

# REACH FOR THE SKY

AEROSPACE AND AVIATION

“

Our position as a national leader  
in aerospace and aviation research  
and education, for over 60 years,  
is built on our partnerships with industry.”

— PROFESSOR MARGARET GARDNER AO  
VICE-CHANCELLOR AND PRESIDENT

# MESSAGE FROM THE VICE-CHANCELLOR



It is with pleasure that I present this overview of RMIT University's capability in aerospace and aviation. This publication highlights the many areas of academic expertise and achievement specific to this important sector.

RMIT University prides itself on the strong industry links it has developed over its 123 year history. The University's collaboration with industry is integral to our leadership in applied research and education, and to the development of work-ready, highly skilled, globally focused graduates.

In no sector is this more apparent than aerospace and aviation.

Our position as a national leader in aerospace and aviation research and education, for over 60 years, is built on our partnerships with industry. Numerous innovations in this publication reflect this strong, ongoing collaboration.

The Sir Lawrence Wackett Aerospace Research Centre is the leading Australian research centre in this sector. Truly characteristic of RMIT University, the Centre draws its research strength from across the organisation, with interdisciplinary teams of scientists and post-doctoral researchers working alongside industry partners to tackle the challenges of today and to innovate for tomorrow.

In partnership with industry, we are developing the aerospace and aviation leaders of tomorrow. RMIT undergraduate and postgraduate students are hosted by global organisations across the world through the RMIT International Industry Experience and Research Program. These talented students are highly sought after and graduate with cutting-edge skills and invaluable applied knowledge.

Consultation with industry is ongoing and deeply embedded in our systems and practice. The RMIT Aerospace and Aviation Industry Forum is now in its fifth year and has made an invaluable contribution to the University's strategic direction, research and partnerships, and to the way we construct our programs at both the vocational and higher education levels.

All of our education programs are guided by discipline-specific program advisory committees. As Australia's largest dual sector university, RMIT contributes highly trained professionals and trades staff to the aerospace and aviation workforce ranging from maintenance officers and systems engineers through to aerospace engineers, logistics specialists and commercial pilots. Postgraduate education is designed with and specifically for the global aerospace and aviation industry.

We are immensely proud of RMIT's ongoing contribution to the aerospace and aviation sector and believe collaboration with industry is integral to its sustained growth. We welcome, acknowledge and encourage your further engagement with RMIT University.

A handwritten signature in black ink that reads "Margaret Gardner". The signature is written in a cursive, flowing style.

Professor Margaret Gardner AO  
Vice-Chancellor and President  
RMIT University



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# AEROSPAC

## AVIATION & RMI

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## WORKING PA

### GLOBAL PARTNERSHIPS

RMIT partners with world leaders in aerospace and engineering:

- » Airbus
- » Boeing
- » Bosch
- » DLR
- » Eurocopter
- » GKN Aerospace
- » MTU Aero Engines
- » Qantas
- » Rolls-Royce
- » Siemens
- » Thales
- » Tesat-Spacecom

RMIT works in close collaboration with leading agencies:

- » Civil Aviation Safety Authority (CASA)
- » Defence, Science and Technology Organisation (DSTO)
- » Defence Materiel Organisation (DMO)

### Strategic engagement

Many organisations partner with the University in ongoing engagement initiatives, including:

*The RMIT Aerospace and Aviation Industry Forum*

- » At this annual high-level industry forum now in its fifth year, industry leaders discuss major issues and advise the University on industry's research, education and graduate skill priorities.

*Program Advisory Committees*

- » Industry members advise the University on the design and content of education programs across disciplines, to maintain industry relevance and graduate skills.

*Sir Lawrence Wackett Aerospace Centre Industry Advisory Board*

- » Industry members provide advice on trends and opportunities in industry for aerospace-related research and commercial activities.

*RMIT International Industry Experience and Research Program*

- » This program hosts internships and facilitates collaborative research projects in Europe and North America for undergraduate and postgraduate students.

RMIT University is an Australian leader in aerospace and aviation education and research. For more than 60 years the University has been deeply engaged with Australia's aerospace and aviation community, educating the professional and trade workforce across the sector and leading collaborative research and innovation.

RMIT is the only university in Australia with a dedicated aerospace research centre—the Sir Lawrence Wackett Aerospace Research Centre. Established in 1991, the Centre aims to create, through research and design in partnership with industry, new intellectual property for commercial use and development.

RMIT is renowned for its world class capabilities in the development of advanced composites and aerospace structures and is leading the development of these in Australia.

### LEADING EDUCATOR

RMIT's aerospace and aviation programs are keenly sought by aspiring engineers across Australia. Aerospace engineering at RMIT attracts the highest quality students in the nation, with the highest ATAR scores.

The University offers the widest range of aerospace and aviation programs in Australia. These programs range from apprenticeships to diplomas, and from undergraduate degrees to postgraduate qualifications. Industry engagement is embedded into all programs.

RMIT provides world class education to more than 1000 students in relevant fields, covering a variety of disciplines and levels including aviation maintenance engineering, aviation science, aerospace engineering, and aviation management.

RMIT aviation management and aerospace engineering programs are offered in Australia and in Singapore.



# E, T, AMIC ARTNERSHIP

## SPECIALIST EDUCATION ALIGNED WITH CAREER STRUCTURES

RMIT aviation and aerospace programs are embedded into local and international defence force career structures. The University's aviation programs are currently undergoing an internationalisation process to comply with global aviation maintenance standards and the proposed Australian Civil Aviation Safety Authority regulatory requirements.

The University also offers specialised training in a range of industry-based courses delivered by an experienced and professional team of educators. Our industry-focused training includes job skills analysis, program design and specialised gap training.

RMIT Flight Training operates as a specialised unit within the University and is dedicated to the training of commercial pilots. The training is run from a modern, purpose-built complex at the Point Cook site that was once home to the Royal Australian Air Force's flight training school. At Essendon Airport our CT4 aircraft is used to support flight test and maintenance engineering programs in a hands-on way.

## LOOKING TO THE FUTURE

Over the next five to 10 years, the University aims to grow our global engineering capabilities in aerospace and aviation, significantly increase our research output in this field, and extend our collaboration with industry.

New strategic areas for RMIT in this field include Autonomous Systems, System Support Engineering and Sustainable Aerospace Technologies, which correlate with other sectors including defence and sustainment.

### Professor Aleksandar Subic

Head, RMIT School of Aerospace, Mechanical and Manufacturing Engineering

Professor Subic is a member of the Board of Directors of the newly established Australian Association of Aerospace and Aviation Industries.

# GROWING TALENT & INNOVATION

RMIT University takes great pride in the significant international achievements of our students and graduates—the future leaders of industry.

Many partners work with the University to help these future leaders to establish international careers through the RMIT International Industry Experience and Research Program.

This publication highlights some of the outstanding current talent in the University, including Bachelor of Engineering (Aerospace Engineering) graduates Jason Seris and Lauren Burns.

Jason Seris graduated from RMIT with first class Honours and completed an internship at Rolls-Royce in Indianapolis, USA. He has now joined the Rolls-Royce North American leadership development program—the first Australian to be chosen for this prestigious program.

Lauren Burns cutting-edge research project Biomimetic Design of Aerospace Composite Joints, is supported by Boeing Research and Technology Australia and was recently recognised with the award of a US\$10,000 Amelia Earhart Fellowship.

Dr Caleb White, Dr Adrian Orifici and Daniel Almagor are all talented graduates who have joined the University's aerospace community. Dr White is developing a technology that imitates the human nervous system to sense structural faults in composite planes as they occur.

Dr Adrian Orifici conducts research as part of the Cooperative Research Centre for Advanced Composite Structures, which has included projects in damage models for composite materials, post-buckling aerospace structures, multi-axial material characterisation and failure, aircraft repair, automated modelling and analysis tools.

Both Dr White and Dr Orifici are now lecturers at RMIT, part of the new breed of academics who have joined the University in recent years.

After graduating from RMIT with a double degree in Aerospace Engineering and Business Administration, Daniel Almagor established Engineers Without Borders Australia which provides a framework for young engineers to enhance the lives of disadvantaged people around the world through small-scale engineering and capacity-building projects.

Our PhD graduates are taking up post-doctoral research positions at leading international universities. For example, Dr James Waldie is now working at MIT on the development of new-generation spacesuits for NASA.

These graduates represent the new breed of leaders driving innovation in aerospace and aviation engineering.



# RMIT

## A SNAPSHOT

Established in 1887, RMIT is one of Australia's original educational Institutions.

**RMIT is the largest dual-sector university in Australia.**

- » RMIT has a total student population of 71,628
- » RMIT offers 1029 higher education and vocational programs.
- » Programs range from apprenticeship training through to doctoral programs.
- » RMIT has 3615 staff in Melbourne and 421 in Vietnam.
- » RMIT University offers programs of study in 24 Schools across three Colleges:
  - Business
  - Design and Social Context
  - Science, Engineering and Health

**RMIT's campuses are in Australia and Vietnam:**

- » Melbourne:
  - Central Business District
  - Brunswick
  - Bundoora
- » Vietnam:
  - Ho Chi Minh City
  - Hanoi

**RMIT is the largest Australian provider of offshore education**

- » RMIT has 16,350 offshore students (5000 in Vietnam).
- » RMIT degrees and diplomas are delivered with partner institutions in Singapore, Hong Kong, China, Malaysia, Sri Lanka and Laos.
- » RMIT has research and industry partnerships on every continent.

**RMIT is a global university of technology**

- » RMIT enables student mobility through its 196 international partners for student exchange.
- » RMIT's alumni network comprises 388,000 alumni in more than 100 countries.
- » 11,000 international students study at the Melbourne campuses.
- » The RMIT English Language Test for Aviation is the world's largest Aviation English test provider.

**International Centres at RMIT:**

- » European Union (EU) Centre
- » Chinese Medicine Confucius Institute
- » World Health Organization (WHO) Collaboration Centre for Traditional Medicine (Chinese medicine)
- » UN Habitat Asia-Pacific research partner
- » Australia APEC Study Centre

### RESEARCH INSTITUTES AND CENTRES

RMIT's four Research Institutes undertake outcome-related research and innovation and provide consultancy services in areas of demonstrated research excellence within the University. The Research Institutes and their research themes are:

#### RMIT Design Research Institute

- » Customising space
- » Digital design and manufacture
- » Geoplaced knowledge
- » Intervention through art
- » Urban liveability

#### RMIT Global Cities Research Institute

- » Climate change adaptation
- » Community sustainability
- » Globalisation and culture
- » Human security
- » Urban infrastructure

#### RMIT Health Innovations Research Institute

- » Electromagnetism: biophysical modulators
- » Ion channels and transporters as therapeutic targets
- » Metabolism, exercise and disease
- » Traditional and complementary medicine

#### RMIT Platform Technologies Research Institute

- » Intelligent industrial information technologies
- » Nano materials and devices
- » Sports engineering technologies
- » Security and safety

#### Specialist research centres

RMIT also has a number of specialist research centres which build on existing or developing research strengths:

- » Sir Lawrence Wackett Aerospace Centre
- » Australian Centre of Expertise in Noise, Vibration, Harshness (NVH)
- » Centre for Applied Social Research
- » Centre for Design
- » Centre for Finance
- » Microelectronics and Materials Technology Centre
- » Rheology and Materials Processing Centre



## THE SIR LAWRENCE WACKETT AEROSPACE CENTRE

# LEADING AEROSPACE RESEARCH IN AUSTRALIA

As the leading centre for aerospace-related research in Australia, the Sir Lawrence Wackett Aerospace Centre focuses on key research and works closely with leading industry bodies such as Boeing, BAE Systems and the Civil Aviation Safety Authority.

