Science could be the perfect match.

Years in the making, the space science degree was launched in 2020 and offers up a tailored mix of physics, engineering, geospatial science, mathematics and specialised space studies.

The three-year, full-time degree also includes a 12-week industry placement at one of the university's big-name partners, like the Bureau of Meteorology Space Weather Services, CSIRO or Defence Science and Technology (DST) Space Systems. There is also an opportunity to take part in the European Space Agency's Young Graduate Trainee program.

Here are just a few of the awesome gigs a degree like this could set you up for...

### #1 Satellite engineer

Satellites are a huge part of humanity's technological progression, and are used in everything from communications to GPS and scientific research. As a satellite engineer, you design and manufacture satellites and even help write software to remotely control them from Earth. During the Bachelor of Space Science, you'll also learn how to build nano and micro satellites. Companies like Optus, Sitael and Lockheed Martin hire satellite engineers.

### #2 Space weather analyst

Wondering if the Sun is going to explode any time soon? Or what impact those sunspots are going to have on us back on Earth? As a space weather analyst, you'll monitor sunspots and solar flares to provide early warning of impacts to power grids and satellite operators, as well as emergency response communications on Earth.

Training kicks off during your degree with courses developed in conjunction with the Bureau of Meteorology's Space Weather Services.

### #3 Payload scientist

'Payload' means all the extra stuff loaded on a vehicle (we're talking spacecraft). It could be equipment or a science experiment. A payload scientist or specialist is a member of a team chosen for their specific expertise in operating or working with a particular payload – for example, they might be the one conducting the experiment that is the whole point of the mission, or operating some vital equipment on the spacecraft. Big public research organisations like CSIRO and DST are always on the lookout for scientists to help build payloads.



### #4 Propulsion technician

Can't count backwards from 10 without screaming, "LIFT OFF!"? Then this could be the gig for you. Propulsion technicians or engineers are the brains behind propulsion systems – think rocket and jet engines. You'd be responsible for designing and manufacturing these machines to be safer, faster, more efficient or more powerful. You could land a job at one of RMIT's industry partners, Black Sky Aerospace or Equatorial Launch Australia.

### #5 Flight or mission controller

NASA calls this job "the people behind the astronauts". They play a crucial role in every space mission, monitoring and controlling all aspects of space flight in real-time, from launch to landing. Course subjects such as mission control, computer programming, and signal and systems engineering are all offered in the Bachelor of Space Science, setting you up for this seriously cool gig. Saber Astronautics – the company building the Australian Mission Control Centre in Adelaide – is also a partner on the RMIT degree. – Gemma Chilton





# Be part of

# *SPACE 2.0*

RMIT's Bachelor of Space Science is a specialised STEM degree designed for the next generation of scientists to enter into an exciting career.

The space industry is rapidly growing and as a leader in space science and engineering research, RMIT can teach you the skills needed to work in the \$495 billion dollar industry. You'll learn in custom-designed facilities, utilise industry-ready products and work with companies in Australia such as the Australian Space Agency, Saber Astronautics, Bureau of Meteorology, CSIRO, DST, Black Sky Aerospace and Equatorial Launch Australia. Be part of what's next in Space 2.0.

Learn more [rmit.edu.au/space-science](https://rmit.edu.au/space-science)

**Decide  
What's next...**



# Build your own space company

Do you love space? Think galactic and create your own startup!

**FLAVIA TATA NARDINI**  
SPACE ENGINEER

**A**ustralia has blasted off into the 'new space age' and there are loads of homegrown new-space pioneers on the science startup scene, too.

## Find your passion

Flavia Tata Nardini is the co-founder and CEO of Fleet Space Technologies. After an illustrious international career as a space engineer and business developer, Flavia moved to Australia.

She wanted to keep working in the space industry, but there weren't a lot of local companies to choose from. "So I decided to build my own," she says.

## Cosmic view

Flavia started Fleet Space to create a digital 'nervous system' to connect every device on Earth to satellites through the Internet of Things (IoT).

The launch of Fleet's first four shoebox-sized satellites, called cubesats, was a first for an Australian private company – and Flavia plans to grow the constellation to 140 satellites. "It will have a profound impact on the way we manage energy, water and resources," she says.

