



National Beyond visual line of sight Experimentation Corridor

Final Airspace Change Proposal
version 1.0

31 March 2021

Cranfield NBEC ACP – Final Proposal

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Glossary

ACP	Airspace Change Proposal
AGL	Above Ground Level
AIP	Aeronautical Information Publication
ATC	Air Traffic Control
ATZ	Air Traffic Zone
BVLOS	Beyond Visual Line of Sight
CAA	Civilian Aviation Authority
DAA	Detect and Avoid
GA	General Aviation
ILS	Instrument Landing System
NATMAC	National Air Traffic Management Advisory Committee
NBEC	National Beyond visual line of sight Experimentation Corridor
UAV	Unmanned Aerial Vehicle

1.0 Introduction

Cranfield University and Cranfield Airport in collaboration with industrial partners (Aveillant, Blue Bear Systems Research, Thales and Vodafone) are developing an Unmanned Aircraft Vehicle (UAV) corridor, also known as the National Beyond visual line of sight (BVLOS) Experimentation Corridor [NBEC], in Class G airspace that will be used for demonstrating a surveillance-based Detect-and-Avoid (DAA) capability and other navigational technologies.

The project is part of a Sandbox initiative with the Civil Aviation Authority's (CAA) Innovation Hub and completed the Sandbox planning phase at the end of October 2020. It aims to develop navigational and operational capability for operating UAVs when BVLOS of the remote pilot – i.e. for when unmanned aircraft are flying out of sight. This project aims to better understand the requirements for unmanned aircraft operating BVLOS in UK airspace and to develop a DAA ecosystem for unmanned aircraft. This is necessary to help enable future services in the UK such as rapid low-cost aerial medical deliveries and to validate technology and procedures for such use-cases.

The proposed corridor extends from Cranfield Airport's Air Traffic Zone (ATZ) North East towards Blue Bear's Twinwood facility between Oakley and Clapham (see Figure 1).

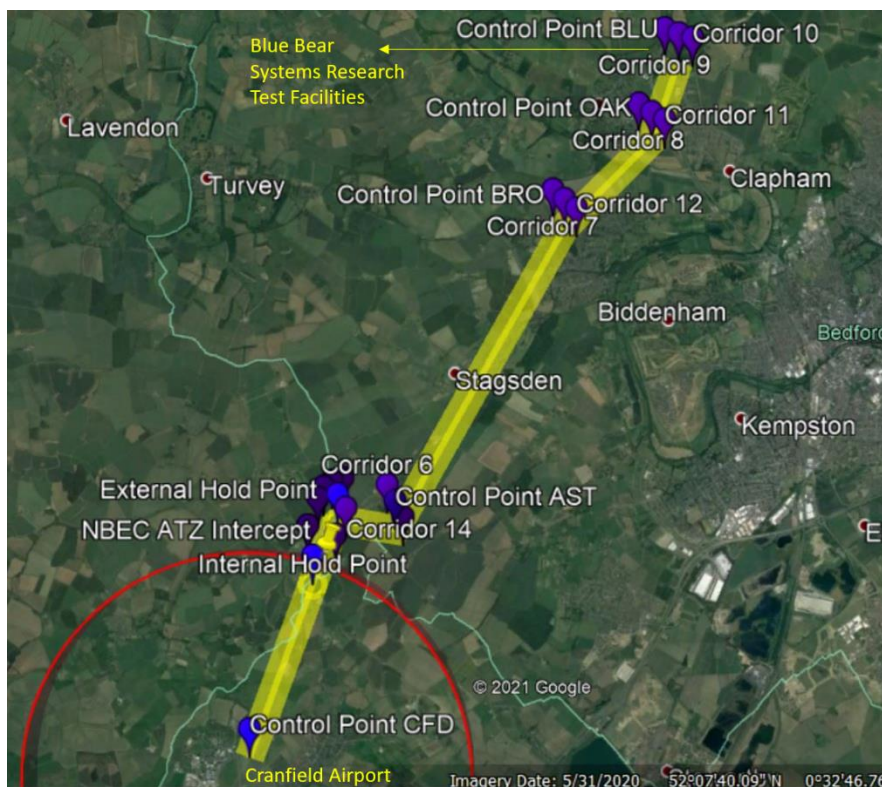


Figure 1: NBEC airspace volume

The routing of the corridor has been designed such that it minimises overflight of congested areas, road, railways etc. and is mostly located under the Instrument Landing System (ILS) approach to Runway 21 at Cranfield Airport. Unmanned Aircraft routing and operational procedures have been developed in conjunction with Cranfield Airport's Air Traffic Control (ATC).

