ESA-EDA workshop on

New Capabilities for Unmanned Aerial Systems

Noordwijk, the Netherlands, on 11th – 12th May, 2010

SUMMARY AND OUTCOME

CONTENTS

1 Introduction

1.1 Definitions

- Users:

Users are to be understood as the stakeholders buying UAS services.

- Enablers

Enablers are to be understood as all stakeholders working on making the development of UAS civil applications a reality. It encompasses a variety of organisations, from service providers to manufacturers, R&D organisations, and regulatory bodies.

1.2 Aim of the workshop

ESA and EDA's primary objective is to trigger the interest of user communities in space enabled UAS services. The workshop is also taken as an opportunity to consolidate our understanding of user needs and to select the upcoming demonstration project. This demonstration is essentially aimed at showing the usefulness of space assets for UAS integration into the non-segregated airspace. It will be carried out in the context of one particular civil application. Other projects demonstrating the relevance of space enabled UAS operational capabilities to other user communities may follow.

1.3 Scope of the workshop / structure of the workshop

The workshop was carried over three half days on May 11th-12th. It consisted of three separate sections, dedicated to (sequentially):

- User needs with respect to UAS services and their expectations from a demonstration project. Essentially three streams of users where represented: those involved with environmental monitoring, critical asset inspection and security applications.

- Concerns of enablers and expectations from a demonstration. The partners of the consortiums implementing the ESA-EDA feasibilities studies significantly contributed to the discussions.

- Discussion on the selection criteria of candidate missions.

1.4 Audience: size, quality

83 participants from 18 countries attended the workshop. Over one third of them where (potential) end users of UAS services, the remaining two third being composed of service providers, manufacturers, regulation authorities and R&D organisations, designated in this document by the word "enablers".

2 User needs

The applications addressed during the discussion of the workshop are listed below:

- Emergency services
- Border surveillance
- Police applications
- Agricultural, Environmental and Forestry Monitoring

- Road Surface Monitoring and Traffic Information
- Biodiversity conservation
- Pipeline inspection and exploration
- Atmospheric and oceanographic research
- Disaster mitigation
- Monitoring of fishing vessels
- Ash cloud monitoring
- Power line monitoring
- Oil pollution monitoring in coastal areas

2.1 Why are UAS relevant to users?

(over satellite solutions, or manned aircrafts)

NB: Users are essentially interested in getting high resolution geo-referenced data, easily, timely, and cost effectively. The enabling technology behind it is not of concern. Now, to achieve their goals, UAS have significant advantages over satellites and manned aircrafts.

Perceived advantages of UAS over Earth Observation satellites:

- Higher resolution
- Flexibility and availability of data acquisition: UAS could potentially be deployed anywhere and anytime, while the time resolution is of satellite observation is limited by the satellite revisit time (for non geostationary satellites), and may be subject to weather conditions.

Perceived advantages of UAS over manned aircrafts

- Operational costs (e.g. flying, maintenance).
- No pilot at risk when operations in hazardous theatres.

NB1: this list is not exclusive. It reflects the needs repeatedly stated by users over the workshop.

NB2: UAS are not meant to replace Earth Observation satellites and manned aircrafts, but rather to be used in complement, where and when they are more appropriate.

2.2 Operational requirements and concerns

Most users concurred on common requirements or concerns. Those are mentioned below:

- Need to modify legislation, for an easy access to the general airspace
- Fast and easy deployment
- Cost effectiveness of the solution is critical
- Beyond line of sight operation is required in many applications presented
- Many of applications require UAS flying at low altitude (below 1000m)
- Need of high resolution data
- Availability of system, and robustness in adverse weather conditions
- Safety and reliability of UAS, to avoid damage of inspected assets and/or risk to people over populated areas.

Some trends where however specific to the various streams of applications considered. For example, applications related to environmental monitoring do not

really need real time access to the mission data. Conversely, security applications often do. They also have higher requirements for secure and reliable communication links.

3 Concerns of enablers

Demonstrating the reliability of using UAS is pivotal to open the way to UAS civil applications. Two categories of risks should be addressed: risks to 3rd parties on ground, and risks of collision with other flying objects. In fact, due to uncertainty on the reliability of UAS, insurance costs and legal barriers are major obstacles to the development of the UAS civil market. Public acceptance is also an issue. All above mentioned parties expect solid evidence of the reliability of UAS prior to moving forward. Such evidence should be collected step by step, from low risk operation ranges (e.g. unpopulated like the Artic regions, and / or at altitudes with low air traffic density, typically below 7000 m and over 12000 m) to demonstration in real conditions. To accumulate safe flight time and convince regulators, technological capabilities must first be demonstrated. In particular, a sense and avoid system is necessary, as well as reliable and permanent communication links.

