



UAS Operations in Antarctica

A One Day Conference Organised by UAVS in Association with the British Antarctic Survey (BAS) at Cambridge on the 4th November 2009

This informative conference was hosted by the BAS at their facility at Cambridge University and was facilitated by Gary Clayton, Chairman of UAVS. The conference provided a successful opportunity for BAS members to meet with industry representatives and others interested in UAS development. The agenda is at [annex 1](#) and the papers presented are all available on the UAVS Website (<http://www.uavs.org/document.php?id=55&ext=pdf>).

1. Overview of Possible UAS Operations in Antarctica, David Blake (BAS)

David Blake started the business of the meeting with an introduction to Antarctica and the role of the BAS there. While the airspace is technically not controlled, it is managed by the research community there through COMNAP (the Council of Managers of National Antarctic Programmes), who maintain the AFIM (Antarctic Flight Information Manual). As discussed later, this could provide a useful environment to rehearse and demonstrate airspace integration. David went on to identify some potential uses of UAS in Antarctica:

- Photography and mapping
- LIDAR for height measurement and terrain mapping
- Animal surveys
- Air physics and chemistry
- Logistic support.

2. BAS UAS Operations – 2007 – Successes and Failures, Phil Anderson (BAS)

Some time ago, the BAS realised that UAS offered approaches to scientific work in the polar regions which could not be achieved by other means. A light UAV (Carolo T200) which had been developed by the University of Braunschweig was identified as the most suitable platform available. This aircraft uses electric power, which while it limits missions to one hour just now, avoids pollution when part of the science involved is precise measurement of the atmospheric chemistry in the Antarctic. Phil described the first campaign in 2007, the primary objective of which was to validate the approach, both operationally and as a scientific tool (slide 16 shows spectrograms from turbulence measurement over both sea-ice and shelf-ice). Many valuable lessons were learned and reported, including the need for a team of engineers and scientists (the environment is too demanding for a plug and play approach to the UAS); and the importance of an auto-land facility (radio control of landing led to most of the airframe losses — only 1 of 4 airframes came back).

3. Future UAS Requirements for the Polar Boundary Layer Research Community, Phil Anderson (BAS)

Moving swiftly on from the previous session, Phil described future plans, including aircraft upgrades (including auto-land). The main feature of the session was Phil's description of the opportunity to explore the PBL (planetary boundary layer) and so capture data on the



sporadic turbulence which is found there in the stratified conditions. The UAS is a unique instrument platform for research in this area. Modelling of this boundary layer is one of the major unknowns in climate modelling and is critical to understanding the processes which control the gain or loss of the polar ice-caps. Phil's presentation included cartoon movies of a horizontal sheet of w' wind vector, showing homogeneous (slide 7) and sporadic (slide 9) turbulence. This explains why UAS, with faster line integration, is an improvement on the current use of static mast(s) for low wind speed stratified boundary layers: they are uniquely able to explore the entrainment zone which is the region of greatest uncertainty in boundary layer air chemistry models.

4. Latest Developments in CAP 722, CAA Guidelines on Unmanned Aircraft System Operations in UK Airspace – Industry Perspective and Developments, Gary Clayton (EADS)

As a prelude to the next session, Gary outlined the significance of CAP722 (available from the CAA website or via the UAVS website). CAP722 was introduced by the CAA with the encouragement and support of the UAVS. The first edition while not embodying formal policy, provided guidance and points of contact for all potential users of UAS in UK airspace. The document has been a great success and is regarded as a baseline for UAS regulation by significant international bodies and the regulators of many other nations. The UAVS continues to represent the interests of UK industry by organising workshops to support development of CAP 722 and representation of UK industry on other national bodies (see [annex 2](#) to this report).

A significant change in CAP 722 is that *any* UAS with *any* instrumentation or surveillance will come under the CAA guidelines. This is the legal separation between model/hobby aircraft and UAS. The reasoning is to control the use of miniature spy UAS by paparazzi and other possible uses of UAS for commercial/private spying. This may impact on the plans for micro-UAS (< 2 kg), as, even with such small weights, it still requires some level of CAA approval.

5. The CAA's Perspective on Future UAS Operations Globally, Lt Cdr Gerry Corbett (CAA)

Lt Cdr Corbett confirmed that while CAP722 is not a formal policy document in its entirety, it does contain elements which are: (It contains guidance on how to operate within the law). At the highest level, it is policy that:

UAS will pose no greater threat to persons or property in the air or on the ground than that presented by equivalent manned aircraft.

This policy is reflected across the globe by other regulatory authorities. This policy statement has many consequences and issues for UAS in UK airspace such as:

- There is no automatic right of airspace use, for UAS or anyone else
- The role and responsibilities of the Pilot in Command
- Management of UAS operations outside controlled airspace (the ATC service does not have the resource to do this!)
- Integration, and therefore transparency, in controlled airspace



- Radio spectrum allocation for civil UAS (now a topic at the next World Radio Conference in 2011)
- Legislation changes to permit UAS operations: they will not provide any major concessions!
- The UK Air Navigation Order (Article 98) is about to be amended giving the CAA authority for all Small Aircraft (including sub 7kg) equipped for surveillance or data acquisition purposes. Essentially, permission from the CAA is required to operate unmanned aircraft within specified distances of persons or property – operators need to prove to the CAA that their operation is safe.
- UAV Pilot licensing
- Public Perception is a major challenge to the industry: we need more positive stories
- We must ensure harmony with European and International bodies such as ICAO.
- What are the implications of autonomous operations for all of these issues? Use of the word 'Autonomous' – used differently by different bodies- are some actions "Autonomous", or are they really "Automatic"?

