ACP-2023-061
London Health Bridge
Trial Submission Pack

7th March 2024

Version 1.4

Revision history

Version 1.0 published to CAA December 2023
Version 1.1 published to CAA January 2024, section 3 updated
Version 1.2 published to CAA February 2024, section 3 updated
Version 1.3 published to CAA March 2024, section 5 adjusted.
Version 1.4 published to CAA March 2024, dates removed from table 2 and figure 2 based on new timelines

1. Introduction

1.1. Purpose

Apian (Airspace sponsor) on behalf of Guy's and St Thomas NHS Foundation Trust (GSTT), is planning a trial to assess the benefits of a daytime on-demand UAS (Uncrewed Aircraft System) delivery service, for high-priority pathology samples between the laboratories at Guy's and St Thomas' NHS Foundation Trust (GSTT). This service has the potential to greatly increase access and efficiency to best-in-class diagnostic platforms, thereby enhancing patient care, saving costs, and promoting sustainability.

This document is the Trial Submission Pack for the Trial named 'London Health Bridge'. The following sections and annexes address the requirements outlined in CAA document CAP1616 (Part 1b) for airspace trials.

For the purposes of this report, the fifth version, CAP1616FUT: The Process for Changing the Notified Airspace Design that became effective in January 2024 has been used. The associated CAP1616g, Guidance on Airspace Change Process for Temporary and Trial Airspace Change Proposals, has not yet been published. Therefore CAP1616 version 4 has also been considered regarding the approach for temporary and trial changes.

1.2. About Apian

Apian is a medical logistics company, focused on the use of UAS to deliver faster, smarter and greener healthcare. Founded by a team of NHS doctors and ex-Googlers, Apian is building products and platforms that connect the healthcare industry with the UAS industry to improve patients' health outcomes and staff well-being.

You can find out more about Apian on their website here.

[redacted]

1.4. Description of the trial

In 2018, the Nesta Flying High: shaping the future of drones in UK cities described this use case and the potential benefit it could deliver to the NHS. Five years later, UAS technology has significantly advanced to now be able to demonstrate these benefits in an operational trial.

Significant developments of the healthcare use case by Apian and GSTT has resulted in identifying multiple medical payloads that extend outside the initial use case that makes this service even more impactful than initially identified in 2018.

Apian is therefore proposing a trial to assess and demonstrate the benefits that a UAS delivery service can deliver by conducting a regular daily service between Guy's and St Thomas' Hospitals.

The following principles have been used in the trial design;

The trial will;	The trial will not;
✓ Be conducted using current CAA airspace regulation and policy	Be the scalability solution for all types of UAS operations across London
✓ Be conducted in accordance with the latest CAA regulation regarding UAS operations	Introduce a permanent airspace change without consultation
✓ Be conducted in a TRA (Temporary Reserved Area) for safe accommodation of UAS operations in unsegregated airspace	
✓ Prioritise Emergency service and Military state operations requiring access to the TRA	
✓ Capture data to support the steps for the safe integration of BVLOS UAS operations	

Table 1: Trial principles

The trial is planned as follows:

The intended UAS BVLOS delivery flights will take place between the following two hospitals in the inner-city London boroughs of Lambeth and Southwark, as shown in Figure 1 below:

- Guy's Hospital, Great Maze Pond, London, SE1 9RT; and
- St. Thomas' Hospital, Westminster Bridge Rd, London, SE1 7EH.

The details of the trial are outlined in Table 2.

