Academic workshop
UK Drone Pathfinder Programme

Connected Places Catapult, 3rd December 2019

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Department for Business, Energy & Industrial Strategy

Civil Aviation Authority

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Agenda

10:00 Arrival

10:30 Welcome & Agenda

10:45 **Academia**

- Dr. Mario Ferraro – Southampton University
  CASCADE Update
- Prof. Gokhan Inalhan – Cranfield university
  UK-ARC Update
- Hae-In Lee – Cranfield University
  RED-UAS Workshop Summary
- Dr. Mike Jump – Liverpool University
  ORCA Hub
- Dr. David Cleaver – Bath University
  MROC

12:30 Lunch

13:00 **Industry Challenge**

- Tim Murrell – Police and Fire Services

13:20 **Industry working with academia**

- Anna Plaster – Oasis
- Prof Nicolas P. Avdelidis – InnotecUK

14:10 **Coffee Break**

14:20 **Group Discussion**

- Aligning research with Pathfinder challenges and the industry agenda
- Other opportunities and next steps

15:00 End of workshop

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Objectives

- Explore how the Pathfinder Programme challenges, and academia research can align
- Explore how current and planned academic research fits into the industry agenda
- Explore barriers and opportunities for collaboration

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Drone Pathfinder Programme

- Part of a wider programme of work, both government led and across the UK's public and private sectors, aimed at enabling integration of drones into UK airspace
- Aims to rapidly drive progress in drone technology and regulation, enabling industry and the public sector to fully exploit this technology
- Identify the commonalities between use cases and facilitate live testing of operational concepts
- Initial Pathfinder projects: BVLOS linear infrastructure surveys across electricity and gas networks, Infrastructure Inspection construction industry

https://cp.catapult.org.uk/case-studies/pathfinder/

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Drone or Unmanned Aircraft System (UAS)

- In the context of the Drone Pathfinder Programme, the word ‘drone’ is another term for unmanned aircraft
- Unmanned aircraft come in a variety of shapes and sizes, ranging from small handheld types up to larger aircraft, and they may be of a fixed wing design, rotary winged, or a combination of both
- Unmanned Aircraft may also be referred as:
  - Drones
  - Remotely Piloted Aircraft Systems (RPAS)
  - Unmanned Aerial Vehicles (UAV)
  - Small Unmanned Aircraft (SUA)
- They all share the common characteristic that the person responsible for piloting the aircraft is not onboard it. Just like any other aircraft however, an unmanned aircraft must always be flown in a safe manner, both with respect to other aircraft in the air and also to people and properties on the ground.

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The Pathfinder objectives and outputs

Pathfinder Programme Objectives

"Articulating the challenges faced in bringing a new BVLOS drone-based service to market in the UK"

1. Routine BVLOS operations in unsegregated airspace
2. Cross-cutting capabilities
3. Safe, secure and sustainable operations

Outputs

- Standard scenario template:
  - Long linear operations in Rural/Remote Locations/Low Population
  - Large area operations in Rural/Remote Locations/Low Population
  - Urban operations
  - One-to-many drone operations
- Common themes/aspects to enable cross-cutting applications
- Safe, robust, resilient, redundant challenges answered

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Operational challenges

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Safety challenges

COMMUNICATION	RF spectrum access & risks	Access to/requirements for robust RF spectrum - Is there a case for establishing the threats to command and control link performance on ISM bands? Do these threats justify seeking alternative spectrum or alternative methods for improving robustness?
	Command and control range capabilities	Is there a case for establishing control link performance and limitations for systems based on COTS devices? Do practical, economical methods exist for extending command and control link range for BVLOS operations?
	Understanding of the BVLOS operating environment not visible to the remote pilot	How should this information be presented to the remote pilot/autonomous sUAS? Is there a case for setting minimum requirements in terms of the information presented to and used by the remote pilot? terrain, weather, other airspace users, airspace restrictions, etc
	Robustness of the Comms link	Is there a case for establishing interference level thresholds for command and control link performance on ISM bands? Do these threats justify seeking alternative spectrum or alternative methods for improving interference tolerance?
	External limiting factors	If RF spectrum proves to be a limiting factor to sUAS functionality, what Is the trajectory needed to build in appropriate levels of automation onboard the sUAS?
NAVIGATION	Reliance on GNSS	GPS/GNSS is heavily relied upon for positioning, but is susceptible to service interruption through jamming, spoofing and interference. Is there scope for exploring alternative methods of navigation capability such as radio positioning services (cellular communications), signals of opportunity (cell towers, radio/TV broadcast signals) etc?
	Radio positioning service capabilities	Are current networks sufficiently resilient and have appropriate levels of performance and what are the risks and barriers to implementation?
	Geofencing and geo-awareness capabilities	What is acceptable in terms of positioning performance and availability? Can it be met by current COTS GNSS receivers and are back-up solutions capable of achieving it? Enhancements to the GNSS capabilities – Is there a case for requiring multi-constellation or augmented GNSS systems for BVLOS operations to maintain system availability? How can current GNSS be made more robust and less susceptible to jamming, spoofing and interference?
	Non-cooperative surveillance	This has advantages in terms of sUAS operator burden and cost and impact on the current aviation system but has operational disadvantages in terms of UA visibility. Can Non-cooperative surveillance provide an effective safety net for BVLOS operations?
SURVEILLANCE	Management of unmanned traffic	How can other airspace users be detected and information on them be presented to remote pilots in a manner that does not require cooperative surveillance or impact the current aviation system?
	Providing the airspace picture	How can this be made available to a number of airspace participants to provide a useful level of situational awareness and in which environments should this be considered a requirement? What information needs to be displayed by the drone to enable target depiction? How can interoperability of different information gathering tools be assured?
	Topographic Intelligence	How can topographic features such as hazardous terrain be added to produce a 3D airspace picture? How can this information be integrated with the communication and navigation aspects?