## The time is right!

There's never been a better time for entrepreneurs in the space sector in Australia, says Flavia, but you need to have tech and biz know-how. The business side is more important – but you don't have to do it on your own, she says. "Find a business partner that completes you. Together you can understand both parts of the equation." And thinking big is a must.

"Space entrepreneurship is a big step into the unknown. Keep the ambition very high – the higher the better," Flavia says. – Nadine Cranenburgh

## STEM stars in startups

Check out this stellar lineup of Aussie space entrepreneurs... Could you be next?

### Dr Anastasia Volkova (FluroSat)

Anastasia is an aerospace scientist and engineer who founded her Sydney-based startup to improve food security with data from drones and satellites. "I believe the world can be a better place if we make smarter decisions," she says.

### Dr Alex Grant (Myriota)

Electronic engineer, entrepreneur and researcher Alex co-founded Myriota to pioneer a new way of sending information between nanosatellites and devices worldwide. "Ninety per cent of the Earth's surface lacks connectivity," he says.

### Dr Patrick (Paddy) Neumann (Neumann Space)

Paddy is a physicist and aerospace engineer who started Neumann Space to commercialise his research into miniature electric propulsion systems for spacecraft.



BACHELOR OF AEROSPACE  
ENGINEERING, UNIVERSITY  
LA SAPIENZA, ITALY

MASTERS OF SPACE  
ENGINEERING, UNIVERSITY  
LA SAPIENZA, ITALY

PROPULSION TEST ENGINEER,  
EUROPEAN SPACE AGENCY,  
NETHERLANDS

BUSINESS DEVELOPER  
– INTERNATIONAL  
RELATIONS, TNO, QATAR

CONSULTANT CUBESAT DEVELOPMENT,  
UNIVERSITY OF ADELAIDE

CO-FOUNDER AND CEO,  
FLEET SPACE, AUSTRALIA



# REACH FOR THE STARS

Get inspired by these three awesome – and diverse – pathways to launch your space career...



**1** Growing up, Thomas Ireland was fascinated by how things worked. "I was always pulling toys apart," he says. After high school he signed up for a Bachelor of Engineering (Honours) at Griffith University, majoring in electrical and electronic engineering. As part of his degree, Thomas did work placement at Gilmour Space Technologies – an aerospace startup based on Queensland's Gold Coast – which turned into a full-time gig. He's now a software engineer and part of a team designing and building a rocket set to deploy commercial payloads by 2022.

Thomas loves his job and is working on some super-exciting space projects. "I never really imagined working in the space industry. I didn't think there'd be companies so close to home," he says.

**THOMAS IRELAND**  
SOFTWARE ENGINEER,  
GILMOUR SPACE TECHNOLOGIES



BACHELOR OF ENGINEERING (HONS)  
(ELECTRICAL + ELECTRONIC),  
GRIFFITH UNIVERSITY

UNDERGRADUATE ENGINEER,  
GILMOUR SPACE TECHNOLOGIES

SOFTWARE ENGINEER,  
GILMOUR SPACE TECHNOLOGIES

**2**

**PAULO DE SOUZA**  
HEAD OF ICT, GRIFFITH UNIVERSITY

Curiosity is the most important ingredient for a successful STEM career, says Griffith University's Head of ICT, Paulo De Souza.

Curiosity is also the name of one of the Mars rovers – spacecraft that have travelled on the Red Planet. During his PhD in Germany, Paulo worked on a sensor used by NASA aboard the Mars rovers Spirit and Opportunity. He has now collaborated on NASA rover missions for 15 years.

Paulo grew up in Brazil and went to small,

remote schools in the Amazon. He signed up for a degree in electrical engineering but switched to physics because he wanted to learn about the fundamental nature of how things work.

Space projects continue to be part of Paulo's day job at Griffith University, which has partnered with Gold Coast-based aerospace company Gilmour Space Technologies to design and build the largest-ever Australian-made satellite, due for launch in 2023. "There's so much happening in Australia's space sector right now, and there'll be so much happening over the next 10 to 20 years," Paulo says. "There are more opportunities than people available in Australia to take them up."

