

- Europe, particularly the UK, is beginning to introduce more UAVs into service and industry is developing niche capabilities
- In three years' time a number of new systems will have begun to enter service and Italy's indigenous UAVs should be more mature

Europe has taken leaps and bounds in the industrial and operational fields of unmanned aerial vehicles (UAVs) in the past five years, although, in terms of in-service platforms, an international influence remains strong.

The UK has led the way operationally, moving from the troubled Phoenix battlefield surveillance and targeting UAV (removed from service in April) to the Israeli Elbit Systems Hermes 450 and Lockheed Martin Desert Hawk variants and most recently General Atomics Aeronautical Systems Reaper armed UAVs.

While Italy's Alenia Aeronautica is pushing ahead with a family of development UAVs and developing its own ground control station (GCS), western Europe's other large aerospace industrial powers – France, Germany and Spain – are driving ahead with either imported platforms or development programmes.

The still relatively small requirement base for larger UAVs in Europe has left industry, according to some sources, awaiting direction.

HERTI UAV

BAE Systems' concealed work on UAVs was revealed in late 2005 with details on a number of demonstrator platforms being released; the key one of these was HERTI (High Endurance Rapid Technology Insertion).

The first version, HERTI 1D, was based on the J5 Marco power glider and the following HERTI 1B on the larger J6 Fregata, as was the BMW engine-powered HERTI 1A, which is now only used for ground trials.

The HERTI 1B is powered by a Rotax 914 engine, is 9.1 m long and has a wingspan of 12.5 m. It has a maximum take-off weight (MTOW) of 500 kg and a payload weight of 125 kg. Maximum altitude is more than 25,000 ft, with endurance at more than 20 hours.

The company's Military Autonomous Systems (Air) Director of Sales and Marketing, Andy Wilson, said the programme was focused on "not just developing the system because the technology is good or because it is the latest gadget".

Wilson continued: "It is actually making sure we get a system that is going to deliver a genuine operational capability to the guys that need it."

As part of the effort a HERTI 1B and GCS were deployed to Afghanistan with the support of the UK Royal Air Force's (RAF's) Air Warfare Centre under a programme called Project Morigan.

This evaluation had originally been planned to take place at the Woomera range in southern Australia, but operational imperatives led to the real-life evaluation of the system.

The first production-standard HERTI was delivered in late 2007 and the second three months later; the UAVs are being manufactured in the UK by Slingsby.



EURO UAVs find a path

Europe has tended to look elsewhere for its UAVs but, as Damian Kemp reports, that is now changing

"We've still got a fair amount of flight test work [as part of the productionisation programme]; one of the first aircraft [DV007] is doing flight tests in Woomera [up to the end of May] and a second aircraft [DV010] is on its way to Australia," Wilson said.

"[Woomera] is a fair way to go, but once we are down there we've got the range environment booked for us to do whatever we want to do.

"We're planning to go down there for an eight-week period and it is an environment where we can do a really good cross-section of flying, high/low altitude and generated scenarios. It is hot and sticky and dusty, and one of the things we were keen on doing is [clearing

it] fully for worldwide operations; having the opportunity to fly around in 45 degrees C and dusty environments is very useful.

"If we pitch up at Woomera on a Monday to fly you can be pretty much guaranteed to fly every day. It is a lot easier to put an intensive programme in place in a place where it is pretty much within your remit to control."

BAE Systems is unable to reveal total flight hours on the airframes because many of these were under the control of the RAF and cannot be disclosed, but DV007 has completed about 25 hours with the company and thousands of 'hardware in the loop' hours have taken place.

The option of a launched system remains a

BRIEFING

EUROPEAN UAV DEVELOPMENT

possibility. The company completed trials using DV008 to measure suitability for a Robonics brand launcher and launched a weight representative body to evaluate power of launcher.

More work would be required to prove the launcher option but, according to Wilson, the operational concept for HERTI means standard runway launch and recovery is more likely because of the aircraft's size and endurance.

"Most of the launcher-launched systems are just for people who want to react very quickly, just to peek over the hill," he said.

"With [HERTI] you can have it sit up there for 20 hours and call it down when you want to."