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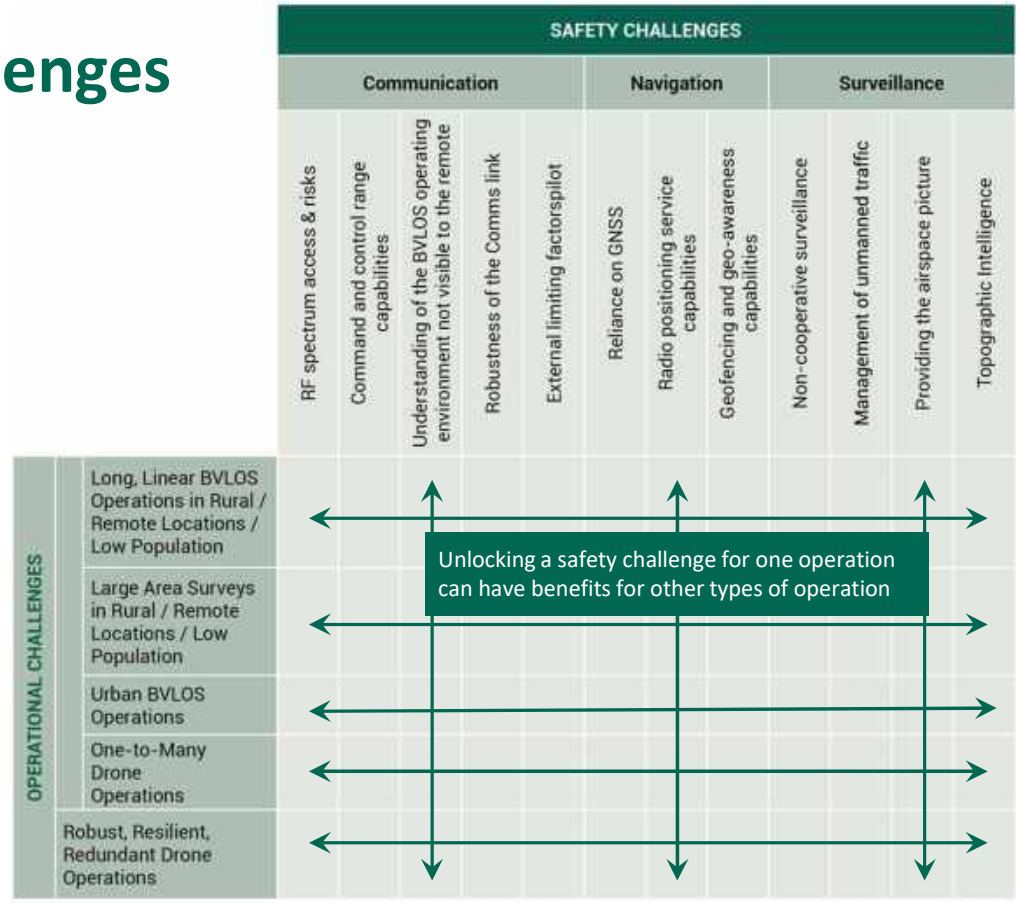
Pathfinder challenges – the Approach



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Pathfinder projects

Energy Pathfinder “Above and Beyond”

Objective: Beyond Line of Sight (BVLOS) linear infrastructure surveys across electricity and gas networks

Achievements:

- Consortium brought together with help from the Pathfinder Programme
- Successfully tested four different Concepts Of Operations
- Created standardised operations for maintenance of critical infrastructure for UK gas and electricity networks
- Worked hand in hand with the CAA and stakeholders to help enable routine commercial BVLOS capabilities on network assets

Pathfinder projects

Infrastructure Construction Pathfinder

Objective: Beyond Line of Sight (BVLOS) capabilities to reduce delivery and operational costs in a construction project

Achievements:

- Succeeded in getting a regulator-approved Beyond Visual Line of Sight (BVLOS) methodology and Operational Safety Case
- Gained a deeper understanding of drone BVLOS feasibility and challenges in the context of road infrastructure inspection in the UK
- Strengthened CAA relationships