

# Reduced Night Noise Trial Submission Pack

**Gatwick Airport Limited**

*Prepared by Helios*

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CAA Trial Reference number ACP-2018-62

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## Introduction

### Purpose

Gatwick Airport is planning a trial to assess the extent to which PBN (Performance Based Navigation) can deliver noise benefits to arriving aircraft during the night.

This document is the Trial Submission Pack for the Reduced Night Noise (RNN) trial, comprising 7 sections and 15 annexes which address the requirements of CAA document CAP1616<sup>1</sup> for airspace trials:

1. Industry Consultation
2. Engagement
3. IFP Design
4. Environmental Assessment
5. Safety Assessment
6. Trial Procedures
7. Activities Undertaken

The Statement of Need and Trial Plan were developed and submitted to the CAA in Q3 and Q4 2018 respectively, and an Assessment Meeting was undertaken with the CAA in Q1 2019. Trial documents can be found on the [CAA Portal](#). Details of subsequent activities (listed above) are summarised in this document.

This document supersedes the RNN Trial Plan submitted to the CAA in Q4 2018<sup>2</sup>.

### Description of the trial

In April 2017, Gatwick Airport's Noise Management Board (NMB) agreed that opportunities for night noise respite should be explored to reduce the number of people disturbed by night arrivals. Subsequently, independent research<sup>3</sup> conducted by the University of Sussex for Gatwick indicated that 'outlier' noise events, defined as aircraft which are significantly lower or noisier than the mean, are responsible for a disproportionate impact on communities.

PBN is a means of modern aircraft navigation that allows the vertical profile of arriving aircraft to be controlled in an accurate manner that could remove outliers.

Gatwick is therefore proposing a trial to assess the extent to which PBN technology can deliver noise benefits for arriving aircraft during the night period, by reducing the number of noisy 'outliers' that are significantly lower or noisier than most aircraft.

The following principles have been presented to and agreed at the NMB, and have been used in the trial design:

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<sup>1</sup> CAP1616 Airspace Design: Guidance on the regulatory process for changing airspace design including community engagement requirements, November 2018.

<sup>2</sup> Reduced Night Noise Trial Plan, Version 1.0, 7<sup>th</sup> December 2018.

<sup>3</sup> <https://www.gatwickairport.com/business-community/airspace-noise/airspace/height-perception-study/>

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The trial will:	The trial will not:
✓ Compare environmental performance in 'with PBN' and 'without PBN' scenarios by placing the new procedures in the existing airport night-time arrivals swathe.	✗ Identify routes for use in future airspace design.
✓ Identify and address the planning, implementation and operational challenges associated with PBN arrival transitions, and inform future planning.	✗ Overfly people currently outside of the night-time arrivals swathe.
✓ Gather data on PBN operational performance and noise impacts.	✗ Move the minimum night-time ILS joining point from 10NM.
✓ Further develop the NMB's understanding of arrivals PBN.	✗ Optimise routes for capacity improvements or efficiency.
✓ Evaluate new community engagement initiatives and processes.	✗ Evaluate future mechanisms for higher-density sequencing, Fair and Equitable Distribution (FED), respite or other concepts.
	✗ Introduce an airspace change without consultation.

The trial is planned as follows:

- Length of trial: 6 months in total, planned to start in March 2020.
- Timings<sup>4</sup>: 01:30 – 05:00 (local time).
- Runway: Transitions will intercept the ILS on runway 26L & 08R / GNSS approach on 26R & 08L.
- Routes: Based on RNP-1 with RF legs.
- Participation: PBN routes to be flown by capable aircraft, with others being vectored as at present.
- Flight volumes: Based on 2017-2019 data, nightly average flights range will likely range from 1 arrival in low traffic months to 21 in high traffic months. A summary of the data used to generate a baseline for the trial can be found in **Annex J**.
- Data capture: Mobile Noise Monitor Terminals (NMTs) will capture the baseline and trial data environments.
- Suspension: Trial may be suspended for operational reasons (e.g. high levels of traffic, weather avoidance) or if the trial is not meeting its objectives.

