

Wales Unmanned Air Vehicle (UAV) Environment – Understanding the Potential Requirements; a précis paper.

Introduction

The Welsh Assembly Government has created ParcAberporth to facilitate and stimulate the development of the Unmanned Systems industry in the UK. This initiative was borne out of the imperative to develop and maintain sustainable economic growth in West Wales.

Recognising the need to support the burgeoning requirement in the UK to develop a UAV support capability, a pan-Government ParcAberporth Stakeholder group was formed to take forward the initiative. Chaired by the Department for Transport and with representation including the Civil Aviation Authority, MOD and industry, the ParcAberporth Stakeholder Group identified the need for an operational entity to be established that would serve as a focus for UAV activity. To this end, QinetiQ joined with West Wales Airport in a teaming agreement to create the West Wales UAV Centre.

Although there is an aspiration to use the Danger Area airspace associated with MOD Aberporth Range - EG D 201 - for routine civil unmanned aircraft applications, it is used intensively by the MoD as primary users, and it is likely that there will be significant constraints on the use of EG D 201 by Industry. Furthermore, as an over-sea range, EG D 201 is not suitable for certain types of UAV sensor development trials and demonstrations.

The ad hoc creation of Restricted Airspace (Temporary), as currently employed at West Wales Airport, to support unmanned aircraft flights is not a satisfactory long-term solution for either the developing UAV industry or the Directorate of Airspace Policy. Consequently, a permanently established temporary segregated airspace, managed in accordance with the Flexible Use of Airspace principle, is required over land to support unmanned aircraft flying. The establishment of new, segregated airspace over-land, when coupled to the ability to access EG D 201 will form what is being colloquially referred to as the Wales Unmanned Air Vehicle Environment (WUE).

In seeking to understand the likely market requirements for any such new facility or capability, the West Wales UAV Centre has been engaged with the UAV Industry market sector in order to draw together a wide-ranging set of likely requirements needed to support the near, mid and long term development and evolution of the industry has been formed. This information has been collated and detailed within a single document entitled "Wales Unmanned Air Vehicle (UAV) Environment – Understanding the Potential Requirements" which identifies the potential and actual needs of the UAV Industry based on responses received and analysis of current understanding of this developing market. The collated information shall be used to inform and influence the Design Stage of the CAP725 Airspace Change Process for the proposed new, segregated airspace within the WUE. Additionally, the information within this document will help illustrate the fundamental demand underpinning the pursuance of new, segregated airspace and will be presented as part of the overall submission to the Directorate of Airspace Policy for an airspace change to support UAV operations.

This paper summarises the above document for the purposes of inclusion within the overall public consultation briefing pack.

Market Overview

At this point, it is important to note that the UA Industry, in terms of civil or commercial activity, is relatively immature due to, in the main, regulation. There is no appreciable market for UAS in civil and commercial applications in Europe, since this is dependent on the evolution of a number of factors; the military market world-wide predominates but the potential for the civil market is considerable if the barriers that impede the wide deployment of civil systems can be overcome. The barriers mainly affect the developed world where the density of air traffic and population are high and where complex Air Traffic Management infrastructures exist. Outside these areas the civil and para-public use of UAV systems is becoming more widespread.

Therefore to expedite and develop a UK-based industry (and economy), an environment is required that will allow 'routine' UAV activity.

Background – Establishing the Need

The establishment of new, segregated airspace to support UAV operations, development and demonstrations is not predicated on any one absolute demand or requirement. Indeed, since the inception of the West Wales UAV Centre, it has been apparent that the civil UAV industry has the potential for exponential growth, yet remains disappointingly free of any real, sustained activity.

The barriers to routine operations comprise the current 'unknowns' surrounding safe operation and integration of UAVs with *normal* - or manned - aviation and, until these issues are tackled and demonstrated by real activity (as opposed to simulation), it will prove difficult for the aviation authorities to consider the perceived risks overcome or mitigated to acceptable levels that might lead to subsequent greater approvals for flying over wider areas (and ultimately within non-segregated airspace). In the UK, whilst no areas are available to support routine flying, operators and manufacturers will be forced into 'permissive' environments elsewhere in the world, thus robbing the UK of the ability to position itself at the forefront of UAV development and acceptance, particularly in the civil application of UAVs.

