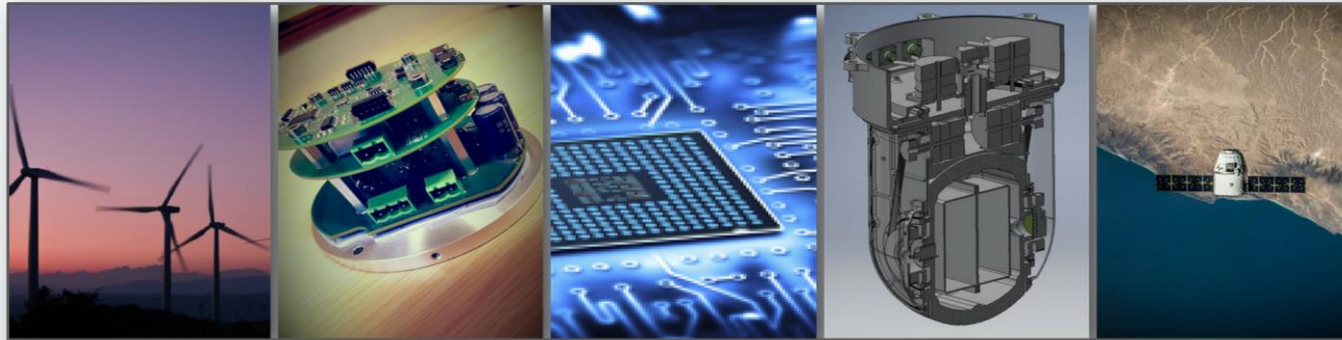


MAGE

CONTROL SYSTEMS



Electrification of Flight

10th May 2023

Matthew Love

Managing Director



WHO ARE MAGE CONTROL SYSTEMS LTD?

Serving as one of Scotland's largest product design houses, Mage Control Systems is the one-stop-shop for bringing new innovations to fruition.

The company's core capabilities in complex **embedded control systems** design, **advanced algorithm development**, **power electronics**, IoT & sensing solutions and **safety critical software** development to name a few are what sets Mage apart from the rest.

Having history and experience in the leadership team stemming from the aerospace & defence sector, Mage is able to bridge the gaps in designs from other sectors with the reliable and robust practices utilised in aerospace & defence sector.



WHO ARE MAGE CONTROL SYSTEMS LTD?

- Founded in 2016
- Leadership background from Aerospace & Defence primes
- Safety-critical control systems & power electronics experts
- In-house teams of electronics, software & mechanical engineers
- One of Scotland's largest product design houses today
- Delivered 50+ projects since inception
- Collaborative approach to business & design
- Delivering innovations locally, nationally & internationally
- Technology-agnostic work spanning various sectors
- Plans to expand considerably over next 5+ years



OUR SPECIALIST SERVICES AND CAPABILITIES



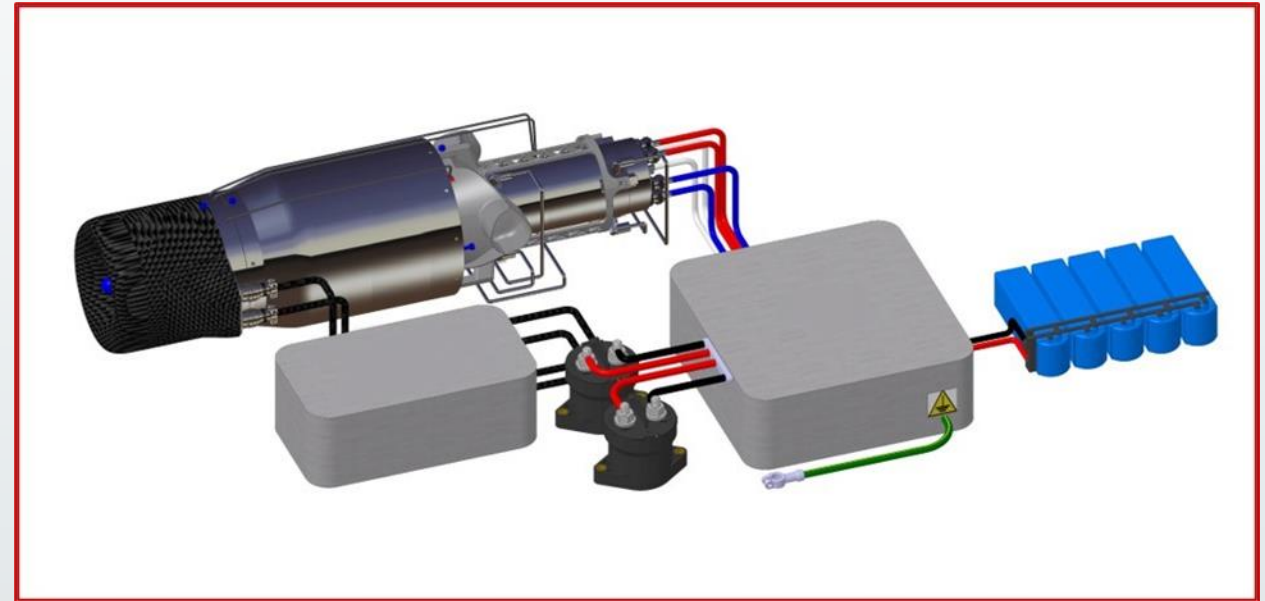
- Bespoke design, manufacture and documentation of complex embedded systems
- Feasibility studies
- Prototype design and development
- Mechanical modelling
- Product redesign and cost reduction
- Advanced mathematical modelling
- Safety critical designs
- High power density electronics
- High precision adaptive control

