National Beyond visual line of sight Experimentation Corridor

Airspace Change Proposal

Targeted Engagement report

14 May 2021

Engagement report – Cranfield NBEC ACP

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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 a UAV corridor, NBEC, in Class G airspace that will be used for demonstrating a surveillance-based DAA capability and other navigational technologies.

The project is part of a Sandbox initiative with the CAA's Innovation Hub and completed the Sandbox planning phase at the end of October 2020.

The proposed corridor extends from Cranfield Airport's ATZ North East towards Blue Bear's Twinwood facility between Oakley and Clapham.

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 ILS approach to Runway 21 at Cranfield Airport. Unmanned Aircraft routing and operational procedures have been developed in conjunction with Cranfield Airport's ATC.

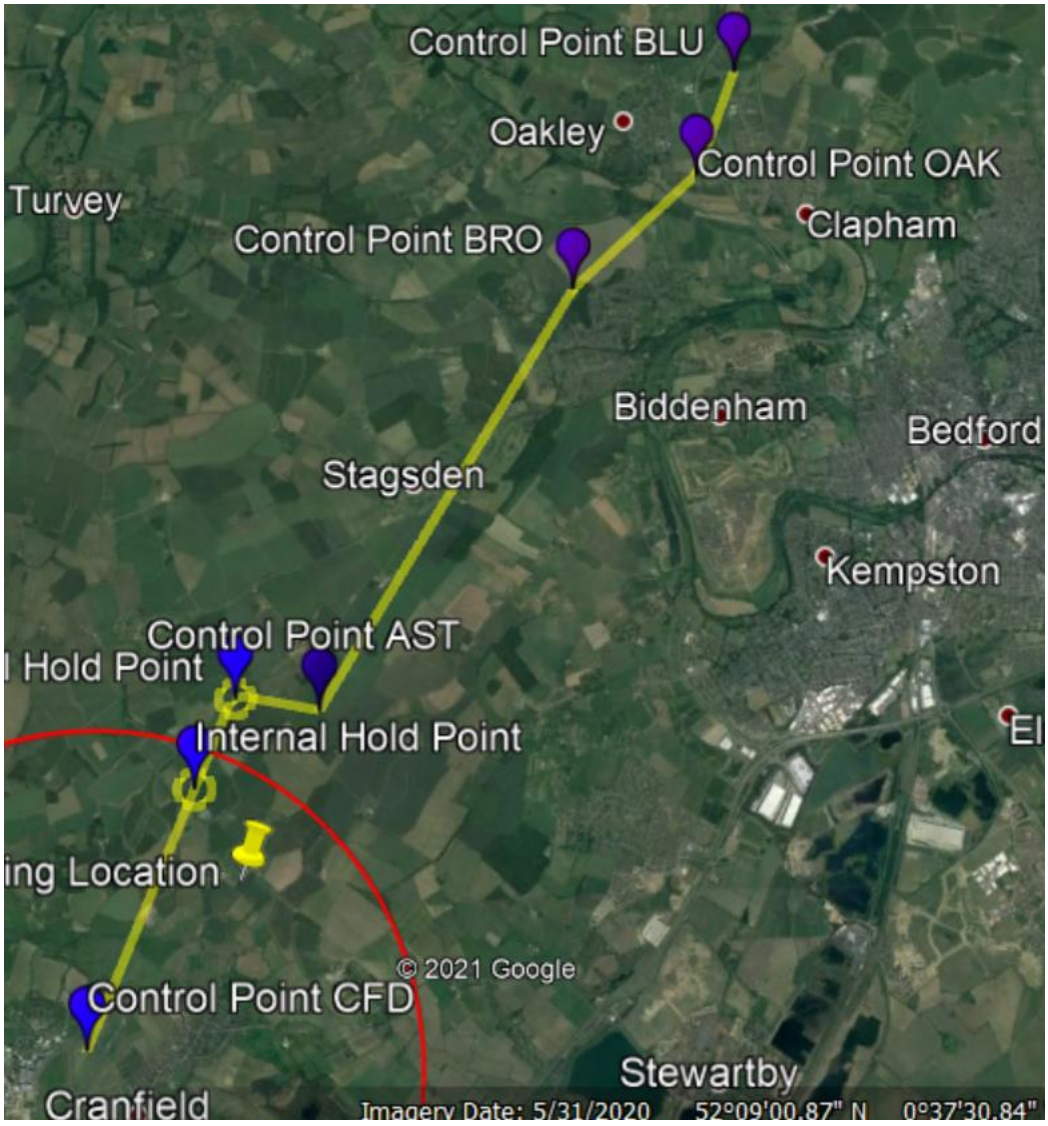
This document describes the engagement process followed as required by CAP1616 for a temporary airspace change to the notified airspace design, it includes results from an online survey devised to gather targeted feedback, and explains conclusions drawn and actions taken resulting from the engagement.
It also includes an updated and detailed proposed NBEC route together with a suggested volume of encompassing airspace within which to segregate the UAV flights.

2.0 Airspace requirements and definition

This ACP is to 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

The image below shows the proposed NBEC flight path routing which has been reviewed and updated slightly in order to minimise overflight of residential areas, and to be coherent with operational procedures developed with Cranfield ATC:



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 following table.

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

This information is available as a .KMZ file.

2.2 Suggested NBEC segregated airspace

It is proposed for an airspace corridor to be 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 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 can also be provided.

3.0 Intended operations overview

UAV flights will operate inside the NBEC, typically departing from and returning to Cranfield Airport or Blue Bears 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.

4.0 Targeted engagement conducted

An engagement process was carried out as per the Targeted Engagement Strategy (v2.0 15/12/2020) developed and reviewed with the CAA in advance of the engagement process commencing.

4.1 Audience

Potentially affected stakeholders have been considered in two groups: airspace users and ground-based.

Appendix A contains a contact list developed for and during the targeted engagement. Note that the list grew during the engagement due to the ACP communication being shared more widely beyond the originally identified list, which resulted in further responses to the published survey.

Individual/personal identification details have been removed from the responses, unless deemed necessary due to respondents holding posts which are publicably identifiable.

4.2 Approach

A press release was posted on the Cranfield University website explaining the ACP and requesting engagement. Links were included to a briefing sheet, and later a briefing presentation after it had taken place.

