**Dr David Abrutat** explores how utilising Unmanned Aerial Vehicles can give military forces the edge

# THE STRATEGIC ADVANTAGE OF UAV TECHNOLOGY

*An MQ-9 Reaper during a training mission*

These British-designed unmanned aircraft will fly at the very edge of the earth's atmosphere and allow us to observe our adversaries for weeks on end providing critical intelligence for our forces." These words, conveyed by the British Prime Minister David Cameron during his Strategic Defence and Security Review (SDSR) speech in November 2015, highlighted the growing appetite in Government for a strategic persistent surveillance capability for the UK. This would augment the more tactical Unmanned Aerial Vehicle (UAV) capabilities that have been so tried and tested in the theatres of Iraq and Afghanistan over the last decade. Britain's armed forces experienced firsthand the versatile capabilities of a number of UAV systems, which have subsequently generated an enthusiasm to procure and deploy Unmanned Aerial Systems (UAS) across a wide swathe of differing military scenarios.

Cameron was talking about the ZEPHYR, a joint MOD and Airbus Defence and Space Executive project to build and deploy the UK's first High Altitude Pseudo-Satellite (HAPS). Three of the new variants of the airframe, the ZEPHYR 8, will be bought by the UK, and will have the capability to fly at altitudes in excess of 70,000 feet for up to three months at a time. Their first test flights are due next year, in 2017, and will give the military and civilian agencies the ability to mount enduring or persistent surveillance at a fraction of the cost of a mainstream surveillance satellite or manned aircraft. The ZEPHYR 8 can be used for multiple purposes including maritime and border surveillance, continuous/Near Real Time (NRT) imagery, environmental surveillance, in-theatre C4ISTAR relay, missile detection, navigation, Signals Intelligence (SIGINT) and adhoc communications bandwidth.

But why bother? People often talk of the advantages of unmanned aircraft and how instrumental they have been in changing the battle space, but how have they been utilised? Unmanned Aerial Vehicles (UAV) can provide a military operation with a number of strategic advantages over more conventional methods. Key among these is ISR (Intelligence, Surveillance and Reconnaissance).

The real strength of the military UAS is to develop 'Pattern of Life' on targets, or to put it another way

to identify and track a subject utilising the loiter capability that they provide. With the enduring loiter capability many of the larger UAV systems are able to provide 24/7 surveillance (the Global Hawk High Altitude and Long Endurance or HALE UAS was built to provide high altitude strategic ISR) and can transit across international borders with no risk to military personnel. At a tactical level, UAVs can be deployed to provide near space situational awareness for fighting units.

Measuring just 4in x 1in and weighing in at just 18g, the BLACK HORNET PD100 Nano UAV deployed with British infantry units in the war in Afghanistan, highlighted the true value of small UAVs, with its tiny cameras feeding back real-time situational awareness before having to commit troops.

When blended with intelligence collection from SIGINT (Signals Intelligence), HUMINT (Human Intelligence gathered via agents) and other strands of intelligence, the output from aerial ISR platforms can be a huge instrument of advantage for a war fighter. There are three core advantages here: cost, endurance and deployment, and we shall explore each in turn.

Although UAS are expensive to design and build, they are generally considerably cheaper to purchase, fuel and to maintain than regular aircraft. Although this picture can be blurred when we explore some of the US high-altitude surveillance aircraft and UAVs.

After serving for well over 50 years with the US Airforce, the U2 'DRAGON LADY' (so named as it was so difficult to fly) surveillance aircraft is about to be retired as the US Government cannot afford to maintain both the U2 and the Global Hawk UAS. The U2 could famously fly for 12 hours at 70,000 feet with top speeds of more than 475mph.

The U2 costs approximately $2,380 per flight hour compared with the $6,710 that the Global Hawk costs (as of 2014). This means that they cost somewhere in the region of $40million in comparison with the unit costs of a Global Hawk at around $222 million. The GLOBAL HAWK also has no defensive capability against a sophisticated air-defence system, unlike the U2.