### Why an operational trial?

Noise models can be used to predict the noise impact of aircraft. However, these are not considered accurate beyond about 12NM (Nautical Miles, approx. 22 km) from an aircraft's touchdown. The PBN procedures are expected to have a positive noise impact in the region of 10-20NM from touchdown, so the noise modelling tools would not be sufficiently accurate to determine their impact.

<sup>4</sup> Timings refer to the times between which ATC will instruct pilots to PBN approach procedures. Aircraft will land 10 - 15 minutes later.

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The trial will allow data to be recorded on mobile Noise Monitor Terminals (NMTs) which are placed around the airport at ranges out to 20NM. Noise from aircraft before and during the trial will be recorded and analysed.

### Quantitative objectives

The following metrics are proposed as ‘success criteria’ to determine if PBN is successful in removing outliers. The metrics were developed as part of the noise modelling in **Annex K**. They will be measured using recorded noise data at noise monitor locations and will be calculated for each aircraft type participating in the trial:

- Objective 1: The loudest outliers<sup>5</sup> reduced by 90%.
- Objective 2: The lowest outliers reduced by 90%.

How this is calculated is illustrated below for Objective 1:

- Pre-trial at each noise monitor for each aircraft type, calculate the loudest 5<sup>th</sup> percentile – ie the noise level above which are the loudest 5% of aircraft (eg 70dB).
- During the trial, count how many noise events for the same aircraft type are above that limit (in this case, 70dB) and see if the proportion of events has reduced by 90%.

In earlier engagement with industry and communities, the additional objective “*A reduction in X% of N60 events*” was also proposed, where X would have to be calculated for each noise monitor location. This has proved too complex to calculate reliably because of the limited accuracy of existing noise models, particularly at longer range from the airport. This reinforces the need for the trial since it will analyse recorded noise data to determine the impact of the PBN procedures.

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<sup>5</sup> For the purpose of the trial, outliers are defined as those in the ‘worst performing’ 5% of aircraft, i.e. the loudest 5% (within the aircraft category) or the lowest 5%.

## Section 1: Engagement

### Introduction

Significant engagement with the NMB<sup>6</sup> and with industry<sup>7</sup> has taken place since July 2017 on all aspects of the trial. This section summarises the key engagement activities undertaken to date and those planned for the future, including pre-trial, implementation and post-trial engagement activities.

### NMB engagement activity undertaken to date

This section is concerned with NMB engagement through meetings and workshops which has primarily focussed on environmental concerns, trial hours, safeguarding, route placement and other topics. The RNN trial has been discussed as a priority topic at 7 NMB meetings and workshops to date.

For the engagement listed below, input papers, meeting slides and meeting minutes/summaries have been produced to capture inputs and outputs of each meeting. This documentation is stored on a remote server and can be accessed by members of the NMB. The NMB meeting minutes are also published on Gatwick's website.

Community concerns raised through the NMB have been addressed through this engagement, and changes to the trial plan have resulted from the feedback received. For example, the design of multiple routes to both runway ends to aid the dispersal of traffic and reduce concentration.

Engagement with the NMB has taken place through the following meetings and workshops:

1. Initial discussion at NMB-6 in June 2017, including a discussion of a previous night-time RNAV trial. (see paper: [NMB-6 IP08](#))
2. An NMB discussion at NMB/7 in September 2017 on the Reduced Night Noise initiative, originally known as 'Quiet Night Arrivals' (see papers: [NMB-7 IP07](#), [NMB-7 IP08](#), [NMB-7 IP09](#), [NMB-7 IP10](#) and [NMB-7 WP08](#)).
3. Discussion at NMB/8 in November 2017, including a review of Community Noise Group (CNG) pre-conditions. (see NMB 8 minutes: [NMB-9 WP02](#))
4. A review of RNN trial next steps at NMB/9 in January in 2018. (see papers: [NMB-9 IP26](#), [NMB-9 WP03](#))
5. An NMB RNN workshop in March 2018 to discuss the proposed RNN initiative, including an overview of the trial, the concept of RNAV operations, and the design considerations. (see papers: [NMB-10 IP26](#))
6. An update of RNN trial discussions and next steps was provided to NMB/10 in April 2018 (see papers [NMB-10 IP25](#), [NMB-10 IP27](#), [NMB-10 IP30](#), [NMB-10 IP33](#), [NMB-10 WP03](#))
7. Another update was provided to NMB/11 in June 2018. (see papers [NMB-11 IP07](#), [NMB-11 IP30](#) and [NMB-11 WP03](#))

