

# Fully Automated BMAV for Surveillance and Reconnaissance on the Move

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The Blue Bear Systems Mini Air Vehicle (BMAV), is a fully automated unmanned air vehicle. developed under the DTIC funded MAV program this vehicle was selected as the low level vehicle in Team Stellar's successful entry into the MOD's Grand Challenge. Blue Bear Systems Research have developed rapid prototyping technologies enabling bespoke airframes to be developed in minimum time. The benefit of such an approach is the ability to wrap an airframe around a payload depending on operator requirements. The direct consequence of this is an ability to scale BMAV to meet user requirements. This paper discusses the development of such a system, its bespoke subsystems and the development of the fully automated algorithms.

## I. Nomenclature

$a$	=	Free variable
$x$	=	X position
$x_0$	=	Initial x position
$x_f$	=	Final x position
$y$	=	Y position
$y_0$	=	Initial y position
$y_f$	=	Final y position
$\psi$	=	Heading angle

## II. Introduction

THIS paper discusses the development of the fully automated Unmanned Air Vehicle BMAV. While UAVs offer significant benefits to many different military and civilian organizations, further development is required to reach the high standards in terms of efficiency offered by conventional air support [1]. The BMAV UAV system is designed to significantly reduce operator workload through advanced control systems and algorithms and hence improve efficiency.

One such demand on the operator is the set up time required per airframe before flight. The BMAV airframe is a small portable UAV with a wing span of 1m. It can therefore be easily transported and either hand or catapult launched. With an automatic launch mode, once launched the control law engages and progresses through a number of control phases until the vehicle reaches a required height. After this point the vehicle can follow a predetermined control sequence or can receive instructions from the ground control station. A catapult launch can be performed with the catapult placed in the back of a small van, it is therefore possible to drive to the launch site and simply open the doors before launching. This results in a negligible set up time.

The BMAV airframe itself is a completely scalable airframe. Rapid prototyping enables the wrapping of an airframe around a payload to meet user requirements. By standardizing subsystems such as the BBSR Surveillance and Navigation Autopilot (SNAP), the airframe can be sized according to requirements and therefore the airframe specification is extremely flexible. For a standard 1m airframe with simple gimbaled camera the maximum flight time is approximately 45 minutes. However, due to the scalable nature of the airframe this can be increased as well as decreased to suit the demands of the operator.

After the completion of the mission BMAV switches to an advanced guidance algorithm which enables fully automated landing in a constrained area. A good landing algorithm will bring the vehicle close to the desired target