BACHELOR OF SCIENCE AND MASTER  
OF ENGINEERING, FEDERAL UNIVERSITY  
OF ESPIRITO SANTO, BRAZIL

PHD, NATURAL SCIENCES,  
JOHANNES GUTENBERG  
UNIVERSITY, GERMANY

CHIEF RESEARCH  
SCIENTIST, CSIRO

HEAD OF SCHOOL (ICT),  
GRIFFITH UNIVERSITY

**3**

**JESSIE CHRISTIANSEN**  
RESEARCH SCIENTIST, NASA

An amateur astronomer in high school, Jessie Christiansen had no idea her passion for stargazing would lead to a career at NASA. "I didn't know you could get paid to do this job. As soon as I realised it was an actual career, I was really excited," she says.

With a Bachelor of Science (Advanced Studies) from Griffith University under her belt, followed by a PhD in astronomy and

astrophysics, Jessie has worked at NASA in the US for more than eight years. As a research scientist at NASA's Exoplanet Science Institute, she spends her days looking for planets around other stars.

"I love discovery. I love being the first person to look at the data and go, there it is, there's a new planet, or planet-like system or Earth-like planet," she says. –Gemma Chilton



BACHELOR OF SCIENCE (ADVANCED STUDIES),  
GRIFFITH UNIVERSITY

PHD, ASTRONOMY AND  
ASTROPHYSICS, UNSW

RESEARCH SCIENTIST, NASA



# Bringing space jobs down to Earth

There's more to a food and farming career than studying soil and crops. Next-gen farming smarts are needed in out-of-this-world industries, like space

## TO INFINITY AND THE FARM

Forget the tractor-driving stereotype – these days farmers are flying drones and rocking wearable tech. But the coolest thing about Old MacDonald's 21st century upgrade, is the fact that agriculture roles are no longer reserved for physical farms – or even Earth in general. Space companies are crying out for STEM grads with an advanced knowledge of farming processes and systems to manage crops and water supplies via sophisticated space systems.

And the awesome news for recent high school grads? It's the perfect time to think about kickstarting a study path into the industry, with Australia and New Zealand both recently establishing dedicated space agencies and committing to growing their industries.

## Now hiring!

Agri-space roles to apply for on Earth:

**AI specialist**  
**Data scientist**  
**Electrical engineer**  
**Machine learning engineer**  
**Software engineer**  
**Satellite engineer**

## 4 COOL SPACE TECH USES

New tech from the space sector is revolutionising farming, and there are loads of roles for STEM grads in creating it. Here are just a few of the coolest examples driven by data scientists, computer scientists and software engineers.

### #1 HARVESTING SPACE DATA

Although satellites might hang out in space, the data they collect is a huge bonus to those in agricultural and farming fields on Earth. Harvesting info on the state of soil in a particular area, pollution levels and water temps – all from accurate satellite set-ups – is revolutionising the accuracy of the landcare game.

### #2 TRACKING AND TAGGING

Farmers have been tagging and tracking cattle for years, but thanks to a new reliance on space tech, their systems have come a long way from manual monitoring. In one of the coolest research projects to come out of 2020, large herds of wild water buffalo in the NT are being tracked and managed by next-gen space tech to generate data that rangers can use to reduce the impacts of the cattle on the environment. Hit up [bit.ly/space-herding](https://bit.ly/space-herding) for the full story.

### #3 DRIVERLESS TRACTORS

Yep, these are a thing! In the US, self-driving tractors cultivate the majority of farmlands, with many of them relying on software straight out of NASA. In fact, the highly accurate GPS signal errors and increased location smarts, makes this tech one of the space agency's most game-changing contributions to life on Earth.

### #4 SATELLITES FOR MAPPING

Experts at Australia's national science agency, the CSIRO have developed a new product – ePaddocks. According to remote-sensing specialist Dr Franz Waldner, the tech will set the standard for future geospatial digital agriculture products to improve land-use maps and to track species. "The satellite images we use, although publicly available, are cumbersome to download, store and analyse by the average person," Franz explains. "Our method only needs one satellite image and relies on data-driven processes and decisions." CSIRO staff skilled in agronomy, satellite imagery and data science have all had a hand in developing the agri-tech. Space age, right? – Cassie Steel



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