

ASTRAEA - Mapping The Future

By Nick Miller, Vice-Chairman

The Potential Role of Autonomous Technology

For previous generations, the ability to survey land from an aerial perspective was an unreachable ambition. Many dreamt of flight, but it wasn't until the 18th Century that this actually became a human reality when people were able to take to the skies for the first time. Later developments during the last century saw aircraft created that could fly for longer periods of time and eventually photograph and survey the land beneath. Yet, remarkable as these developments have been, they have limitations.

Many of the modern maps of the world were produced from aerial photographs shortly after the Second World War. However, these surveys were conducted by expensive-to-operate, ex-military aircraft operated by skilled multi-person crews. The technology of aerial photographic and geophysical surveys has changed little in the last 50 years and is becoming increasingly expensive as fuel and labour costs rise and new aircraft have to be fitted with the necessary cameras or geophysical sensors.

Satellite imaging has therefore become an established, efficient and sometimes preferred means of undertaking aerial surveys for a variety of means. A good example are the photographs used in the popular Google Earth application. However, even satellite imaging has limitations if the user requires quick, detailed and cost-effective information about a changing landscape.

Unmanned Aircraft

Unmanned aircraft offer a potential solution. Already utilised in military situations around the world, unmanned aircraft can be quickly deployed and provide real-time imagery. There have been reports of farmers strapping handheld camcorders to radio-controlled toy planes. This, combined with a well-publicised test flight over farmland by QinetiQ and Aberystwyth University and similar trials in Australia using electric-powered micro UAS, has already proven unmanned aircraft to be an effective monitoring tool. However, the widespread use of unmanned aircraft beyond a military environment is currently limited by regulations on the use of airspace. For example, Civil Aviation Authority (CAA) regulations currently prevent the unrestricted use of unmanned aircraft in UK airspace. Put simply, if you wanted to send an unmanned aircraft up tomorrow to measure flooding levels over Worcestershire you would not be allowed. However, that may change.

Three years ago, a pioneering £32 million aerospace programme was established to investigate the topics that currently limit the unrestricted use of unmanned aircraft in non-segregated airspace. The programme, which is investigating both technological and regulatory issues, is called ASTRAEA. ASTRAEA involves a consortium of major aerospace companies, including BAE Systems, EADS, Cobham, QinetiQ, Rolls-Royce, and Thales, working with autonomous systems specialist AOS, many of the most innovative small companies in the sector and leading academic minds. The consortium was brokered by BERR

and is backed financially by the Technology Strategy Board, South West RDA, North West RDA, South East England DA, Scottish Enterprise and Welsh Assembly Government. It has also established a close cooperative working relationship with the Civil Aviation Authority, the body responsible for establishing the regulations that ensure aircraft safety.

Although ASTRAEA won't actually produce an aircraft, it will assess the feasibility of unmanned aircraft operating without restrictive, specialised or non-routine conditions of operation. To prove such feasibility, unmanned aircraft systems (UAS) must be able to operate with equivalent safety levels to manned aircraft, and must be transparent to air traffic control and other air users. Assuming that these tests can be met (and evidence so far shows that they can), it is expected that many of the industry partners in ASTRAEA will be involved in the future manufacture of such aircraft. There is a clear opportunity, therefore, for the UK to take a lead in this area – a lead that could produce substantial economic benefits for manufacturers in this country and give them a clear lead in the worldwide export market.

Autonomy

Progressing beyond a concept of remotely-controlled unmanned aircraft, ASTRAEA is assessing the viability of enabling *autonomous* aircraft to operate in UK airspace. Such a concept could see aircraft equipped with technology that would not only enable them to fly themselves, but also make decisions that enable them to successfully complete mission tasks such as monitoring a particular landscape from a variety of angles. Although manned aircraft will continue to operate, unmanned aircraft would offer functionality above and beyond existing planes, with the capability of flying at much lower cost and for far longer periods of time. Typically, it is envisaged that such aircraft could fulfil roles classed as 'dull, dirty or dangerous' and therefore otherwise unsafe for a human pilot. Environmental monitoring is one of a number of such roles, but crucially, all are civil rather than military applications.

Because of the depth of the topic, ASTRAEA has been split into a number of projects over two distinct phases. The first three-year phase of ASTRAEA has focused on examining the technologies, systems, facilities and procedures that could allow unmanned aircraft to operate safely and routinely in UK airspace. ASTRAEA is currently working to secure funding from across the existing partnership and other relevant organisations to move into phase two, which could see the potential applications of commercial unmanned vehicles to operate autonomously in non-segregated airspace by around 2012.

Testing The Technology

In October 2008, this goal became a step nearer with a major demonstration of autonomous technology. In a week of events at ParcAberporth in West Wales, the ASTRAEA programme brought together much of the technology developed through the programme and demonstrated it through simulated scenarios.

Two simulated missions were undertaken at the ParcAberporth event. The first simulated a flight to perform a search mission over North Wales before landing on Anglesey. After being given a number of instructions the simulated unmanned aircraft was able to identify particular objects in the mountainous terrain and send photographs of these back to base. The second mission simulated a flight through existing airways from ParcAberporth to Sumburgh in the Shetlands, demonstrating the safe avoidance of other aircraft en route and the ability to behave in the same manner as a manned aircraft.

The event was a significant milestone for the industry, showing how unmanned aircraft can be integrated into wider airspace and helping a range of stakeholders to understand the steps needed to make their widespread use a reality. Phase two of the programme would see many more demonstrations to illustrate the usefulness of such aircraft to a range of possible users – with environmental and landscape monitoring being just one.

Whilst the idea of unmanned aircraft operating in civil airspace is new to some, ASTRAEA is demonstrating that it could become a reality in within as little as three years. It's worth remembering that even the concept of flight seemed futuristic before 1903.

There will undoubtedly be further developments following ASTRAEA's 2012 goal which may see further innovations to create aircraft that can fulfil a number of roles. At this stage however, it's important to simply recognise the potential that ASTRAEA offers. The market therefore is very real and the future opportunities for suppliers are there.

If you are keen to learn more about the programme, please visit our website at www.projectastraesa.co.uk.

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