

Rapid Prototyping of Micro Air Vehicle Control Systems

G G Dickman & Dr S W Willcox

Blue Bear Systems Research Ltd

gordon@bluebearsystems.com

ABSTRACT

Technological progress in a number of areas including micro-electronics, micro-electromechanical systems (MEMS), power cells and propulsion systems are presenting the possibility for a new breed of flight systems known as Micro Air Vehicles (MAV). The unique characteristics of these small air vehicles present opportunities for their application to a range of both military and civil operations, generally focussed on reconnaissance and surveillance tasks. In order to provide the necessary functionality in such vehicles, they will require autonomous functionality. Therefore control systems and autopilots will be required that have a high level of complexity. Conventional approaches to control system design have historically required comprehensive mathematical models, generally derived from extensive wind tunnel testing. It is unlikely that this level of expenditure would be forthcoming for the development of future MAV systems. This on-going project at Blue Bear Systems Research aims to develop alternative physics based approaches to platform development and control system design. Phase 1 of the project was successful in demonstrating an MAV airframe in the 25 to 30cm wingspan class, but due to weight and technology limitations, the flight control algorithms were separately demonstrated on a 1m wingspan vehicle. This paper discusses the Phase 2 project which aims to bring together these separate technology threads to deliver an integrated MAV prototype system. The paper describes the development of innovative fast-prototyping processes, addressing both the design and manufacture of an example airframe and also the development of the flight control system hardware and software. The techniques developed have been shown to offer an accelerated development cycle from concept through design to first flight.

BIOGRAPHY

Gordon Dickman is a Chartered Engineer, graduating from Kingston Polytechnic with a degree in Aeronautical Engineering before joining the Guidance and Control group at Hunting Engineering Ltd (now Insys Ltd). Gordon then worked at the Defence Evaluation and Research Agency (DERA) Bedford, working in flight simulation and mathematical modelling. He also worked on the Typhoon control system flight clearance programme before joining Blue Bear Systems Research. At BBSR, Gordon has worked on a variety of projects, including design and flight testing of UAV platforms, UAV control system prototyping and rapid prototyping for Micro Air Vehicles.

Simon Willcox completed his PhD in 1988 and joined the RAE developing the UK experimental fly-by-wire Harrier. There, he worked on missile control systems and lead research into advanced re-configurable control algorithms using Artificial Intelligence (AI). He then joined Cyberlife where he developed intelligent control methods based on artificial life technology. Working at Symbian, he developed next generation, real-time embedded operating systems. At BBSR he specialises in the design and development of embedded flight control environments for UAV/MAV projects, experimental interfaces between AI agents & simulation/analysis tools, visualisation tools for flight control and multi-agent communications systems for distributed agents.