airborne engineering

Research, testing, and innovation for propulsion, dynamic systems, and challenging environments.

Company Profile

Airborne Engineering Limited (AEL) provides design and test services to the aerospace industry and academia, with a focus on chemical propulsion research. Established in 2001 and based at Westcott Venture Park since 2009, we operate two state-of-the-art propulsion test facilities, supporting rocket engines using a variety of liquid and gaseous propellants. We have designed bespoke test rigs and control systems, tested injector and nozzle geometries, and evaluated the performance of new propellants and materials. Our customers rely on us to deliver successful cutting-edge test programmes on time and on budget.

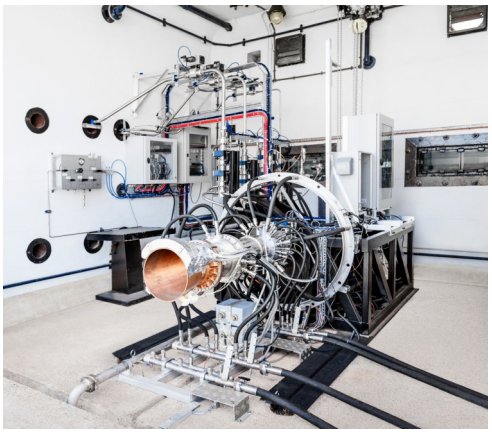
Alongside commercial test work, we have also undertaken a variety of in-house research programmes, including developing a vertical takeoff vertical landing rocket platform, designing and testing 3D-printed combustion chambers and injectors, and testing novel materials and coatings for propulsion applications.

Our in-house expertise in electronic instrumentation, control systems, and software gives us the competitive edge in providing fast turnaround, complete testing solutions to our customers — from initial specification of sensors through to automated data reduction and analysis post-firing. This unique combination of capabilities has allowed us to grow from strength to strength, leading to AEL now being one of the UK's key propulsion research facilities, and one of the key providers in the UK's space propulsion supply chain.

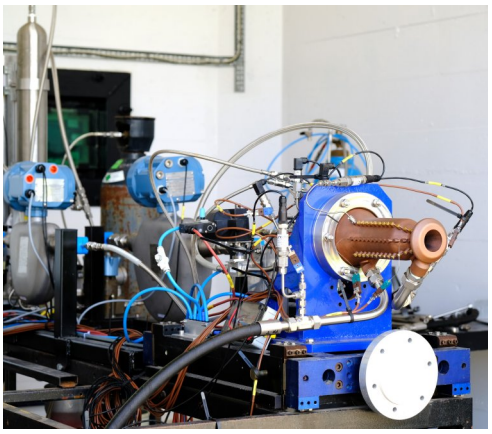
Facilities

At our Westcott facility, we have a well-equipped on-site mechanical workshop and instrumentation lab and two rocket engine test bays covering a variety of propellants and thrust ratings up to 40kN. We are able to test at higher thrust levels elsewhere on the Westcott site if required. Each test bay has extensive data acquisition and control support, which can be extended for specific experimental requirements as necessary. Raw data and automated reports are available immediately after a firing is complete, allowing rapid turnaround and efficient test schedules.

The J1 test bay can accommodate a wide range of engines and propellants, including, as standard, liquid oxygen, liquid methane, nitrous oxide, alcohols, and hydrocarbons. Its modular structure allows us to quickly reconfigure the test bay to support different customer requirements, including hybrid engines and speciality propellants.



STOIC engine installed in J2 firing bay



LAMBDA engine installed in J1 firing bay

Our J2 test bay has a purpose-built high-pressure air flow system for air-breathing rocket engine research. This facility includes a high flow rate air and hydrogen supply, water cooling, water-spray sound suppression, and automatic metering valves on all propellant lines. Our custom designed metering valves are digitally controlled and can either follow a specific mass flow profile to better than 1% accuracy or can be set to allow closed loop control of engine operating conditions such as chamber pressure. While J2 is predominantly used for air-breathing rocket work and gaseous propellants, it can also be configured for other types of rocket engine, hot gas generation for heat exchanger research, and hypersonic wind tunnel testing.