Invites to an online briefing session hosted on Zoom were then sent to initially identified recipients in Appendix A, which included a link to the Cranfield press release webpage. Recipients were able to read the briefing sheet to ascertain if the ACP is of relevance to them, and then accept/ignore the Zoom invite as required.

The online briefing session was held and included a presentation followed by 30 minutes for Q&A. The full 30 minutes was used, and many clarifying questions were answered. The presentation given is included in Appendix C.

At the briefing session it was explained that an online survey would be open for six weeks as a primary means of capturing feedback on the proposal. Those attending the briefing session were encouraged to complete the survey when it opened, and to share the link when available to any other parties they believed could be interested.

An anomaly related to the online Zoom invitations resulted in a recipient not joining the briefing session, and so a subsequent dedicated session was held one week later specifically for them.

The survey opened shortly afterwards with an encouraging number of responses being received. A reminder email stating the survey would soon be closing was sent to the initially identified contact list plus all additional parties identified during the engagement process (e.g., survey recipients who had received the survey link from other recipients).

Analysis of survey feedback data was conducted as survey responses were completed and again after the survey closed.

Conclusions were drawn based on the review of the feedback data which also enabled coherent responses to each piece of feedback data to be defined.

An Activation, Communication, and Utilisation strategy was subsequently produced which is included in Appendix E.

4.3 Materials

The following materials were produced for the engagement process.

1. An explanatory press release on Cranfield University's website requesting feedback on the ACP: https://www.cranfield.ac.uk/press/news-2021/feedback-sought-for-temporary-airspace-change-proposal

2. A briefing sheet containing core Q&As in order for recipients to establish whether the ACP would be relevant to them. This is included in Appendix B.

3. A presentation given during the online briefing session to convey the intended use of the NBEC, and to provide adequate information for recipients to understand in detail any potential effect on them. This is included in Appendix C.

4. An online survey was created as a means of capturing feedback. This is included in Appendix D.

5. This report.

4.4 Length

The engagement process has been completed within 11 weeks.
The table below shows a breakdown of the key dates within the engagement.

Date	Key stage
15 January 2021	Briefing invites sent to identified recipients with link to briefing sheet included. Registration for online briefing session opens.
22 January 2021	Press release posted on Cranfield University website
29 January 2021	Online briefing session conducted
4 February 2021	Online survey opened and recipients emailed with the link and request to complete
12 March 2021	Email sent to remind recipients of survey closing on 18 March 2021
18 March 2021	Survey closed to further responses
29 March 2021	Completion of engagement report and targeted engagement process

5.0 Results

There were 15 responses to the online survey.

The results in the table below have been extracted from the survey.

Due to how the survey was completed by recipients and to ensure each and every aspect requiring review was clearly considered, individual points were extracted from the 15 responses.

A full data extract of the survey can be made available for audit purposes.

Respondent names and contact details have not been included within the extracted results unless relevant, for example if they are representing an organisation.

Review of the results is explained further in Sections 6 and 7, and has been added in the response column in the table below. Responses which have impacted final procedures and arrangements are in highlighted in **bold**.

No.	Question / Query / Comment	Response
1	Need to be reassured that this is a temporary change and not part of the expansion of Cranfield Airport as we are already seeing an increase in light aircraft flying and circling around the north Bedfordshire villages.	Yes, this is a temporary change.
2	That the Air Traffic Control will be active at all times.	Yes, Air Traffic Control will be active at all times when the corridor is in use.
3	Contingency plans are in place for loss of control of the aircraft over urban areas. We questioned why the testing could not be done over unoccupied land or out at sea.	Contingency plans together with a full Risk Assessment will be in place. All aircraft, manned or unmanned, are required to follow rules of the air to ensure risk to those on the ground, including urban areas is as low as reasonably practical. The corridor is located at Cranfield as that's where the ground-based navigational-enabling technology is based.
4	Concern regarding the integration with emergency vehicles (air ambulance, police) gliders and hangliders.	Low-level airspace users have been included in this process, including the BGA, BHGA, Police, and MOD.
5	**{Pipeline inspection} Upper limit of 400ft along with our patrol height of 600ft doesn't leave much of a margin for error.**	**A Danger Area Crossing Service (DACS) will be available from Cranfield ATC when the corridor is active.**

6	Please could you move your flight path so the drones do not fly over my horses.	Further engagement taken together with the British Horse Society considered the risk to disturbing overflown horses to be low, due to the relatively high flight altitude and the quiet single-motor fixed-wing unmanned aircraft type.
7	What insurance do you have in place if your Experimental Drones cause an accident resulting in death or injury to people and livestock?	Operators will hold UAS insurance compliant to EC785/2004.
8	Please provide details of the level of ACP as defined by the CAA relating to CAP 1616.	CAP1616 Version 4 (1 March 2021) – 'A temporary change to the notified airspace design (usually less than 90 days, except in extraordinary circumstances).'
9	If VLOS is considered to be safe why does it require segregated airspace	VLOS does not require segregated airspace. BVLOS UAS flight does require segregated airspace if an approved see and avoid capability is not in existence.
10	Why does the hold need to be outside the ATZ when the ATZ has so much space and so little traffic.	Holds have been identified both inside and outside the ATZ. These are primarily for routing purposes, but can also be used as holds for separation and permission purposes.
11	Why are these trials to be held in the middle of summer when the impact would be so much lower over winter.	Unmanned aircraft are also subject to weather limitations which are typically more restrictive than manned aircraft.
12	Why are the trials not being conducted at night when the impact to others would be so much lower.	Operational limitations preclude flying at night.
13	**The planned activity level does not seem to justify the length of time for which the segregated airspace is being sought.**	**Whilst a period of up to 90 days is required for operational data collection, the airspace would only be activated for the days it will be used.**
14	What form of collision avoidance does UAVs have - FLARM would help mitigate the risk to gliders landing out.	UAVs will be fitted with EC compliant ADS-B. It is being investigated whether FLARM can safely be fitted.
15	It is not clear to me what happens if the UAV does not follow the planned route.	A number of safety systems are present in the UAV Command & Control system which will result in automated behaviours such as return to take off point should abnormal behaviours be detected. The remote pilot located at the take-off location must and will monitor the flight path and can take control/modify the planned route to ensure that the UAV maintains the planned path.

