CATAPULT Connected Places

Supported by Trax

UAS integration

Concept of operations

Briefing for Pathfinder

16 July 2019

Contents

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Project Overview

Participants

- Led by the Connected Places Catapult (CPC)
- Sponsored by the UK Future Airspace Strategy Programme
- Supported by Trax International
- Consulted 40+ aviation stakeholders/groups/associations

The project

- Identifies potential benefits and mitigations to reduce risk for CAT, Military and GA
  1. Safety improvements
  2. Improved airspace access
  3. Operational resilience
  4. Business continuity
  5. Cost efficiency
- Seeks to obtain data/evidence
  1. Address research gaps
  2. Develop a ConOps for the integration of unmanned operations with CAT, Military and GA

Overview ConOps and validation

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Building a ConOps for integrated UAS

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Background

- **Demand** for small UAVs in the UK will increase significantly over the next decade
- **Demand** from the established CAT and GA sectors will continue to grow
- Currently - little consideration of the **requirements** of the CAT and GA sectors and what CONOPS they should follow
  - Integration with the established ATM, CAT, military and GA sectors in a safe and efficient way through **technology** and **regulation**
  - Requires alignment with the UK Airspace Modernisation Strategy

Objectives of a ConOps

- Identify **performance improvements** that are expected to generate benefits for CAT and GA operators:

  safety, improved airspace access, operational resilience, business continuity and cost efficiency

- Address research gaps for the integration of unmanned operations with the established CAT and GA sectors

Building a ConOps for integrated UAS

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Assumptions

1. Only **Very Low Level (VLL) UAV operations** up to 400 feet are considered unless otherwise stated;
2. Both **VLOS and BVLOS** are included within the scenarios;
3. **Manned aircraft non-nominal behaviour** (e.g. aircraft off-route) is not directly assessed;
4. **Night-time operations** are excluded;
5. **Encounters with single UAVs only**; multiple UAV *swarms* or *formations* are not considered;
6. **Managed separation of airspace for UAVs** (at least for certain operations/airspace zones) and/or **authorised access to UAVs** are necessities for building evidence towards future integrated UAV operations with conventional aviation

Demand-Capacity approach to the ConOps process

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Performance improvements based on risk assessment

- Based on the current and future impact of unmanned operations on established aviation sectors and impacted aviation stakeholders
- Responses received during a stakeholder engagement that involved representatives from more than 40 organisations across the UK and Europe
  - Gather views on challenges and opportunities associated with UAV integration
- Areas of control measures that may be necessary to reduce the overall risk

Performance improvements

Safety performance

Reducing the likelihood and (where possible) impact associated with

- Loss of separation/ collision
- Aircraft avoiding manoeuvre
- Indirect public interaction
- Radiation/chemical impairment or fatality

Environmental impact

Reducing the likelihood and (where possible) impact of

- Increase in CO2 emissions/fuel through increased track miles
- Noise disturbances to communities
- Community radiation/ chemical exposure

Through:

- Closure of a runway, airport, airspace or heliport
- Re-routeing or holding of aircraft
- Manoeuvring of aircraft in sensitive areas
- Increased permitted UAVs in sensitive new and existing populated and wildlife areas

Resilience

Ensuring improved UAV performance characteristics to enable

- Reduced buffers between aircraft and UAV areas

Ensuring ability/improved ability for recovery from

- Runway/approach/ descent/helipad infringement
- Other operational disruption

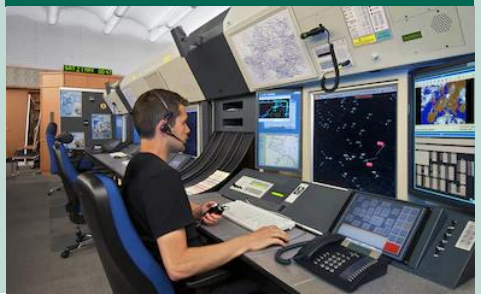
Reducing the likelihood and (where possible) impact associated with