Established in 1991, the Centre carries out fundamental and applied research in a number of key areas including advanced aerospace materials and structures (lightweight alloys, composites and multifunctional structures), aerodynamics, unmanned aerial vehicles (UAVs), and through-life support technologies.

As an RMIT research centre, the Wackett Centre brings together researchers from across the University and from five schools—Aerospace, Mechanical and Manufacturing Engineering, Applied Sciences, Electrical and Computer Engineering, Mathematical and Geospatial Sciences, and Fashion and Textiles.

Professor Chun Wang was appointed Director of the Wackett Centre in 2009. He was formerly the Head of Advanced Composites at the Defence, Science and Technology Organisation (DSTO).

Twenty academic staff, supported by a large number of research scientists and doctoral researchers, conduct interdisciplinary research in close collaboration with industry and government agencies.

Professor Chun Wang

The Centre has an extensive network of partnerships with national and international aerospace organisations including:

- » Australian Aerospace Limited
- » BAE Systems
- » Boeing Aerostructures Australia
- » Boeing Research and Technology
- » Civil Aviation Safety Authority
- » Defence Science and Technology Organisation
- » GKN Aerospace
- » QinetiQ Australia
- » Australian Composites Pty Ltd

In addition, the Centre undertakes research projects with funding from the US Air Force Office of Scientific Research and the US Office of Naval Research. The Centre is a major participant in the Cooperative Research Centre for Advanced Composite Structures and the Defence Materials Technology Centre, and is DSTO's Centre of Expertise in Aerodynamic Loading.

As a designated design organisation of the Civil Aviation Safety Authority of Australia under Civil Aviation Regulations 30, the Wackett Centre also conducts continuing education and training to professional engineers in the aerospace sector.

The Centre has four areas of speciality:

- » Aerospace structures and materials
- » Through-life management technologies
- » Dynamic aerospace systems
- » Aerospace design and manufacturing processes

Using the latest techniques and state-of-the-art facilities, the Centre has Computer Aided Design facilities and experience in CATIA v5, AutoCAD and rapid prototyping, as well as access to a range of experimental testing facilities including wind tunnels, MTS structural testing machines for static and fatigue testing, composite manufacture and testing, data collection and analysis, and dynamic and vibration measurements.



## AUSTRALIA—A CENTRE FOR INNOVATION & PRODUCTIVITY

Boeing's presence in Australia is the company's largest footprint outside of the United States. With an overall investment of more than \$800 million in its Australian businesses across every state and territory except Tasmania, the company has strategically expanded its presence to become much more than an aerospace company.

Ian Thomas, President of Boeing Australia and South Pacific, said that to the company, Australia represents innovation and productivity. "We're not here because we have to be here," he stressed. "Australia is not a low-cost destination for us.

"It's the compelling value we find here that continues to validate the reasons for our activities and inspires the company to find new ways to encourage and support the local industry. Australia is a microcosm for Boeing world-wide."

Research and development is a high priority for Boeing. As a global technology leader, the company collaborates with the world's best R&D experts, and this is showcased through its Australian activities. Boeing's R&D unit, Boeing Research and Technology, provides RMIT researchers the opportunity to collaborate on a wide range of research themes.

"The substance of the research carried out at RMIT, such as in the area of advanced composite components, epitomises the productivity and innovation we find across the board in Australia," Mr Thomas said. "The programs within the University—in computer science and mechanical, manufacturing and electrical engineering as well as in aerospace—are of real significance and present strong synergies with our endeavours to address emerging customer and industry needs."

## BOEING & RMIT

# WORKING TOGETHER FOR THE LONGER TERM

RMIT University is proud to be one of only four Australian universities—and the only university in Victoria—appointed as a focal university under the Boeing University Relations program.

As a leader in global aerospace, Boeing knows that the future of the industry lies in the talented and enthusiastic students of today. The world's largest aerospace manufacturer backs this belief in Australia through its University Relations program.

By working closely with an elite list of 22 selected universities world-wide, Boeing aims to enhance undergraduate curricula, recruit candidates for employment, and collaborate on research and development that benefits the company's long-term business needs as well as the industry at large.

In welcoming RMIT's appointment as a Boeing focal university, RMIT Vice-Chancellor and President, Professor Margaret Gardner AO, said the University prided itself on the strong industry links it has developed through more than 60 years' experience in the aviation and aerospace sector.

In RMIT, Boeing has found a University partner that impresses for its strong leadership and long-term focus on excellence in the field of aerospace engineering. In particular, the University's people—both its academic staff and its talented students—have prompted Boeing to further invest in the partnership.

“ The substance of the research carried out at RMIT, such as ... advanced composite components, epitomises the productivity and innovation we find across the board in Australia ”

Mr Ian Thomas, President of Boeing Australia and South Pacific



# FER

“We consistently find world-class people at RMIT”  
Mr Ian Thomas, President of Boeing Australia and South Pacific

The President of Boeing Australia and South Pacific, Mr Ian Thomas said “We are keen to engage with the best and the brightest in the field for today and for tomorrow, and we consistently find world-class people at RMIT.”

“The quality and calibre of the people continue to impress. We’ve been fortunate to retain some graduates in our business for the longer term, while others have gone on to contribute to the industry in other ways.”

The collaboration between Boeing and RMIT comprises a wide range of engagement activities such as guest lecturing and involvement in industry forums, together with funding to support student scholarships, awards and travel bursaries.

The Boeing Scholarships at RMIT provide opportunities for high-achieving students, as well as those from disadvantaged backgrounds or from regional/rural areas who might otherwise miss out on an engineering career.

Adnan Raghdoo, Boeing Engineering and Quality Director, said: “It’s critical that we support and help these students to enable equality of opportunity and to enhance diversity in the workforce.”

Travel bursaries from Boeing give students the opportunity to experience the US aerospace industry and obtain cutting-edge work experience. These are key elements in RMIT’s strategic priorities of providing work-integrated learning and ensuring its students gain the experience, attributes and ability they need to pursue their careers world-wide—which in turn contributes to the employability and potential of RMIT graduates.

RMIT aerospace students displaying outstanding academic and leadership qualities have toured the US aerospace industry sector, visiting the likes of Boeing Satellite Systems and NASA at Cape Canaveral.

Ian Thomas sees Boeing’s engagement with RMIT as mutually profitable. “We are committed to supporting and implementing the best tools, the best talent and the best technology,” he said. “It reflects well on both parties to foster such a strong partnership for the longer term.”

Image above: RMIT Vice-Chancellor and President, Professor Margaret Gardner AO, with Tony Carolan, formerly of Boeing Aerostructures Australia



## RMIT SCIENCE ROAD SHOW ROLLS INTO GIPPSLAND

Boeing's support for the University's work to increase science awareness extends into secondary schools, courtesy of a team of young scientists from RMIT.

The RMIT Science Road Show visited four primary and secondary schools in the Gippsland area to encourage students to engage in science subjects and break down negative stereotypes of scientists in white lab coats.

The team, comprising five student volunteers and a road crew manager, spent a week on the road covering the areas of Orbost, Lakes Entrance and Stratford.

Each session included a science show where students experienced what it was like to sit on a bed of nails, see film canisters fly, and find out the science behind magic tricks.

Students also took part in hands-on science activities looking at electronic circuits and analysing the properties of freaky fluids in lava lamps and slime.

RMIT University Science Road Crew Manager, Amanda McKenzie, thought the enthusiastic volunteers were ideal communicators for young people at school.

"The RMIT student volunteers did a wonderful job of presenting the science shows and activities, and their enthusiasm quickly spread to the school students. It was great to see students from Prep through to Year 8 so engaged by exploring science concepts through our fun-filled activities."

"The staff and students in these regional areas appreciated us taking the time to travel to them and bring in activities and knowledge that their students wouldn't otherwise have access too. This was made possible by the generous support of Boeing."

This program is one of a number of activities that are supported by Boeing through their CyberGrants program and is part of RMIT's appointment as a Boeing focal university.

# BOEING TAKES YEAR 10 STUDENTS ON A MISSION TO MARS

As part of a three-day nationwide event, 90 Year 10 students from across metropolitan and rural Victoria recently visited RMIT for the Science Experience program.

The program, sponsored by Boeing Australia, provided budding scientists with a taste of university life and a glimpse of what a career in science would be like.

Over the three days students were given the opportunity to perform experiments, meet and hear university lecturers and gain valuable knowledge in the areas of physics, chemistry, food technology, and computer, medical and health sciences.

Comedian Rod Quantock opened the event and encouraged students to 'get their hands dirty' in workshops and experiments presented by staff and students.

One of the highlights was a trip to the Victorian Space Science Education Centre where students put on spacesuits and role-played a real space

landing on Mars including mission briefings, flight control and simulated space exploration in hostile and dangerous environments.

The RMIT Science Experience gives school students a greater insight into science in a fun learning environment and has the added bonus of providing the opportunity for them to meet and work alongside their slightly older peers.

"The RMIT undergraduates inject a lot of energy into providing a fun way of communicating possible career options to prospective university students," said RMIT Event Coordinator Clare Russell.

"The hands-on activities involve all the students and it's great to see them so excited about science."

The Science Experience was introduced to Melbourne in 1990. Supported by Siemens as an annual event at 34 universities Australia-wide until 2008. It is also supported by Rotary.

Melbourne secondary school students experiencing science at the Victorian Space Science Education Centre in Strathmore, supported by Boeing.





## AMELIA EARHART FELLOWSHIP RECIPIENT

Lauren Burns' innovative research continues, but it has already received recognition with the award of a US\$10,000 Amelia Earhart Fellowship.

The Fellowship was established in 1938 in honour of the pioneering US aviator Amelia Earhart, who was a member of the Zonta Clubs of Boston and New York, and is awarded annually by Zonta International.

"I am thrilled to be a recipient of the Fellowship and to have my work recognised by an international organisation.

"The award has given me extra financial support to attend conferences and present my research on a world stage, which I will do in 2010 at the International Council of Aeronautical Sciences conference in France," she said.



# BUILDING ON NATURE'S STRENGTHS

What do branches in pine trees have to do with aircraft? You might think not very much, but a doctoral student at RMIT is researching the parallels between the strength of tree branches and the construction of aircraft.

Lauren Burns' research project is supported by Boeing Research and Technology and is titled 'Biomimetic Design of Aerospace Composite Joints'.

Ms Burns, who works in RMIT's School of Aerospace, Mechanical and Manufacturing Engineering, said Biomimetic research looks to nature for inspiration.