16	The ceiling of 400ft is based upon what datum?	UAV flight plans will not exceed 400 feet AGL.
17	It is assumed that GA already keep clear of this area - they do not. It is Class G airspace and a very important bit of Class G to many pilots - I realise that this comment has little relevance to this project but I raise it as the comment is made and is a dangerous mindset.	Locating the proposed corridor at low-level, below 500 feet, and under an instrument approach lane to an airport, and providing a DACS (see Appendix) should reduce the impact to other airspace users significantly.
18	You refer to high levels of maintenance but do not give any kind of qualitative or quantitative detail to the comment.	Although not certified, the CAA require that the operators of UAVs demonstrate and document adequate measures of continued airworthiness process, commensurate with the operational use, size and complexity of the UAV.
19	Why is poor weather not suitable for running these trials?	Unmanned aircraft are also subject to weather limitations which are typically more restrictive than manned aircraft.
20	Is one week for analysis of the survey results sufficient. The timescales indicate that there is a massive amount of resource available to the project.	Review and consideration of the survey data has been conducted whilst the survey has been open, and so has taken nearer seven weeks.
21	The London Gliding Club at Dunstable has not been invited to get involved yet is by far the busiest operator in the area.	Due to the number of gliding clubs in the UK and the range gliders can operate to, the British Gliding Association (BGA) were included within the contacts list which follows the principle as explained in CAP1616.
22	**Will the airspace be activated by NOTAM or is it intended to be solely allocated to Cranfield throughout the entire period.**	**It is planned that the airspace will be activated by NOTAM such that it is only activated when required.**
23	**Gliders, hang gliders and paragliders are all at risk of landing out in this area particularly as the airfield at Cranfield become less able to help in this matter due to significant capacity issues within their ATZ.**	**Communication with Cranfield ATC is strongly encouraged to check for relevant NOTAM details during flight planning, and in flight as required. If a landing is required, then it is safer to be in contact with ATC to establish the safest course of action.**
24	The underlying question to all of these is " if an unpowered aircraft were to need to land out in the area would the pilot be at risk of collision or prosecution or both?"	This is not a question the ACP sponsor can answer other than to recommend taking the safest course of action.
25	**POlice aircraft may have a short/ no notice need to operate within the airspace and we have asked for details of DACS/ DAAIS prpovision**	**A DACS service can be offered (see Appendix).**

26	Priority in the Cranfield ATZ and instrument approach lanes should be given to planned aircraft operations. Any airspace restrictions must be notified to Cranfield-based operators in advance to allow mitigating plans to be made.	Unmanned aircraft operations are also planned. Airspace restrictions will be kept to the minimum necessary, will be cognisant and respectful of other airspace users, and will be communicated reasonably in advance to aid planning for other Cranfield-based operators.
27	like to know the final position and shape of the proposed TDA as this did not seem to be fixed between versions of the proposal.	This is defined in Section 2.
28	a similar proposal in 2019 for the Cambridge-Huntingdon A14 corridor set the height of the TDA at 500ft AGL even though the BVLOS unmanned aircraft were supposed not to fly above 400ft. Could you clarify whether this is likely with your proposal.	The maximum planned UAV flight height is 400 feet AGL. Ultimately the CAA will decide on the type of airspace required and its overall volume.
29	**Can the activation of the TDA be done on a day by day/week by week basis? For instance, if you need to activate it Tuesday & Wednesday next week, but not the rest of the week and not next weekend, then could the NOTAM state this, so airspace users know when they can fly through this airspace. This could make a significant difference to the impact on other users. If you are not intending to activate the TDA at weekends this would also be useful to know.**	**The airspace will be activated in advance by NOTAM and only when required. It is planned that activation requirements in a given week are established at the end of the prior week to aid wider flight planning. The airspace will not be in use at the weekend. See Appendix for further details.**
30	Will flying activity and tests within the TDA be any time in a day or will there be certain times of day when it is used and not used, hence certain times of day when the TDA is not required to be activated? This is important to the hang gliding and paragliding community.	It is anticipated that flying will be earlier in the day, however this could change if waiting for appropriate weather. Flying will only be conducted when ATC is operating and the ATZ active.
31	Will flying activity be taking place during active thermic conditions, i.e. those that can be usefully used by hang gliders and paragliders (a minimum of 100fpm average thermal strength)? If so will this be from near the start of the 90 days or only towards the end? If the latter then it would be really useful for you to time-delimit the TDA to be outside of thermic periods for the first part of the 90 days. This can be done in a NOTAM.	Flying could be within both thermic and non-thermic conditions.
32	**There are probably a handful of days in any year when we can do cross-country flights that could go through this area, but those days are the ones that are crucial to us as they are the best days to be out flying. Can you set up a contact number so our pilots can check whether you will really be active on a good cross-country day when they might end up needing to transit this airspace to keep flying and not risk a forced out-landing?**	**The contact number will be Cranfield ATC 01234 750005. Activation of the corridor will be by NOTAM normally done at least 48 hours in advance.**

33	**Closing off this airspace for 90 days, for a few flights a week, is a massive impact for a small number of test flights. The utilisation of the airspace is poor, why does it have to be middle of summer when hang gliding, paragliding and gliding activity is at its peak. If the 90 days was scheduled between the start of November and the end of February then it would have almost no impact on BHPA members as thermal activity, and hence our cross countries flights, are almost non-existent at that time of the year and would not cross the TDA. Similarly, limiting BVLOS flying before a certain time of day (11.00am for instance) would also help.**	**The airspace will not be active every day for up to a 90 day period. It will not be active at weekends. It will only be activated when it is required to be used. In the event that it is shown to be activated for a future date which cannot then be used, any pertaining NOTAMs would be cancelled at the earliest opportunity.**
34	With other drone operations we have experienced, the operators were able to solve the BVLOS issue by having someone who could take control in visual contact with the drone all the time, despite the work and testing being to ensure it could be run BVLOS. Is it not possible to do this and hence reduce/remove the need for a TDA for this experimental work? For instance we noticed that the Cambridge-Huntingdon A14 corridoor BVLOS operation appeared to end up making their corridor a warning area, not a danger area, which implied that they could keep it in sight. If you could find a way to make your experimental airspace a warning area then you would reduce the concerns of other airspace users. We would, with care, cross a warning area when there may be aircraft flying between 400-200ft that are flying at similar speeds to us and are visible to us. This is something we are used to doing on a see and avoid basis. Hang gliders and paragliders frequently share class F and G airspace in close proximity with each other and with aeromodellers & controlled drones on a see and avoid basis.	Having adequate spotters to monitor entire flight profiles is not practical – This is Extended Visual Line of Sight flight. The CAA decide on the airspace type required. Unmanned aircraft operating in the airspace have no onboard means to see and avoid traffic threats, and it is for this reason that a segregated airspace is required.
35	**With the 2019 Cambridge-Huntingdon A14 corridor operation we ended up agreeing to have a contact number to call to say that we may be flying through that area that day so we could check status and they could schedule around us if possible. Is it possible to arrange this for the TDA and associated activity that you are proposing?**	**Yes – It will be Cranfield ATC 01234 750005 which will also be on the NOTAM.**
36	You are not trying to make the drone visible, if anything you are emphasising the invisibility. From our perspective this is completely the wrong way of thinking about it from an air-user's safety perspective. We would much prefer you make it highly visible from the air, by use of colour or lights for instance.	The UAVs to be used have very low surface areas and small wing spans compared to manned aircraft, which therefore cannot aid appreciable effect on the visual conspicuity.

