civic drone centre

Responses to Questions Asked by BIS Ahead of Challenger Business Programme – UAV Workshop, 23/11/15

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Introduction

This document is the University of Central Lancashire's (UCLan) Civic Drone Centre's responses to the questions asked by the Department for Business, Innovation and Skills (BIS) prior to Challenger Business Programme – Unmanned Aerial Vehicles (UAV) Workshop event to be held on 23 November 2015, 10am-2pm at the BIS Conference Centre[1].

As a university based research centre we are providing our responses based upon the university's research, engagement with industry, and through the industrial experience of our staff members.

About the Civic Drone Centre

The Civic Drone Centre (www.civicdronecentre.org) works with companies, individuals and organisations that are using, or planning to use, remotely operated vehicles across a wide range of scenarios. It seeks to provide technology and know-how to these organisations, and collaborate with a range of partners – locally, nationally, and internationally – to explore and develop new technologies and knowledge in the civilian use of drones.

Operating as a joint project between the Media Innovation Studio, based in the School of Journalism, Language & Communication, and the university's Engineering Innovation Centre. Our multidisciplinary research focusses both on the technical challenges and the social issues of developing the next generation of drones.

About the University of Central Lancashire

The University of Central Lancashire (UCLan) in Preston was founded in 1828 as the Institution for the Diffusion of Knowledge. 'Ex solo ad solem', or in translation, 'From the Earth to the Sun', has been its motto ever since – helping people from all walks of life to make the most of their potential is what UCLan's all about.

Today UCLan is one of the UK's largest universities. With a student and staff community approaching 38,000 it is the fifth largest employer in the North West of England. Internationally UCLan has academic partners in all regions of the globe and it is on a world stage that the first class quality of its education was first recognised. The University has an increasingly thriving campus in Cyprus delivering UCLan programmes and original research within a UCLan environment and culture.

In 2010 UCLan became the first UK modern university to appear in the QS World University Rankings. In 2015 the Centre for World University Rankings placed UCLan in the top 3.8 percent of all worldwide universities, highlighting the progress the institution has made in providing students with real-world learning experiences and reflecting the institution's broad pool of academic talent.

[1] BIS, 1 Victoria Street, London SW1H 0ET

1. What are the most significant barriers/challenges you face in realising your plans to grow as a manufacturer, operator or user of commercial UAVs or their services and applications?

The most significant barriers are a result of the restrictions on line-of-sight command and control imposed by CAA regulations. While these restrictions are in place for well understood and good risk mitigation reasons, they limit the scope of commercial applications of UAVs (both current and proposed applications). Although exemptions can be requested, this does not lead to an agile or responsive business model.

The approach taken by consortia of aerospace industry primes is to produce risk-mitigating technology that can be integrated onto larger UAVs (typically over 150kg) in order to reduce the risk of damage to people, property, or other aircraft (e.g. ASTRAEA Programme). This technology is expensive to develop as high integrity complex hardware and software is required in order to make these safety systems dependable.

This requirement for dependable systems represents a significant barrier to operators of small UAVs (less than 20kg) who are often Small and Medium-sized Enterprises (SMEs) and cannot afford to develop this technology, and nor is it available in a suitable form factor for installation on small platforms. While some 'small UAV' manufacturers, such as DJI, are integrating additional safety related software functions into their platforms (such as geofencing) to reduce the risk of operation, this software comes with no formal guarantees of dependability, integrity, or airworthiness certification.

2. What are the implications of these barriers/challenges for your business?

From the perspective of a university research centre, focussed on the civilian applications of UAVs, these barriers prevent small UAVs from reaching their full potential and in many cases from delivering civic services such as unrestricted search and rescue to emergency services.

These challenges also create an opportunity to tackle these issues through structured programmes of research and development. These challenges are already creating opportunities for creating partnerships with industry who would like to integrate UAVs into their business models.

3. What are the specific solutions or actions you would like to see government/agencies/regulators undertake, and when, to enable your business to realise its ambitions?

To improve the access to commercial opportunities, some additional safety technology needs to be developed and readily available to small UAV operators to either buy and add to their existing platforms or to be integrated into new platforms. Such technology could prevent operational regulations being broken by UAV operators (such as dependable geo-fencing).

A phased-approach is recommended, beginning as soon as possible, with each new technology/sub-system that is produced and integrated with small UAS[2] leading to an extension of operating limits specified in CAA regulations.

