ADAS20 = Airborne Detect and Avoid System 2020

Barnard Microsystems (Lead), OptoSignal and Tony Henley Consulting

ADAS20 is developing Remotely Piloted Aircraft systems (RPAS) suitable for use in oil, gas and mineral exploration activities and in land and maritime monitoring applications. The key challenge of the project is to enable the platform to have Beyond-Line-Of-Sight (BLOS) operating capability, by developing and characterising a prototype collision Detect and Avoid (DAA) system.

The project is led by Barnard Microsystems, a SME company, who first got involved in RPAS back in 2004. BML participated in the MOD "Grand Challenge 2008" to identify ways in which robotic vehicles could be used to detect threats to military personnel. This project focuses on civilian applications for RPAS and builds upon previous InnovateUK Proof of Market and Proof of Concept projects. Two other SMEs are participating in the project as partners, one focusing on sensors and the other on regulations.

This is Barnard Microsystem's first ATI project and the opportunity was brought to his attention through the help of the Aerospace Knowledge Transfer Network (KTN) emails. "We found the applications process to be very well streamlined", commented Joseph Barnard MD, "with helpful feedback provided along the way". The project also benefits from cross-fertilisation with another ATI-funded project, AQUILA, where Barnard Microsystems are participating as a project partner.

Table 1: Summary of the project grant details

Project	Funding	Lead Partner	No. of Partners	Partner Composition	Duration
ADAS20	Total: £1.95m Grant: £975k	Barnard Microsystems	3	3 SMEs	Aug 2015 - July 2018

Technical details

At present the long-range, 6m wingspan BML InView RPA can only operate within segregated airspace for BLOS applications. Although the InView RPA has on it an L Band satellite communications terminal, work that was supported by European Space Agency projects, these links do not have a guaranteed 100% connectivity with the Remote Pilot Station (RPS) on the ground. Furthermore, it takes time to relay the signals between the ground terminals and the geostationary satellite, hence the need to develop an alternative solution, which can operate safely, quickly, and without signals from the RPS.

The key technology used to deliver this will be an electro-optic sensor consisting of a pair of thermal imaging cameras in a stereo vision configuration together with a linear electromagnetic imaging array. This will enable the RPA to detect and track airborne objects in real time during day and night, in cloud and approaching from the sun.

The first phase of the work involved the development of a collision DAA flight simulation capability, the realism of which was enhanced through the use of the actual RPA autopilot in a hardware-in-the-loop configuration to enable the setting up of collision scenarios to enable an evaluation of the sensor designs and steer the collision avoidance strategy to comply with the Rules of the Air. Currently work is underway on the sensor design and testing. The 6m wingspan RPA are already undergoing test flights prior to being fitted with prototype DAA sensors, as part of the "test early and test often" approach that is being used in this project. Of great importance is the work being performed by Tony Henley on the regulatory aspects of a collision DAA system, where he is the interface with the CAA, ICAO and EuroCAE.

Table 2: Summary of the project focus areas

ATI Value Streams		ATI Enablers		ATI Attributes		Strategic Horizon	
Whole Aircraft	x	Aerodynamics		Safety	x	Secure	
Structures		Manufacturing		Cost		Exploit	x
Propulsion		Materials		Environment		Position	
Systems	x	Infrastructure		Fuel Burn			
		Process and Tools	x	Operational Needs	x		
				Passenger Experience			

Economic benefits

Shell Aircraft International, based in Rotterdam, have expressed an interest in the use of RPA to monitor oil pipelines in remote areas such as Nigeria. “The pilot fatality risk for these types of low-level, long-range flights in which light aircraft are typically used can be very high, and operational safety is the top priority for Shell”, explained Dr Barnard, “followed by having the required accuracy of data”.

In 2010, pilot fatality rates for low-level, long-range flights by aircraft used in Oil and Gas activities were 30 per million flight hours, compared to 0.9 for commercial passenger aircraft flights, due to the dangers associated with operating in these flight conditions (loss of situational awareness, conflict risk etc.). By relocating the pilot and co-pilot to the safety of the Remote Pilot Station, and operating the RPA in remote areas, the pilot fatality rate can be significantly reduced in oil and gas operations. Operational service costs in which RPAS are used are forecast to be on a par with light manned aircraft to start with, with the likelihood that they will decrease over time while not compromising the safety of the airspace, nor the safety of people on the ground.

“Without government funding through the ATI this project would have never happened”, stated Dr Barnard. “The cost of the R&D, trials, testing and customer interactions would have been prohibitive for an SME to get involved in to ensure successful commercial exploitation”, he explained.

Next Steps

The project aims to demonstrate the capability by mid-2018, and then conduct tests around the world and have regulatory approval in place by 2020 from the Civil Aviation Authority (CAA). The project has already helped open up doors to other potential customers, such as for geophysical survey applications and other oil and minerals exploration and production companies. Initial discussions have also been held with AgustaWestland, who are interested in adapting the technology for use in helicopter applications.

Interestingly, once proven on remotely piloted aircraft, this technology could later on be migrated for use in light manned aircraft, so contributing to the safety of manned flight in time to come. This project could demonstrate a route for innovative technology, which is first exhaustively and cost effectively tested using RPA in realistic scenarios, some of which could be too dangerous for testing using manned aircraft, before refining and further testing the technology for use on manned aircraft and helicopters.