The Welsh Assembly Government has invested in ParcAberporth and also in the pursuance of an Airspace Change Process to support the location. It remains the belief and strategy of the Welsh Assembly Government that once the infrastructure has been finalised to support routine UAV operations, the ultimate goal of sustainable economic growth may be achieved in West Wales. The spin-off for the rest of the UK – and UK taxpayer – is that a facility will be positioned to capitalise on an Industry on the cusp of tremendous growth.

EUROCONTROL, as part of its UAV Air Traffic Management integration work has stated the view that there will be an increasing need for segregated airspace in the short to medium term to support UAV development. Frost and Sullivan has concluded that, whilst presently underutilised, the ParcAberporth facility is expected to expand, particularly when civil UAV use increases in the future.

Airspace Design

The requirements for UAV operations and development cover a broad range of potential applications and parameters pertaining to known systems or programmes.

The cross section of organisations that responded to the request for specific input has highlighted the plethora of UAV characteristics and the spectrum of operational abilities. The majority of respondents indicated that flying operations involving flight distances in excess of 10km from the airfield would be required. In addition, the requirement for longer distance/duration operations also includes the need for any new airspace to be capable of accommodating 'ground features' to enable exercising of any sensor-fit to operating platforms.

User Requirements at ParcAberporth

EG D 201 is expected to be used for an expanding number of military UAV flights (and not just target towing military UAVs). Suitable for fast and high dynamic aircraft such as Unmanned Combat Air Vehicles, high flying aircraft, and maritime UAVs, tasks are usually undertaken as MOD work with sorties typically being up to one hour in duration. Multiple sorties are facilitated on any given day. However, undertaking long endurance flights of a UAV would, potentially, tie up the range facilities and disrupt the range programme.

Furthermore, the potential to use of EG D 201 to test land surveillance systems, such as Synthetic Aperture Radar and Ground Moving Target Indicator systems is likely to be limited. Nevertheless, it is expected that high altitude and long distance tests of all UAVs, civil and military, would take place in EG D 201.

West Wales Airport is a small airfield with a paved runway of approximately 1200m in length. It is not envisaged that it will be used or useable by larger UAVs (the high-performance systems alluded in the paragraphs above). However, it is suitable for, and has been used by medium sized, conventional fixed wing, 'tactical' UAVs such as the Elbit Systems Ltd Hermes 450 and the Selex Falco.

Such UAVs tend to have a propeller based propulsion system. Single and twin engine, fixed wing aircraft and twin engine helicopters currently use, or are based at West Wales Airport so it is conceivable that the airport could be used by similar unmanned aircraft types. Possible examples of the largest UAVs that could feasibly use the facility are the General Atomics Mariner and Altair long endurance systems. The turbo-jet powered Northrop Grumman Global Hawk is unlikely to be a user.

Once the ParcAberporth and West Wales Airport expansion plans are realised, the airport will be co-located with a number of industrial units (such as the current Selex test facility) and a small passenger terminal.

From these notes it is clear that almost all the unmanned aircraft using the airspace will only have occasional access to EG D 201 and will be of a size and weight that can operate from a 1200m runway.

Some elements of the UAV industry are likely to establish a base, either permanent or temporary, at ParcAberporth to mount a test or demonstration campaign. Such campaigns may be mounted for specific customers. Other parts of the industry will have an almost routine requirement to conduct development flying and post manufacture, equipment integration or post-maintenance flight tests. Examples of equipment integration tests currently envisaged are Synthetic Aperture Radar (SAR) tests on Falco and Watchkeeper (SAR flight trials usually require an aircraft to fly on a straight track for several minutes while the radar compiles radar returns to create an image).

Other users may include academic and research institutes that wish to use a production standard UAV system to obtain research data. An example of such a project has involved the Institute of Grassland and Environmental Research (IGER), utilising a UAV to gather environmental data from a site in West Wales.