Trial details	
Location of Trial	Between Guy's Hospital, Great Maze Pond, London, SE1 9RT; and St. Thomas' Hospital, Westminster Bridge Rd, London, SE1 7EH.
Airspace requirement	Trial Temporary Reserved Area (TRA)
Take-off location	Secure roof-top of Guy's Hospital (~65m AGL)
Delivery location	Secure roof-top of St Thomas' Hospital (~30m AGL)
UAS cruise altitude	[redacted]
TRA ceiling	450ft AMSL
Length of trial	6 months
Days	Monday - Friday
Timings	6 daylight hours between the time of 0900-1700L
Number of Deliveries	Maximum 10 deliveries per day (A delivery is UAS departing Guy's Hospital, delivering to St Thomas Hospital, and returning to Guy's Hospital). Not more than one delivery at a time.
Estimated time for each delivery	[redacted]

Table 2: Trial details

The trial will be conducted within a Temporary Reserved Area (TRA) in line with the CAP2533 Airspace Policy Concept: Airspace Requirements for the Integration of BVLOS Unmanned Aircraft.

Note: Apian is in active communication with Lambeth and Southwark councils regarding planning permission requirements for operations at Guy's and St Thomas' Hospitals.

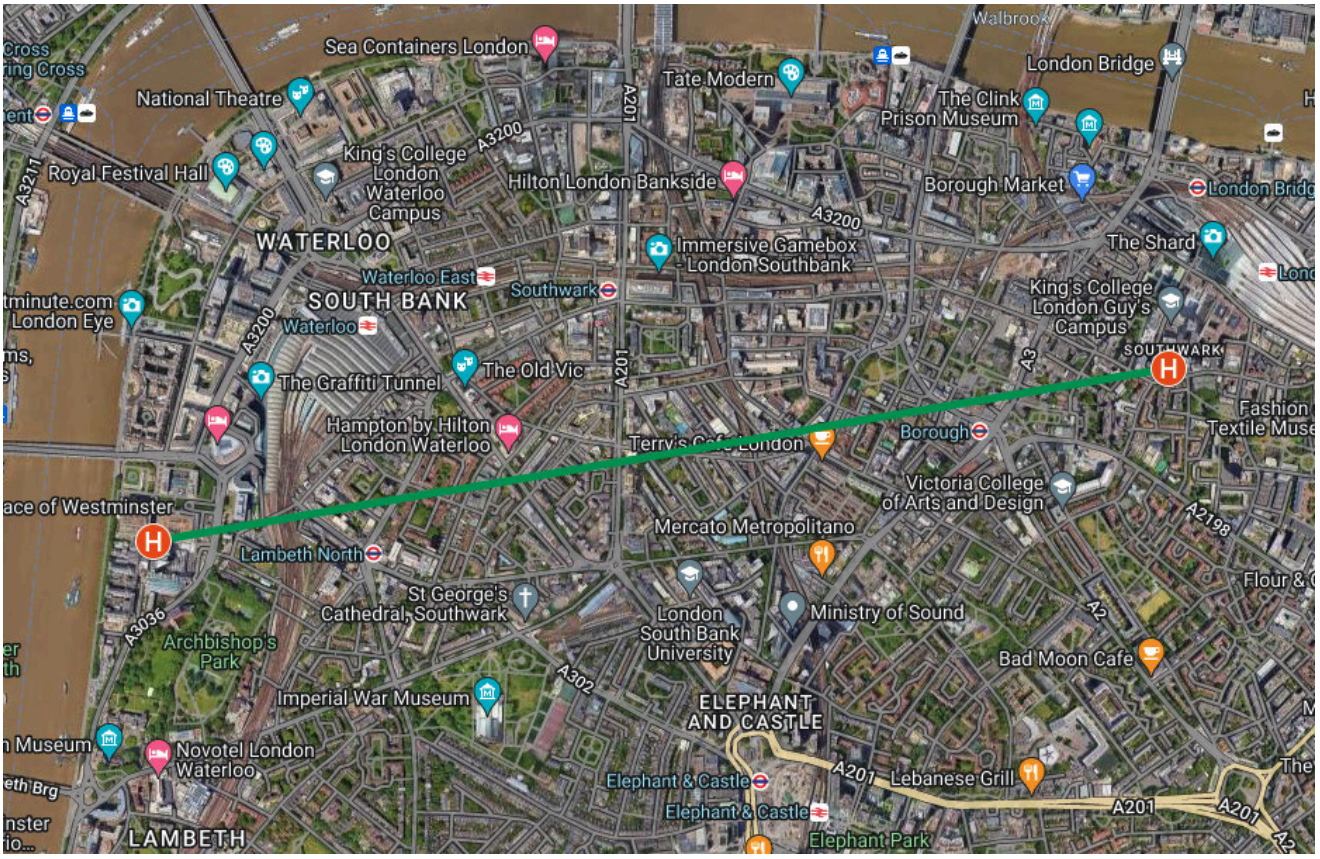

Figure 1 – Representation of the direct line connecting the planned Nest at Guy's Hospital and the intended delivery zone at St. Thomas' Hospital

The trial is intended to last for a period of 6 months, however, reviews with the CAA Innovation Advisory Services Team as part of the CAP2533 sandbox will be conducted at 1, 3 and 5 months. If the objectives of the trial are completed in advance of the 6 months then the trial will be concluded. However, if further data is required, then Apian may consider an application for an extension of less than 6 months, considering the guidance set out in CAP1616. The purpose of this extension would be to allow for additional data capture from which sensible conclusions can be drawn, and will only be considered necessary if it has not been possible to collect the data that was identified to fulfil the objective of the trial. We will inform all stakeholders well in advance if any changes to the timeline are necessary.

1.5. Why an operational trial?

In April 2023, the CAA published CAP2533, which presents an airspace policy concept that describes a pathway forward to deliver the integration of BVLOS UA. The concept utilises specific types of airspace structures to transition from segregated BVLOS operations, through the managed accommodation of a varied range of airspace operations, toward the ultimate objective of enabling integrated, unsegregated operations for all airspace users in standard ICAO classifications of airspace.