- UAVs' intentional gathering/penetration of ATC data or military data/intelligence

Business continuity

Reducing the likelihood of UAV impacts on business continuity or military functions through

- Aircraft having to be re-routed
- One-off versus multiple disruptions
- Breach of data in terms of major disruption, public security and/or reputation
- RF spectrum capacity that may limit data transmissions



Commercial impact

Reducing impact costs to business through delays, increased fuel burn, affected schedules and reputation damage:

- Reduced buffers between aircraft and UAV areas and increased availability of airspace so as not to restrict capacity and where aircraft can efficiently route
- Reducing likelihood of disruption/closure to airport/heliport
- Reducing aircraft damage/loss or third-party injury/ exposure
- Ability to cope with one-off versus multiple disruptions

ConOps - Development

Concepts to reflect performance improvements

- 5 concepts to reflect the performance improvements

  A: Established pre-tactical and strategic deconfliction plans;

  B: Defined known environment for situation awareness;

  C: Tactical deconfliction and separation;

  D: Geofencing and restricted zones; and

  E: Flexible use low-level airspace.

- Supported by scenarios
  - CAT, GA, helicopter transits
  - Glider, military operations
  - UAV operations

5 Concepts to define the core requirements

A: Established pre-tactical and strategic deconfliction plans

Continuous education of best practices, which should have no increase in ATS and pilot workload.

UAV operations in regulated airspace should be restricted to commercial UAV operations only.

Regulation and procedures regarding rogue UAVs will require special attention in terms of technology and legislation

B: Defined known environment for situation awareness

Based on electronic surveillance and transmit/ re-broadcast interoperability

Should avoid information overload and possible adverse effects on other aircraft systems

Ability of ATM systems and RF spectrum capacity to process and distribute data for display to the ATM and UTM service providers

C: Tactical deconfliction and separation

Need to account for the levels of experience of some of the many single GA pilots

The limited ability for a UAV to avoid military and glider operations (or vice versa) - managed separation, combined with geofencing?

D: Geofencing and restricted zones

Unlikely UAV operators will have knowledge of heliports/smaller helicopter landing sites/ smaller aerodromes/ gliding sites, etc. Geofencing should therefore be developed and applied to such sites/areas

Geofencing should continue to be developed for aerodrome, military and other restricted areas.

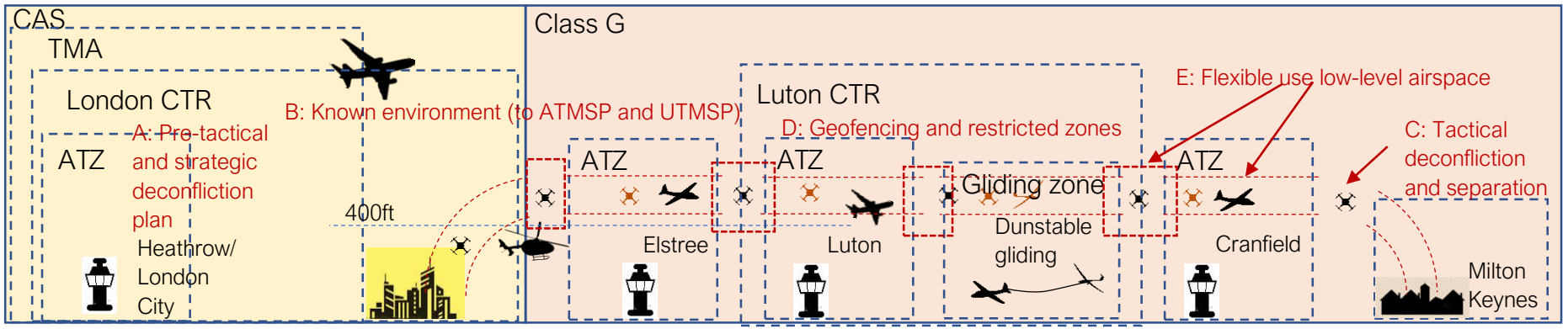
E: Flexible use low-level airspace

Managed separation from conventional operations necessary in the short term for class G airspace.