Project Morrigan's Afghanistan deployment was also used to inform the development of, and improvements to, the GCS, which can control three HERTIs at once.

The company is committed to creating a GCS with the greatest possible commonality with other control units but some hurdles are difficult to clear, for instance the fact that Predator and Reaper UAVs – as used by the RAF – are manually flown and remotely launched and landed, whereas the HERTI GCS is designed for full automation.

The original intention for Project Morrigan was for it to progress as a seven-phase effort.

"It took a swerve to the left with the Afghan deployment; we have completed three phases and we are now looking at the programme with the Air Warfare Centre and how we go forward," Wilson said.

"Do we want to go back to the seven stages we had originally, or is [the deployment to Afghanistan] going to move us at a different pace in a different direction?"

Alenia Aeronautica largely began its UAV efforts from a standing start in 2003; Italy's previous work in the field of targets and drones had been led by Gallileo Avionica, which also developed and sold to two customers the Falco medium-altitude tactical UAV.

A rapid development process led to first flight in mid-2005 of the Sky-X demonstrator UAV. The aircraft has a 5.78 m wingspan, is 6.94 m in length, MTOW is 1,450 kg and maximum payload 150 kg, it has a maximum altitude of 25,000 ft and an endurance of two hours.

The company describes it as the first European UAV of its size. Further development, beginning later in 2008, will focus on its mission management system, including collision avoidance and autonomous attack with further work likely to involve the platform and include tail-less controls, thrust vectoring and integrated weapons bay.

In mid-2006 Alenia began further development of a larger UAV, the Sky-Y, with first flight in mid-2007 followed by integration of a diesel heavy-fuel engine and autonomous take-off and landing, which has also been conducted in low-light conditions.

The 9.7 m-long aircraft has a wingspan

of 9.9 m, an MTOW of 1,200 kg and a maximum payload of 150 kg. Maximum altitude is 25,000 ft, with an endurance of 14 hours.

A key improvement over the Sky-X is a planned satellite communications capability to provide beyond line-of-sight communication and its capability to be operated with a sensor.

MALE UAVs

These demonstrator programmes are intended to lead to a single-engine medium-altitude long-endurance (MALE) UAV and, more particularly, the Molynx civil and Blacklynx military twin-engine MALE UAV.

It is planned that Molynx will have a length of 18 m and a wingspan of 25 m, a MTOW of 3,200 kg and payload of 800 kg. Altitude is set to be 45,000 ft and endurance more than 30 hours.

The heavier, but smaller, Blacklynx (MTOW 4,100 kg, length 9 m) will carry a similar payload with an identical wingspan, but is planned to have an endurance of 36 hours.

Alenia's rapid activity in the field – two demonstrator UAVs flying and development started on a marketable MALE UAV in less than five years – is driven by its high expectations for revenues.

Alenia Aeronautica's head of UAV new initiatives, Alessandro Amendola, said the company believes the surveillance and combat UAV market will be worth about USD92 billion over the next three decades, with the United States forming about 45 per cent of the market.

"We are making a long-term prediction for what is a new market, so it is difficult to assess the accuracy of our predictions [but] we have few doubts that this will be the future," Amendola said.

In the immediate field in which the company will be competing – described by Alenia as medium MALE (MALE-M, Predator A or Heron class) and heavy MALE (MALE-H, Predator B or Heron TP class), and high-altitude long-endurance (HALE, such as Global Hawk), in which it does not expect to compete – it is predicting sales of about USD48 billion. It believes about half of this will be in the MALE-H class, MALE-M about 15 per cent and the remainder to HALE with the number of platforms expected to number about 1,900.

Alenia's prediction is that more than half of the aircraft will be MALE-H, about 35 per cent MALE-M and the remainder HALE.

The company believes that MALE-M sales will drive the market up to 2016, with MALE-H dominating for the following two decades; it



Alenia Aeronautica's Sky-Y (left) and Sky-X demonstrator MALE UAVs

Alenia Aeronautica: 1293556



BAE Systems' HERTI UAV has been evaluated in Afghanistan

BAE Systems: 1293559

BRIEFING



The Schiebel S-100 Camcopter has been trialled for Spain and Pakistan

Schiebel: 1293548

predicts annual HALE sales to be at about 10 up to 2036.