This move by the United States Government isn't the end for manned surveillance aircraft, however. The U2 was designed and built by the Lockheed Martin Skunkworks teams, which has recently publicised the next generation of manned surveillance aircraft – the TR-X.

In the maritime domain, the cost differential is clear when we focus on one of Boeings' best selling UAV systems, the SCANEAGLE. This is often deployed off Naval vessels at sea to provide over-the-horizon situational awareness – normally only a task that could be achieved through launching expensive rotary or fixed-wing manned aircraft.

The UAV is launched using a pneumatic 'Superwedge' launcher, patented by InSitu. It is recovered using the skyhook retrieval system, which has a hook on the end of the wingtip to catch a rope hanging from a 30-50ft pole. SCANEAGLE has a range of over 100km and a flight endurance of over 20 hours

By 2014, SCANEAGLE had flown over 800,000 combat flight hours and it has been estimated at any one time, an average of 17 SCANEAGLE aircraft are in flight around the world.

When it comes to endurance, many deployed UAS can remain on target for longer, unrestrained by the more traditional limitations of human-piloted aircraft.

One of the leading countries in UAV design is Israel. Its most famous UAV design is the Heron TP Eitan, which costs somewhere in the region of $35 million. The aircraft boasts a wingspan of 26m – the same as a Boeing 737 passenger jet – and it can be deployed to an altitude of 12,000m. It can stay airborne for over 20 hours, which makes operational missions over Iran easily achievable.

The RQ-4 GLOBAL HAWK can stay aloft at its ceiling altitude of 55-60,000ft for up to a day longer than its comparison airframe – the U2, which

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*A French military officer pilots an Israeli Harfang drone*

operates at 70,000ft.

A few years ago, the US agency DARPA spawned a research programme entitled VULTURE (Very High Altitude Ultra-Endurance, Loitering Theatre Unmanned Reconnaissance Element). The aspiration was for the UAV to stay aloft for as long as five years. The project has since been de-scoped and has morphed into BOEING/PHANTOMWORKS SOLAREAGLE (VULTURE II) project. This HALE platform will aim to reach that five-year endurance mark with its striking 120m wingspan.

When it comes to deployment, UAS are considerably easier and faster to deploy than most alternatives. The projection of surveillance footage often thousands of miles away through satellite relay provides operational commanders in multiple locations feeds of the same Near Real Time (NRT) information. Having UAVs operating in often hostile or deniable airspace prevents the exposure of manned aircraft to these environments and the opportunity for casualties.

UAVs can deliver supplies into dangerous areas, which may be heavily mined or mountainous terrain without endangering pilots or truck drivers on the ground. Operating UAVs in 'denied airspace' generates its own unique challenges for their future development – it is almost inevitable that stealth technology will evolve into UAS aircraft as it has for manned aircraft.

For a military unit to operationally dominate a geographical area, UAV systems have now become so heavily intertwined into military planning that it is hard to envisage a military operation without them. Unmanned Combat Aerial Vehicle (UCAV) systems such as the PREDATOR have as a core role to provision Close Air Support (CAS), which can provide vital kinetic options for infantry teams deployed on the ground.

The MQ-1B PREDATOR has had this capability since 2002, armed with two Hellfire II missiles, which can strike from a range of 8km (5 miles). The MQ-9 REAPER has four Hellfire missiles and laser-guided munitions like the Paveway II and GBU-12 bombs. The REAPER has a cruising speed of 230mph. These airframes provide critical and sometimes lifesaving functions against a determined enemy. As General Tommy Franks mentioned in a 2003 US Airforce paper: "The PREDATOR is my most capable sensor in hunting down and killing Al-Qaida and Taliban leadership and is proving absolutely critical to our fight".

Modern warfare has transformed in the last decade of counterinsurgency operations in Afghanistan and Iraq faster than any period in recent memory. Wars have a tendency in accelerating technology innovation and this last decade can certainly be dominated by the evolution we have seen in UAV technology. The appetite for good-quality and near-real-time ISR is now greatly enhanced post-Afghanistan. There is no sign yet of the UAV technology arms race abating, which can only positively influence the UAV as an instrument of advantage.

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