"Nature deals with evolutionary pressures, scarce materials and resources, and has adapted different methods of doing things to achieve systems that work well.

"For example, shark skin has ribs in it that keep water flowing and reduce drag for the shark so that it swims faster," she said.

"Using this idea from nature, a film was produced that mimicked shark skin and was applied over the skin of aircraft which resulted in more aerodynamic planes."

Her research looks into natural joints that occur in nature and that are already strong. One of the key aspects of aircraft design and production are the joints, which tend to be the weakest part of a plane.

"In the past, aircraft were usually built from metal, mainly from aluminium. Now, due to weight considerations, fuel efficiency, environmental concerns about carbon emissions and consumer expectations, planes are being built from composites made up of carbon fibres," she said.

"Carbon composites are much lighter and stronger but don't have as much damage tolerance as metal. So finding a way that structure can be used to make carbon composites behave like metal will be a breakthrough for aircraft design."

Her research has included testing pine tree branches to look at their internal structure and how they break or fail. The strength of different varieties of tree branches varies but they all have a similar underlying structure.

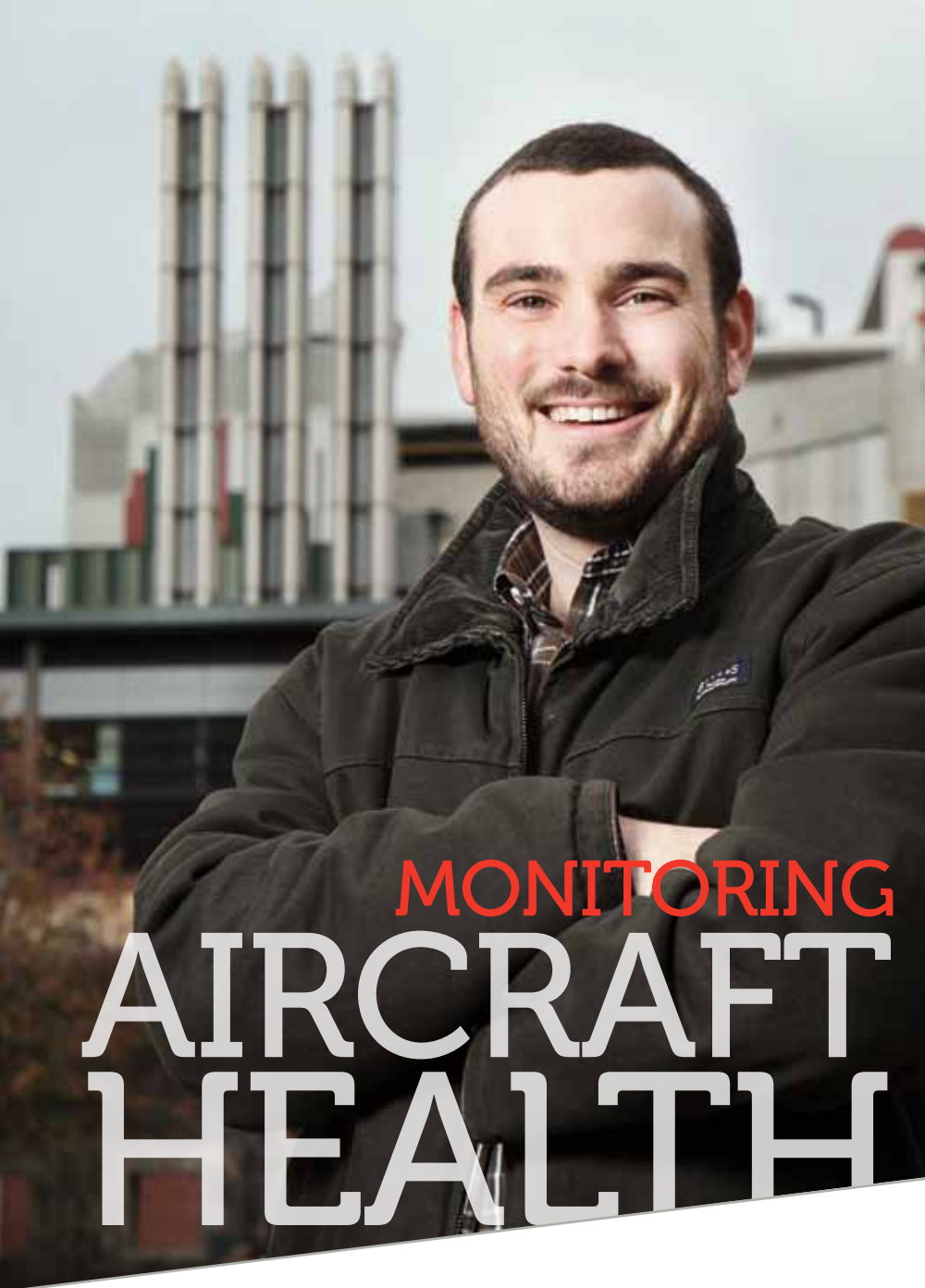
"I replicated a tree branch joint using aerospace material embedding it about half-way into the T-joint, just like a branch is joined to a tree. The resulting joint showed real improvements in the bending strength of the carbon composite joint," she said.

"This is great news but we do need to take into account that there are limitations with the current manufacturing techniques on offer."

As well as tree branches, Ms Burns has also been looking into other natural forms and structures including shells, bone, teeth, marine creatures, sea sponges, bamboo and cacti.

"I am interested in the structure of each form and how the various levels of structure interact. A good example is carbon which, depending on its structure, can be weak like graphite or strong like diamonds," she said.

"These natural structures could offer clever ways to make carbon composites behave differently and to strengthen them as materials for use in aircraft construction."



# MONITORING AIRCRAFT HEALTH

An innovative technology developed at RMIT University could allow real-time monitoring of the structural health of aircraft, enabling cracks in planes to be detected mid-flight.

Dr Caleb White has worked on developing a technology that imitates the human nervous system to sense structural faults as they occur. A lecturer in the School of Aerospace, Mechanical and Manufacturing Engineering, Dr White said the ability to monitor aircraft in real time would help both flight and maintenance crews.

“Continuous health monitoring would make flying safe and cheaper—it’s the next step for tomorrow’s aircraft,” he said.

“If an aircraft is damaged by hitting a bird on take-off, for example, this system would raise the alarm instantly, giving the crew a crucial window of time to take any action.

“The system would also help maintenance crews determine precisely which parts of an aircraft need attention, improving the efficiency of maintenance checks by making them more targeted.”

Dr White, who worked on the research with the Cooperative Research Centre for Advanced Composite Structures (CRC-ACS), has extended a monitoring system developed in Australia for metal aircraft.

In recent years, large aircraft manufacturers have begun investing in carbon fibre composite structures, which could make their planes 20 per cent more fuel-efficient than standard metal airliners.

“From a maintenance aspect, planes built out of aluminium and metal are more prone to fatigue and cracking, as well as having real corrosion issues. Planes built out of composite fibres still have some fatigue issues but their resistance to fatigue is greater and there are no corrosion problems,” Dr White said.

Metal planes are joined together via rivets, with the joints being the weakest parts of the plane. Planes built from composite fibres are much lighter than metal planes and are bonded together with glue. These glued joints are much stronger than riveted metal ones.

“However, with the glued joints there is no way of checking the remaining fatigue life or how strong each joint is. The only checking mechanism we have is that the production process was good in the factory where the plane was manufactured,” he said.

“If we know that a good production process was followed, then we can have a certain level of confidence in the plane’s joints, strength and durability, but this doesn’t actually tell us how the joint is performing in service.”

Dr White’s research has developed a way to understand how the joints are wearing and to give early warning of any impending failure.

“It is important to understand how the inclusion of a sensor affects the strength of the joint. Putting sensors in joints does offer early warning of failure, but it also weakens these stronger joints somewhat,” he said.

However, users have to weigh up having access to important information about the state of the joint against the number of reclaim cycles that the joint and plane can go through.

“The reclaimed cycles may be slightly less than usual, but with the joint sensor the user has access to good information and consequently has confidence in the plane’s structure and the strength of its joints for flying and maintenance,” he said.

Dr White’s research has focused on enabling real-time monitoring of the new generation carbon-fibre jets, applying his system to aircraft parts made from the advanced composite materials and developing guidelines for aircraft designers.

His work has generated widespread interest, including from the European Aeronautic Defence and Space Company (EADS).

Dr White was recognised as an outstanding early career scientist at the Cooperative Research Centres Association’s 2009 conference in Canberra, where he was one of just eight researchers from around Australia, and the only engineer, selected for the event.



# REVOLUTIONISING AIR TRAFFIC CONTROL



“ These new cohesive systems will enable humans to increase their capacity to deal with the world’s increasingly crowded airways. ”

Paul Simon,  
School of Aerospace, Mechanical  
and Manufacturing Engineering

RMIT research into new ways of managing air traffic could revolutionise the way planes fly and are tracked. Ultimately it could reduce flight times, put more control into the hands of the plane’s flight crew, and result in more eco-friendly flights.

Currently when you board a plane to fly from Melbourne to Sydney, you probably think that the plane flies in a straight line between the two cities. However, in reality, the airspace in the sky is divided into “roads” for planes that are controlled by air traffic control.

RMIT’s Associate Professor Cees Bil said human air traffic controllers can only monitor a certain number of planes at one time.

“As the number of flights increases, the airspace is sub-divided into smaller sections with additional air traffic controllers to look after each section,” he said.

“Each air traffic controller passes the aircraft on to the controller for the next section. This increases the number of handovers, the workload and also the chance of errors.”

Another myth is that planes’ flight paths can be tracked as they fly around the world, but this is not strictly true.

“Over land, planes can be tracked by radar or signal their position to a ground station, but once a plane is flying over the ocean, radar can no longer be used. Instead, the plane’s position is called in by the pilot at set intervals. So we can estimate the plane’s position, but there is no automatic tracking,” Associate Professor Bil said.

This means that when planes fly long haul, for example from Los Angeles to Melbourne, they allocate a buffer zone between planes flying the same route.

“A plane will take off from LA and fly to Melbourne and then no other planes will be allowed to take off on that route for a certain period of time. The buffer zone is to make sure that planes maintain safe separation over the ocean, where their exact positions cannot be tracked in real time.”

As airspace becomes more crowded, and with the world’s air traffic increasing 5 per cent annually, the research by RMIT is much needed and well-timed.

“The air traffic management system we are researching looks at automatic aircraft tracking using satellite-based rather than ground-based systems. This can cut down the buffer zone between planes on long haul flights and makes more efficient use of airspace capacity,” Associate Professor Bil said.

“The concept is based on transmission of an aircraft’s position and flight plan information to a satellite, which is then broadcast back to other aircraft and air traffic controllers in the vicinity. In addition to knowing the positions of aircraft in a wider area, we also know where they intend to go”.

For example, planes in a given airspace will each know the others’ intentions well in advance and the system will allow users to compute each plane’s recommended speed and altitude co-operatively. This will avoid any conflicting flight paths and associated expensive re-routing.

“In addition, this technology allows each aircraft to act as a weather station and share this valuable information with other aircraft. For example, if a Qantas plane flying from Los Angeles to Melbourne encounters bad weather it can inform a United flight that is two hours behind and the United plane can divert to avoid the storm,” he said.