Alongside CAP2533, the CAA launched a regulatory sandbox to assess and refine the details of the BVLOS policy concept. CAP2540, Regulatory Sandbox for BVLOS Accommodation Airspace Policy Concept, provides information about the sandbox which will see the use of temporary reserved areas (TRA) in conjunction with appropriate procedures and/or technology to accommodate the operation of UAS in unsegregated airspace. Apian's London Health Bridge project was one of six successful applicants selected to participate.

The trial aims to move UAS operations a step closer to integration, rather than segregation.

A trial also provides valuable healthcare insights, which would not otherwise be identified.
We will be able to gather healthcare data to demonstrate how expediting deliveries by UAS can: enhance patient care, increase service efficiency, improve sustainability, provide service resilience and support centralisation of other Trust services such as stocking medical devices.

Apian and GSTT's departments will co-author a benefits and business case for the Trust to be used internally only. This would outline the healthcare insights gained as a result of this 6 month trial as well as what the future would look like when scaled up to include a greater number of use cases, locations and flights. The trial will also allow us to identify and test the physical and, importantly, the digital integration of a drone delivery service into GSTT's systems and workflows.

1.6. Trial objectives

The proposed TRA has been designed to meet the healthcare objectives of the project by enabling BVLOS UAS delivery flights between Guy's and St. Thomas' Hospitals. Alongside the healthcare aims, the trial also has the following aviation objectives which have been taken into account when designing the airspace.

- Support the vision of the Airspace Modernisation Strategy (AMS) by trialling safe integration of BVLOS UAS operations using technology and procedures to remove the need for segregated airspace.
- Safely operate BVLOS within controlled airspace.
- Support CAA airspace policy development by demonstrating and validating procedures for the safe integration of UAS in controlled airspace.
- Support the Aviation 2050 Net Zero targets with fully-electric UAS services that have zero tailpipe emissions.
- Identify and collate data to enable robust evaluation of the trial objectives (aviation and healthcare).
- Support the CAA's Regulatory Sandbox for BVLOS by contributing data and evidence applicable to the sandbox objectives detailed in CAP2540.