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<sup>6</sup> NMB members include Gatwick Airport Consultative Committee (GATCOM), County Councils, Community Noise Groups, Gatwick Airport, CAA, DfT, NATS, ANS, Airlines.

<sup>7</sup> Industry stakeholders include Gatwick Airport, CAA, NATS, ANS, Airlines.

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8. An NMB RNN ad-hoc meeting was held in July 2018 to resolve outstanding items raised at NMB/11.  
(see paper [NMB-12 IP12](#))
9. An update on RNN activities was provided to NMB/12 in January 2019.  
(see papers [NMB-12 IP13](#), [NMB-12 IP13](#))
10. An update on RNN activities was provided to NMB/13 in January 2019.  
(see paper [NMB-13 IP19](#))
11. And an update was provided to NMB/14 in May 2019.  
(see paper [NMB-14-IP09](#))

All of the documents listed above are available on the NMB “Box” folder so have not been provided as annexes.

The trial has also been presented at the Gatwick airspace and NMB public meetings in December 2017 and December 2018.

### Industry engagement activity undertaken to date

This section is concerned with engagement relating to the consultation objectives (safety and operational viability of the trial). As with NMB engagement, input papers, meeting slides and meeting minutes/summaries have been produced where applicable to capture inputs and outputs of each meeting and any changes to the trial plan and proposed routes as a result of these discussions. Engagement with industry stakeholders relating to these aspects has been primarily through the following activities:

1. An industry workshop (Jul 2017) to explore potential options for night noise reduction. This included representatives from Helios, Gatwick, ANS, Airlines, CAA, NATS, Trax and DfT.
2. An industry workshop (Feb 2018) to assess the feasibility of the proposed trial and to identify any potential constraints. This included representatives from Helios, Gatwick, ANS, Airlines, CAA, NATS, Trax and DfT. Minutes from this workshop were circulated to the NMB and are provided in **Annex A**.
3. An industry workshop (Mar 2018) to further discuss possible concepts of operation and the Instrument Flight Procedure (IFP) design process. This included representatives from Gatwick, ANS, Airlines, BALPA, Helios and Trax. Minutes from this workshop were circulated to the NMB and are available as **Annex B**.
4. An industry workshop (Sep 2018) to review indicative trial routes and potential airspace issues and constraints, discuss the IFP design process, and to consider ATC and airline trial procedures. This included representatives from Gatwick, Airlines, NATS, Helios and Trax. Minutes from this workshop were circulated to the NMB and are available as **Annex C**.
5. An airline survey was circulated (Apr 2019) to members of Gatwick’s Flight Operations and Performance Safety Committee (FLOPSC) to capture airline operational and procedural requirements to support the planning and development of the trial PBN routes. Feedback from the survey is summarised in **Annex D**.

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6. A Technical Workshop (May 2019) to further engage on the trial and to discuss activity timescales, airline survey responses, proposed trial routes, operational procedures, trial constraints, IFP validation, and training and system requirements. This included representatives from Gatwick, EasyJet, Virgin Atlantic, TUI, Norwegian, ANS, Trax and NATS. Minutes from this workshop are available as **Annex E**.

### Other engagement

As well as at NMB and industry meetings, the trial has been discussed at meetings with the Noise and Track Monitoring Advisory Group (NaTMAG), FLOPSC, Gatwick Airport Consultative Committee (GATCOM), and wider community groups/representatives at public meetings over a period of two years.

