SHEPHARD
UNMANNED VEHICLES
www.UVonline.com
Volume 14 Number 6
December 2009/January 2010

CONTENTS

Subscriptions
Annual rate £50
Tel: +44 1858 438879, Fax: +44 1858 461739
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www.subscription.co.uk/shephard

Unmanned Vehicles (USPS 014-131) is published six times per year – in February/March, April/May, June/July, August/September, October/November and December/January – by **The Shephard Press Ltd**, 268 Bath Road, Slough, Berks, SL1 4DX.

The 2010 US institutional subscription price is £50 ($100). Air freight and mailing in the USA by agent named Air Business, c/o Priority Airfreight NY Ltd, 147-29 182nd Street, Jamaica, NY 11413. Periodical postage paid at Jamaica, NY 11431. US Postmaster: Send address changes to Air Business Ltd/Priority Airfreight NY Ltd, 147-29 182nd Street, Jamaica, NY 11413.

Subscription records are maintained at CDS Global, Tower House, Lathkill Street, Sovereign Park, Market Harborough, Leicestershire, LE16 9EF, UK.

Air Business Ltd is acting as mailing agent.

ISSN 1351-3478

DTP Vivid Associates, Sutton, Surrey, UK

Print Williams Press, Maidenhead, Berks, UK

SHEPHARD

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268 Bath Road, Slough,
Berkshire, SL1 4DX
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Fax: +44 1753 727002
www.UVonline.com

16

Front cover: The latest version of AAI's Shadow 200 UAS features an extended wing. *(Photo: Textron Systems)*

Not all spin

Unmanned Vehicles' Middle East Editor, **William F Owen**, looks at how smaller VTOL UAVs are beginning to gain traction in the market.

Compared to almost any fixed-wing platform, helicopters are notoriously inefficient in terms of speed, range and payload. Indeed, the only thing they bring to the party is a unique form of operation for which conventional forms of aeroplane are unsuited. While this may all be a statement of the blindingly obvious, it is essential to remember it when assessing the future of rotary-wing UAVs, such as Skeldar, Camcopter and various other designs now prevalent on the military market.

Specifically, we need to look at vehicles which are smaller than the smallest conventional manned helicopter, but which are not micro or man-carried UAVs. Skeldar, Camcopter and even Dragon Warrior are indicative of just this area.

SO WHAT?

The Schiebel Camcopter's MTOW is about 200 kg, which is comparable to those of fixed-wing UAVs that usually have a five- to ten-hour endurance, as well as payloads in excess of 30 kg, as seen in Hermes 180. Having said that, the figures in the table below are instructive.

Figures like these actually show nothing surprising and are merely indicative of the issues that need to be discussed. The real point in question may not be the weight of the 'airframe', but actually the weight and space of the entire system. Hermes 180 does require a runway or a catapult to launch, and it needs either a parachute-airbag system or a runway to be recovered.

At least in theory, the VTOL UAVs can be carried on a light truck and operated from any small patch of clear ground. No manpower is needed to set up or maintain any launch or recovery equipment. This can arguably create a small, simple, sustainable operating concept. Transporting a VTOL system by vehicle is not a problem, and it only seems a minor engineering challenge even to have the vehicle be the launch and recovery point. For example, a fully assembled Camcopter takes up less volumetric space inside an armoured vehicle than four fully equipped soldiers. Additionally, it would not take an ergonomic genius to configure and fit a ground station into the same vehicle.

At least in theory, the time from the vehicle halting to actually launching such a VTOL UAV should be substantially less than that for a more conventional design. The same should be true for recovery. If conventional fixed-wing launch assembly times come to over 15 minutes, then this arguably has an operational impact. This is especially relevant to formations or units on the move. As is the case with artillery, there are some operational indications that time into and out of action may be important. There may well be times and conditions when a prepared UAV sitting ready to launch on a catapult or runway is actually impractical.