OUR SPECIALIST SERVICES AND CAPABILITIES



Our key expertise is both in **high-power electronics** and **motion control** for hardware design; essentially, this is achieved via the development of **complex control laws and algorithms** using state of the art tools such as MATLAB, Simulink and associated toolchains.

Development using these tools allows for fault-free automatic code generation to meet DO-178C standard.



Full Authority Digital Engine Control (FADEC)

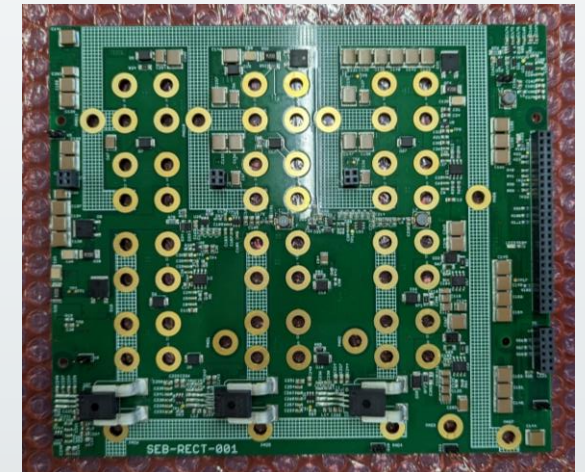
OUR SPECIALIST SERVICES AND CAPABILITIES



Our unrivalled **high-power density** designs are perfectly suited to meet the project requirements for a complex battery/generator solution.

The **PMU** and the **FADEC** systems utilise a very fast processor loop cycle period for efficient space-vector modulated sinusoidal commutation – the electronics are rated up to 200,000RPM.

The system is also fully dual-redundant and **bespoke electronics** have been designed to meet the required DO-254 standard. Hardware is also designed to meet DO-160G standard.



**FULL AUTHORITY
DIGITAL ENGINE
CONTROL (FADEC)
PCBS**

SUSTAINABLE AVIATION

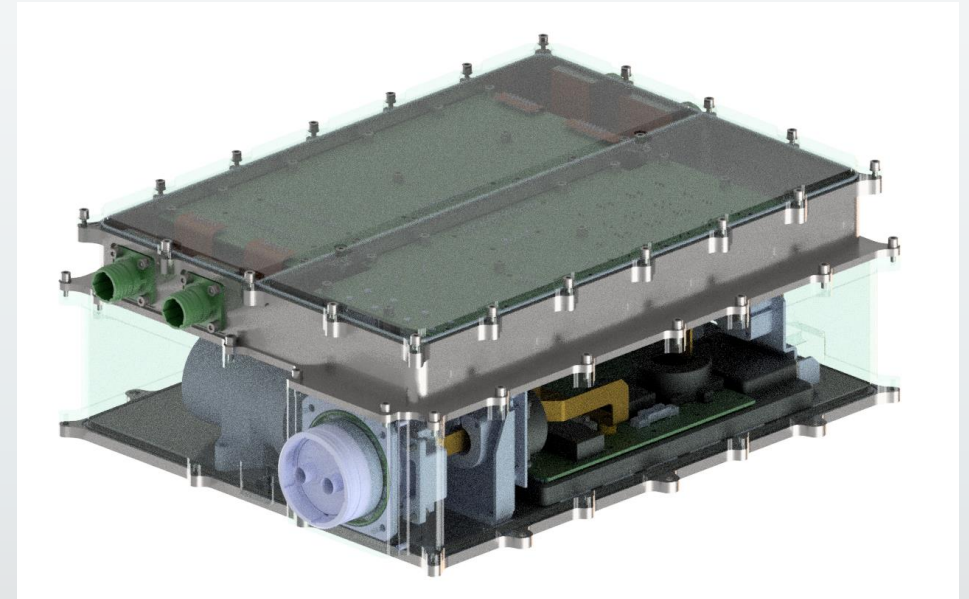


Developed for a propeller-driven **full-electric UAV**, our 50kW Propulsion Inverter will be powering flight significantly above standard commercial flight levels.