37	Hang gliders and paragliders do not typically use EC and certainly will not be using ASDB. You stated in response to a question that you will not use FLARM, which a small number of our pilots may be able to use. Is there any other EC that you will be trialling?	UAVs will be fitted with EC compliant ADS-B. It is being investigated whether FLARM can safely be fitted. No other EC is planned to be trialled.
38	Hang glider pilots will not be carrying airband radios so there would be no way to seek permission to cross any airspace while in flight.	Non-radio equipped aircraft would not be able to access a DACS, or receive an ATC Service, or be made aware of instrument approach traffic. Prior contact with Cranfield ATC during flight planning would identify if the corridor were planned to be active and if instrument traffic are expected.
39	**Have you been, or intend to be, in contact with the BHPA? Free flyers (hang gliders and paragliders) in the BHPA are the most likely set of airspace users to be impacted and at risk from the type of aircraft and safety issues you are researching.**	**The BHPA have been added to the contact list during the engagement process.**
40	**There should be a person on a published aviation radio channel (The controller at Cranfield perhaps) who can be notified by a sailplane pilot if they think that they are at risk of infringing so that their entry can be coordinated with the UAV operating team to:** **1. Mitigate the risk of collision.** **2. Make the potential infringement legal.**	**Cranfield ATC frequencies are published in the AIP. The airspace will only be activated and used when Cranfield ATC are operating.**
41	When the presentation mentions flights rarely below 200ft, it would be helpful to know if and when they could go below this and by how much so as to at least know they are not going to be close enough to cause alarm to livestock or the birds of prey in the area.	Normal operations will be between 300 and 400 feet AGL, but some testing may be conducted as low as 200 feet AGL. The UAVs being operated have a very low noise footprint and are practically indistinguishable above the ambient noise levels at this operating height. Birds of prey pose a very small but occasional risk to the UAV types being operated, and are curious about their presence, sometimes to the point of attacking and sometimes causing minor damage to airframes. The NBEC operators have not experienced this in 20 years of operation.

42	Will NBEC flights mitigate against collision with unlicensed drone users, birds in flight etc?	Other drone users have a legal obligation to follow the drone code which includes keeping their drone in sight at all times and avoiding other aircraft. Birds of prey can pose a very small but occasional risk to the UAV types being operated, and are curious about their presence, sometimes to the point of attacking and sometimes causing minor damage to airframes. The NBEC operators have not experienced this in 20 years of operation.
43	Calibrating heights to be high enough to miss ground hazards and low enough to miss light aircraft.	Separation from ground-based obstacles is ensured at the flight planning stages by creating Keep Out Zones (KOZ) and Minimum Safe Altitudes (MSA). Separation from other air traffic is mitigated by use of the TDA and the technology deployed and under test such as Radar and Electronic Conspicuity
44	Bird migration patterns - outgoing in Autumn and incoming in Spring cross-referenced with known breeding spots eg Canada geese at Harrold Country Park migrate out in Autumn	The NBEC operators have not experienced any collisions bet weenbirds and their UAVs in 20 years of operation and have operated regularly in the general area for the majority of that time.
45	As this research proposal has been approved by CURES, the applicant should have been required to submit a risk assessment in order to gain this approval. It would have been very useful if this information had provided in the briefing notes as this is potential area of concern (see responses below). We would like to see details of the risk assessment, particularly those relating to flight systems failures, to help us assess the impacts and mitigations for our parish.	The survey was approved by the Ethics committee at Cranfield University. A specific Risk Assessment is defined as part of the process of the UAS Operator obtaining an Operational Authorisation from the CAA. Approval for operations is only issued if the mitigations presented are considered to be reducing risk to as low as reasonably practical.

46	However, as this is a research activity testing prototype software, there is a potential risk of a flight system failure causing the AUV to lose position e.g. fly outside the proposed corridor or lose height and crash with potential for impact on people and/or buildings.	The systems being tested are of a significant maturity. The Operational Safety Case (OSC) submitted to the CAA contains a detailed Risk Assessment that covers risk to those on the ground as well as in the air. Approval for operations is only issued if the mitigations presented are considered to be reducing risk to as low as reasonably practical
47	**The MOD would like a means of contacting the airspace operator when the airspace is active, in the unlikely (but possible) event that operational, short notice access through the airspace is required.This could be in the form of an ATC frequency, or a contact number listed on the NOTAM.**	**The airspace operator Cranfield ATC can be contactable by phone on 01234 750005, and by radio on the frequencies published in the AIP. This information will also be included on NOTAM.**
48	It would be very beneficial if the CAA could provide a contact for the British Horse Society Safety Team to discuss safety incidents that occur with drones and civil aircraft involving horses either ridden or at grass. The British Horse Society have a contact in the RAF Safety Centre where incidents involving horses and military aircraft have caused concern to equestrians. Please forward the contact name and details if possible to Alan Hiscox. Director of Safety. British Horse Society.	As this is a generic query it is being followed up outside of this ACP.
49	ARPAS UK fully supports the NBEC initiative. Post the review of feedback that you will be undertaking after 18th March we would be very happy to have a conversation with you about how an increasing number of TDA applications have progressed through the various stages of the CAA's ACP process. Over the last couple of years as a member of NATMAC we have accumulated some experience that may prove useful for the next stages.	Noted.