Improvements in air traffic control management will also cut down on waste of time in the skies and other inefficiencies and can result in a saving in fuel burn of between five to eight per cent, making flights more environmentally friendly as well.

Project researcher and PhD student, Paul Simon, from RMIT’s School of Aerospace, Mechanical and Manufacturing Engineering, said that technological innovations for managing airways have stagnated since the middle of last century.

“With the skies becoming increasingly crowded and no signs of this slowing down, more accurate systems are needed to make flying and flight management more efficient,” Mr Simon said.

“These new cohesive systems will enable humans to increase their capacity to deal with the world’s increasingly crowded airways.”

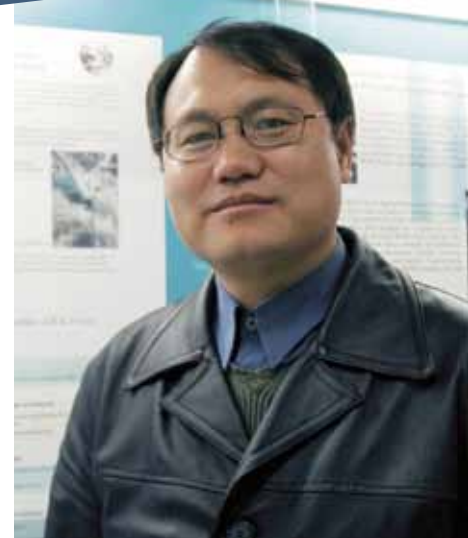
INTERNATIONAL

# SPACE TECHNOLO



“ We expect it will lead to a significant global competitive advantage for Australian companies involved in the use of advanced space technologies for positioning, tracking and environmental monitoring. ”

Professor Kefei Zhang,  
RMIT University School of Mathematical and Geospatial Sciences  
and Director of the Centre of Surveying, Positioning and Navigation



# GY CONSORTIUM

An RMIT-led research team has received significant funding from the Australian Government in support of a new \$7 million international space technology consortium.

A grant of \$2.85 million from the Australian Space Research Program, in addition to funding from partner organisations, will allow a team of national and international researchers to develop advanced platform technologies for space, atmosphere and climate research.

Professor Kefei Zhang of RMIT's School of Mathematical and Geospatial Sciences, who is also Director of the Centre of Surveying, Positioning and Navigation, is leading the expert team (listed below right).

The 'Platform Technologies for Space, Atmosphere and Climate' project will develop a suite of satellite-based technology platforms for the purposes of in-space tracking and navigation, precise positioning, space weather, atmospheric modelling and climate monitoring.

Professor Zhang said: "This is a significant step forward to position us into the space-related future. The consortium brings together key researchers to address important and challenging scientific and technical issues."

Real-time orbit determination, precise satellite positioning and atmospheric studies are critical for space situational awareness, as well as for the maintenance and operation of satellites. This research will make a major contribution to the space industry in efficient and effective space tracking, PNT (positioning, navigation and timing), debris surveillance and collision avoidance, and in the design, launch and operation of future Australian micro and nano satellite missions.

"We are intending to develop new algorithms and enhanced atmospheric models in the context of the latest Global Satellite Navigation Systems (GNSS), which will enhance Australia's capability in space research and meteorology," Professor Zhang said.

"For example, we aim to achieve an order of magnitude improvement in atmospheric mass density modelling, which will lead to a significant breakthrough in space tracking and orbit prediction."

Climate change and hazards such as tropical cyclones, drought, extreme heat and bushfires are serious problems faced by Australia. The insufficient density of ground-based meteorological observation stations – particularly in the Southern Hemisphere – and the lack of accurate data over the world's oceans and polar regions, significantly limits the accuracy and reliability of the current climate models. There is a need for new observational techniques to be developed and evaluated to gain an improved understanding of climate change in the Australian region.

Satellite-based remote sensing provides a low-cost, powerful means of precise measurement of characteristics of the earth environment on a global scale. This project will explore the acquisition, data processing and models that the new-generation GNSS and geo-environmental satellite programs offer for space, atmosphere and climate research, particularly in the Australian context.

Success of this research will put Australia in a leading position world-wide in the study of atmospheric mass density and innovative applications of satellite technologies in PNT, climate and space weather.

"Geo-environmental satellite programs such as the Constellation Observing System for Meteorology, Ionosphere and Climate (COSMIC) will allow high-accuracy monitoring of climatic hazards," Professor Zhang said. "This will represent a vital step in improving understanding of the impact of climate change on Australia."

"The platforms developed will enhance our capacity and play a critical role in supporting the Australian space industry for technological innovation and future Australian satellite missions."

"We expect it will lead to a significant global competitive advantage for Australian companies involved in the use of advanced space technologies for positioning, tracking and environmental monitoring."

The project is being funded as part of the Federal Government's Super Science Initiative with the goal of promoting new opportunities, linkages and investment in Australian space science and innovation.

Innovation Minister Senator Kim Carr said: "The projects we are funding will promote new opportunities and investment in Australian space science."

"Australia can be a serious player in the global space industry if we focus on niche areas that match our special capabilities. That is what these projects do."

## AN EXPERT TEAM

The key collaborators in the 'Platform Technologies for Space, Atmosphere and Climate' project include:

- » Professor Kefei Zhang, Dr Robert Norman and Dr Chuan-sheng Wang, RMIT University
- » Professor Peter Teunissen, Curtin University of Technology
- » Professor Chris Rizos, University of NSW
- » Professor John Le Marshall and Professor Yuriy Kuleshov, Bureau of Meteorology
- » Dr Jizhang Sang and Dr Craig Smith, Electro Optic Systems
- » Mr Graeme Hooper, GPSat Systems Australia
- » Professor Yuei-an Liou, National Central University, Taiwan

In conjunction with:

- » World Data Centre for Meteorology
- » Taiwan National Space Organisation

ADVANCED

# TEX-TILES

## LABORATORY

Australia's textile industry received a technological boost in 2010 through the opening of a \$2 million Advanced Textile Materials laboratory launched at RMIT.



A thermal mannequin will enable researchers to study the response of human skin to different textiles

The controlled-environment laboratory within RMIT's existing advanced materials testing studio features state-of-the-art testing and development equipment including organic carbon gas analysis, spectrophotometry and devices to measure the moisture and air permeability of different textiles.

Researchers and students will have access to a weatherometer for simulating the impact of the natural environment on textiles, and a thermal mannequin to enable observation of how the skin responds to different textiles.

Textiles are used extensively in the aviation and aerospace industry, with composite textiles often cited for their structural performance and light weight. Other end uses are floor coverings, non-woven fillings, upholstery, uniforms and flame-resistant apparel with superior comfort.

Keith Cowlshaw, head of RMIT's School of Fashion and Textiles, said the new laboratory would allow RMIT to develop research, testing and education capabilities focused on textiles technology.

"The facility will have relevance to a wide range of industry applications including aviation and aerospace," Mr Cowlshaw said. "We will be able to test materials for structural performance and against specific criteria such as moisture management, flammability and chemical content.

"Our new laboratory will allow researchers to assess new and existing products including nanofibres and nanowebs for their application into aviation and aerospace. It significantly expands our capability to better service the development of advanced materials for a range of end uses within the industry.

Sustainability and green certification are the future for textiles, and this new laboratory will help Australia's textile industry enhance and develop products that are both high-performing and environmentally-friendly," he said.

"We are focusing on performance apparel, the analysis of contaminants in textile materials and the establishment of a testing regime to inform environmental textile and clothing standards in Australia."

The new equipment will be used to teach students about impurities in textiles and the durability and performance of products using alternative resources, and to apply this knowledge in designing 'green' textile products.

"We are working closely with industry to provide in-depth, quantitative assessment of sustainability by analysing carbon emissions, water quality, contamination and energy management in textile and garment designs," Mr Cowlshaw said.

The School also has knitting and weaving facilities to create various composite structures with aramid, glass and other synthetic fibres needed in the aerospace and automotive industries including 3D and seamless structures.

RMIT's advanced material testing laboratory will strengthen research and development in high-performance textiles.

“ This is a first in Australia. As a worldwide engineering innovator, LMS is able to play an important role in keeping the local industry up to speed with what is happening around the globe. ”

Boris Marrone,  
South-East Asia/Pacific Area Manager, LMS International

## RMIT & LMS INTERNATIONAL— THE AUSTRALIAN CENTRE OF EXPERTISE IN **NOISE, VIBRATION, HARSHNESS**

A leading Belgium-based technology partner for the automotive and aerospace industries has taken a key role in the establishment of a collaborative research centre with potential benefits for students and for the local industry.

In 2009, RMIT established the Australian Centre of Expertise in Noise, Vibration, Harshness (NVH) in collaboration with LMS International, a world leader in simulation and testing technology.

The centre's laboratories at RMIT utilise LMS equipment and specialise software for modal analysis, spectral testing and sound intensity measurements, including an advanced multi-channel acoustic camera, providing unique capabilities for both internal and external acoustic field mapping.

The NVH centre provides an innovative model for academic and industry engagement. Its activities consist of education and research, with RMIT students also given the opportunity to undertake internships at LMS International's offices world-wide.

South-East Asia/Pacific Area Manager for LMS, Boris Marrone, said this is a first in Australia.

“As a world-wide engineering innovator for companies in the automotive, aerospace and other advanced manufacturing industries, LMS is able to play an important role in keeping the local industry up to speed with what is happening around the globe,” Mr Marrone said.

“We are keen to support the industry in Australia by enabling the use of our equipment, providing regular technology updates, and offering seminars for students and industry professionals.”

For students, this will mean the opportunity to engage in work-simulated learning and research activities using state-of-the-art equipment with technical input provided through the involvement of industry experts.

Head of RMIT's School of Aerospace, Mechanical and Manufacturing Engineering, Professor Aleksandar Subic, said the partnership provided a new way for industrial partners and universities to undertake joint research activities and develop complementary expertise in a specialised area of strategic importance, both nationally and internationally.

“The joint centre brings together LMS's know-how in instrumentation, simulation and testing, and RMIT's expertise in NVH research, education and application for aircraft and road vehicles.”

“ .....manufacturers have to become more performance focused with aircraft design being only a small part of the total life-cycle of a product. ”

Associate Professor Cees Bil

RMIT University School of Aerospace, Mechanical and Manufacturing Engineering



# A SERVICE DRIVEN APPROACH FOR AIRCRAFT MANUFACTURERS



Up until now, aircraft manufacturers have concentrated on designing and building planes that they sell to operators. Once the planes are delivered, that's usually the end of the exchange, apart from spare parts. However, this way of supplying planes is changing.

RMIT's Associate Professor Cees Bil (pictured above) said aircraft users are moving towards an arrangement that is more service-driven.

"For example, instead of an aircraft manufacturer selling planes to a government for military use, the customer is now asking the manufacturer to guarantee a minimum number of serviceable aircraft at any time. In the case of pilot training, this could mean supplying fully-maintained aircraft to support a certain number of pilots per year to complete their training," Associate Professor Bil said.

