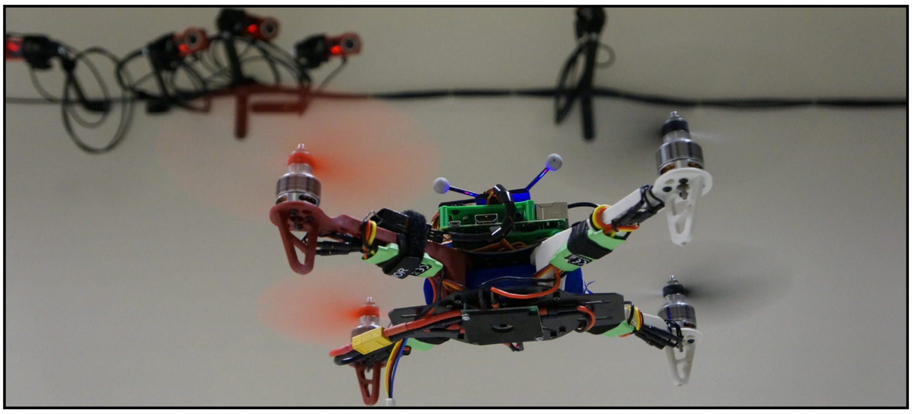
Micro-Air Systems Technology (MAST) Laboratory



Contact details:

Dr David Anderson
Aerospace Sciences
School of Engineering
University of Glasgow
Glasgow G12 8QQ UK

Tel: +44 (0)141 330 5918
dave.anderson@glasgow.ac.uk

The challenge

Unmanned Airborne Systems (UAS), currently a 'must-have' asset for all air forces throughout the world, will transition to an indispensable part of society in the coming decades. There is a growing and immediate need to develop technology that will allow UAS operations to transfer from military to the civilian domain with many civil applications being identified, and new ideas and products appearing almost daily. Potential applications include surveying, air ambulance, construction, disaster relief, transportation and logistics. Although many technical challenges exist, the primary ones are safety, reliability, operational cost and public acceptance of 'drone' technology.

Underpinning all UAS research addressing these challenges is the idea of infusing autonomy into the system. An autonomous system obtains information about its environment through a suite of sensors and uses this information, in combination with some á priori mission objectives, to decide upon an appropriate course of action. Achieving true autonomy requires skills from fields including; artificial intelligence, cognitive control & neuroscience, control theory and sensor fusion.

How is it being solved?

Our autonomous systems research follows two interwoven approaches – complex simulation and experiment. Simulation is performed using MAVERIC, a multi-resolution, multi-agent simulation engine specifically tailored to autonomous systems. The experimental phase is performed in the Micro-Air Systems Technology (MAST) laboratory.

The MAST laboratory provides the ideal platform for research and investigation of autonomous vehicles and their associated technologies. A motion capture system allows accurate position and attitude tracking of multiple bodies within an indoor flight volume, offering a wealth of possibilities in multi-agent autonomous systems research. Using additive manufacturing (3D printing) we rapidly build new UAS platform concepts, which may then undergo wind-tunnel testing and system identification prior to final flight test. The MAST lab offers a complete solution for design & test of small-scale autonomous systems.

Our research explores the conceptual design space of μ-UAS platforms (from an aeronautics perspective) and consequently we develop new technologies to address the primary challenges.

Current MAST-Lab projects include:

- Nonlinear predictive control methods for gust alleviation in μ-UAS,
- Cooperative control of multirotor UAS with a single underslung load,
- Enhanced aerodynamic performance of flapping wing μ-UAS using tuned aeroelastic response.
- The Compound Multirotor – an investigation into potential performance benefits to be gained from applying compound helicopter techniques to μ-UAS.

Why this is important?

As the level of autonomy in a robotic system increases – airborne or otherwise – the operational capability of the system increases dramatically. Autonomous systems are particularly well-suited to dull, dirty and dangerous tasks that are either hazardous or detrimental to human health and well-being. From military tasks such as casualty evacuation, bomb-disposal and 'over-the-wall' military reconnaissance to the civilian operations envisaged such as disaster relief/inspection, homeland security, construction, medical robotics etc., autonomous systems have the capacity to make significant societal and economic impacts.

Partners

Leonardo UK (formerly) Selex Electronic Systems in Edinburgh have supported this lab with both capital investment and a PhD case award.