6.0 Conclusions

Of the 15 responses to the survey there were 49 specific points identified for review.

The results were reviewed by the NBEC consortium which included Cranfield ATC.

From reviewing the results, it was clear that the most commonly occurring questioning themes were around activation, communication, and utilisation of the corridor. 16 of the 49 points were in relation to these considerations.

The conclusions have been grouped into four categories.

Changes made to the ACP as a result of the conclusions are listed subsequently in Section 7.

6.1 Activation

It is clear from review of the survey response results that clarity was required as to how the airspace restriction would be activated.

6.2 Communication

Interested parties need to know who to contact to establish if the airspace is planned to be active and whether it is active.

6.3 Utilisation

Given the airspace in proposed to be in place over the summer months it was clear that it should only be activated when required and that activation should be minimised where possible to minimise any impact to potentially affected airspace users.

6.4 Routing

A further review of the route considering avoidance of villages was also conducted.

7.0 Changes made to the ACP as a result of the engagement

7.1 From initial review of the data received from the engagement

The following clarifications will be added to the ACP:

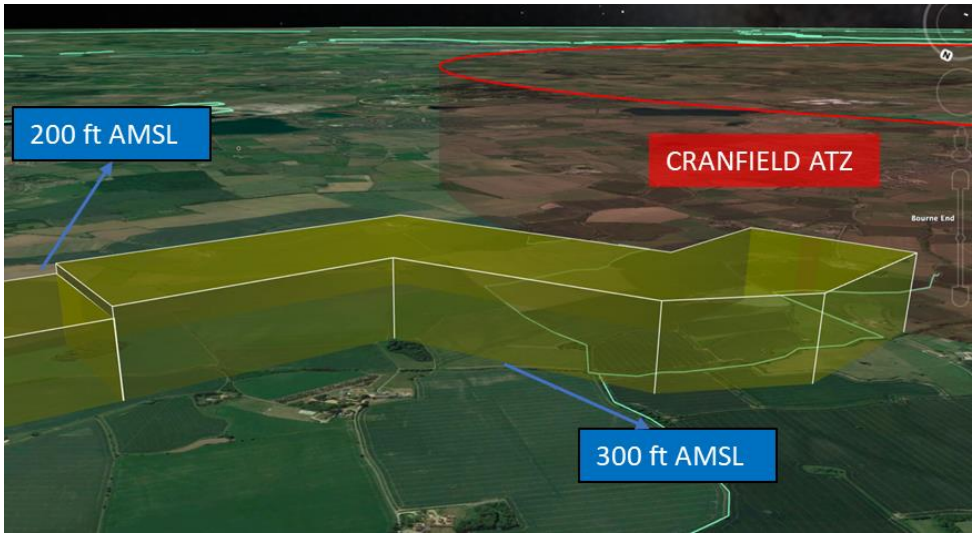
- The airspace will be activated by NOTAM.
- NOTAMs will include contact details including Cranfield ATCs telephone number and frequency.
- NOTAMs will be published at least 24 hours in advance.
- Cranfield ATC will provide both a Danger Area Crossing Service (DACS) and a Danger Area Activity Information Service (DAIS) as described in Appendix E.
- UAV flight path routing has been adjusted to minimise residential overflight.

7.2 From further review with the CAA and Cranfield Airport ATC

7.2.1 Proposed Airspace Volume Topographical Adjustment

It was identified that the proposed airspace routes over a descending landscape away from Cranfield Airport's ATZ. This is shown in the following image along with proposed airspace volume's effective bottom surfaces identified.

In order to minimise any impact to manned aircraft, the proposed airspace has therefore been split into two sections with different heights. The furthest-most section has a ceiling 100 feet lower than the inner section. This is shown in the following image (Cranfield Airport ATZ is the red cylindrical volume and the proposed NBEC airspace is the yellow 'stepped' volume):



The details of the two-section updated proposed airspace volume are as follows:

Section 1 (adjacent to ATZ)

Surface to 800 FT AMSL

1. 520610N 0003544W
2. 520625N 0003535W
3. 520619N 0003445W
4. 520651N 0003414W
5. 520659N 0003437W
6. 520637N 0003458W
7. 520641N 0003539W
8. 520634N 0003558W
9. 520616N 0003610W

Section 2 (furthest from ATZ)

Surface to 700 FT AMSL

1. 520651N 0003414W
2. 520905N 0003204W
3. 520952N 0003044W
4. 521029N 0003023W
5. 521038N 0003046W
6. 521002N 0003107W
7. 520915N 0003225W
8. 520659N 0003437W

7.2.2 Acoustic Noise

Dedicated noise measurements were taken at Cranfield Airport on the 27th of April 2021 using recognised equipment in line with that in use at airports such as Heathrow. The following photo shows the setup.

The results were included in a report provided to the CAA as part of the ACP.

The outcome of the measurements is that real-world acoustic noise of the UAV flying in the configuration planned within the proposed airspace is expected in to be in the region of 46dB(A), as heard from the ground. This is only 2dB(A) more than the background noise measured at that time, which is comparable to a quiet office. The background noise notably comprised of bird noise.

8.0 Communication and complaint handling

8.1 Operational communication

As defined in Appendix E, NOTAM's will be used to communicate activation of the airspace.

NOTAM text will include contact details of the controlling authority, which is Cranfield ATC. Contact details will include active frequencies and ATC's operations telephone number.

8.2 Other communication

A dedicated email address, nbec@cranfield.ac.uk was setup and used during Stage 3 (Engagement) phase of the ACP. It is planned to keep the NBEC email address for the duration of the ACP process and to retire it upon expiry of the temporary corridor airspace. Further ongoing monitoring of both the NBEC email address and the Airport's existing complaints/feedback systems will be carried out.

Cranfield Airport's complaints procedure can be found at:
https://cranfieldairport.com/complaints-procedure/

Appendix A – Contact list

Note individual names and details have been removed but are available for audit purposes.