This document describes the final Airspace Change Proposal (ACP) as required by CAP1616 for a temporary airspace change to the notified airspace design. It includes an updated and detailed

proposed NBEC route together with a suggested volume of encompassing airspace within which to segregate the UAV flights. The updated design takes into account the feedback from the targeted engagement activity.

It is envisaged that the temporary airspace corridor will be used on a few occasions a week over the 90-day period of its validity, currently anticipated to be between 02/07/2021 to 29/09/2021 inclusive. Flights will be for research purposes and are primarily related to navigation and location-identification themes. Flights are not aimed at collecting visual images or video, and unmanned aircraft may not even carry cameras. Flights are also not for repetitive commercial/logistics, or for military purposes. Flights will take off and land from Cranfield Airport under the Airport's control.

2.0 Airspace requirements and definition

The final ACP has been designed such that to solely request the minimum segregated airspace necessary to enable the safe operation of UAV flying the path as shown in the image below when outside the ATZ.

2.1 Updated proposed NBEC route

Figure 2 shows the proposed NBEC flight path routing which has been reviewed and updated slightly from the initial proposal in order to minimise overflight of residential areas, and to be coherent with operational procedures developed with Cranfield ATC.

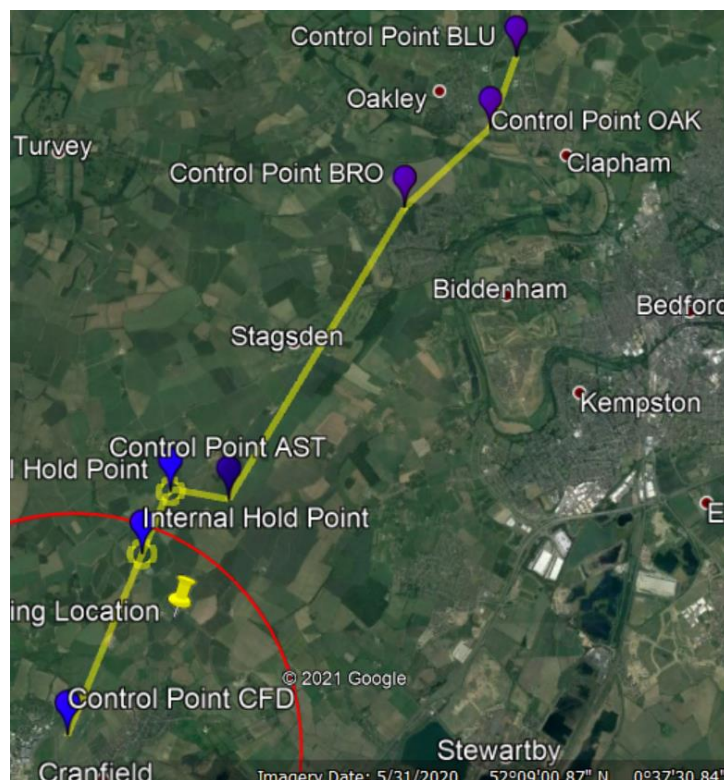


Figure 2: NBEC flight path routing

This includes two 400 metre diameter circular hold points (small yellow circles), one inside the ATZ and one just outside.

The UAV will deviate from this route solely for the purposes of conducting a 180° turn to either side which can be comfortably completed within a radius of 100 metres, and to accommodate expected actual positional accuracy variation compared to a flight plan path, which is known to be <50 metres laterally.

The specific locations defining the route are shown in the table 1.

Point	Latitude	Longitude
1	52.07371155	-0.618108446
2	52.10777108	-0.596536361
3	52.10800669	-0.596424295
4	52.10824356	-0.596242575
5	52.10844339	-0.596030848
6	52.10870482	-0.595656596
7	52.10888755	-0.595256528
8	52.10900959	-0.594860232
9	52.10908787	-0.594538618
10	52.10914554	-0.59413922
11	52.10917848	-0.593706546
12	52.10915308	-0.593257863
13	52.10909936	-0.592798702
14	52.1077518	-0.580924395
15	52.15290704	-0.537476297
16	52.16583361	-0.515400292
17	52.17768319	-0.50827668
ATZ Intercept at:	52.10362222	-0.59916944

Table 1: NBEC flight path airspace volume coordinates

This information is available as a .KMZ file, which has been sent by email to the Airspace Regulator (Technical) – Airspace Utilisation overseeing this proposal.