Alenia Aeronautica's director of MALE UAV programmes, Franco Sella, said the "future is a bit cluttered" but the company was preparing itself for as yet unknown requirements.

"It is a very dynamic situation, which sooner or later will generate a very real market and industrial opportunity; our task at the moment is to make sure that by the time it comes we are ready," Sella said.

"We developed a roadmap to take us from virtually not having designed a UAV to launching a development programme to first flights.

"You cannot design and build UAVs in the way you design and build manned aircraft; the lifecycle for UAVs is much shorter. We developed Sky-X to first flight within 18 months and Sky-Y in 11 months."

Sky-Y has already completed several key tests including take-off in low-light (one hour before sunrise), automatic take-off and landing (ATOL), and flight with a Selex Galileo EOST-45 electro-optical sensor.

As part of the roadmap, key milestones in the near term for Sky-Y include operation with a wide-band datalink, likely to be in September, and automatic taxiing. Before the end of the year work is expected to begin on the larger Sky-YS, which will operate with a 3.4 litre engine compared to Sky-Y's 2 litre engine. First flight is expected within a year of development beginning.

The company is predicting higher-than-manned attrition rates for UAVs: five aircraft per 100,000 flying hours for some variants, compared with about 1.62 hours for Lockheed Martin's F-16 aircraft per 100,000 flying. However, these high rates are due to the immaturity and the expendable nature of the platforms.

A balancing act is still being conducted by manufacturers to meet a cost-versus-capability equation and this is also driving Alenia's development programme.

"We don't want to make the system so complex that it is as expensive as a manned aircraft," Amendola said.

"In our ageing society welfare costs will rise so we need to find efficiencies. It is not like it was in just producing very simple and cheap systems; the cost of the system is increasing as the complexity increases and the goal is to maintain some level of cost reduction compared to manned.

"The winner of the market will be the one who combines capability with cost efficiency."

Remote operation

As well as designing UAVs from scratch, Alenia has developed a GCS as a containerised four-station system and as the basis for a remotely operated system, similar to the laptop computer-based US Remotely Operated Video Enhanced Receiver (ROVER), or in a receive-only tablet form.

The large containerised GCS consists of two remote operator stations (ROS I and ROS II) in tandem with some shared controls to prevent over-ride, a mission operator station for exploiting data and an avionic operator station for monitoring the health of the GCS and payloads.

The ROSs share some similarity to an actual pilot's position, including pedals and throttles in ROS II along with aural cues.

The company's argument for the similarity to a manned cockpit is that it is required to meet European regulations and if certification authorities allowed it "we would take out the pedals".

"We have been repeatedly told that mouse control is the wrong way and safety principles should not be tied to keyboard and mouse," one official said.

The UK's first effort with UAVs was Phoenix, a troubled programme to develop an indigenous system. This was retired after fewer years of service than it took to procure and bring it into service.

Operations in Afghanistan and Iraq since 2001 were behind the rapid procurement

of off-the-shelf platforms; in the case of the purchase of RAF Reapers this followed experience of RAF personnel working with US equipment.

The UK's Watchkeeper system, which used the Elbit Systems Hermes 450-based WK450 MALE UAV, is expected to achieve initial operating capability (IOC) in February 2011 under the guidance of Thales UK. IOC had been planned for 2010 and full operating capability is expected for 2012/13.

The WK450 is more powerful than the Hermes 450 and will be equipped with ATOL and dual payloads, neither of which were fitted on the Hermes 450.

It will be fitted with the Elop CoPASS IV multisensor system and the Thales I-Master ground moving-target indicator/synthetic aperture radar.

First flight of a WK450 occurred in Israel on 16 April and in the following three weeks, according to Thales Business Director (UAV Systems) Nick Miller, up to 10 more flights took place.

The first tests were to judge the robustness of the aircraft and systems will now be added on, including ATOL, payload extension and data fusion – described by Miller as the first phase of the programme.

"The second phase will take place in the UK, either late this year or early 2009 at Parc Aberporth [in Wales] and it is here we will start looking at the UK-specific aspects of the system, the secure aspects of the system and we will also repeat the Israeli tests," Miller said.