Details of the trial have been also publicised on Gatwick's website.

### Future engagement

We propose to engage through the following existing groups as we progress with the design, development, implementation and post-trial activities. However, we will also be including a much wider audience for engagement nearer the trial start date and will continue this engagement during and after the trial:

- NMB
- NaTMAG
- Airlines, through FLOPSC and the Airline Operators Committee (AOC)
- GATCOM

Presentations and information papers will be produced and circulated to representatives of each of the groups listed above.

A short 'easy to read' description of the trial will be uploaded to Gatwick's website with Frequently Asked Questions. Regular updates will be also be promulgated through the website with links to the CAA Portal.

The trial will also be presented at the Gatwick Airport Annual Airspace/NMB public meeting in December 2019.



## Section 2: Industry Consultation

### Overview

The objective of our consultation was to establish whether the trial is ‘safe and operationally viable’ to meet the requirements of CAP1616 Stage 3: ‘Consult Gateway’, and specifically paragraph 311:

*‘Before the CAA will agree to a trial, the sponsor must demonstrate to the CAA that it has consulted 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.’*

Our consultation targeted industry stakeholders only, to satisfy the requirement above. However, extensive engagement with communities through the NMB and other platforms, as indicated in Section 1 of this submission pack, has been undertaken and will continue.

### Approach

Significant consultation with industry stakeholders has taken place since July 2017. A number of technical workshops have been undertaken, and an airline survey circulated, to understand the operational, procedural, training and system requirements, and any constraints of the trial. The trial plan and proposed routes have evolved over time as a result of the discussions undertaken with both industry stakeholders and the NMB.

Following on from the Technical Workshop held on 3<sup>rd</sup> May 2019, Gatwick prepared an Industry Consultation Document (available as Annex F), aimed at aviation stakeholders impacted by the trial, i.e. airlines, air navigation service providers, and airports. The consultation document provided an overview of the trial including the trial objectives and principles, parameters, operations and proposed routes. In addition, responses to the airline survey were captured in the document as a supporting Annex.

Aviation stakeholders were invited to review the Consultation Document and to provide feedback to Gatwick Airport on whether the trial is safe and operationally viable as well as other questions. A feedback form was provided along with a dedicated email address, set up to receive the RNN trial responses.

### Audience

The Consultation Document was disseminated to industry stakeholders only, including members of Gatwick’s FLOPSC<sup>8</sup> and the National Air Traffic Management Advisory Committee (NATMAC<sup>9</sup>).

### Consultation Period

Industry consultation was formally launched at the FLOPSC meeting on 29<sup>th</sup> May 2019. Members were informed that the consultation would run for 4 weeks and would end on Friday 28<sup>th</sup> June at 23:59. Consultation with NATMAC commenced 1 week later than that with FLOPSC, lasting also for 4 weeks.

A period of 4 weeks is shorter than a typical public consultation period. It was agreed for the following reasons: the consultation population was limited to relevant aviation stakeholders directly targetable

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<sup>8</sup> The FLOPSC Committee includes representatives of Gatwick Airport, Air Traffic Control service providers and airlines operating at the Airport.

<sup>9</sup> NATMAC constitution can be found [here](#).

through FLOPSC and NATMAC; the scope of consultation was limited; and, there had been considerable pre-consultation engagement with industry stakeholders.

#### Industry feedback

Feedback was received via a dedicated email address and is summarised in **Annex G**. In total, 9 responses were received from a range of stakeholders, including Airlines, an ANSP, Aviation representatives from NATMAC, and the Ministry of Defence (MOD). A detailed review of the feedback received through consultation was undertaken to determine its impact, if any, on the trial, and how this feedback has been taken account of in the trial (also in Annex G).

Based on the feedback received, no changes to the proposed trial procedures or proposed IFP designs, presented as part of the consultation, are necessary. However, several questions were identified and later addressed in the flight procedure ground validation simulator sessions.