Organisation
Airspace Users – From NATMAC
Airspace4All
Airfield Operators Group (AOG)
Aircraft Owners and Pilots Association (AOPA)
Airspace Change Organising Group (ACOG)
Association of Remotely Piloted Aircraft Systems UK (ARPAS-UK)
Aviation Environment Federation (AEF)
British Balloon and Airship Club
British Business and General Aviation Association (BBGA)
British Gliding Association (BGA)
British Helicopter Association (BHA)
British Hang Gliding and Paragliding Association (BHPA)
British Microlight Aircraft Association (BMAA) / General Aviation Safety Council (GASCo)
British Model Flying Association (BMFA)
British Skydiving
Drone Major
General Aviation Alliance (GAA)
Helicopter Club of Great Britain (HCGB)
Light Aircraft Association (LAA)
Military Aviation Authority (MAA)
Ministry of Defence - Defence Airspace and Air Traffic Management (MoD DAATM)
NATS
NATS
Navy Command HQ
PPL/IR (Europe)
PPL/IR (Europe)
UK Flight Safety Committee (UKFSC)
Airspace Users - Local
Bedfordshire Police
Local Air Ambulance
Luton ATC
Cranfield ATC
All Cranfield's local Operators
Henlow Flying Club
Old Warden Aerodrome
Bedford Aerodrome
Tower Farm
Sackville Farm
Earwig Farm

Kimbolton Airfield
Cardington Danger Area (D206)
Northampton (Sywell) Aerodrome
Military low flying cell
National Police Air Service*
Specialist Aviation Services*
Babcock Mission Critical Services*
PDG Helicopters*
Helicentre*
Heliair*
Ground-based
Bedford Borough Council
Central Bedfordshire Council
Milton Keynes Council
Astwood and Hardmead Parish Council
Pavenham Parish Council
Cranfield Parish Council
Stagsden Parish Council
Oakley Parish Council
Stevington Parish Council
Additional added during engagement process
Cranfield University (x 3 contacts)
Oakley Parish Council (additional contact)
British Helicopter Association
Cranfield and Marston Vale Chronicle
Drone Major Group
East Anglian Air Ambulance
National Police Air Service (additional contact)
London Gliding Club
British Horse Society
Airtask
NFLC
Blue Bear Systems Research Ltd
Earwig Farm (alternate contact)
Light Aircraft Association
BMAA (additional contact)
London Gliding Club (additional contact)
Royal Air Force – Military Airspace Management Cell
Royal Air Force
Cambridgeshire Aertow Club
Saab

* Advised by CAA during Strategy review

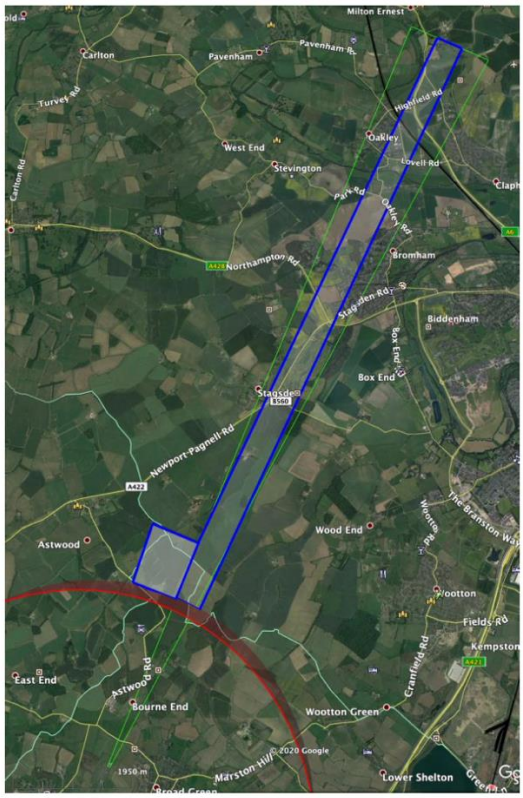
Appendix B – Briefing sheet

Briefing sheet: Temporary airspace change proposal – Cranfield National Beyond visual line of sight Experimentation Corridor (NBEC)

What is proposed?

The creation of a small volume of low-level airspace 500 metres wide and 400 feet high that will be solely used for small unmanned aircraft flight for a temporary period of 90 days. This volume will extend from Cranfield Airport's Air Traffic Zone (ATZ) and will enable the segregation of unmanned aircraft from that of all other airspace users in open (Class G) airspace. The area covered by this volume is shown in the image below.

The location of NBEC:



Why is it necessary?

To develop navigational and operational capability for operating UAVs when Beyond Visual Line of Sight (BVLOS) of the remote pilot – i.e. for when unmanned aircraft are flying out of sight. This activity is being led by Cranfield University from its research airport and in conjunction with the UK's Civilian Aviation Authority (CAA), to better understand the requirements for unmanned aircraft operating BVLOS in UK airspace and to develop a Detect and Avoid system 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.

Who is involved?

In addition to Cranfield and the CAA, industrial partners are also collaborating to bring and develop specific expertise. These partners include Thales, Blue Bear Systems Research, Vodafone and Aveillant.

What kind of flights will take place?

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.

How high and low will the flights be?

The maximum height of the flights will be 400 feet above ground level (AGL), and the minimum height rarely less than 200 feet AGL.

How many flights will there be?

It is envisaged the temporary airspace corridor will be used on a few occasions a week over the 90-day period, with no more than five flights per occasion expected.

What type of unmanned aircraft will be flying?

Most if not all unmanned aircraft will be of the fixed-wing (aeroplane) type, as shown in the image below, weighing less than 10 kilograms with wingspans around 3 metres. They will be electrically powered, flying at cruising speed of 30 mph and capable of following predefined flight plans.

<u>The type of aircraft that will be used in the project:</u>

Can the unmanned aircraft be seen and heard?

The unmanned aircraft will be just visible to the naked eye during flight and due to the quiet electrical propulsion it is unlikely that they will be heard.

The aircraft will have electronic conspicuity (EC) fitted which continually transmits their position, height and speed to suitably equipped other (manned) aircraft and to Air Traffic Control (ATC) units.

The corridor extends from Cranfield Airport's ATZ north east towards Blue Bear Systems Research's facility. The routing of the corridor has been designed so that it minimises overflight of congested areas, roads, railways etc. and is mostly located under the ILS approach to Runway 21 at Cranfield (outlined in green on the map above). As such, air traffic flow patterns would be similar to what they are today. Aircraft routing and operational procedures have been produced in conjunction with Cranfield Airport's ATC. The corridor is 500 metres wide and includes a stub to the south west for UAV holding purposes.