"The third aspect will begin in 2009 and include the integration and testing of the Watchkeeper ground infrastructure."

The first 10 WK450 aircraft will be manufactured in the UK and assembled in Israel and Miller expects assembly of the remaining 44 aircraft in the UK to begin in 2009.

"The first battery will form IOC followed by the delivery of a further three batteries up to 2014 for FOC [full operating capability], but additional aircraft will be delivered beyond FOC," he said.

Neither Thales nor the Ministry of Defence would disclose the number of aircraft or systems in each battery.

The lessons of the use of Hermes 450 by UK forces are being fed into the Watchkeeper programme and more than 8,000 operational flight hours have now been completed.

According to Miller, key to the system is onboard processing and ground systems.

"The aircraft has onboard imagery-on-demand compression techniques, there is more and more autonomy on board and that helps with data transfer rates; we have compression on aircraft already and we can do that further," he said.

"We can do change detection on board and process the video and come up with an answer set, or co-ordinates, or change detection classification and send that down the pipe and meet full motion video requests as well."

Trans-European EADS' UAV efforts are focused on two programmes, with foreign-designed platforms: Euro Hawk, based on the Northrop Grumman RQ-4 Block 20 Global Hawk, and the French Army programme SIDM (Système Intérimaire de Drone MALE), based on the Israel Aerospace Industries Heron (designated Eagle in its modified form).

As part of the acceptance trials, SIDM undertook its first flight from Air Base 118 at Mont-de-Marsan in France in February. The company told *Jane's* in a statement that this flight "confirmed the functional efficiency of the UAV in a new environment and its air traffic insertion capability". During the final stage, planned before the end of 2008, the French Army's UAV test wing will then evaluate the system for its operational readiness.

The Euro MALE programme – which includes Germany, France and Spain – was originally planned to be based around the Eagle 2, derived from the larger Heron TP, but the programme was reorganised when the aircraft did not meet requirements.

Germany is now leading a 15-month risk-reduction study and that country's government, on behalf of all three nations, has commissioned EADS to define a joint technical solution to inform any decision on the

full-scale development of an intelligence, surveillance, target acquisition, and reconnaissance (ISTAR) UAV.

Network centric concept

As part of another effort, in late 2007 the German government commissioned EADS Defence and Security Military Air Systems to lead the 'Agile UAV within Network Centric Environments' (Agile UAV-NCE) research and technology programme to investigate enabling technologies and concepts of operations.

First simulation exercises for Agile UAV-NCE have been conducted and verification flights are expected to start in 2009/10; it is expected to run until 2013, demonstrating systems and aircraft through real flight and simulation.

The sole EADS Barracuda technology demonstrator UAV crashed in September 2006 but a second aircraft, described by the company as having "increased capabilities", will form part of the Agile UAV-NCE programme.

The Euro Hawk programme for Germany, expected to be worth about EUR431 million, (USD666.4 million) was launched with a risk-reduction contract in January 2007. This is expected to produce an IOC for a full-scale development system in 2011.

The Euro Hawk's first flight is expected in December 2009 (in the US where it is being manufactured), before flying to EADS Maching in mid-2010 and then onto flight tests.

This is likely to be followed by a production decision and deliveries from 2014 that would produce a system with four air vehicles.

More than 100 of Austria's Camcopter S-100 rotary UAVs have been sold and on 18 April manufacturer Schiebel announced that it had completed trials from the *Rio Mino* patrol ship of the Spanish Guardia Civil several days earlier.

More than 100 S-100s have been sold to three export customers and it has also been trialled on a Pakistan Navy Type 21 frigate.

Industrially, Europe has the capability to develop and produce UAVs, although compared to the US and Israel it is substantially behind the curve. There is an apparent willingness not to 'reinvent the wheel' but, particularly in the case of Alenia and BAE Systems, there is an acknowledgement that a core capability is necessary for support and upgrade.

It is largely only the UK that is being driven by the operational imperative, particularly with larger systems, with other ISDs stretching out to the next decade in some cases.

Damian Kemp *Jane's Aviation Desk Editor,*
London

From design to reality

Navantia