For example, if a dependable solution to protect the public from UAVs falling from height was developed (e.g. parachute, airbags, break-apart platforms) then overflight of people could be permitted. Similarly if a high integrity and hence dependable cut-down or forced landing system

[2] Unmanned Aerial Systems - which comprise of the UAV and any additional equipment needed to operate it. For small UAS this typically included a hand held RC-transmitter and/or a laptop computer.

was available, then operation at higher altitudes could be considered further reducing operational limits.

Such an approach would require a group of small companies (SMEs) and/or industrial primes to collaborate and share this risk mitigating technology in order to make the technology development affordable and accessible to all. It will also require the support of the regulatory authorities to engage in regular discussion and feedback on the approaches to ensure certification and approval paths are possible.

The phased approach should begin with a thorough risk/cost benefit assessment of the various (and now well understood) operations of small UAS in commercial applications, together with solutions proposed by academic innovation teams and industry to mitigate these risks.

A funded innovation competition that addresses this challenge would be one way forward, however the technology produced must be freely available for UAS users (or for a reasonable fee) - not retained by the developers for their own purposes or competitive advantage. The technology should be seen as a UK market enabler.

Other barriers and challenges for consideration include:

1. Uncertainty about future regulations, which limits the industry's ability for long term planning and technology development.
    a. At UK level.
    b. EU level
        i. Issues relating the EU referendum.
        ii. The UKs role in fulfilling the EU roadmap[3].
    c. International Level – ICAO and individual countries (e.g. US).
2. Small UAV integration into the airspace.
3. Terminology (Drone, UAV, UAS, RPAS, RPA, etc. autonomous vs automation) – it does confuse and is barrier to harmonised regulation, as well as engaging with the public.
4. Sub 20kg, 20kg-150kg, over 150kg weight banding fragments the industry and it is unclear if these thresholds are the right ones.
5. UK as a leader in drone tech – more should be done to promote what existing research and current applications) and spread the message that the UK is a good place to experiment/develop the next generation of UAVs. Could also be linked with similar UK based activates, such as the autonomous car trials in Milton Keynes.
6. The UAV supply chain (especially the sub 20kg supply chain regarding provenance and reliability) – many market leaders are from the Far East.
7. Need to share data (open-data, not big) with researchers. For example, information on the number and cause of crashes is key to making UAVs safer. This information can come from both government and industry (e.g. insurance companies).
8. Privacy & Data Protection – better awareness for the public that they are protected by existing regulations and laws.
9. Environmental – general and more specific concerns, such as:
    a. Animal-Machine Interaction (AMI) – UAVs are operating where aviation has previously been unable to for nature and farming support (also close to the ground, in and around buildings, trees, etc.).
10. Education of current (and future) regulations.
    a. Industry.
    b. Recreational.

[3] http://ec.europa.eu/growth/sectors/aeronautics/rpas/index_en.htm

11. Enforcement of the law.
    a. Overall strategy and different organisations fit within it (Police, CAA, ICO, HSE, etc.).
    b. Approaches (geofencing, anti-UAV measures, etc.).
12. Needed level/types of pilot skill/knowledge & associated training/qualifications – for manufacturing, maintenance, and piloting.
13. Trust in autonomous systems.
14. Aerial trespass – how UAVs fit within current laws and how they might need to be changed as more UAVs are used, both by industry and recreational users.
15. Technical solutions to societal issues – technology (hardware & software) can be used to overcome some of the societal issues (many of which are mentioned above e.g. privacy) if it is know what the standard/ideal is (e.g. regulations, laws, standards) – in a similar fashion to what is described the opening paragraphs of the response the question three
16. Certification of autonomous/learning software – this has wider impacts within the aviation industry.
17. Sense & avoid (particularly for small UAVs) of:
    a. Other airspace users, both cooperative and uncooperative.
    b. Buildings and the environment (trees, water, rain, etc.).
    c. Animals and people.
18. Battery life & safety – current battery technology is limiting the flight time of electrically powered multi-rotors to tens of minuets, there are the dominant type of sub 20kg UAV. There are also safety issues (predominantly fire related) with using Lithium-Polymer (LiPo) battery – during use, charging, and post-crash. The development of new battery chemistries and technologies would be beneficial to the industry.