	Camcopter S-100	Skeldar V-200	Hermes 180 (fixed-wing)
MTOW	200 kg	200 kg	195 kg
Endurance	six hours – with 22 kg	five hours	ten hours
Payload	Max combined fuel and payload 50 kg	30 kg	32 kg
Speed	120 kt (dash) 55 kt (endurance)	70 kt	105 kt

Parachute recovery methods are inherently risky to airframes and can sometimes be impossible due to wind. Wind conditions can certainly change considerably in a ten-hour mission, just as they can in six-hour ones. Runway operation is, of course, dependent on a suitable operating surface, and in some terrains and conditions, these may be hard to find in a place that does not make their location fairly predictable to all. This is not an issue in security operations when operating from a fixed base, but it is not hard to conceive of some security-related operating environments, such as urban terrain, where finding such space may be challenging.

Again, at least in theory, VTOL UAVs can even be flown to remote operating sites, such as mountaintops, rooftops and small clearings in jungles, all inaccessible to their transporting

Camcopter seen transitioning out of the hover from a ship while under way. *(Photo: Schiebel)*

vehicles. They would merely require a ground station, fuel and tools to be maintained at the remote site; a small manned helicopter can deliver all of this to the location concerned. It is also worth noting that fully assembled and near flight-ready Camcopters and Skeldars can be loaded onto and transported by support helicopters such as the AW101.

All of these possibilities are traded off against fairly modest performance handicaps, the lack of endurance, compared to a fixed-wing platform, being by far the most pronounced.

VTOL UAVs also have some noticeable advantages in terms of poor-weather operation. Due to higher wing/blade loads, they can operate in much stronger winds, and their very low speed also helps when operating in reduced visibility in confined areas.

Like helicopters, VTOL UAVs are primarily useful when the location they are asked to operate from is unsuitable for fixed-wing aircraft. Additionally, their small size and logistic footprint gives them many other obvious benefits, for a performance envelope that the even smaller tactical UAVs, such as Elbit's Skylark 1 LE, simply cannot match.

ALL AT SEA

A lot of interest has been stirred up by the idea of operating these kinds of VTOL UAV from aboard ships or patrol craft. Obviously, they can launch from any vessel that can operate a conventional helicopter. The arguments as to why a ship that already operates a helicopter might also want to launch a VTOL UAV are very context-specific; but the ability to give a / vessel which is too small to operate a rotorcraft a near helicopter-like capability is extremely useful.

One of the problems that small vessels have always had as armed platforms is that the weapons they mount nearly always outrange the sensors they carry. Simply put, the radars cannot see as far as the missiles can fly. For example, the MM40 Exocet has a range of 40 miles (64 km), and the new Block 3 variant will reach a reported 110 miles (177 km). Both Skeldar and Camcopter can potentially operate out to over 100 miles (161 km), thus giving small vessels an over-the-horizon targeting capability, which previously required data from maritime patrol aircraft or some other vessel. Indeed, Camcopter has been sold to the German Navy to operate from one of its Corvette-class ships.

This also creates the possibility of employing new weapons systems such as missiles with laser-seeking or electro-optical warheads, using illumination and positional data provided by the UAV. This means that the munitions conducting the attack can be entirely passive, so provided that the weapons can lock on after launch, there will be no seeker emissions to detect. This would seem especially relevant when missiles such as Kongsberg's NSM and JSM are considered.

Obviously, this also means that a small VTOL UAV launched and sustained on station some distance off shore can also provide targeting information and illumination for a whole range of strike platforms.

It is also theoretically and technically possible to arm small VTOL UAVs, though the weapons fit would probably have to be very specific to a particular target set. For example, Camcopter has been shown armed with one 'multi-role' missile.

The possibility for submarines to operate small VTOL UAVs is also not that far-fetched, taking into account some minor engineering challenges and the acceptance that the boat would have to surface to conduct a launch. Most of the types concerned are relatively compact when fully assembled and ready for flight. It does not seem impossible that a submarine could launch a VTOL UAV from its conning tower, while under way with decks awash. Control links would be maintained from periscope depth.

There is also the possibility of similar UAVs operating from 'civilian vessels' in support of special operations. While this may be discounted from a legal point of view, there are certainly conditions where it might be an extremely useful capability given a strong enough political imperative.

