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UNMANNED AIR SYSTEMS: A TOOL IN NOVEL AIRCRAFT DESIGN, VALIDATION AND EVALUATION

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SUMMARY

Unmanned Aircraft Systems (UAS) have existed for decades, with the primary market drivers being military requirements. While the value of the UAS as a military asset is well known, civilian use of UAS has seen a dramatic increase in activity in recent years. This talk will present some of the research and development in the area of "Unmanned Air Systems: Design, Build, Test and Fly" at the Center for Aerospace Research at the University of Victoria in partnership with OEMs such as Boeing (USA), Embraer (Brazil), and nationally with Meggitt Training Systems and Bombardier Aerospace.

Keywords: Unmanned Air Systems / Aircraft Design / Experimental Flight Testing

1. INTRODUCTION

Air travel is becoming available to a higher number of people who can afford to travel by air for leisure and business purposes. This is evidenced by the fact that according to Air Transport Action Group, more than 3 billion passengers were carried in 2010. Despite the effects of socio-economic crisis over the past few decades, recent studies forecast that both passenger and freight traffic are expected to grow worldwide at an average rate of 5% per year. Thus, the aeronautical industry is facing several challenges of contradictory nature: the demand for speed and capacity increase while simultaneously minimizing the environmental impact cause by air travel.

Despite the great technological improvements in the fields of emissions and noise reduction, high-lift devices and advanced materials, if one looks at the transport airplanes of today, it is very easy to identify many similarities in both shape and configuration of different aircraft. One of the reasons is related to the fact that the conventional configuration is optimized for a limited range of conditions, especially cruise conditions for commercial airliners, in terms of speed and altitude. Outside this range, aircraft behaviour is far from the optimal. Nonetheless, since the vast majority of commercial aircraft fly most of the time at cruise stage, only with a technology breakthrough or aircraft shape shape adaptation it will be possible to significantly increase flight efficiency, and in particular decrease fuel consumption which is a direct measure associated to both emissions and costs reduction. Several configurations such as the blended-wing-body, joined-wing and strut-braced-wing configurations have been studied as promising solutions to supplant the conventional

airplanes of today. To this end, numerical and experimental studies must be conducted to prove out the claimed potential of these configurations.

Unmanned Air Vehicles (UAV) have proven to be an integral instrument in a suite of defence and security capabilities for persistent intelligence, surveillance and reconnaissance, and more recently, the technology transfer to civilian and industrial sector remote sensing applications has been demonstrated.

The current computational and experimental research program aims to improve the performance of complex aerospace engineering systems through advances in mathematical and computational models, and experimental methods that incorporate multidisciplinary analysis, design optimization and subscale UAV model flight testing for the synthesis of optimal and novel aircraft designs. The design and development of physical flight test platforms provide a low-cost opportunity to evaluate flight worthiness of new and unconventional aircraft configurations. The keynote lecture will outline some of the experimental UAV flight test programs for evaluation of joined-wing and high-aspect ratio aircraft configurations in collaboration with OEMs, illustrated in Figure 1. The UAV based flight test programs enable designers to retrieve quantifiable data and to provide a qualitative assessment of the aircraft handling qualities. It provides new perspectives that may lead to identification of design issues early in the development process thus avoiding expensive re-designs at the detailed design phase of the full scale transport aircraft.

Fig. 1 – Unmanned Air Systems Operations at the Center for Aerospace Research.