1.7. Data collection and analysis

The following data will be collected and analysed during the trial to monitor progress and facilitate CAA Innovation Advisory Team sandbox review meetings.

- Flight logs (take-off, delivery, flight duration, etc.).
- Requests received by NATS from crewed aviation to enter the airspace who are permitted to under ORS4 No.1496, (UK) Standardised European Rules of the Air - Exceptions to the Minimum Height Requirements (e.g. Helicopter Emergency Medical Service (HEMS), aerials works, etc.).
- Requests received to enter the airspace by uncrewed aircraft.
- TRA operating procedures will be reviewed and evaluated during the trial. Further analysis will also be carried out with the CAA's Innovation Advisory Services Team during the sandbox review meetings.
- In addition to mandatory reporting requirements, any safety related information will be shared between Apian, [redacted] and NATS to ensure procedures are sufficiently robust to provide assurance of safe flights.

2. Temporary Reserved Area (TRA)

2.1. TRA dimensions

The trial will be conducted within a Temporary Reserved Area (TRA) as per CAP2533 Airspace Policy Concept: Airspace Requirements for the Integration of BVLOS UA.

The proposed TRA (see Figure 2 for details) is located within the London City Control Zone (CTR) Class D airspace which operates from Surface (SFC) to 2500 ft Above Mean Sea Level (AMSL). All crewed flights in Control Zones are subject to Air Traffic Control (ATC) clearance due to their proximity to London Heathrow and London City Airports. NATS provides ATC services within the London Control Zones.

The following maps illustrate the airspace intended to be utilised as part of this trial, which is controlled by Heathrow Radar at NATS. Detailed coordinates for the area can be shown in Table 3.

Route	UAS will depart Guy's hospital deliver to St Thomas and return to Guy's hospital
TRA dimensions	Height: Surface level to 450ft AMSL Lat/Long: See Table
Activation period	Monday - Friday 0900-1700L (daylight hours only)
Frequency	Approx 10 return flights per day
Duration of operations	6 months (start dates as per stakeholder engagement)
Activation	NOTAM minimum of 24hrs in advance