All UAS operations in UK airspace must use an approved method of collision avoidance (Sense {or Detect} and Avoid).

- Within "Line of sight" operation this is normally achieved through visual observation by the pilot. This constraint will limit operations to 500m horizontally or 400 feet vertically unless further constraints are imposed due to aircraft size and colour or adverse weather conditions.
- Beyond Line of sight, the objective may be achieved by various means:
 - A mobile observer (basically extending the visual "Line of Sight")
 - An acceptable (autonomous) sense and avoid system – how this would be achieved is still very much in the hands of the technology developers rather than the regulators and might feature:
 - On board sensors
 - Ground based or other sensors
 - A combination of these
 - The use of segregated airspace, including RA(T)

Two airspace change proposals to create new Danger areas (DA) specifically for UAS operations are being developed, covering areas around the West-Wales airport (Parc Aberporth) and on Salisbury plain. If successful these changes should be in place by mid 2010.

6. Light UAS Scheme André Clot (EuroUSC)

André began with an introduction to the background to the new Light UAS Scheme (LUASS™). When the EU directive forming EASA took effect in 2004, the CAA determined that while it had responsibility for (unmanned) aircraft below 150kg, it did not have the resource to manage them. UAVS was asked in the first instance to develop a scheme for airworthiness exemption: after some initial development it was concluded that this was not an appropriate activity for a trade association, and the initiative was taken up by EuroUSC, who are now the first Qualified Entity, approved for Independent Assessment of Light UAS and their operations, allowing them to make recommendations and submit reports to the CAA. LUASS™ covers three key areas:



- What can fly: independent design and construction assessment
- Who can fly: UAV pilot and ground crew assessment and qualification
- Where to fly: Operation and environmental risk assessment and management

More information on LUASS™ can be obtained from the EuroUSC website at <http://www.eurousc.com>

7. Antarctica: An Opportunity for Autonomous Flight, Phil Anderson (BAS)

Phil highlighted two major aspects of Antarctica for UAS operations.

- Antarctica is a large and empty: the peak density in the US airspace is 4000 aircraft in 10 million square kilometres, compared to 20 aircraft in 14 million km² in the Antarctic summer.
- COMNAP has an established procedure for airspace collaboration among treaty signatories over the whole continent, which works well and could be adapted to UAS operations.

From a collision avoidance perspective, therefore, the two first levels of risk reduction "Air Space Structure" and "Strategic Separation Services" are in place.. Hence, Antarctica therefore provides an opportunity to test novel systems and collect statistics on collision avoidance protocols and technology for UAS. Collaboration between UAS industry and the polar science community should benefit both.

8. EU COST Action, ES0802: "Unmanned Aerial Systems in Atmospheric Research", Phil Anderson (BAS)

COST is an intergovernmental framework for "European Cooperation in Science and Technology. The COST programme is intended to reduce fragmentation in European research by funding networking meetings and conferences on various topics. While not providing funding for equipment or research, it is seen as an enabler for developing proposals in future grant applications.

COST action ES0802 is an initiative to develop a plan for the use of UAS for atmospheric research and is organised around four work packages

- WG1: Unmanned Aerial Systems
- WG2: UAS sensors for atmospheric research
- WG3: High resolution 3D atmospheric measurements by UAS
- WG4: UAS operation

25 Institutes, from 15 countries intend to participate in the activity, with further details at the web-site. <http://www.cost-uas.net>

Following a meeting in Cyprus in the spring, there will be a 2 day conference at Cambridge (19-24th September 2010) which is intended to include a day of demonstration flying at Cardington. Planning for the flying day is about to begin.



9. Holding Successful UAS Display Days, André Clot (EuroUSC)

The scope of this talk is no coincidence, and drew on André's experiences at ParcAberporth and elsewhere. The flying **demonstration** will in fact be part of a larger event with its own set of issues, including visitor management, catering, emergency access etc which must all be planned and coordinated. This approach should reduce the complexity of the flying event, the key to which will be to develop a safety case for CAA approval. As with any major event, the first task will be to identify the objectives for it: for example who will participate and how would they expect to benefit from it.

An aircraft can only be allowed to fly if it has been designed, manufactured, maintained and is operated in accordance with **relevant** regulations and if its crew are also qualified in accordance with relevant regulations. In the UK these regulations vary according to the mass of the airframe and type of operations envisaged.

Formal permission will also be needed from: the Landowner; the Local Authority and Police; and the CAA. The Local Authority will usually have a view on the level of insurance required for the whole event.