## Section 3: Instrument Flight Procedure (IFP) Design

### Introduction

RNN trial routes have been discussed over the past 2 years with members of the NMB and industry stakeholders. The routes have evolved over time as a result of this engagement, ultimately resulting in the designs which are presented in this pack. Trax International, the procedure designers for the trial, have designed 16 routes split between both runway ends, including routes to both the Northern Runway (26R/08L) and Southern Runway (26L/08R).

Due to the technical nature of this section, a list of acronyms has been compiled in **Annex H**.

### Evolution of IFP Designs

Trial conditions and objectives were discussed with the NMB in the early stages of trial planning to address community concerns. Communities were concerned about an increase in traffic concentration. The trial sponsors were keen to avoid newly overflowed communities as a result of the trial since this would make it impossible to gather noise statistics before and during the trial from the same noise monitors. To meet these requirements, the following conditions were agreed at the NMB:

- The trial would propose multiple routes for both westerly and easterly arrivals, with the intention of minimising concentration and dispersing arrivals whilst not creating newly overflowed.
- The proposed routes would be placed inside of the existing arrivals swathes and where the existing traffic density is highest. The pre-trial traffic distribution is shown in **Annex I**.
- The proposed routes would not overlap or cross before joining the extended centreline to avoid concentration of traffic.
- The proposed routes would be adequately spaced to reduce overlap of 'overflight'<sup>10</sup> areas.
- The trial would not move the minimum night-time joining point from 10NM and, as such, would not relocate traffic.

The conditions above have been met by the IFP designs for this trial.

Initial designs focused on routes to the Southern Runway only. As planning and preparations progressed, a number of airport operating constraints were identified which limited the availability of the Southern Runway during the trial period, i.e. runway refurbishment and works. As a result, it was agreed to design routes to both the Northern and Southern Runway to alleviate this potential constraint. In total, 16 routes have been designed based on RNP-1 with RF legs; 4 to each runway end.

### PBN Specification

An airline survey was circulated to members of Gatwick's Flight Operations and Performance Safety Committee (FLOPSC) on 18<sup>th</sup> April to capture airline operational and procedural requirements to support the planning and development of the trial.

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<sup>10</sup> CAA CAP 1498 Definition of Overflight, Edition 2, April 2017

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Airlines were asked if their fleet, operating into Gatwick Airport, is currently equipped and approved by the State for RNAV-1 and RNP-1 operations in Terminal Airspace, and if they have RF capability.

Responses, received from EasyJet, Virgin Atlantic Navigation Service, TUI Airways, Norwegian UK, British Airways & BALPA, were as follows:

- RNAV-1 – 100%
- RNP-1 – 100%
- RNP-1 with RF capability – 67% (2 of the 6 airlines only have partial fleet capability)

Designing to RNAV-1/RNP-1 specification with fly-by and/or flyover turns would ensure 100% participation in the trial based on airline equipage. However, RNP-1 will be mandated by 2024 and the use of RF legs could form part of a longer-term solution if they deliver noise/ flight efficiency benefits. To better understand this, RNP-1 with RF legs is the preferred PBN specification for this trial.

### Number of Approach Transitions

To effectively accommodate all traffic, four transitions to each runway end were designed; one from the West via the WILLO 3B 1F 2H Standard Arrivals (STARS), one from the South West via the ABSAV 1G, GWC 1G and TELTU 1G STARS, one from the East via the TEBRA 1G and KONAN 1G STARS and one from the South East via the TIMBA 2G 4B STARS.

### Location of Approach Transitions

Analysis of radar data from Jan 2017 – Jun 2017 (between 01:30 - 05:00local) determined the lateral distribution of night-time traffic below 7000ft and showed where the existing traffic density is the highest. From this, four Easterly arrival swathes and four Westerly arrival swathes were identified.

