

IAF SPACE PROPULSION SYMPOSIUM (C4)  
Electric Propulsion (4)

Author: Prof. Christine Charles  
Australian National University (ANU), Australia

Mr. Dimitrios Tsifakis  
Australian National University (ANU), Australia

Mr. Alex Bennet  
Australian National University (ANU), Australia

Prof. Rod Boswell  
Australia

Mr. Weston Braun  
Stanford University, United States

Prof. Juan Rivas-Davila  
Stanford University, United States

Dr. Kazunori Takahashi  
Tohoku University, Japan

Prof. Akira Ando  
Tohoku University, Japan

Ms. Eszter Dudas  
Institut de Physique de Rennes, France

Dr. Abdessamad Benidar  
Université de Rennes, France

Prof. Robert Georges  
Institut de Physique de Rennes, France

Mr. Scott Doyle  
York University, United Kingdom

Dr. James Dedrick  
York University, United Kingdom

Mr. Félicien Filleul  
University of Auckland, New Zealand

Dr. John Cater  
University of Auckland, New Zealand

Dr. Nicholas Rattenbury  
University of Auckland, New Zealand

KEYNOTE: “LAB TO LAUNCH”

**Abstract**

Progress in satellite technologies is ongoing and eventually finds applications back on Earth. The global space industry is expecting significant growth based on cheaper launch capabilities and standardised satellite platforms. Thousands of small satellites (such as CubeSats) are expected to be launched over the next decade: a disruptive space revolution boosting Earth imaging, internet, global positioning and

space weather forecast capabilities. Electric propulsion (EP) has been an innovative solution in a number of space missions but its scalability remains a challenge. Many mature or under development space propulsion systems could also benefit from more compact and efficient power supplies. There is strong interest in the development of inexpensive micro-thrusters which could be used on single spacecrafts or constellations. Pocket Rocket is an Australian-born miniaturised electro-thermal radio frequency plasma thruster which uses environmentally friendly propellant such as argon. The Australian Space Agency recently launched: a complete end-to-end small satellite industry — "Lab to Launch" — is now available wholly within the Trans Australasian Pacific region, thanks to the recent demonstration of Rocket Lab's access to orbit and successful commercial launches with the Electron Rocket. Groups at the Australian National University, Stanford University and the University of Auckland have joined forces to pave a path to space heritage for Pocket Rocket via the CubeSat platform. Innovative miniaturized power supplies and gas handling systems totaling a few hundred grams in weight for a few Watts within a U have been designed, tested and modelled to improve efficiency and ease of operation in space. Of importance is its pulsed operation and "instant on" capabilities which can also be applied to electron neutralisers used by mature EP technologies (e.g. ion gridded thrusters, Hall thrusters). These innovations will help the future development of nano-satellite orbit control, attitude control, formation flying and docking capabilities. We have recently demonstrated that EP can be used for space debris mitigation.