2.2 Suggested NBEC segregated airspace

It is proposed that the airspace corridor is sized such that all UAV operations can be confidently conducted within a defined volume of airspace whilst minimising both the impact to other airspace users and overflight of residential areas.

2.2.1 Corridor width

Recognising the requirement for the UAV's turning radius and the inherent flight plan profile following accuracy, a corridor of width 300 metres would be the minimum required to contain the UAV flight. It is requested that this be increased to 500 metres to provide clear safety margins either side of the minimum required width. This aligns with the request in the initial proposal to the CAA ACP process.

2.2.2 Corridor height

Flight plans for the UAV will not exceed 400 feet Above Ground Level (AGL), with this height being the typical target height.

Given that most manned aviation traffic would not normally be operating <500 feet in the area of the proposed corridor airspace, the requested ceiling height for the corridor is 500 feet AGL, in order to allow a minimum of 100 feet buffer between the UAV flights and other airspace users.

A .KMZ file for such a volume of airspace has also been sent by email to the Airspace Regulator (Technical) – Airspace Utilisation overseeing this proposal.

3.0 Intended operations overview

UAV flights will operate inside the NBEC, typically departing from and returning to Cranfield Airport or Blue Bear's Twinwood facility. Additionally, operations will be conducted from locations along the NBEC, subject to permission from respective landowners.

Separation from manned aircraft will be achieved through communication with Cranfield ATC when inside the ATZ, and through remaining within the requested segregated airspace (i.e., within the corridor) when outside of the ATZ.

Communication will be maintained with Cranfield ATC at all times enabling the UAV to be separated from instrument approach traffic outside of the ATZ.

UAV operators will have specific Operational Authorisation from the CAA for BVLOS type flights in the segregated corridor.

Note that UAV flights within the proposed NBEC corridor are for the primary purposes of testing novel surveillance and navigation technologies. Such technologies are being tested in parallel to the UAS' GPS-based navigation. The UAS will be operated with no onboard connection between its flight control and navigational systems to such new technologies, and is therefore not reliant on them in any way for its own navigational purposes.

The following clarifications have been made to the initial design following the targeted engagement work:

- The airspace will be activated by NOTAM.
- NOTAMs will include contact details including Cranfield ATCs telephone number and frequency.
- NOTAMs will be published at least 48 hours in advance.
- Cranfield ATC will provide a DACS as described in the next section.
- UAV flight path routing has been adjusted to minimise residential overflight.

4.0 NBEC activation and communication strategy

Airspace operational requirements and considerations

- The corridor will not be active at weekends.
- The corridor will only be active during hours that Cranfield ATC is active.
- It is the intention that preferred activation times and days of the week will be utilised, however it is too early to define the exact details at this stage.
- Flight durations are anticipated to be 1-2 hours in duration
- It is anticipated that there will be 1-2 flights per day when the corridor is active.
- All UAV flights will require permission from Cranfield ATC to operate in either Cranfield's ATZ or the NBEC corridor, and will be under the control of ATC whilst inside the ATZ.
- UAV flight routing inside the ATZ will be pre-agreed with Cranfield ATC.
- Potential hold points inside and outside the ATZ have been identified and agreed with Cranfield ATC.
- UAV remote pilots will have communications availability with Cranfield ATC at all times (using radio-telephone and/or phone as required).
- Cranfield ATC will hold a copy of the UAV Eventualities Procedure for reference.

Cranfield ATC will therefore know if a UAV is airborne and if it is inside or outside the ATZ and in the NBEC airspace.

Cranfield ATC will not know the specific location of the UAV other than position reports provided by the remote pilot.

Airspace activation

- The NBEC TDA will be activated by NOTAM.
- Cranfield ATC will file all NBEC NOTAMs.
- NOTAMs will normally be filed by the end of the week that precedes the activation week (expected to be by the Friday before).
- Activation will be cancelled as soon as the NOTAM TDA is no longer required, and where relevant at the end of the preceding day, e.g., if unsuitable weather is forecast.