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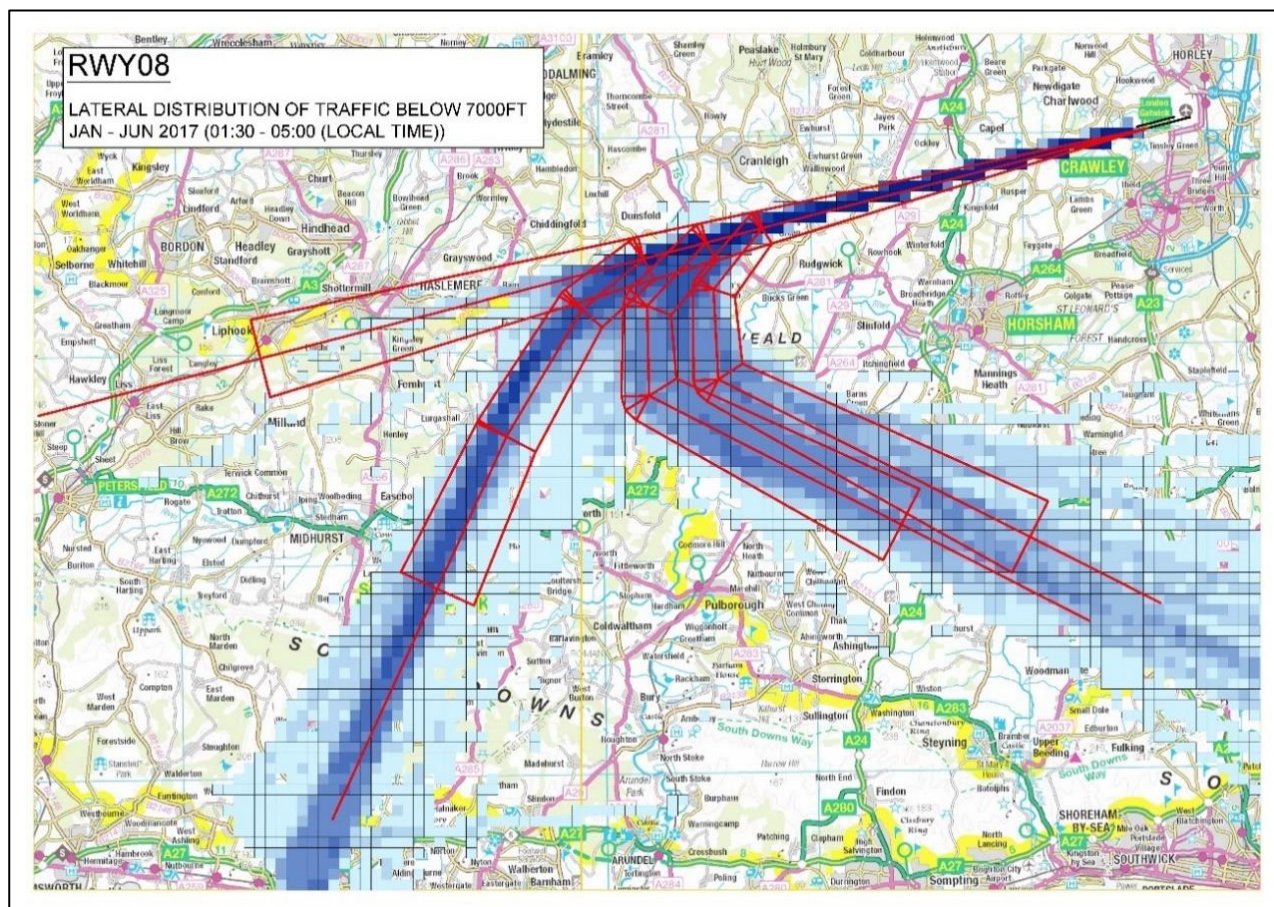