Figure 2 – Representation of the TRA dimensions and summary table

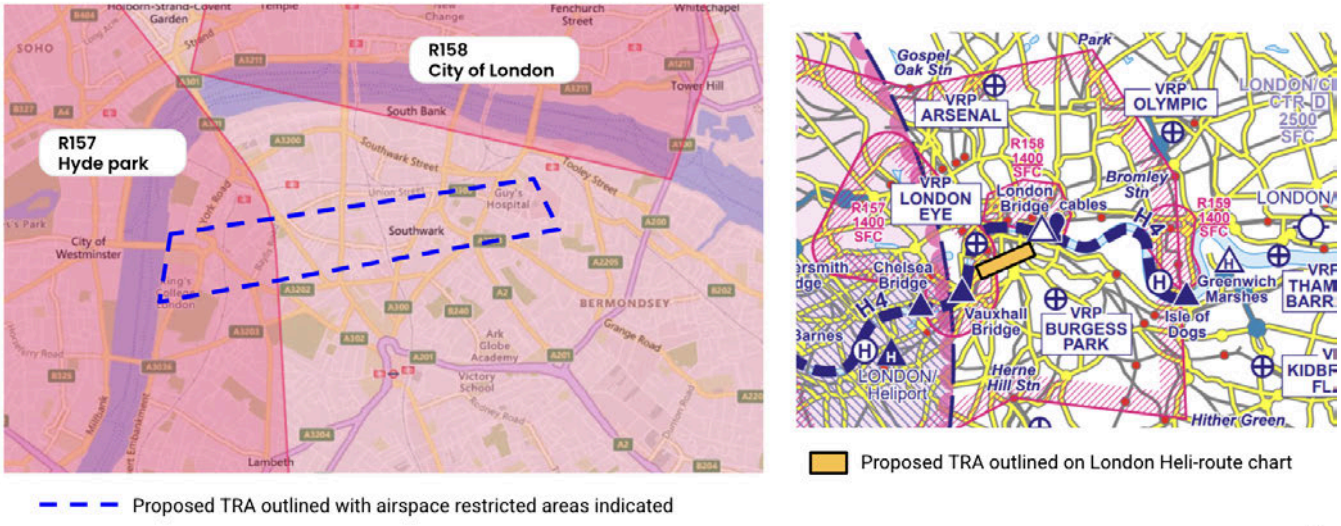

Figure 3 – Representation of the TRA dimensions and Airspace

ID	Latitude		Longitude	
	DD	DMS	DD	DMS
1	51.5010780	51° 30' 03.8808" N	0.1198825	00° 07' 11.577" W
2	51.5037626	51° 30' 13.54536" N	0.0863038	00° 05' 10.69368" W
3	51.5008644	51° 30' 03.11184" N	0.0858235	00° 05' 08.9646" W

4	51.4978281	51° 29' 52.18116" N	0.1204496	00° 07' 13.61856" W

Table 3 – TRA Lat/Long WGS84 Coordinates

2.2. Management of the TRA

The Operating Authority for the TRA is Apian Ltd.

Activation and de-activation of the TRA by NOTAM will be notified by Apian Ltd at least 24 hours in advance of operations.

The daily UAS operations and, supported by Heathrow Radar NATS airspace management services on an as needed basis, the deconfliction with other crewed or uncrewed aircraft will be managed by NATS in coordination with [redacted]

Sponsor Enquiries relating to the subject TRA should be directed in the first instance to the Head of Aviation at Apian Ltd Tel: 020 3714 4145 or email: london.airspace@apian.aero

Note: Should the TRA submission gain approval, then the Sponsor (Apian) will put in place appropriate measures for the monitoring, collating and reporting on the level and contents of any complaints received to the CAA. Stakeholders will be notified of how they can provide feedback or a complaint prior to activation of the TRA.

3. Engagement

3.1. Introduction

Engagement for this project will be separated into two areas

- **Targeted aviation stakeholder engagement**: As per CAP1616 1B 317, 'the sponsor must demonstrate to the CAA that it has carried out targeted engagement with aviation stakeholders (specifically, that is airspace users, air navigation service providers and airports only) to establish that the trial will be safe and operationally viable'.
- **Public engagement**: CAP1616 1B 318 states 'If a live operational trial is permitted by the CAA, the trial sponsor must next identify and inform the full range of stakeholder groups that the trial will be taking place.'

This section outlines the engagement that has been conducted to date and the planned public engagement that will take place following approval of the TRA. For details on the approach taken, please refer to the Stakeholder Engagement Plan - London Health Bridge which can be found here.

3.2. Targeted Aviation Stakeholder Engagement

Approach

Apian's approach to targeted aviation stakeholder engagement is set out in the Stakeholder Engagement Plan (ACP-2023-061).

When considering the aviation audience for engagement, Apian used the location and dimensions of the TRA to identify aviation stakeholders, which would either be impacted by the TRA or benefit from being part of the engagement process due to proximity to the TRA location, nature of operations, or aviation organisation scope, for example.
The Stakeholder Engagement Plan contains information on engagement before the formal engagement period took place.

Engagement period

Briefing material was shared with targeted aviation stakeholders which included information on the TRA including dimensions and operating procedures. These stakeholders were invited to provide feedback on the operational and safety aspects of the TRA between the 6th of October 2023 and 17th of November 2023.

The engagement period lasted 6 weeks, this was considered proportionate and was agreed for the following reasons:

- The engagement was limited to relevant aviation stakeholders who are legally allowed to operate within the TRA
- Procedures are proposed to allow access for emergency services at short notice

Stakeholders were further contacted at the start of 2024 regarding the change to the start and end date of the trial, and the TRA height which is noted as 450ft AMSL. Material for this engagement can be found here.