The real strength of these unmanned vehicles is that they are potentially extremely hard to detect at any range where they might usefully identify a major surface vessel. This is a characteristic common to all UAVs, but MALE/HALE platforms, commonly associated with maritime missions, are substantially larger, more expensive and more complex aircraft than the types under discussion.

TRUCKING ALONG

Another potential application that has been widely discussed, but not yet realised, is using such platforms for re-supply. A disposable payload of 30 kg is significant to a small ➤

Saab's Skeldar V-200 has been developed in conjunction with Swiss UAV. *(Photo: Saab)*

infantry or special forces team. This equates to 5 kg, or two to three days' worth, of rations for a six-man patrol. Should more be needed, it is simply a matter of more aircraft or more sorties. Simple arithmetic shows that 10 sorties could deliver 300 kg. An out-and-return flight of 25 km, including loading and unloading, might take 45 minutes, meaning that eight hours of operations could accomplish 10 sorties.

The required flight profile is very simple. The aircraft has to lift, establish a normal flight profile and then descend into a known point, possibly being guided by another ground station. The sensor fit required can be an extremely modest 1.5 kg electro-optical payload – or, rather, the minimum required to provide the necessary flight control data.

Is 30 kg a useful load? It would equate to about 48 'Meals, Ready-to-Eat', but the bulk of such a load would almost certainly mean that it could only be carried underslung. In terms of materials with a higher density, 30 kg is 1,100 rounds of 7.62 mm links or eight M72A6 LAW launchers. It is also equivalent to about 60 multiband, handheld transceiver radio batteries.

While it has to be confessed that such a role is far more suited to special operations than normal infantry missions, the possibility of re-supplying remote surveillance or observation positions is operationally significant given that the capability of such teams to deliver a persistent presence in an area is largely a function of their ability to be re-supplied.

A small VTOL UAV's sound, heat and visual signature is substantially less than that of even the smallest military helicopter. Moreover, the vehicle could operate into far more degraded weather conditions than would be possible for manned aircraft.

STILL VULNERABLE

A good deal of the criticism aimed at small VTOL UAVs refers to their alleged expense, complexity and vulnerability. In terms of total operation, it has to be asked if a Camcopter really is more expensive, vulnerable or complicated to operate than a fixed-wing UAV like Hermes 180. If there is a body of evidence to this effect, then it is not immediately apparent.

Manned rotorcraft are certainly perceived to be, and to a certain extent are, more vulnerable to ground fire than fixed-wing aircraft. We do not yet know whether the same is true for UAVs. VTOL unmanned vehicles are physically smaller and thus harder to see than fixed-wing models of the same weight. Arguably, they do have a higher noise signature, but to what degree and how significant that is would have to based on some type of operational comparison and not on 'some guy's opinion', so beloved by defence industry marketing departments. Camcopter has a 55 hp engine, while Hermes 180 has a 38 hp engine. However, power settings, altitude and wind conditions would all have a part to play. The arguments as to size versus noise signature may be entirely academic.

No part of this article attempts to suggest that small VTOL UAVs are better than fixed-wing unmanned vehicles of a comparable weight. What it does suggest is that, as with manned aircraft, there are some things that helicopters can do that give them a unique capability which is operationally relevant to how they are employed. Today, small VTOL UAVs are not significantly more difficult to fly or operate than fixed-wing ones. Landing within inches of where you wish, or even onto a small boat, is something they are more than capable of doing.

It would be very easy to suggest that the biggest challenge to the widespread adoption of small VTOL UAVs lies in ignorance, but this would be unfair. Their potential utility is mostly obvious, but even in the short time that unmanned vehicles have been operational within armies, they have already created their own social and organisational needs within the branch in which they reside. The person planning the budget for a given UAV battery may not want a system which requires less manpower or which seems to incur the perceived potential risks of rotary-wing flight. Technical arguments tend to have technical solutions; human and organisational arguments are, by their very nature, far more complex and essentially more powerful. Only time will tell whether these small machines will be adopted extensively across the armed services. **uv**

Camcopter shown in one of its transport configurations. *(Photo: Schiebel)*