STOIC engine firing with water sound suppression

Letterbox-shaped hot gas generator for heat exchanger testing up to 1500K

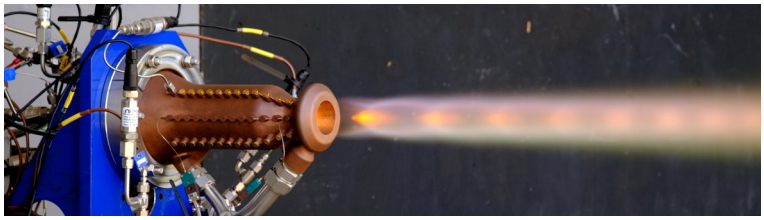
"The STOIC test rig and instrumentation are state of the art"

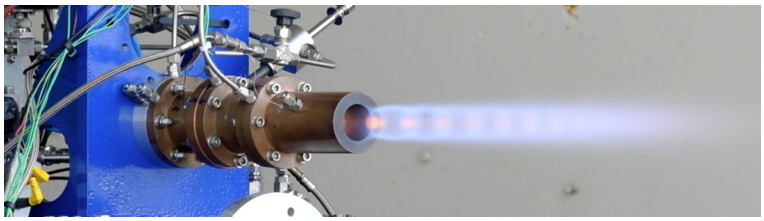
Mark Ford, Head of Propulsion Engineering, ESA

Capabilities

Propulsion Research

- Rocket engine testing and analysis
- Test-rig and instrumentation design
- Mechanical/thermal design and CAD
- Mathematical modelling
- Injector and nozzle geometry testing
- Propellant testing
- Materials testing
- Pump testing





Top: Europe's first additively manufactured copper chamber firing
Bottom: Propellant research with nitrous oxide fuel blends

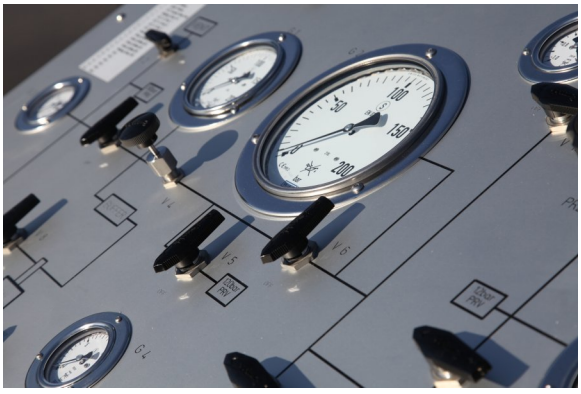
Instrumentation cabinets with 360 channels at 10kHz sample rate

Instrumentation and Control

- High sample rate, high channel count data acquisition systems
- Manual and automatic valve actuation
- High bandwidth closed loop control
- In-house electronics and software engineering, including embedded
- Automatic data reduction and report generation

Ground Support Equipment

- Gas and liquid propellant handling systems
- Purge panels and loading carts
- Remote telemetry
- Temperature and pressure control
- Booster pumps



Xenon propellant loading panel

"Airborne consistently delivers excellent technical solutions, and are a pleasure to work with"

Alan Bond, Founder, Reaction Engines Ltd

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Recent Projects

We are actively developing novel technologies for additively manufactured rocket engines, including new cooling techniques and materials research. Our J1 test bay is ideally suited for rapid testing of new engines and feed systems, and our automated data analysis and reporting software allows us to rapidly close the cycle between design and test.

Additively manufactured injector head

Gyroc vertical takeoff vertical landing rocket

We are currently flight-testing our stabilised vertical takeoff vertical landing (VTVL) rocket platform, called Gyroc, as part of an ESA programme. This flight vehicle is a prototype for a future vehicle which would enable testing of planetary lander systems and other VTVL instrument testing, such as modern LIDAR sensors and autonomous guidance and landing algorithms.

Gyroc uses our SNARK throttleable bipropellant nitrous oxide and isopropyl alcohol rocket engine, with a gimballed chamber to permit thrust vectoring. The avionics and control systems were developed entirely in-house, with a state of the art inertial measurement unit, RTK GPS system, and LIDAR unit to constantly monitor and adjust the vehicle position and attitude.

Laser instrumentation on a combustion test rig

Recent commercial projects have included high-temperature heat exchanger testing, hydrogen combustion research with laser instrumentation, hybrid rocket engine testing, and providing instrumentation and control support at a customer's own test facility.

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