Our design is rated for use, at this challenging height, in an unpressurised nacelle.

As standard, our hardware is developed to meet **DO-160G**, **DO-254** and firmware developed to **DO-178C**.

Firmware modelling has been developed using Simulink for accelerated V&V, auto-analysis to **DO-178C** and direct model-to-code build using Embedded Coder.



50KW PROPULSION INVERTER

SUSTAINABLE AVIATION

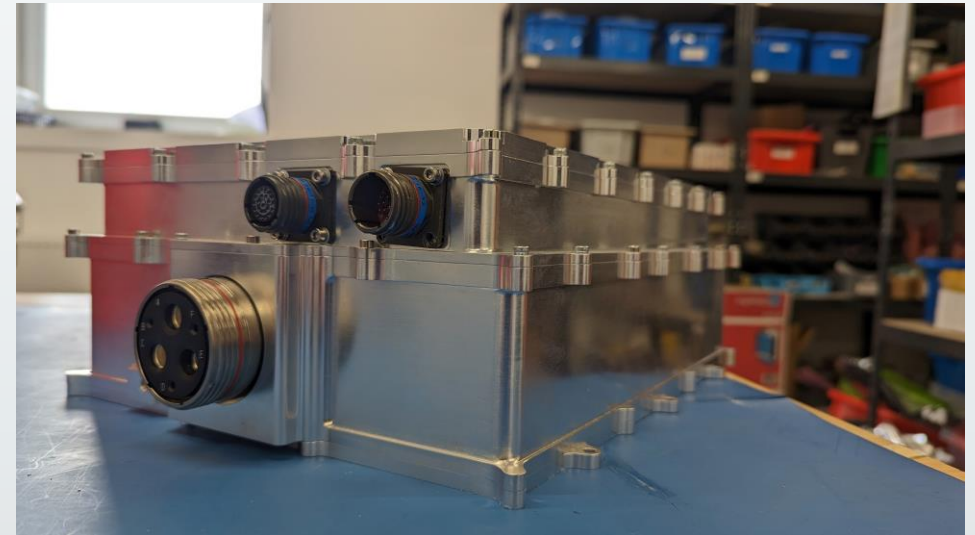


Through our commitment to innovation, modern high temperature **3D printed materials** and coatings have been utilised for lower casing weight while maintaining EMC immunity.

Internal flight control laws and on-board non-volatile memory allow for safe power-down (“graceful degradation”) and system recovery if communication with the flight controller is ceased or interrupted.

Real-time sensor monitoring is used including **BIT and HUMS** as well as data evaluation for live **fault analysis and fault prediction** (rotor demagnetisation, inverter temperature and current, motor temperature and motor vibration sensor).

Faults and system diagnosis are recorded on the inverter's NV memory.

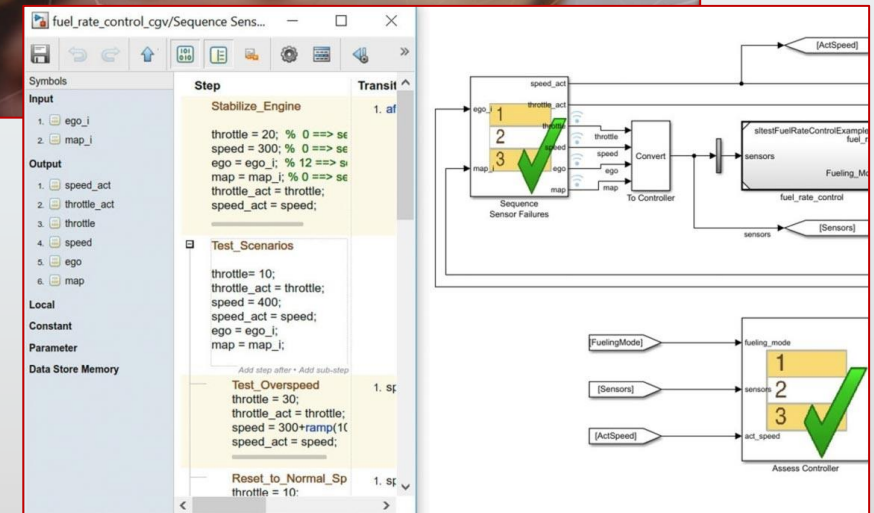
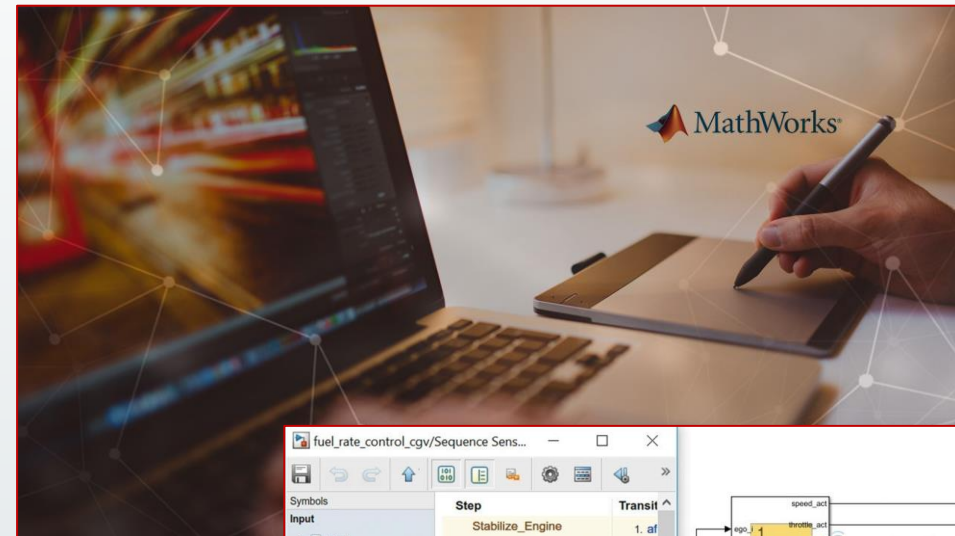