This engagement period lasted 2 weeks, from 2nd Jan to 16th Jan. All details can be found in Annex G.

Industry feedback

Feedback was received to a dedicated email address and is summarised in Annex G.

In total, 12 responses were received to the first stakeholder engagement period. A detailed review of the feedback received through engagement was undertaken to determine its impact, if any, on the trial. There were 8 stakeholders who provided feedback to the second stakeholder engagement period.

The following provides a summary of responses from aviation stakeholders on the TRA complex proposals.

Emergency service operators were contacted in advance of the formal stakeholder engagement to discuss mitigations to ensure safe deconfliction with their operations.

A. Emergency service operators

- Emergency service aircraft are authorised to conduct flight operations at low level if required. However, they all stated that it was highly unlikely for them to be below 500ft in this area for transits, due to the height of the buildings. Transits regularly took place at approximately 1000ft.
- Emergency service (HEMS) stated that they may be required to land in the TRA in response to a tasking, whilst this was not a daily occurrence, they would need access to the area at short notice.
- Other emergency services confirmed it was unlikely that they needed to land in the TRA, but that it should be made possible if required.
- Some of the emergency services stated that they may need to operate VLOS drones within the area, and confirmed they do not operate BVLOS.

B. Military operations

- The military confirmed that there will be negligible impact on their operations.

C. ANSP/Aerodromes

- London Heliport confirmed that the TRA would not affect their operations.
- NATS confirmed that they have been working with Apian to ensure access for emergency services, and confirmed that they are comfortable with the measures put in place and agree with them.

D. Other operators

- National Grid and Network Rail confirmed there was no impact on their operations.
- National Grid noted that VLOS activities in the area were minimal, and that the NOTAM was an appropriate mitigation measure ensuring contact details are provided.
- ARPAS noted that VLOS operators may request to operate in the TRA, and noted contact details on the NOTAM would be an appropriate mitigation.

E. Other

- The Airprox Board, whilst supportive, noted the H4 of the London Heli Lanes. They suggested that 500ft could be the minimal separation between aircraft and the UAS, and suggested the use of ADS-B out.

Apian's response

Apian values the feedback that aviation stakeholders have taken the time to provide, and look forward to working with them (and the CAA) to agree on an airspace design and robust deconfliction process, that satisfies everyone where reasonably practicable. Having reviewed this feedback, Apian considers and/or proposes the following:

- Developed and agreed safe procedures to ensure emergency services (crewed and uncrewed) can access the airspace at short notice with NATS and the UAS Operator.
- Agreed to include contact information and instructions on the NOTAM for non-emergency VLOS operators to request access.
- Provided appropriate feedback regarding the requirement of a TRA, mitigations with other crewed aircraft and confirm the Operational Safety Case requirements regarding the operations of the UAS.

Based on the feedback received, no changes to the proposed TRA area or trial procedures were judged to be necessary.

Future engagement

Targeted aviation stakeholders will be updated on the output of the ACP application and will receive links to the Aeronautical Information Circular (AIC) documentation. Activation of the TRA will be communicated by NOTAM.

If the trial is approved, Apian (as Airspace Sponsor) will put in place appropriate measures for the monitoring, collating, and reporting on the level and contents of any complaints received to the CAA. Stakeholders will be notified of how they can provide feedback or complaints prior to activation of the TRA.

3.3. Community and public engagement

If the trial is approved, Apian and its partners will be conducting significant community and public engagement activities leading up to and during the trial. Details of the proposed activities can be found in Annex F.

Like the targeted aviation stakeholders, the CAA will be kept informed of any feedback and/or complaints throughout the trial.