"This changes the business dramatically. As well as designing and building aircraft, manufacturers are now maintaining planes for a performance-based contract rather than just delivering the finished product," he said.

An RMIT PhD engineering candidate, Luke Webb, is investigating the issues associated with this change of focus for aircraft manufacturing companies—for example, access to design information of middle-aged aircraft, knowledge capture and retention, and customer relations. The project is supported by BAE Systems Australia.

There is a real culture change for manufacturing companies in the shift to service provision.

"It results in more ongoing design activity and organisational concerns for a manufacturing company, now having to focus on plane design and delivery as well as ongoing maintenance and support," Mr Webb said.

Customers are moving to this service-driven approach for a variety of reasons.

"Firstly, it means customers pay for what they really need: a service or a capability. Secondly, the risks associated with sustaining the required level of service or capability over a period of time are transferred to the manufacturer," Mr Webb said.

This allows the operator to concentrate more on core competencies—training personnel and flying aircraft. This trend towards the service-driven approach is happening in all sectors of the industry, from defence to commercial airlines.

"To an operator the aircraft or helicopter is a means to an end, not the end. For the service-driven approach, manufacturers have to become more capability or performance focused with aircraft design being only a small part of the total life-cycle of a product," Associate Professor Bil said.

Providing guarantees on performance over the life of the aircraft has become the new way of doing things, which is a significant change in the business model for traditional manufacturers.

"The RMIT project is not a typical engineering assignment, as it involves complex service issues such as business ethics, human relationships and commercial activities rather than just straight engineering," Associate Professor Bil said.

"However, it's an interesting one to work on and particularly relevant to the Australian environment, where system integration and support is a large part of the business compared to aircraft design and manufacture."

To meet this need and to take advantage of Australia's strengths and competencies in this area, RMIT's School of Aerospace, Mechanical and Manufacturing Engineering is introducing a new Master degree in Systems Support Engineering from 2011.

“ Production Parts operates in the defence and aerospace sectors at world’s best practice standards, and we are very excited to be partnering with them in this vital project. ”

Professor John Mo,  
Discipline Head, School of Aerospace, Mechanical and Manufacturing Engineering

# OPTIMISING TITANIUM MACHINING FOR THE JOINT STRIKE FIGHTER

An advanced capability in high-speed machining of complex titanium alloy components for the aerospace industry—that is the goal of research being undertaken at RMIT with industry partner, Production Parts Pty Ltd.

There is a significant shift occurring in a number of manufacturing sectors, with composite materials, titanium and superalloys replacing aluminium. Very light, strong materials that can reduce weight and therefore energy consumption are being sought by many manufacturers in areas which include aircraft and renewable energy systems.

Demand for cost-effective, high-performance aircraft has been driving the industry to use non-traditional materials and design for aircraft structures. To support the new-generation aircraft design philosophy, the use of larger single components to replace assembled components is growing.

Director of Production Parts, Peter Nicholls, said: “Titanium alloys have the advantage of a greater strength-to-weight ratio than aluminium and steel. New aircraft designed with thin-walled unitised monolithic structures deliver more reliable outcomes, while at the same time significantly reducing manufacturing times.”

To meet this demand, a collaborative research project is aiming to develop new methods and systems that will substantially improve on the slow titanium machining that currently operates in the industry.

Professor John Mo, Discipline Head of Aerospace, Mechanical and Manufacturing Engineering at RMIT, is leading the research in conjunction with Production Parts, a specialist supplier of high precision aerospace components. Production Parts was one of the first Australian companies to participate in the manufacture of titanium and aluminium components for the Joint Strike Fighter.

“Our project has three main objectives—faster machining, utilisation of existing equipment and greater efficiency in production processes,” Professor Mo said.

“We are investigating the cutting parameters and machine tooling to facilitate metal removal rates from forged titanium raw materials at greater rates than currently achieved using conventional methods.

Our aim is to reduce machining times by a factor of 10, with operational cost reductions of up to 70 per cent.”

The potential world market for exotic metal machining is \$3-4 billion per annum, with continuing strong annual growth expected over the next 10-year period.

“The ultimate goal is to develop an integrated material processing capability which will represent a quantum leap in enabling Production Parts to compete successfully against an elite group of leading international suppliers in this high potential but demanding market sector,” Professor Mo said.

“Production Parts operates in the defence and aerospace sectors at world’s best practice standards, and we are very excited to be partnering with them in this vital project.”



Working towards high speed machining of titanium alloys at Production Parts



# AEROSPACE ENGINEER KNOWS NO BORDERS

## RMIT ALUMNUS OF THE YEAR

Aerospace Engineer and young entrepreneur with a passion for helping others became the third recipient of RMIT's Alumnus of the Year award in 2009. Daniel Almagor's achievements since graduation have demonstrated a commitment to excellence, dedication to communities who need a helping hand, and a vision for future RMIT students to aspire to.

After completing a double degree in Aerospace Engineering and Business Administration in 2001, Mr Almagor founded not-for-profit organisation Engineers Without Borders Australia (EWB). EWB partners with disadvantaged communities worldwide to improve their quality of life through education and the implementation of sustainable engineering projects. It now has 20 active chapters around Australia.

Past EWB projects include the development of a wind turbine to produce electricity for remote areas in Nepal, a computer project for refugees around Australia and for an orphanage in India,

biomedical training in Cambodia, water treatment in East Timor and road assessment in an indigenous Australian community.

As well as working as CEO of EWB, Mr Almagor is Managing Director of national vaccination company Medivax. He is a Churchill Fellowship recipient and in 2005 was named among the 100 most influential engineers in Australia.

The Alumnus of the Year is awarded to graduates whose endeavours after their time at RMIT reflect the work ethic and values of the University, and who have used the education they received at RMIT for the greater good. In accepting the award, Mr Almagor said he began mapping out his future at the age of 21 one Friday afternoon in an Aerospace Engineering class. "My mind started racing and I talked to classmates about what we as engineering students could do to make a difference and help people in need," he said.

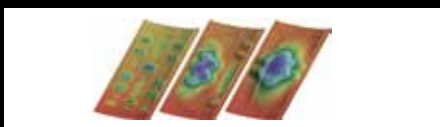
After leaving RMIT, he established EWB as a framework for young engineers to support disadvantaged people through small scale engineering and capacity building projects.

"I love being busy, especially when you know it's all for a good cause. I wake up in the morning and feel great. You know that you're contributing to help those who really need it."

## TALENTED YOUNG RESEARCHER

Dr Adrian Orifici graduated from RMIT with a PhD in Aerospace Engineering in 2007. He now conducts research as part of the Cooperative Research Centre for Advanced Composite Structures (Composites CRC), which has included projects in damage models for composite materials, postbuckling aerospace structures, multi-axial material characterisation and failure, aircraft repair, automated modelling and analysis tools.

Dr Orifici also works as a Senior Lecturer in the School of Aerospace, Mechanical and Manufacturing Engineering and is responsible for teaching activities in the field of aerospace structures. He was a recipient of the 2008 RMIT Emerging Researcher Grant award and his research involves the design and analysis of aerospace structures with a focus on fibre-reinforced composite materials.



Dr Orifici finds his field of research rewarding and also values "being part of a supportive and collaborative team of experienced researchers in aircraft structures and composite materials which includes fellow staff, students and colleagues from institutions such as the Composites CRC as well as industry partners".

"Composite structures are one of the key technologies for tomorrow's aircraft, so improving our understanding of how they behave and how to analyse them is critical for the aerospace industry" said Dr Orifici.

RMIT is proud to be a core member of the Composites CRC which has established an international reputation and is rated as one of the top centres in the world in the field of composite research. The centre works to develop advanced technologies which foster the growth of an efficient, globally-competitive, Australian composite industry. This is achieved by conducting research and development programs into the design, manufacture, testing, durability and supportability of advanced composite structures.





Dr James Waldie flew on a zero-gravity aircraft to test the comfort, mobility and material properties of his skinsuit.

RMIT ALUMNUS SHOWS

# NASA

THE FUTURE OF

# SPACE SUITS

RMIT alumnus Dr James Waldie is working on a range of next-generation spacesuits for NASA and other space agencies to use on missions to the moon and Mars.

Dr Waldie's gravity-loading skinsuits tackle a significant health problem faced by astronauts—extreme bone loss—by mimicking the effect of gravity on the skeletal system.

A Postdoctoral Scholar at the prestigious Massachusetts Institute of Technology in Boston, Dr Waldie developed the concept for the skinsuits while studying for his PhD at RMIT. His research is co-sponsored by the European Space Agency.

Following successful testing on a zero-gravity aircraft, five-time shuttle astronaut Jeff Hoffman, who is currently seconded to MIT from NASA, said the innovative skinsuit "could be a tremendous breakthrough in solving one of the fundamental problems of long-duration space flight".

The gravity-loading skinsuit replicates the normal forces of standing on Earth, so it makes the body think it needs to be strong even in the weightlessness of space.

Dr Waldie explained: "On Earth, our bones are strong enough to support and move our body mass, but in space astronauts float around without any weight or loading," he said.

"Their bodies adapt by allowing their bones to weaken at an alarming rate. It's like an extreme version of osteoporosis.

In research that bridges science fiction with reality, Dr Waldie is also working on skinsuits for spacewalks on Mars. He has studied the physiological aspects of the suits in vacuum chambers and looked at their mobility advantages by conducting simulated spacewalking tasks in the Australian outback with the Mars Society of Australia.

"The current Apollo spacesuits are big body-shaped balloons—they let you take a bit of the atmosphere around with you when you go for a spacewalk," Dr Waldie said.

"They are a marvel of engineering, but because they're inflatable they become bulky and rigid in space. Future explorers of Mars will require safe, light and flexible suits for years of use.

"Skinsuits may be able to offer that technological leap."

# GLOBAL ADVANTAGE

RMIT actively encourages students to consider working, studying or undertaking research overseas, as part of the University's work-integrated learning and global engagement strategies.

A key platform in enabling student mobility is the RMIT International Industry Experience and Research Program (RIIERP). Every year, this innovative program enables up to 200 RMIT students to obtain international work experience and research project involvement with partner organisations in 16 countries.

By establishing links with some of the world's leading companies and providing unique opportunities for work experience, RIIERP enables students to gain the experience, attributes and ability they need to pursue their careers worldwide.

The highly regarded program includes industry work experience, graduate traineeships, final-year projects, postgraduate research and postdoctoral research fellowships.

Overseas work placements, usually of six to 12 months duration, are available in Europe, Japan, Britain, Canada and the United States. On-the-ground training, overseas networks and the opportunity to see world's best practice first-hand are some of the many benefits that these placements provide. Students are exposed to the global aviation industry, and their learning is tested and tuned in the global marketplace.

RIIERP is open to undergraduate and postgraduate students, with places offered on the basis of academic merit and interviews to determine candidate suitability. The program is currently being expanded to include vocational education students, as well as students from RMIT Vietnam.

RIIERP Director, Professor Sylvester Abanteriba, said RMIT provides graduates with a global passport—a qualification that arises not only from an internationalised curriculum delivered by globally experienced academic staff, but one that incorporates experience of world's best practice.