It should be noted that currently, UAVs and manned aircraft cannot use the airport facilities simultaneously. West Wales Airport's civil license is, in effect, suspended when UAVs are using the airfield or flying within the immediate vicinity. This has a detrimental impact on cost as the UAV operator is expected to pay for all the lost manned aviation business of WWA during the sortie. This cost is a disincentive to businesses for using ParcAberporth as a UAV base and makes long sorties in the vicinity of the ATZ prohibitively expensive. The cost could be made much less if UAVs were able to leave the immediate vicinity and allow manned aircraft to use the airfield whilst a UAV was flying in segregated airspace away from the airfield.

Defining New Segregated Airspace dimensions – Contributory Factors

One of the determining requirements for the proposed segregated airspace will be SAR tests. Such tests would require enough space for the aircraft to fly relatively long stable legs. As an example, a 10 minute leg flown at 180 knots would need a dimension of 30 NM plus a turning area. Internal safety buffer zones would also need to be added to any planned dimension to allow for the UAV system's navigation error budget and any reaction time needed to respond to ATC instructions, advice or information.

Detailed in Table 1 below is a snapshot of typical platforms that may require to undertake flight operation in West Wales. From this table, the broad spectrum of systems and their associated flight parameters is apparent.

Name	Type	Dimensions	Performance
Camcopter S-100	Rotary	L 3.1m, 1m, rotor Ø 3.4m	Spd n/k, Endurance 6 hrs, Ceiling 18000 ft (mission radius 150km)
SR 200	Rotary	L 3m, H 0.8m, rotor Ø 3m	Spd 80kph, Endurance 4 hrs, Ceiling n/k
Falco	Fixed Wing	L 4.8m, H n/k, W/s 7.3m	Spd 140kt (260kph), Endurance 14 hrs, Ceiling 20000ft (mission

Name	Type	Dimensions	Performance
			radius 200km)
Fire Scout	Rotary	L 7m, H 2.9m, rotor Ø 8.4m	Spd 125kt (231kph), Endurance >5 hrs, Ceiling 20000ft (Operating radius 110nm)
E-Swifteye	Fixed Wing	L0.82m, H0.12m, W/s 1.5m	Endurance of 1h and an operational radius of 9km.
Cybereye	Fixed Wing	L1.6m, H0.2m, W/s2.6m	Electric powered, twin pusher prop, endurance 3 hours, operational radius of 40km (22nm).
Orbiter	Fixed Wing	L1m, H0.22m, W/s2.2m	Spd 75kt, Endurance 2hrs, Ceiling 10,000ft (mission radius 40km)
Silver Fox	Fixed Wing	L1.5m, H0.3m, W/s2.4m	Spd 102kph, Endurance 8hrs, Ceiling 3,600m (mission radius 40nm)
Fanwing STOL	Cross Flow Fan	L2m, H1.5m, W/s3m	N/k
Vision-E	Fixed Wing	L1.3m, H0.3m, W/s2.5m	Electric powered; Spd 60kph, Endurance 55mins
Strix	Fixed Wing	L1.5m, H0.3m, W/s3m	Electric powered; Spd 40knots, Endurance 1.5hrs, Ceiling 3,200m
Asio	Ducted Fan	L0.8m, H0.8m, Ø 0.45m	Electric powered; Spd 25knots, Endurance 40mins
Sky-Y	Fixed Wing	L9.7m, H2.5m, W/s9.9m	Spd 125knts, Endurance 14hrs, Ceiling 25,000ft (range 500 miles)
SR-20	Rotary	Ln/k, H0.6m, W/s1.8m	Spd 50kph, Endurance 24mins
Aerostar	Fixed Wing	L4.4m, H1.14m, W/s7.5m	Spd 110knts, Endurance 12hrs, Ceiling 18,000ft (mission radius 200km)
Vigilant	Fixed Wing	L2.2m, H0.7m, W/s2.5m	Electric powered; Spd 130kph, Endurance 4hrs, Ceiling 16,000ft (mission radius 60 miles)

Table 1 – exemplar UAV systems

From responses received, it is apparent that the selection of platforms has varied operating scenarios or operational situations which would tend to

suggest that, in order to maintain a Flexible Use of Airspace, varying airspace options would need to be explored.

