CASE STUDY

University of Nottingham
UK | CHINA | MALAYSIA

WHEN BUILDING A WORLD LEADING AEROSPACE RESEARCH LAB, THE UNIVERSITY OF NOTTINGHAM NEEDED A VERSATILE POWER SYSTEM TO ENSURE THE FACILITY TAKES OFF.

Civil aviation has exploded in recent years. Since 1960, the total worldwide annual passenger count has increased by 4000% to 4.1 billion journeys.

This vast movement of people comes at an environmental cost. There are currently no regular commercial flights which use electric aircraft. The industry currently relies on hydrocarbons as fuel.

The University's PEMC (Power Electronics, Machines and Control) research group have built a new facility. The UK Electrification of Aerospace Propulsion Facility will cater for a wide range of electric aircraft developments. Testing electrical machines, motors, controllers and power sources - both individually and as a complete system.

ETPS supplied the University with a modular 3000V/2MW bidirectional power system. The versatility of the G5-RSS allows the group to conduct research and development across many applications.

Chris Varley, Propulsion Centre Manager for the PEMC, explained "Future trends and technology breakthroughs are often unpredictable. So the programming capabilities and reconfigurability of the G5-RSS system is critical."

"Innovation doesn't respect the size or depth of pockets. Minimising time spent switching between configurations is critical in keeping a low cost base so our services are competitive for SMEs. ETPS provided a solution that facilitates this."

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SWITCHING TO ELECTRIC AIRCRAFT

The G5-RSS system was delivered with a specially designed remote switch cabinet (RSC), to make fast and accurate configuration changes. The RSC electronically switches between high voltage (3000Vdc/±1944A) and high current (1500Vdc/±3888A) configurations. The process takes approx. 5 seconds. Safety devices are installed so it is not possible for a user to make a mistake.

While almost all electric road vehicles are rated below 1000V, research into electric aircrafts typically takes place at higher voltages. The higher voltages results in lower current, therefore minimising heat loss. This means that smaller components and cables can be used, ideal where space and weight is at a premium.

Many challenges are presented by the high altitude that these components must operate at. Air is less dense, meaning that it's harder to remove any dissipated heat. Flashovers are also more likely, which designs must guard against.

When asked why the University opted for the G5-RSS, Chris Gerada Professor of Electrical Machines added "The need to test a wide variety of power components was a key factor in our purchasing decision."

"We couldn't find anything else on the market that provided this level of flexibility at the appropriate power and voltage levels. We're able to accurately emulate fuel cells and batteries, as well as recreate complex DC waveforms through comprehensive software packages. We're confident we can test virtually any DC power device using the system."

Belonging to the elite Russell Group, the University of Nottingham was founded in 1881. The PEMC sits within the University's Department of Electrical and Electronic Engineering. The department is ranked first in electrical and electronic engineering in the UK.

The PEMC group has a total Research Portfolio of over £25 million. Their academics lead or are partners on many high-impact, internationally recognised projects.

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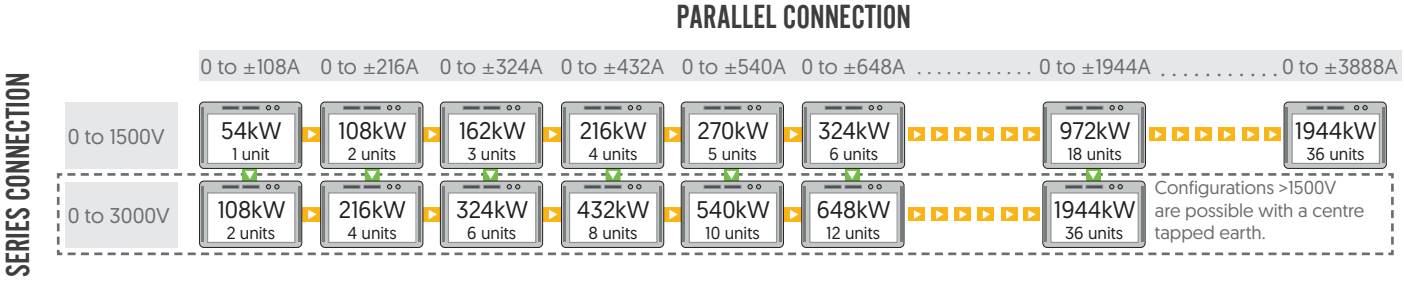
CONFIGURING A LOW CARBON FUTURE

The diagram below shows a simplified visualisation of the different configurations the PEMC can create using their modular G5-RSS system. Individual units can be used for testing of multiple small devices in different test cells, then grouped together for larger projects.



ABOUT THE G5-RSS

With two current ranges for high accuracy, the G5-RSS is ideal for cycling energy storage devices. The module's ultra-fast dynamics with switchable capacitance also allows accurate simulation of batteries, fuel cells and capacitors.

Each module has an extensive feature set which includes programmable PI parameters, programmable ripple, and an inbuilt 8 channel recording scope. Adjustable power and resistance limits are provided, as well as a selection of remote control options including multi-protocol CAN.

An intuitive operating GUI is standard. This provides a variety of programming features and second level parameters. Ideal for optimising test processes.

Modules can be arranged in series, parallel or matrix configurations. Outputs up to 3000V are possible into the megawatt range. Units can be connected in master/slave with different nominal values. For example, a 36kW/500V module will connect in parallel with a 54kW/500V unit to provide 90kW/500V.

Besides bidirectional systems the ETPS product range includes new and rental DC & AC sources, electronic loads and battery chargers/dischargers.

To discuss how the G5-RSS can propel your aerospace research, contact us today.

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