During discussion it was noted that Cardington already has an established Danger Area of 1 nautical mile radius which "just" needs appropriate notification to the sponsor

In addition to the detail planning of a successful event, there will also need to be contingency plans, for example in case of adverse weather preventing flying or rain disrupting car-park facilities.

Finally one should expect the planning of an event of this nature to take at least 12 months:

10. Discussion Forum, led by John Moreland (UAVS)

All the talks received comments and discussions as they progressed, especially the revelations in the last talk and the implications for the planned demonstration in September. It was an indication of the success of the conference that no new points of any significance were raised in the final discussion session. Delegates left expressing satisfaction with an informative and interesting day.

Colin Burbidge
Head of Information Systems, UAVS

© UAVS 2009



Annex 1 Full Agenda



A ONE DAY MINI-CONFERENCE AND INDUSTRY DAY

AT BRITISH ANTARCTIC SURVEY, HIGH CROSS, MADINGLEY ROAD, CAMBRIDGE CB3 0ET

Item No.	Time	Title/Speaker	Speaker/Moderator
	09:30 – 10:00	COFFEE AND REFRESHMENTS	
1	10:00 – 10:05	Welcome	Gary Clayton (EADS) UAVS Chairman
		BAS OPERATIONS IN ANTARCTICA	
2	10:05 – 10:20	Overview of Possible UAS Operations in Antarctica: A Continent for UAS	David Blake (BAS)
3	10:20 – 10:40	BAS UAS Operations in Antarctica – 2007 – Successes and Failures	Phil Anderson (BAS)
4	10:40 – 11:00	Future UAS Requirements for the Polar Boundary Layer Research Community	Phil Anderson (BAS)
	11:00 – 11:15	COFFEE BREAK AND NETWORKING	
		ANTARCTIC AIRSPACE	
5	11:15 – 11:30	Latest Developments in CAP 722, CAA Guidelines on Unmanned Aircraft System Operations in UK Airspace – Industry Perspective and Developments	Gary Clayton (EADS)
6	11:30 – 12:00	CAA's Perspective on future UAS operations globally	Chris Finnegan (CAA)
7	12:00 – 12:15	Light UAS Scheme	André Clot (EuroUSC)
8	12:15 – 12:40	Antarctica: An Opportunity for Autonomous Flight	Phil Anderson (BAS)
9	12:40 – 13:00	Discussion Forum – BAS Operations in Antarctica and Antarctic Airspace	John Moreland (UAVS)
	13:00 – 14:00	LUNCH AND NETWORKING	
		OTHER RESEARCH DEVELOPMENTS	
10	14:00 – 14:30	Introduction to EU COST Action, ES0802 "Unmanned Aerial Systems in Atmospheric Research"	Phil Anderson (BAS)
11	14.30 – 14.45	Objectives of COST ES0802 Display Day – September 2010	Phil Anderson (BAS)
12	14:45 – 15:00	Holding Successful UAS Display Days	André Clot (EuroUSC)
13	15.00 – 15.30	Discussion Forum – Cardington, ParcAberporth and Other UK and EU UAS Test Sites	John Moreland (UAVS)
	15:30 – 16:00	REFRESHMENTS, CLOSING DISCUSSIONS AND NETWORKING	
	16:00	Close	



Annex 2 UAVS Representation

Overview

Not every company, organisation or individual has the time or resources to interface with Government and its departments in all their guises. UAVS sends delegates to most of the important committees and working groups addressing the UAS industry and the issues in front of it. This representation on behalf of all its members is the important service UAVS carries out.

By attending these different fora and by contributing to the strategy being taken forward, the Association can ensure its views and expectations are incorporated in the crucial policy statements and documents issued by the regulatory and certification authorities.

Representatives currently attend the following industry fora:

➤ In the UK

- **Ofcom (Office for Communications)**
Paving the way forward to securing sufficient bandwidth for secure command, control and communications for UAVs operating in civilian controlled airspace
- **Technology Strategy Board (TSB)/Department for Business, Enterprise and Regulatory reform (DBERR)**
Establishing the precedence of UAV projects and programmes such as ASTRAEA
- **Society of British Aerospace Companies (SBAC)**
Autonomous Systems Strategy Group
- **Civil Aviation Authority (CAA)**
Unmanned Aerial Systems Steering Group (UASSG)
Unmanned Aerial Systems Working Group (UASWG)
Surveillance and Spectrum Working Group (SASWG)
National Air Traffic Management Advisory Committee (NATMAC)
General Aviation Consultative Committee (GACC)
Mapping out the future operation of UAVs in controlled airspace through revisions to [CAP 722](#)
- **Ministry of Defence**
UAVS is assisting in the setting up of a pilot Capability Investigation scheme for the UAV sector
- **ASTRAEA**
UAVS represents the wider industry on the ASTRAEA Steering Board

➤ In Europe

- **European Aviation Safety Agency (EASA)**
Attending EUROCAE WG73 - developing UAS airworthiness criteria and additional requirements for certifying UAS
- **European Defence Agency**
Liaison regarding the European UAV roadmap

➤ Internationally

- **Joint Aviation Authority (JAA)**
Working with EuroControl to formulate an international perspective on the international operation of UAVs in controlled airspace.