"RIIERP is an important part of the University's strong commitment to delivering training that's industry-relevant, backed up by international work experience with some of the major aviation companies in the world," he said.

"RMIT students who work overseas with the program gain the advantage of developing skills in new and challenging environments. They are exposed to different work practices and cultures, and gain hands-on experience which in turn benefits employers in Australia and internationally."

More than 1,700 students have participated in the program since it commenced in 1992. Placements run for six to 12 months for undergraduate students and two to three years for Master and PhD research programs.

The postgraduate research component of the program facilitates access to state-of-the-art research facilities and expertise at best practice companies world-wide.

Currently, 165 international companies are involved in RIIERP. The program has particular strengths in aerospace and aviation, as well as in the automotive industry. RIIERP partners include such prestigious names as Airbus, EADS, Bentley Motors, the Siemens Group, IBM, BASF, Robert Bosch, Volkswagen and the Rolls-Royce Group in North America and Europe.

Partner companies have developed a high level of confidence in the capabilities of RMIT students, and this has enabled RIIERP to introduce a special projects component under which companies send projects to RMIT to be undertaken by students while they attend their usual classes.

This initiative has facilitated cross-disciplinary project participation and has extended the number of opportunities for global work experience available to students. Students acquire skills in working in a consulting capacity as they manage the projects without hands-on supervision using appropriate means of communication with overseas companies.

RMIT students who have been involved in RIIERP are highly sought after. International work and study experience are recognised as assets by a growing number of companies.



## EXPERIENCING THE

# F1 FIGH

Rolls-Royce and RMIT have a strong, collaborative partnership in which students contribute to the F136 Fighter Engine team based in Indianapolis, while acquiring invaluable experience in the international business arena.

The GE/Rolls-Royce Fighter Engine Team joint venture is a transatlantic collaborative program created in 2002 to develop the F136—the world's most advanced combat engine—for the Lockheed Martin F35 Joint Strike Fighter.

The F136 is a 40,000 lbf class, two-shaft engine specifically designed to be interchangeable across the three variants of the F35 aircraft. Rolls-Royce responsibilities include the three-stage fan, combustion system, LP turbine and accessory gearbox.

# TRANSATLANTIC COLLABORATION



# 36 TER ENGINE

Jason Seris worked as an intern at Rolls-Royce in Indianapolis while completing a Bachelor of Engineering (Aerospace) at RMIT. He has since become the first Australian to be chosen for Rolls-Royce's prestigious North American leadership development program.

Mr Seris said he feels privileged to be part of the program. "Going to the other side of the globe to work on the F136 program has been such a fantastic experience and has allowed me to gain invaluable skills and experience in one of the world's leading power systems companies.

"I'm very excited to gain a position on the Graduate Leadership Development Program and continue my career with Rolls-Royce."

Mr Jim Payton, Director of Business Development for Rolls-Royce's Fighter Engine Team, believes that RMIT not only prepares its students academically, but "they join us with a level of professional maturity that allows them to join the team and contribute immediately".

"Jason was able to roll up his sleeves and go to work the day he joined the program," Mr Payton said. "Our North American leadership development program is a natural progression for him. It will further develop the talents that Jason has already demonstrated. I know he will continue to enrich Rolls-Royce.

"Australia is a leading partner in the Joint Strike Fighter program, and Jason and his fellow RMIT interns are making a real contribution to the development of the F136 engine which will power that aircraft."

Engine giant Rolls-Royce is one of a number of companies giving aerospace engineering students the chance of a lifetime to gain international work experience.

RMIERP Director, Professor Sylvester Abanteriba, said Rolls-Royce had been taking RMIT interns since 2002. "Including this year's intake, 20 had worked at the Derby plant in England, 15 at Dahlewitz in Germany and five in Indianapolis, US," Professor Abanteriba said.

"We very much appreciate the support of industry partners like Rolls-Royce in providing our students with the necessary industry experience," Professor Abanteriba said.

"The technical skills imparted to our students by the highly professional GE/Rolls-Royce team, augmented by the knowledge from RMIT's excellent teaching and learning programs, ensures the quality of our graduates as competent professionals in an increasingly globalised economy."

**"Jason and his fellow RMIT interns are making a real contribution to the development of the F136 engine which will power the Joint Strike Fighter."**

**Mr Jim Payton, Director Business Development, Rolls-Royce Fighter Engine Team**

# A DIFFERENT

# PATHWAY

# - WAY TO INDIANA

Thanks to the flexibility offered by RMIT's dual sector pathways, RMIT graduate Robert Buettner has successfully completed an unlikely four-year journey from his family home in the Melbourne suburb of Frankston to his current position with aerospace giant Rolls-Royce.

After completing secondary school, Mr Buettner didn't quite get the marks he needed for entry into an engineering degree. So he chose instead a vocational pathway, completing an Advanced Diploma in Engineering (Aerospace-Mechanical) at RMIT before transferring to the Bachelor program in 2008.

In the third year of the degree, he decided to apply for the RMIT International Industry Experience and Research Program (RIIERP) which gives students the opportunity to take up overseas work placements with some of the world's leading companies.

After a rigorous interview process, Mr Buettner was delighted to be accepted as the 2010 RMIT intern with the Business Development office of Rolls-Royce's F136 Fighter Engine Team in Indianapolis. He will return to Melbourne to complete his final year of study in 2011.

Mr Jim Payton, Director of Business Development for Rolls-Royce's Fighter Engine Team, believes the RMIT program takes the traditional internship to a new level. "Students like Rob make the program such a success," he said.

"These students are redefining the concept. They come to us with loads of academic-based tools, and are able to apply those tools to our practical situations. They leave with real-world experience that makes the remainder of their education much more meaningful. It's win-win for everyone."

To date, Mr Buettner has taken on a wide range of responsibilities including working with the team to ensure all of the F136 suppliers are ready to begin initial production, designing presentations for meetings with military and government officials, developing business process flow charts and chairing meetings.

"I am also able to do my thesis while I'm over here, which means having access to Rolls-Royce staff for advice, as well as the use of their extensive library resources," Mr Buettner said.

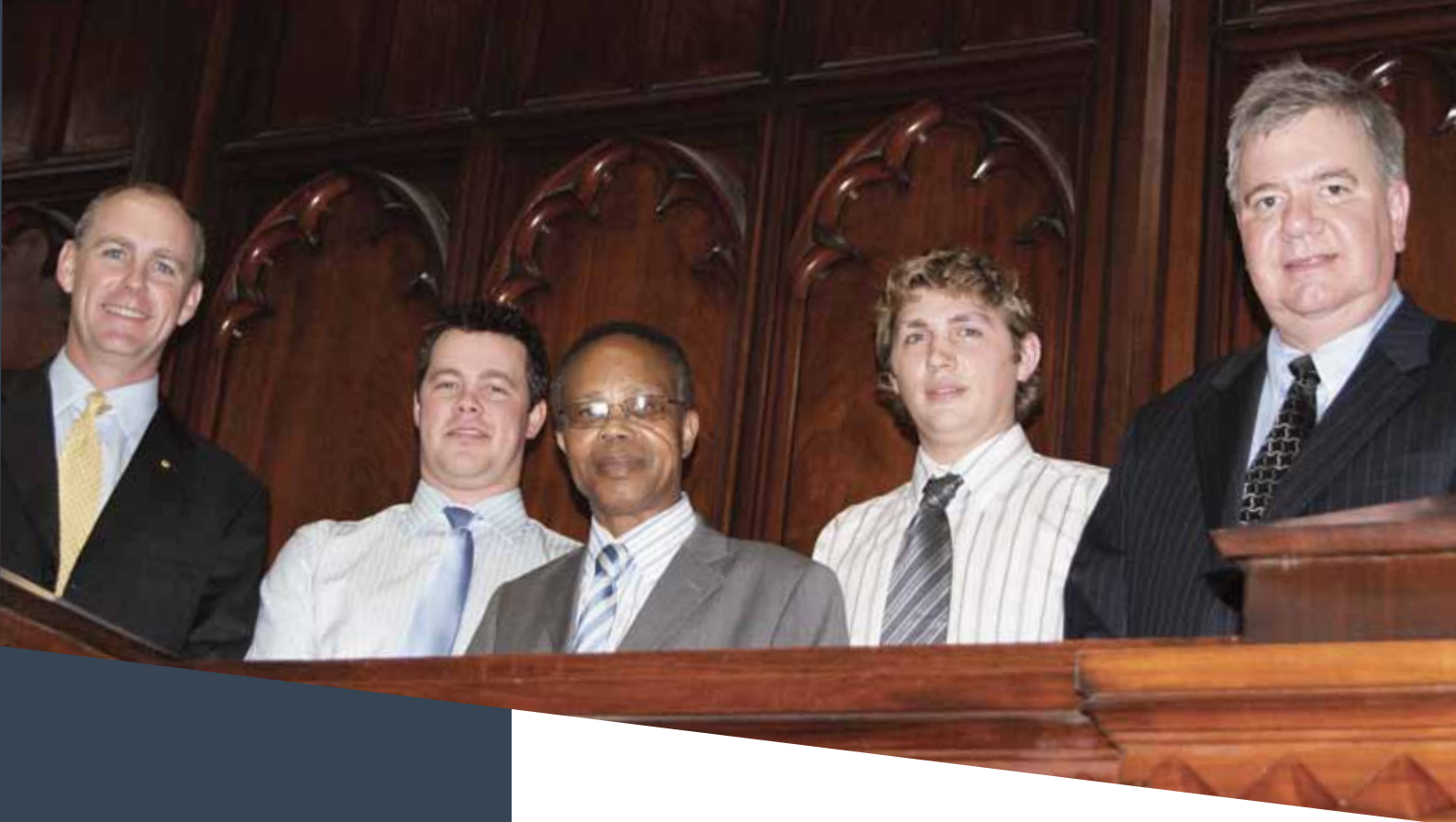
"I was proud to be chosen by RIIERP after articulating from vocational education to a degree program. It's good to be here and I'm very excited about the opportunity to contribute to one of the greatest engine manufacturing companies in the world".

## DUAL SECTOR ADVANTAGE

RMIT University is in the unique position of offering an extensive range of diploma and certificate programs as well as undergraduate, postgraduate and research degrees.

As Australia's largest dual-sector university, RMIT is able to provide options of work-relevant pathways between vocational and higher education, and dual-sector qualifications combining the best of both.





# FROM ROLLS ROYCE TO SCHOLAR LAUREATE

Aerospace Engineering and Business Management student Nick Bradley was selected to take part in the 2009 International Scholar Laureate Program after completing an internship with Rolls-Royce in Indianapolis.

The prestigious program was held over 10 days in New York, Boston and Washington DC.

“Mr Bradley had done an outstanding job with the F136 program, making significant contributions to the entire team while also being a pleasure to work with,” said Mr Jim Payton Director of Business Development for the Rolls-Royce Fighter Engine Team. “Acceptance into the ISLP was a well-deserved honour for this future leader in the aerospace industry”.

“We could not develop and continue programs like this without students such as Nick who demonstrate the leadership potential to make the programs a viable investment for Rolls-Royce.”