50KW PROPULSION INVERTER

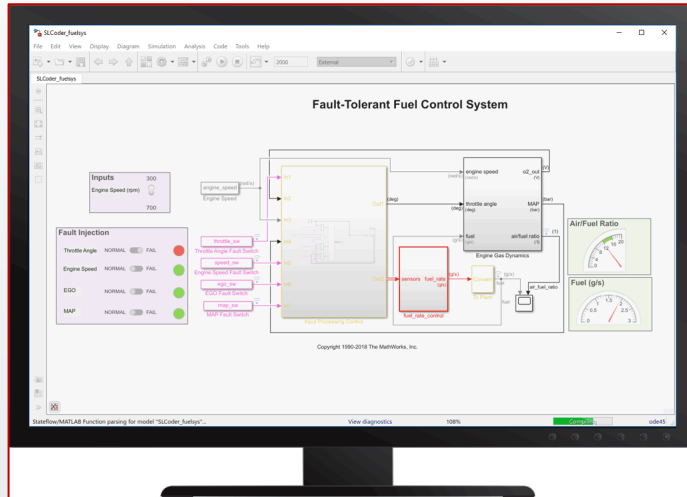
DATA ANALYSIS & SIMULATION



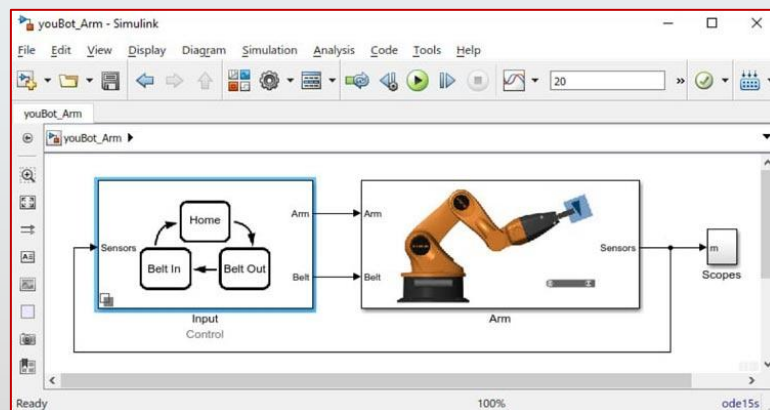
- Simulink Coder™ generates and executes C and C++ code from Simulink® models, Stateflow® charts, and MATLAB® functions.
- The generated source code can be used for real-time and non-real-time applications, including simulation acceleration, rapid prototyping, and hardware-in-the-loop testing.
- You can tune and monitor the generated code using Simulink or run and interact with the code outside MATLAB and Simulink.



DATA ANALYSIS & SIMULATION



- Embedded Coder to generate code that complies with popular software and safety standards such as AUTOSAR and MISRA C.



- Certification and qualification kits to ISO 26262, IEC 61508, EN 50128, IEC 62304, DO-178, DO-254, and other industry standards for automotive, medical, rail, and aerospace embedded systems.



We'd like to hear from you

Get in touch via any of the contact methods here to begin a discussion with our team about your bespoke product design requirements.



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