4 Selection criteria for a demonstration mission

4.1 Integration of space assets in the service enabling system

The mission to be demonstrated should leverage on several types of space assets.

Comments: Satellite navigation and satellite telecommunication are two services potentially valuable to enhance operational capabilities of UAS and facilitate insertion in the non-segregated airspace. Satellite telecommunication are instrumental to BLOS (“Beyond Line Of Sight) communication, for command and control, sense and avoid, ATC relay and / or mission data downlink. Although promising developments are taking place for light and high capacity communication payload, small UAV (with little payload capacity) can only use satellite communication for lower data rate communication, typically for command and control and ATC relay, since high data rate communications require larger antennas. This limitation is not critical for applications where real time access to mission data is not necessary.

4.2 Addressing major challenges of UAV insertion into the non-segregated airspace

The selected operational scenario should provide evidence of the technical capabilities to overcome challenges raised by UAS insertion in non-segregated airspace (as identified in the Air4All study, e.g. ATC interface, sense and avoid system, and secure + reliable C2 link).

Comments: The mission should be run as much as possible in real conditions, to produce solid evidence of the technical capability to properly tackle major challenges related to insertion in the non-segregated air space, as stated in the Air4All study. On the other hand, the demonstration should be feasible in the short term. Therefore there is a trade-off between the technical and legal

feasibility of the demonstration (see subsequent criteria), and the necessity to run it in conditions as real as possible (and therefore in more complex situations).

4.3 Technical feasibility:

Comments: The system to be demonstrated should be capable to accommodate / face the following challenges:

- Use of multiple operational analysis centres
- Use of multiple ground control stations
- Frequent handovers between ground stations, and between telecommunication satellites and terrestrial infrastructure
- Communication interoperability between air, space and ground segments
- Latency constraints for ATC, C2, S&A and mission data links
- Reliability and security of the BLOS links
- Proper distribution of the right information (no less, no more), with appropriate level of safety and reliability, to each stakeholder involved
- Interface with both civil and military ATCs
- Scalability of the system to multiple UAVs.
- Real time communication of high resolution image / videos
- Operations in all weather conditions, days and night, on a wide range of altitude (including very low)
- Robustness to radio-frequency interference.

4.4 Legal feasibility

Comments: Organisations participating in the demonstration should be European. Although European organisations could operate outside Europe, it is desired to run the demonstration within Europe. UAVs over 150 Kg are subject to EASA airworthiness regulations, while those under 150 kg are subject to national regulations. Regarding air traffic, it is worthwhile keeping in mind that it is easier to get authorisation to fly below 7000m and over 12000m, where the air traffic is less busy. Ideally, the demonstration should be run cross-borders. Using already certified UAVs would reduce the burden of certification to selected elements of the system, i.e. ground stations and communication links.

4.5 Business sustainability

Is the market big enough for a sustainable business?

Comments:

- The more significant the market, the more sustainable the business is likely to be. An application addressing various markets (e.g. military, civil institutional and civil commercial) with converging needs would be best.

- It is worthwhile recognizing that large UAV are expensive, and potentially more risky to operate. As a result, a large share of the commercial market for UAS services is directed to light UAVs.

- Given the technical and legal barriers to fly UAS in non-segragated airspace, the “time-to-market” of the services may not be compatible with constraints of commercial users. It is acknowledged that institutional users, or users requesting UAS services in zones subject to less stringent air regulations, are more likely to be interested in taking part in a demonstration project.

4.6 Fulfilment of needs of end-users, and commitment of end-users in the demonstration

Obviously demonstrating a service matching actual user needs is indispensable to the sustainability of such service. The tangible commitment of end-users to the demonstration project is therefore a key selection criterion.

5 Mission selection

In the light of the above mentioned selection criteria, ESA and EDA decided to select a demonstration mission addressing in the first hand maritime surveillance applications. This mission is essentially aimed at demonstrating the usefulness of space assets to integration of UAS in non-segregated airspace. However, beyond this upcoming demonstration project, ESA is open to run other demonstrations, to facilitate the set up of UAS services addressing other user communities.