Nick Bradley added: “The knowledge I gained from my time at Rolls-Royce and my involvement in ISLP has given me first-hand experience in understanding how to be the leader of an international team, how to analyse your product in competitive sales environments, and most of all how to operate within a leading global organisation.”



Nick Bradley stands beside the Charging Bull in Wall Street, New York City

Image above (L to R): Andrew Dudgeon AM, CEO, Rolls-Royce Australia Services; Jason Seris, RMIT graduate; Professor Sylvester Abanteriba, RMIT RIIERP Director; Robert Buettner, RMIT graduate; Jim Payton, Deputy Director Business Development, Rolls-Royce



# FLYING INTO HISTORY

## AUSTRALIA'S FIRST FLIGHT

It is well known that two Americans, the Wright brothers—Orville and Wilbur, designed and built the world's first successful airplane and made the first controlled, powered and sustained heavier-than-air human flight on 17 December 1903 in the USA.

But who made the first flight in Australia?

Everyone agrees on the year, 1910, but there isn't a definitive answer to who flew that first plane.

RMIT's School of Aerospace, Mechanical and Manufacturing Engineering, together with the Royal Aeronautical Society in Melbourne, will celebrate the centenary of Australia's first flight in August this year.

RMIT's Associate Professor Cees Bil said that four or five people flew airplanes in 1910 in Australia and any of them could be credited with the nation's first flight.

"As it's the centenary of the first flight in 2010, we have chosen Australian flight pioneer John Duigan to represent everyone who flew back in 1910. Mr Duigan designed and built his own aircraft and made the first flight in Australia in Victoria on 16 July that year," he said.

The plane Mr Duigan built and flew was made of wood, wires and cloth, and he modified an existing engine. The undercarriage was made of bicycle wheels and the whole plane was open to the elements.

"It really was a time of trying out new ideas to see if they would work, sometimes risking their own lives in the process. Ultimately, they laid the foundation for modern day aviation that we now take for granted," Associate Professor Bil said.

Three students from the School—Stratos Patsikatheodorou, Gregory Till and Thanh Trieu Alex Nguyen—have developed a flight simulator environment for the Duigan aircraft. It involved building a computer-aided design model, as well as a dynamic model that simulates aircraft motion control inputs.

Mr Patsikatheodorou said: "Back then, aircraft builders and pilots did not have all the knowledge about building and flying planes that we have access to today. If something didn't work properly, you just altered it and tried again.

"For example, the front section of the aircraft turned out to be too long, causing the plane to tilt up and down. Instead of building a new front section, Mr Duigan cut the plane length down, pulled it back and re-riveted it on to the rest of the plane. It really was a process of trial and error."

Image: Stratos Patsikatheodorou,  
Alex Nguyen and Greg Till

“ RMIT women graduates are being recognised as future leaders by industry both in Australia and internationally. ”

Professor Aleksander Subic, Head of School, Aerospace, Mechanical and Manufacturing Engineering



Head of School, Professor Aleksandar Subic, said it was part of RMIT's mission to enable young women to develop advanced engineering capabilities to meet the challenges of a changing world.

“There's still an idea that engineering is for men, but the reality is changing rapidly,” Professor Subic said. “We're aiming to move engineering away from being male-dominated, and to encourage young women to consider engineering as a profession, as opposed to traditional disciplines.”

“Our women graduates are being recognised as future leaders by industry, both in Australia and internationally. RMIT provides young women with quality learning, and can also offer them international work placements and challenging multi-disciplinary research projects. The scholarships make it even easier for young women to study engineering with us.”

For scholarship recipients Betul Tok and Kariza Martin, the dearth of female students is evident in their classes. “There can be as few as 8 girls in a class of over 100,” Ms Martin said.

“But if you like what you're doing, it really shouldn't matter,” she added.

Ms Tok and Ms Martin commenced an Engineering (Aerospace Engineering) and Business (Management) double degree in 2010. They were delighted to receive RMIT Women in Engineering scholarships after their strong outcomes in Year 12.

“Through all of Year 12, I devoted time to my study and chose not to work,” Ms Tok said. “The scholarship makes that effort worthwhile by providing a tangible reward. It's a way of supporting myself.”

Ms Martin said the scholarship gave her the motivation to study more and apply herself throughout the course. “I feel like I need to earn it—to live up to the trust placed in me,” she said.

Both girls chose aerospace engineering because of their strengths in physics and maths, as well as a shared ambition to work in a space program. “I want to be involved in going searching for the universe,” Ms Martin said.

They chose RMIT because of its long track record of successful outcomes in engineering. “RMIT's is the longest established program and I heard how the University gives its students work experience in the field. I'd love to work overseas and I think RMIT gives me the best chance of achieving that.”

“I'm really enjoying the course,” Ms Tok said. “It's what I expected and more. We've been able to see how what we've learnt is applied in real-life situations in aerospace around the world, such as how momentum is applied for lift-off.”

“The teachers have been good at introducing us to the actual aircraft,” Ms Martin said. “That's what I love about RMIT: it's so hands-on.”

# BOOSTING YOUNG WOMEN ENGINEERS

With severe shortages of engineers evident in Australia and elsewhere, professional bodies are warning that skills shortages could cause major delays and cost blow-outs to infrastructure projects. Industry leaders comment that Australia's ongoing economic recovery could be jeopardised if there are insufficient skills and people to fulfil critical engineering roles.

In particular, there is a recognised shortfall of women studying engineering in all of its forms, with numbers declining since 2000 rather than increasing.

RMIT has responded to this trend by taking positive steps to attract and provide support for young women entering the profession. The School of Aerospace, Mechanical and Manufacturing Engineering has introduced scholarships for talented female students commencing engineering studies.

Each year, three students who have recorded high-level results at secondary level and have demonstrated leadership potential each receive \$5,000 scholarships on entry into programs in Aerospace, Automotive or Mechanical Engineering or Advanced Manufacturing and Mechatronics.

**RMIT has access to the largest and most modern fleet of training aircraft in Australia.**

RMIT Flight Training is a specialist training unit dedicated to the training of professional pilots at all levels, locally and internationally.

It has highly qualified instructional staff with the qualifications and experience to conduct theoretical and flight training at all levels to Air Transport Pilot.

RMIT holds a CASA (Australian Civil Aviation Safety Authority) Air Operator Certificate. The University also holds approval from the General Administration of Civil Aviation of China and Oman's Directorate-General of Safety and Aviation Services to conduct flight training and testing against Australian and overseas regulatory requirements. These approvals are currently utilised for pilot training for Oman Air and for Chinese carriers including Xiamen Airlines and Air China.

RMIT Flight Training's facilities at Point Cook airfield are ideally situated with easy access to a variety of airspace, terrain and urban development, which maximises navigational experience. The 4,500 feet of airspace allows unrestricted training manoeuvres, and the low level of aircraft movements at Point Cook minimises circuit congestion and enables more take-offs and landings per hour, ensuring rapid development of basic skills and confidence.

The facilities consist of a modern, purpose-built pilot training complex that was once home to the Royal Australian Air Force's Central Flying School. Point Cook is the oldest operating airfield in the world and the birthplace of the RAAF.



# FLIGHT TRAINING

RMIT offers pilot training at all levels and has access to the largest and most modern fleet of training aircraft in Australia. Many aircraft in the fleet are equipped with glass cockpit technology.

RMIT Flight Training delivers training to two broad groups:

- » Individual students undertaking the Diploma of Air Transport (Airline Pilot) award program. This qualification also allows articulation to the Bachelor of Applied Science (Aviation).
- » Airline-sponsored cadetships, enabling airlines to seek tailored training to meet company requirements and local regulations.

All programs are designed to meet aviation industry requirements. These include:

- » Private Pilot Licence
- » Commercial Pilot Licence
- » Airline Transport Pilot Licence theory
- » Multi-Engine Endorsement
- » Gas Turbine Endorsement
- » Aerobatics Endorsement
- » Tail Wheel Endorsement
- » Night VFR (Visual Rules Rating)
- » Command Instrument Rating (all navigational aids—ILS, GPS, LLZ, VOR, NDB)
- » Crew Resource Management

RMIT pilot training programs are of the highest standards with all levels of training presented in a competency-based format.

## RMIT ENGLISH WORLDWIDE

RMIT provides English language training and testing solutions for the international aviation community through its language centre, RMIT English Worldwide.

RMIT English Worldwide (REW) is recognised internationally as a leading supplier of English language training and testing to the aviation industry. REW works with partners all over the world to offer high quality testing and training for aviation personnel to meet international aviation requirements. Delivery partners include major airlines such as Air China, Emirates, Gulf Air and Qatar Airways

International Civil Aviation Organization regulations require pilots and air traffic controllers to demonstrate proficiency in English as part of national licensing procedures. The RMIT English Language Test for Aviation (RELTA) assesses proficiency according to ICAO requirements.

RELTA is endorsed by Australia's Civil Aviation Safety Authority and the equivalent bodies in countries including Bahrain, China, Chile, Oman, United Arab Emirates, Qatar and the Netherlands.

Further information:  
[www.rmitenglishworldwide.com](http://www.rmitenglishworldwide.com)

**RMIT works with partners all over the world to offer high-quality testing and training.**

# TRAINING COMMERCIAL PILOTS FOR OMAN AIR

RMIT Flight Training has established a highly successful partnership with the national airline of Oman, Oman Air.

The first group of cadets from Oman Air undertook their commercial pilot training with RMIT during 2008 and 2009 and now work as First Officers in Oman Air's Boeing 737 fleet. The second cohort arrived at RMIT Flight Training's Point Cook facility in March 2010 and their training is well underway.

The first group of cadets, pictured below, were presented with their wings at the 2009 Australian International Airshow at Avalon Airport (Melbourne) to a highly distinguished audience.

Air Commodore Al Zubair from the Oman Air Force and Sultan Al Khaflan were visitors to the Airshow and were surprise guests at the presentation. They joined dignitaries to witness RMIT University's Vice-Chancellor and President, Professor Margaret Gardner AO, present wings to the 14 cadets from Oman Air.

The event was also attended by Hamed Mohamed Al-Hajri, Oman Consul-General; Mrs Jean Blundell-Caulfield, Academic Supervisor, Consulate of Oman; and Captain Mohammed Al-Ajmi, Fleet Captain Boeing 737, Flight Operations, Oman Air.

Captain Al-Ajmi travelled from Oman for the presentation and was responsible for the cadets' transition training on their return to Oman. Captain Al-Ajmi said: "I am very impressed with the quality of the training delivered by RMIT and the standards achieved by the students".



RMIT's Professor Gardner commended the Omani cadets: "I congratulate the cadets and thank Oman Air. We are delighted to deliver practical training engaging directly with a strong and growing airline and national carrier."

The Oman Air Cadet Pilot Training program was delivered at RMIT's world class pilot training facility at Point Cook, near Melbourne. The training is built around the CASA regulations, with significant additional training to meet the requirements of Oman Air and the Oman Director-General of Safety and Aviation Services. All cadets achieved an Australian Commercial Pilot Licence and Multi-Engine Endorsement and passed the Air Transport Pilot Licence theory subjects necessary for high performance, multi-crew airline operations.