4. UAS operations

[redacted] will obtain an Operational Authorisation (OA) as required by Article 5 of UK Regulation (EU) 2019/947 to conduct UAS operations in the 'specific' category. The OA application has already been formally submitted to the CAA. It is understood, and expected, that the OA is a requirement for the approval of the ACP, and likewise, the ACP is a requirement for the OA. This was acknowledged in the assessment meeting (assessment meeting minutes and slides can be found on the Airspace Change Portal here).

[redacted]

5. Environmental assessment

5.1. Introduction

As per Appendix B to CAP1616:

'B86: 'In line with Government guidance, the CAA requires a trial sponsor to consider and undertake an assessment of the noise impacts of a trial (which the CAA will take into account when deciding whether to agree to the trial). If the CAA agrees to the trial, we require the trial sponsor to use the scale of those impacts to guide the level of information about the trial which the sponsor must provide to stakeholders before the trial commences.'

'B89: The CAA anticipates that there will be no requirement to assess any other environmental impacts (i.e. CO2, local air quality, tranquillity), because these are expected to be negligible for such a short-term change that will affect only a small proportion of current traffic.'

Therefore a Noise assessment has been completed.

5.2. Noise information

In accordance with section B88 of Appendix B to CAP1616, for airspace trials longer than 90 days yet shorter than 12 months, that affect traffic distribution below 7,000 ft, the following information must be prepared by the change sponsor and used to engage with those affected:

1. for noise from day flights (0700 to 2300), 65 dBA Lmax footprints that illustrate the loudest and most frequent types of aircraft that will be participating in the trial;
2. for noise from night flights (2300 to 0700), 60 dBA Lmax footprints that illustrate the loudest and most frequent types of aircraft that will be participating in the trial.
3. equivalent footprints that illustrate where the trial traffic would otherwise have flown (this assumes that any aircraft that partakes in a trial would have flown on an alternate route that reflects current operations)
4. information on the expected frequency (both absolute and as a percentage of total traffic during the trial period) and timing of flights participating in the trial
5. operational diagrams that illustrate the estimated overflight swathe of trial traffic, up to 7,000 feet (see 'Operational diagrams' above).

A full noise analysis report, which provides information relating to the above 5 points, has been provided to the CAA as part of this submission documentation. The Commercial in Confidence report is not available for wider review.

The report primarily focuses on the LASmax metric in representative flight conditions, encompassing both level flyover and hover scenarios. In the case of a level flyover, the LASmax measurement, conducted under conservative height, speed, and wind direction conditions, comfortably remains

below 65 dBA, which is the CAP1616i reference LASmax value for noise from day flights. This holds true also after incorporating the +10 dBA tone correction mandated by CAP1616i. In a hover scenario, the obtained LASmax value slightly exceeds the reference 65 dBA when adjusted with the CAP1616i +10 dBA tone correction. However, this is not deemed problematic since the take-off/landing and delivery sites are strategically located on the rooftop of Guy's and St. Thomas' Hospitals and as a result, no uninvolved individuals will experience direct (unobstructed) exposure within any distance shorter than 30 m. Moreover, dedicated local community and patient engagement initiatives will be conducted prior to the commencement of operations and throughout the trial.

In summary, the expected noise generated by the execution of the proposed healthcare delivery operations in London will be equal to or lower than the typical noise levels experienced from everyday activities in the area, such as road traffic, construction machinery, or cleaning services.

[redacted]

6. Safety assessment

Apian has been working in partnership with NATS in preparation for this trial.

The following activities have been undertaken by NATS as part of this preparation

- Development of the (draft) London Health Bridge Temporary Operating Instructions (TOI)
- Initial Peer review of the ATC Procedure and performance of Hazard Identification (HAZ-ID), known as an APSA (ATC Procedure Safety Assessment).

The following activities will be undertaken by NATS:

- Peer review of the ATC Procedure and performance of HAZ-ID (APSA) following finalisaton of the TOI.