Airspace communication

- Cranfield ATC will provide a Danger Area Crossing Service in accordance with Aeronautical Information Publication (AIP) ENR 5.1.3.3, that is:
 - When the DA activity permits, provide a clearance for an aircraft to cross the Danger Area under a suitable type of service. It should be noted that, dependent on the activity, it may be possible to accommodate a crossing of a DA during its notified hours of operation.
 - The crossing clearance is only in relation to DA activity. The provision of deconfliction advice and/or traffic information in relation to other traffic, either inside or operating close to the DA, will be in accordance with the scope of the specific ATS provided, i.e., Deconfliction Service, Traffic Service or Basic Service.
 - Where possible, the pilot should provide the DACS Unit with an estimated crossing time. When used by a DACS Unit, the term 'active' means that the DA is notified as active and there is activity taking place.
- NOTAMs will contain Cranfield's active frequency and telephone number.
- A scheduled airspace activation plan will be provided to Cranfield local operators, the BGA, the BHGA, and the MOD low flying cell, following approval of the ACP (note this would be subject to change).

5.0 Summary of Final ACP

In summary the final design of the Temporary Airspace Change proposed is shown in Figure 3.

Although flight plans for the UAV will never exceed 400 feet AGL (with this being the typical target height), the ceiling height for the corridor is requested to be 500 feet AGL, in order to allow a minimum of 100 feet buffer between the UAV flights and other airspace users.

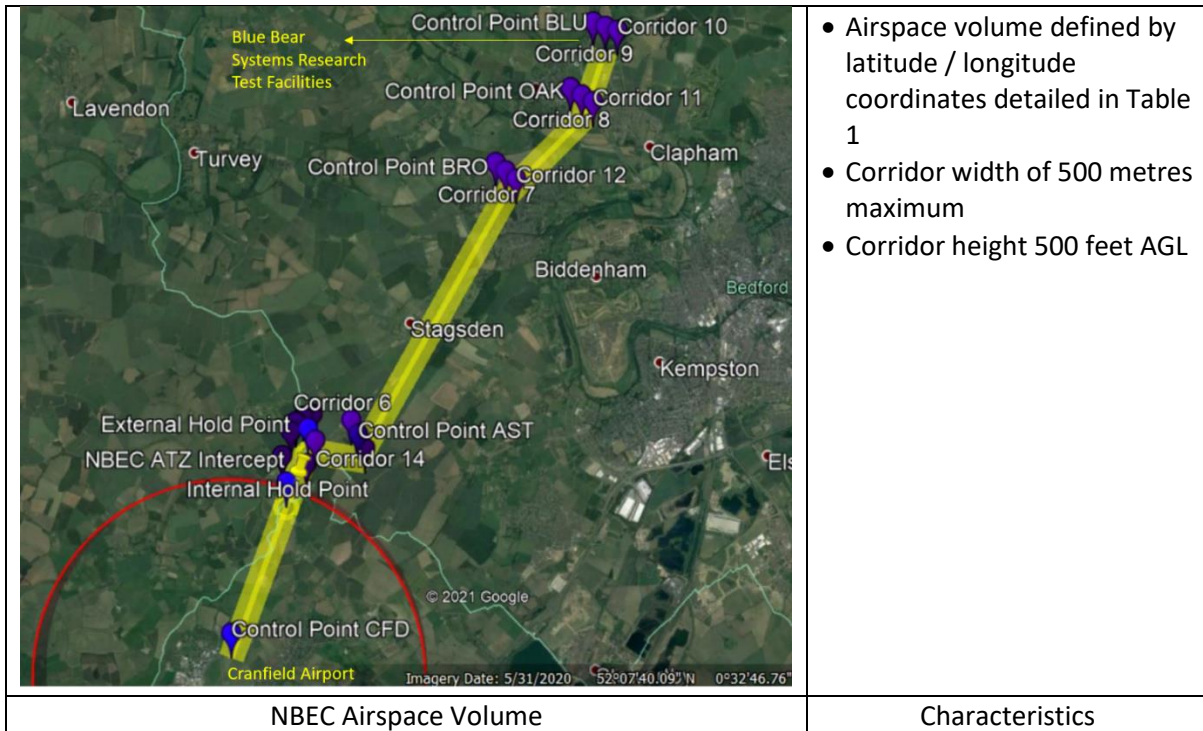


Figure 3: NBEC Final ACP details