The maximum height of any segregated airspace will be constrained by the airspace structure over West Wales. Unmanned aircraft such as Falco have a practical ceiling of between 10,000 ft and 16,000 ft but Altair is a very high flying aircraft and the QinetiQ Zephyr can conduct most of its mission at altitudes in excess of 60,000 ft. The lower altitude limit will need to be set by a perceived requirement for UAVs to remain in segregated airspace even if all propulsion has failed but the aircraft can still be controlled to a safe landing area. In practice the segregated airspace around WWA will need to be at ground level to accommodate UAVs gliding back to the airfield in the event of propulsion failure.

The need to operate at low level i.e. below 3000ft, over longer distances is also evidenced; being driven by capable platforms carrying, usually, optical sensors that would normally operate below typical cloud bases.

Key User Requirements

In order to design airspace that would serve to meet the needs of the UAV industry, a broad cross-section of companies and organisations from the UK and Overseas, with a vested interest in developing, demonstrating or operating UAVs have been approached by the West Wales UAV Centre, to seek their views and input.

Throughout 2008, views were sought from existing contacts and supplemented in-year at various trade shows. Finally, a simple questionnaire was distributed with final responses received in early October 2008; of the 35 organisations approached, 28 responded.

Based on the market engagement identified key user requirements are summarised thus:

- The airspace must include the West Wales Airport Aerodrome Traffic Zone to allow unmanned aircraft to take off and land at the airport;
- The airspace must have a surveillance radar facility able to warn UAV crews of any likely incursion of the segregated airspace;
- The airspace should allow tracks of up to 30NM to be flown overland to allow testing of radar sensors and other payloads.

Sustainable Economic Growth in West Wales

The inception of the West Wales UAV Centre at ParcAberporth supports the Welsh Assembly Government intention of developing sustainable economic growth in West Wales. The Centre's ability to attract, facilitate and conduct UAV work will contribute greatly to this WAG strategy.

The overall aim in the development of ParcAberporth as a UAV Centre of Excellence has been to drive a 'knowledge-based' economy in West Wales, thereby increasing the average salary and providing sustainable employment opportunities. In so doing, this in turn supports a larger local service industry. Part of the mechanism for achieving this has been not only to develop ParcAberporth / West Wales Airport capabilities, but also to raise its profile in the UAV industry.

Increased activity at ParcAberporth will have a direct impact on the local service economy. This not only includes hotel, accommodation and related services, but may also encourage the development of other engineering-oriented service businesses. With enhanced infrastructure at ParcAberporth and increased UAV activity, other UAV operators will undoubtedly be encouraged to undertake activity at ParcAberporth, thereby accelerating its development and economic impact.

Societal Benefit

The UAV industry has not been able to truly demonstrate the benefits of UAV's to potential users, operators or society as a whole, due to, in the main, the inability to readily operate such systems and the immature status of UAV integration into the manned aviation community.

The creation of a capability affording safe and flexible flying opportunities will serve to kick-start the UAV industry in its promotion and engagement with society as a whole.

Environmental Benefit

The acceleration of UAVs into mainstream aviation will bring demonstrable environmental benefits; from the use of smaller aircraft with fuel efficient, reduced emission power plants through to enhanced electric and fuel cell technologies effectively eliminating emissions altogether and introducing virtually silent operations.

In Summary

The establishment of new, segregated airspace to support UAV operations, development and demonstrations is not predicated on any one absolute demand or requirement.

Until the barriers to routine operations are tackled and demonstrated by real activity (as opposed to simulation), it will prove difficult for the Aviation Authorities to approve UAVs for routine operations, ultimately within non-segregated airspace. ParcAberporth and the Wales UAV Environment is poised to position the UK in a niche area to support routine flying at the forefront of UAV development and acceptance, particularly in the civil application of UAVs.

The Welsh Assembly Government has invested in ParcAberporth and also in the pursuance of an Airspace Change Process and It remains their belief and strategy that once the infrastructure has been finalised, the ultimate goal of sustainable economic growth may be achieved in West Wales.

The Wales UAV Environment is poised to make a significant contribution to the stimulation, creation and sustained delivery of vibrant UAV activity in the UK; supporting industry, military and collaborative research, development, demonstration and training requirements.