How will the unmanned aircraft flights will be conducted safely?

Safety is of paramount importance. Operation of unmanned aircraft requires formal review and approval from the CAA for both the temporary airspace change, and for operating out of sight (BVLOS).

Cranfield Airport's ATC has been extensively involved in planning and initial testing to ensure flights are conducted safely.

The small volume of airspace has been designed so as to minimise flight over built-up areas and roads, and has been co-located underneath the Instrument Approach path for Cranfield airport. This is a well-established airspace area for most passing airspace users to avoid.

All potentially affected parties such as the police, air ambulance and military low-flying aircraft are being included and contacted as part of targeted engagement for the airspace change proposal.

Contact Cranfield by email for further enquiries or information: NBEC@cranfield.ac.uk

Temporary airspace change proposal – Cranfield National Beyond visual line of sight Experimentation Corridor (NBEC)

Professor Graham Braithwaite, Director of Transport Systems, Cranfield University

Alex Williamson, Unmanned Aerial Systems Manager, Cranfield University

29 January 2021

www.cranfield.ac.uk

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NBEC* ACP+ - Briefing Session Agenda

1. Introduction - Temporary Airspace Change Proposal
   - Targeted Engagement Process underway
2. Explain the Purpose and Aims of the NBEC
3. Describe what the NBEC actually is
4. Nature of flights
5. The type of Unmanned Aircraft to be used
6. **Safety**
7. List of the key dates
8. Online Survey
9. How to make contact (if required beyond the Survey)
10. How feedback will be analysed and acted upon
11. Limited Q & A

*NBEC - National Beyond Visual Line of Sight Corridor

BVLOS - Beyond Visual Line of Sight

+ ACP - Airspace Change Proposal

2

NBEC ACP - **Introduction**

1. This is a Briefing Session being conducted as part of an Airspace Change Proposal (ACP) being applied for by Cranfield University.
2. The purpose is to explain what the NBEC is to potentially affected parties (Airspace & Non-Airspace users), such that they can identify what / if any impact there is to them.
3. An online survey will be open for six weeks as a primary means to capture this feedback.
4. Post-survey analysis will be conducted to identify if any changes to the ACP are required, and to capture any other information relevant, such as to operating procedures.

NBEC - National Beyond Visual Line of Sight Corridor
BVLOS - Beyond Visual Line of Sight
ACP - Airspace Change Proposal

3

NBEC ACP - **Purpose and Aims**

To develop navigational and operational capability for operating unmanned aerial vehicles (UAVs) when Beyond Visual Line of Sight (BVLOS) of the remote pilot.

- Activity led by Cranfield University from its research airport
- With full support from Civilian Aviation Authority (CAA)
- To safely prove a Detect and Avoid system for UAVs
- **To help show how drones can safely integrate with existing aviation without segregation**
- Results will help inform the CAA on new technology and capability
- To help enable future services such as rapid low-cost aerial medical deliveries and to validate technology and procedures for such use-cases.

NBEC - National Beyond Visual Line of Sight Corridor
BVLOS - Beyond Visual Line of Sight
ACP - Airspace Change Proposal

4

NBEC - Description

- A corridor shaped volume of airspace (**Blue**) extending from Cranfield Airport's air traffic zone (**Red**) towards Oakley, Beds
- 16km long, 500 meters wide, 400 feet (120m) high
- Stub (**Blue**) to the South West for UAV holding purposes
- Located under existing airport approach lane (**Green**) and away from congested areas
- Solely for UAV flight - I.e. Segregated from all other airspace users in this area of open (Class G) airspace
- For a one-off temporary period of 90 days (proposed 1 July - 30 September 2021)
- UAV flights planned to normally be at the maximum height of 400 feet above ground level (AGL) – minimum height by exception rarely less than 200 feet

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NBEC - Nature of the flights

- For research purposes – primarily related to testing ground and airborne based navigation and location technology and procedures
- Flights are not aimed at collecting visual images or video, and unmanned aircraft may not even carry cameras
- Not for repetitive commercial/logistics, or for military purposes
- Flights will take off and land from Cranfield Airport under the Airport's control
- Corridor will be used on a few occasions a week over the 90-day period, with no more than five flights per occasion expected. Flight durations expected to be 60-120 minutes.
- Operation at night is not planned

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NBEC - What type of unmanned aircraft will be flying?

- Most, if not all unmanned aircraft will be of the fixed-wing (aeroplane) type
- Weighing less than 10 kilograms, with wingspans around 3 metres
- Electrically powered, flying at cruising speed of 30 mph and capable of following predefined flight plans
- Monitored real-time throughout by a qualified & experienced Remote Pilot
- Just visible to the naked eye and unlikely to be heard
- Electronic conspicuity (EC) fitted – transmits their position, height and speed to suitably equipped other (manned) aircraft and ATC units.

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NBEC ACP - Safety

Safety is of paramount important to Cranfield University and is the absolute priority

Defining a safe NBEC airspace and associated operational procedures involved the following:

Support from the Regulator
- This project is part of a CAA initiative and has been in planning with the CAA for more than 12 months
- Specific permissions are required for Airspace and Operations such as this, which will be in place

Integration with manned aviation
- Cranfield ATC has been fully involved in the definition and development of unmanned aircraft procedures including testing within the Cranfield Air Traffic Zone.
- All Unmanned aircraft will broadcast their location using systems that manned aviation can receive
- The NBEC has been located in an area already recognised by the General Aviation community to avoid
- Pilots with extensive manned aircraft flying experience have been fully involved throughout

Operational Competency
- Unmanned aircraft will be operated by qualified and experienced Remote Pilots
- Unmanned aircraft are maintained to very high standards
- Operational safety procedures are clear and adhered to

Community Consideration and Engagement
- The NBEC has been located in a rural area away from congested and build up areas
- Airspace and non-airspace users who could be affected have been identified and invited to comment
- Low-level airspace users have been focused on in establishing recipient list

Flights will not be conducted if there are any safety concerns (e.g., bad weather)

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NBEC ACP - **Key Dates**

15th January 2021	Briefing Invites sent to identified recipients Link to Briefing Sheet included
22nd January 2021	Press Release posted on Cranfield University Website
29th January 2021	Online Briefing Session - **This session**
w/c 1st February 2021	Online survey opens
w/c 15th March 2021	Online survey closes
w/c 22nd March 2021	Analysis of survey feedback data
w/c 29th March 2021	Engagement process Report Completed containing Results and Conclusions
1st July 2021	Proposed start date of Airspace
30th September 2021	Proposed end of temporary Airspace