NATS will develop, review and perform a safety assessment on the ATC procedure utilising the NATS SAF006 safety assessment process (APSA); a Hazard identification process ratified by the Safety & Airspace Regulation Group (SARG). Once complete, the output of this will be communicated to SARG (via their local inspector) along with a copy of the draft procedure. This will be reviewed, assessed and, if necessary, challenged by SARG prior to the commencement date of the trial.

The UAS Operational Authorisation application also includes a dedicated UAS operational safety assessment, which will be reviewed by the CAA RPAS sector team.

7. Trial procedures

This section describes the procedures developed for the trial.

7.1. Operational Procedures

The location and dimensions of the TRA are in airspace below routine crewed operations, meaning only Emergency Services and Military on state operations are permitted to operate within this airspace (See ORS4 No.1496 for exemption details).

Procedures have been developed to ensure these operators can gain access to the TRA at short notice, these have been summarised in Annex B.

More detailed information on the development of the (draft) London Health Bridge Temporary Operating Instructions (TOI) can be found in Annex C and D. These are not for wider distribution.

It is also anticipated that UA in support of Emergency Service Operators may also require access. Details of procedures outlined to support these operations are also contained within the same documents stated above.

7.2. Monitoring Trial Process

As the Trial is part of the CAA Regulatory Sandbox, the CAA Innovation team will monitor the trial with reviews anticipated to be conducted at 1, 3 and 5 month intervals. These reviews will summarise the trial and its progress.

The CAA Regulatory team will be updated immediately on any safety concerns and every 2 weeks on any relevant feedback from stakeholders.

7.3. End of Trial Report

As with all Apian projects, an end of Trial Report will be produced. This will summarise whether the objectives have been met and any key observations and findings of the trial. It will also be sent to the CAA and published on the CAA Portal where it will be accessible to all stakeholders.

Annex A: Acronyms and abbreviations

Acronym or abbreviation	Meaning
ACP	Airspace change proposal
AGL	Above ground level
AIC	Aeronautical information circular

Acronym or abbreviation	Meaning
AMS	Airspace Modernisation Strategy
AMSL	Above mean sea level
ANSP	Air navigation service provider
APSA	ATC procedures safety assessment
ATC	Air traffic control
BVLOS	Beyond visual line of sight
CAA	Civil Aviation Authority
CAP	Civil Aviation Authority publication
CTR	Control zone
DfT	Department for Transport
EU	European Union
FAA	Federal Aviation Administration
GSTT	Guy's and St. Thomas' National Health Service Foundation Trust
HAZ-ID	Hazard Identification
HEMS	Helicopter Emergency Medical Service
LAeq16h	A-frequency-weighted equivalent continuous sound level over the period 0700 - 2300 hours [dBA].
LASmax	Maximum A-frequency- & Slow-time-weighted sound level [dBA]
LOAEL	Lowest Observed Adverse Effect Level [dBA]
NOTAM	Notice to Aviation
NHS	National Health Service
OA	Operational Authorisation
ORS	Official record series

Acronym or abbreviation	Meaning
RPAS	Remotely piloted aircraft system
SARG	Safety & Airspace Regulation Group
SFC	Surface
SORA	Specific Operations Risk Assessment
TOI	Temporary Operating Instructions
TRA	Temporary Reserved Area
UA	Uncrewed aircraft
UAS	Uncrewed aircraft system
UK	United Kingdom of Great Britain and Northern Ireland
UTM	Uncrewed aircraft system traffic management

Annex B: Summary TRA Access for Emergency Services and Military operations

Annex C: London Health Bridge Letter of Agreement

This Annex is marked as Commercial in Confidence.

Annex D: Temporary Operating Instructions (draft)

This Annex is marked as Commercial in Confidence.

Annex E: London Health Bridge Noise Analysis

This Annex is marked as Commercial in Confidence.

Annex F: Community/Public Engagement plan

This Annex is marked as Commercial in Confidence. A redacted version will be uploaded to the portal for stakeholders to view.

Annex G: Summary of Targeted Aviation Stakeholder feedback