Following their return to Oman during 2009, the cadets underwent rigorous in-house training delivered by experienced Oman Air crew, preparing them for their roles as First Officers. RMIT Flight Training was pleased to learn in early 2010 that the complete group of cadets who started during 2008 had completed the airline's in-house training and were working in their chosen career with Oman Air.

The second cohort of cadets to be trained for Oman Air are progressing well and the expectation is that they will receive their wings at a ceremony at the 2011 Avalon Airshow.

[www.international.rmit.edu.au/aviation](http://www.international.rmit.edu.au/aviation)



## GIVING AEROSPACE ENGINEERING GRADUATES AN

# EDGE



As a sessional lecturer in Aerospace Engineering at RMIT University, Group Captain John Baker (retired) is passionate about teaching students the practical aspects of this subject.

“Computer and laboratory exercises have their rightful place, but dealing with real aeroplanes is much more challenging. To me it’s really important that aerospace engineering students actually get to touch a real aeroplane, come to grips with it, find out how it works and understand it. It’s crucial to their studies and their future careers,” he said.

At Essendon Airport, where he teaches, RMIT students experience first-hand a CT4 ex-military aircraft owned by the University. Group Captain Baker runs workshops for 20 students at a time, demonstrating how the CT4 was designed and the compromises that the aircraft designer had to make in the final design.

“RMIT’s CT4 is a very practical training aid, on the ground and in the air. We remove the aeroplane’s skin panels so that students can see inside and study the plane’s structure and how it is made, joined, repaired and replaced. We also expose them to how the systems in the aircraft work,” he said.

The CT4 is a rugged aircraft that is not cutting-edge, but provides a good example of an all-metal structural design with composite panels and fairings.

“Students who excel in these workshops also have the opportunity to fly with me in the aeroplane and collect data for laboratory exercises. The data collected on these flights includes plane stability, control and performance characteristics,” he said.

The CT4 is also used by final year students as a research topic, which often results in ways to improve the design and operation of the aeroplane.

“When they are initially confronted with a real aeroplane, some students get worried. However, by the end of their studies they really value the practical aspect of working hands-on with a plane.

“For the industry, this practical learning experience adds an edge to RMIT aerospace engineering graduates, who are ahead of their contemporaries when it comes to being employed,” he said.

Group Captain Baker holds an Airline Transport Pilot Licence and a Grade One Flight Instructor Rating, along with multi-engine training approval, instrument training approval, formation, spinning and tail wheel instructor ratings. He flies exclusively for RMIT and has qualified as an Airframe and Engine Licensed Aircraft Maintenance Engineer.

He joined the Cadet arm of the Royal Australian Air Force in South Australia when he was 13 and was awarded a scholarship. After he finished school, he joined the RAAF and trained at RMIT as an Engineering Officer, graduating with an Associateship Diploma in Mechanical Engineering.

He completed 37 years’ RAAF service including numerous headquarters and unit postings. Career highlights include the introduction of the Air Element to the Papua New Guinea Defence Force and being assigned the airworthiness authority for the Defence Fleet. He also held the authority to modify any Defence Weapon System in his own right—the only authority confirmed across such a wide scope.

In 1991 he was made a Member of the Order of Australia for services to RAAF Airworthiness Engineering and was presented with the Guild of Air Pilots and Air Navigators Australian Bi-centennial award for The Most Significant Individual Contribution to Australian Aviation.

# A FLYING START WITH QANTAS

“ It gave me a great insight into the aviation industry in Australia, and the role engineers play in keeping this important transport sector in operation. ”

Thomas Kenny, *Bachelor of Engineering (Mechanical Engineering) student, RMIT University*

When the Qantas Engineering Summer School commenced in 2008, it marked a new era of engineering talent development.

The Summer School is designed to give promising third and fourth year students the chance to see what it would be like to work for one of the world's leading airlines. Students get the opportunity to apply their skills and knowledge and gain invaluable experience, while working with Qantas engineers on commercial projects that deliver tangible business outcomes.

Following its initial success, Qantas became the first organisation in the country to receive formal accreditation from Engineers Australia for the Summer School program. This means that the competencies students gain from their work experience are endorsed by the professional body and count as Chartered Engineering status credit points, as well as work placement credits.

As a partner in the program, RMIT enables students in Aerospace, Mechanical, Electrical and Computer Engineering to apply for a 12-week position with Qantas.

In 2009, three RMIT students were selected for placement, with two students based in Melbourne and a third working in Sydney.

“I worked on a major project focused on improving engineering management efficiency, which had the potential for significant financial benefits for Qantas,” RMIT Mechanical Engineering student Thomas Kenny said.

This was in addition to several projects designed to give him a taste of the work normally performed by Qantas engineers, and weekly sessions in business areas such as finance, economics and leadership.

“The working environment was fantastic, with so many Qantas staff willing to share their knowledge and experience. It gave me a great insight into the aviation industry in Australia, and the role engineers play in keeping this important transport sector in operation.”

Frank Fajarda, Organisational Development Manager for Qantas Engineering, said the work completed by the students was of an excellent standard.

## ROBOTIC AIRPORT LUGGAGE TRANSPORTER



This year's first prize for the ENGenius Trade Fair was a Robotic Airport Luggage Transporter invention. The major prize of \$3,000 was awarded to Adam Chrimes, James Anderson, Stefan Heaton and Daniele Arena (pictured above).

This annual event is organised by RMIT's School of Electrical and Computer Engineering with strong support from industry. It showcases the talents of third and final year undergraduates, and student projects are assessed by a panel of industry representatives. The five most innovative designs receive prizes.

## A SNAPSHOT OF RMIT EDUCATION

RMIT offers more than 600 Higher Education and TAFE programs. A selection of program areas of relevance for the aerospace and aviation sectors is listed below.

Discipline	Short Course/ Customised	Certificate	Diploma	Adv. Dip/ Assoc. Degree	Degree	Post-graduate	School
Aeroskills (Avionics)		✓					Engineering (TAFE)
Aeroskills (Mechanic)		✓					Engineering (TAFE)
Aeroskills (Structure)		✓					Engineering (TAFE)
Aircraft Maintenance Management		✓					Aerospace, Mechanical and Manufacturing Engineering
Air Transport (Airline Pilot)							
Applied Science (Aviation)					✓		Aerospace, Mechanical and Manufacturing Engineering
Aviation (Industry Management)						✓	Aerospace, Mechanical and Manufacturing Engineering
Aviation (Safety and Risk Management)						✓	Aerospace, Mechanical and Manufacturing Engineering
Aviation (Supply Chain Management)						✓	Aerospace, Mechanical and Manufacturing Engineering
Business Administration	✓					✓	Graduate Business and Law
Business Administration		✓	✓				Business TAFE
Business (Business Information Systems)					✓		Business Information Technology
Business (Entrepreneurship)					✓		Management
Business (Information and Knowledge Management)					✓		Business Information Technology
Business (International Business)					✓		Management
Business (International Trade)			✓	✓			Business TAFE
Business (Logistics and Supply Chain Management)					✓	✓	Management
Business (Management)					✓		Management
Business (Marketing)					✓	✓	Economics, Finance and Marketing
Business (Marketing)		✓	✓	✓			Business TAFE
Commerce					✓		Management
Commerce			✓				Business TAFE
Design (Industrial Design)	✓				✓	✓	Architecture and Design
Electrical (Instrumentation)		✓					Engineering (TAFE)
Electrotechnology (Systems Electrician/Instrumentation)		✓					Engineering (TAFE)
Engineering (Advanced Trade)			✓				Engineering (TAFE)
Engineering (Advanced Manufacturing and Mechatronics)				✓			Aerospace, Mechanical and Manufacturing Engineering
Engineering (Aerospace)					✓		Aerospace, Mechanical and Manufacturing Engineering
Engineering (Aerospace)/Business (Management)					✓		Aerospace, Mechanical and Manufacturing Engineering
Engineering (Aerospace—Mechanical)				✓			Engineering (TAFE)
Engineering (Automotive Engineering)					✓		Aerospace, Mechanical and Manufacturing Engineering
Engineering (Computer and Network Engineering)					✓		Electrical and Computer Engineering
Engineering (Electrical Engineering)					✓		Electrical and Computer Engineering
Engineering (Electrical and Electronic Engineering)					✓		Electrical and Computer Engineering

Discipline	Short Course/ Customised	Certificate	Diploma	Adv. Dip/ Assoc. Degree	Degree	Post-graduate	School
Engineering (Electrical/Electronic Trade)		✓					Engineering (TAFE)
Engineering (Electronic and Communication Engineering)					✓		Electrical and Computer Engineering
Engineering (Engineering Management)						✓	Aerospace, Mechanical and Manufacturing Engineering
Engineering (Integrated Logistics Management)						✓	Aerospace, Mechanical and Manufacturing Engineering
Engineering (International Automotive Engineering)						✓	Aerospace, Mechanical and Manufacturing Engineering
Engineering (Manufacturing)						✓	Aerospace, Mechanical and Manufacturing Engineering
Engineering (Mechanical Engineering)					✓		Aerospace, Mechanical and Manufacturing Engineering
Engineering (Mechanical Engineering)/ Business (Management)					✓		Aerospace, Mechanical and Manufacturing Engineering
Engineering (Mechanical Trade)		✓					Engineering (TAFE)
Engineering—Mechanical Trade (Fitting and Machining)		✓					Engineering (TAFE)
Engineering (Principal Technical Officer)				✓			Engineering (TAFE)
Engineering (Systems Support Engineering)						✓	Aerospace, Mechanical and Manufacturing Engineering
Engineering (Sustainable Energy)						✓	Aerospace, Mechanical and Manufacturing Engineering
Engineering (Systems Engineering)						✓	Aerospace, Mechanical and Manufacturing Engineering
Engineering (Technology)				✓			Engineering (TAFE)
Engineering Technology (Advanced Manufacturing)				✓			Engineering (TAFE)
Engineering Technology (Design and Development)				✓			Engineering (TAFE)
Engineering Technology (Systems and Logistics)				✓			Engineering (TAFE)
Environmental Engineering					✓		Civil, Environmental and Chemical Engineering
Frontline Management		✓	✓				Business TAFE
Information Technology			✓	✓			Business TAFE
International Trade		✓					Business TAFE
Logistics			✓				Business TAFE
Management			✓				Business TAFE
Occupational Health and Safety					✓	✓	Applied Sciences
Occupational Health and Safety		✓	✓				Life and Physical Sciences
Project Management		✓			✓	✓	Property, Construction and Project Management
Retail Operations		✓					Business TAFE
Textile Design and Development			✓	✓	✓		Fashion and Textiles
Textile Technology and Production Management			✓		✓		Fashion and Textiles
Warehousing and Storage		✓					Fashion and Textiles

For further information on individual programs, please contact the relevant RMIT School or RMIT's Info Corner on tel. 03 9925 2260

For workforce development, please contact RMIT Global Business Development on tel. 9925 5110. We will organise for you to meet with the appropriate RMIT staff to discuss training solutions for your organisation.

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