Introduce specified and notified UAV corridors/ zones, supported by UTM and ATM service providers, to enable enroute UAV operations

Status of those corridors/ zones must be determined through regulation to all traffic or advisory notices.

Case study scenario: Long-range operation



A: Take-off from London building / ascent through London CTR	B: Enroute through Class G, circumnavigating aerodrome ATZs	C: Enroute through Class G, circumnavigating gliding zone (with dragged gliders)	D: Decent / landing, class G, to Milton Keynes

NHS delivery operation

- Chosen to reflect comprehensive interactions
- Highlights expected obstacles and complexities associated with a UAV transiting between a city and a large town
- Broken-down into stages of flight

Summarised through 2 Use Cases

Use Case 1: Managed separation (unless authorised) of UAVs from ATZ/Restricted Zone

Use Case 2: Enroute integration of UAVs

- Reflect general progression of operations that represent integration/managed separation of UAV operations
- Group the 5 concepts and related core requirements

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ConOps - Validation

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Concept validation mechanisms

- Ensure progression is made to influence procedures, technology, airspace, policy/regulation and training in relation to the CONOPS

- Determine how evidence may be derived to support compliance with each core requirement

Validation of the requirements is necessary to enable the capacity to meet the demand from UAV operations integrated with conventional aviation

Next Steps - Governance and roadmap aligned with international developments

Incorporate UAV developments into existing strategies

- Balanced outlook should be taken where changes to airspace may significantly improve safety and environmental risk and/or improve overall efficiency

- Aviation stakeholders need to account for UAV integration within existing or imminent ATM change programmes
  - Where not possible, a wider view will be required on whether **UAV operators** requiring airspace changes should be responsible for initiating and resourcing the airspace change

Governance and alignment with international developments

- Strategy, governance and roadmap developed with the DfT and CAA
- Alignment with the Airspace Modernisation Strategy
- Appropriate interface and alignment with EASA and ICAO
- Inform non-UK based operators of required equipment changes for UK airspace
- Managed separation from Class G manned operations might be necessary in the short term
  - E.g. protected zones, ATZs

Next Steps to integrate UAVs

The following steps should therefore be undertaken based on this CONOPS

Business Case

Define the phases/stages of UAV integration through the five concepts

- inc. roles/resp. and identification of participants

Strategy/scoping of trials/testing to demonstrate key elements of the CONOPS

Consider user-based charging mechanisms

Governance and roadmap through DfT/CAA

Guide and track the UAV integration process

- align with and influence international regulation

Progress the roadmap

Trialling, simulation and other testing in accordance with the business case strategy

Development and transition of legislation, policy and regulation, aligned with ICAO and EASA arrangements

UK and international aviation stakeholder awareness of regulation

Expectations on required capabilities

Next Steps - Validation platforms

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Next steps

- Validate the outputs of the CONOPs with conventional aviation stakeholders.
    - Develop blueprints for early adoption of drone integration concepts in specific scenarios.
    - Align blueprints with the outputs of the Catapult Open Access UTM project and the CAA regulatory sandbox.
- Examine funding opportunities for to support further research and trials.

Blueprints: Scoping for live trials

Leeds Bradford International Airport & Humberside

- Electronic conspicuity and the creation of a known environment.
- Identification and management of drone infringements through tactical and pre-tactical planning.
- Safe and efficient integration of VLOS/BVLOS operations
- Drone Surveillance Systems compatible with ATC.

London Borough of Barnet

- Drone operations for street cleansing
- Deconfliction from local General Aviation operations

UAS integration

Concept of Operations

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