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NBEC ACP - **Online Survey**

- A simple to complete Online Survey has been developed by Cranfield's Decision Science research group to capture targeted feedback following this Briefing Session, and with reference to the published Briefing Sheet
- Primary means of capturing feedback - Welcome lots of responses!
- Cranfield University operates a strict Research Integrity Policy, and ethics approval for the survey and consultation activities has been granted from the University's Research Ethics Committee. Survey invitation will be sent to all identified parties
- Survey will be open for six weeks, and opens w/c 1st February 2021
- Feedback provided as required and summary report compiled

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NBEC ACP - **Online Survey Recipient list**

Airspace4All
Airfield Operators Group (AOG)
Aircraft Owners and Pilots Association (AOPA)
Airspace Change Organising Group (ACOG)
Association of Remotely Piloted Aircraft Systems UK (ARPAS-UK)
Aviation Environment Federation (AEF)
British Balloon and Airship Club
British Business and General Aviation Association (BBGA)
British Gliding Association (BGA)
British Helicopter Association (BHA)
British Hang Gliding and Paragliding Association (BHPA)
British Microlight Aircraft Association (BMAA) / General Aviation Safety Council (GASCo)
British Model Flying Association (BMFA)
British Skydiving
Drone Major
General Aviation Alliance (GAA)
Helicopter Club of Great Britain (HCGB)
Light Aircraft Association (LAA)
Military Aviation Authority (MAA)
Ministry of Defence - Defence Airspace and Air Traffic Management (MoD DAATM)
NATS
NATS
Navy Command HQ
PPL/IR (Europe)
PPL/IR (Europe)
UK Flight Safety Committee (UKFSC)

Bedfordshire Police
Local Air Ambulance
Luton ATC
Cranfield ATC
All Cranfield's local Operators
Henlow Flying Club
Old Warden Aerodrome
Bedford Aerodrome
Tower Farm
Sackville Farm
Earwig Farm
Kimbolton Airfield
Cardington Danger Area (D206)
Northampton (Sywell) Aerodrome
Military low flying cell
National Police Air Service
Specialist Aviation Services
Babcock Mission Critical Service
PDG Helicopters
Helicentre
Heliair
Ground-based
Bedford Borough Council
Central Bedfordshire Council
Milton Keynes Council
Astwood and Hardmead Parish Council
Pavenham Parish Council
Cranfield Parish Council
Stagsden Parish Council
Oakley Parish Council
Stevington Parish Council

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NBEC - Contact us

- Online survey: Link will be sent to all in earlier list early w/c/ 1st Feb
  Please complete the survey if you have feedback
- Email: NBEC@cranfield.ac.uk

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NBEC - Contact us

Questions?

Note that this session is primarily for Briefing and so there will be limited time for questions.

Please use the survey as a means to provide feedback.

Where this is not appropriate, please use the nbec@cranfield.ac.uk email address. Note this address will remain available throughout the overall process.

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Appendix D – Online survey

National Beyond visual line of sight Experimentation Corridor (NBEC) Temporary Airspace Change Proposal (ACP) Survey

Cranfield University is undertaking a period of targeted engagement to gather feedback for a temporary airspace change proposal to develop the National Beyond visual line of sight Experimentation Corridor (NBEC).

Full details of the proposal are available in the briefing sheet and presentation, which we encourage you to read before completing the survey https://www.cranfield.ac.uk/press/news-2021/feedback-sought-for-temporary-airspace-change-proposal

This short survey forms part of the NBEC airspace change proposal engagement process required by the Civil Aviation Authority.

NBEC is an unmanned aerial vehicle (UAV) development corridor extending from Cranfield Airport's air traffic zone towards Oakley, Bedfordshire, and UAV operations to develop the corridor are proposed to run from 1 July to 30 September 2021.

The flights will facilitate wider UAV research at Cranfield and feed into civil aviation projects that benefit society such as drone deliveries of medical supplies and disaster relief support.

The routing of NBEC has been designed so that it minimises overflight of built-up areas, roads and railways. Electrically-powered, fixed-wing (aeroplane) type aircraft weighing less than ten kilograms with wingspans around three metres will be used in the trials. The maximum height of the flights will be 400 feet above ground level (AGL) and the minimum height rarely less than 200 feet AGL.

NBEC is part of the Civil Aviation Authority (CAA) Innovation Hub Sandbox and Cranfield is working in close conjunction with the CAA to develop this temporary airspace change proposal, which requires their formal review and approval.

Ethics Statement
The research has been approved by the Cranfield University Research Ethics Committee and as such you need to be aware of the following points before starting the survey:

· Participation in is entirely voluntary and you may withdraw your input from the study at any point.

· The survey will take around 5-10 minutes to complete depending on your responses.

· Your survey responses will be held in confidence and will only be accessible to the research team, stored securely and in accordance with the General Data Protection Regulations.

· All results will be made anonymous and the identities of participants and their organisations will remain confidential.

· Anonymised data from the survey (e.g. quotes) may be used in project outputs including reports, journal papers and presentations.

· As a participant, all results and published outcomes from the research will be made available to you.

Did you attend the briefing session on Friday 29th January?

Yes

No

Has the information provided in the briefing presentation, contained within the press release, enabled you to determine any potential impacts on you or your organisation?

Yes

No

If you feel that you require any further information for you to assess the potential impact of this airspace proposal then please provide details below otherwise leave blank.

Please provide details of any potential impacts of this airspace change proposal you foresee on you or your organisation's activities.

If you foresee any potential impacts, please describe how the airspace change proposal could be adjusted to mitigate them.

We are very interested to hear your thoughts regarding NBEC and the airspace change proposal in general. If you have any further thoughts or feedback then please feel free to provide them below.

If you would like to contacted to discuss your survey responses, or any aspect of NBEC, then please leave your contact details, including your e-mail or phone number in the box below.

Appendix E – 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 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.
- Cranfield ATC will provide a Danger Area Activity Information Service in accordance with AIP ENR 5.1.3.4, that is:
    - to provide requesting aircraft with an airborne update of the activity status of a participating Danger Area whose position is relevant to the flight of the aircraft.
- 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).