Figure 1: Arrival Swathes – Easterlies



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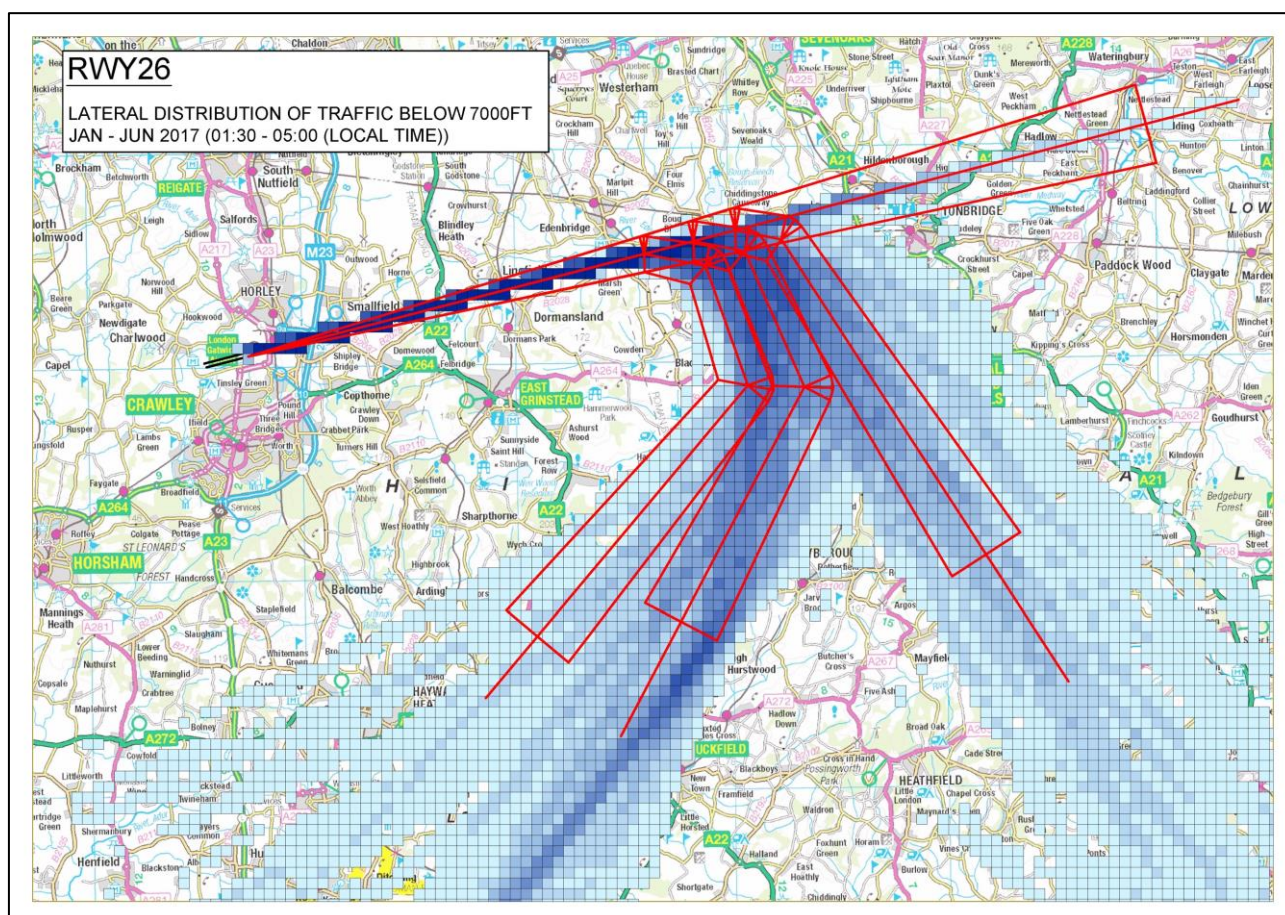


Figure 2: Arrival Swathes - Westerlies

Following discussion with ATC, two of the Easterly arrival swathes, shown in Figure 1, were considered too close and could be re-aligned to better support the different axes of arrival, and it was therefore agreed to create an alternative option for traffic approaching Gatwick from the East via the TEBRA 1G and KONAN 1G STARS, as shown in Figure 3.



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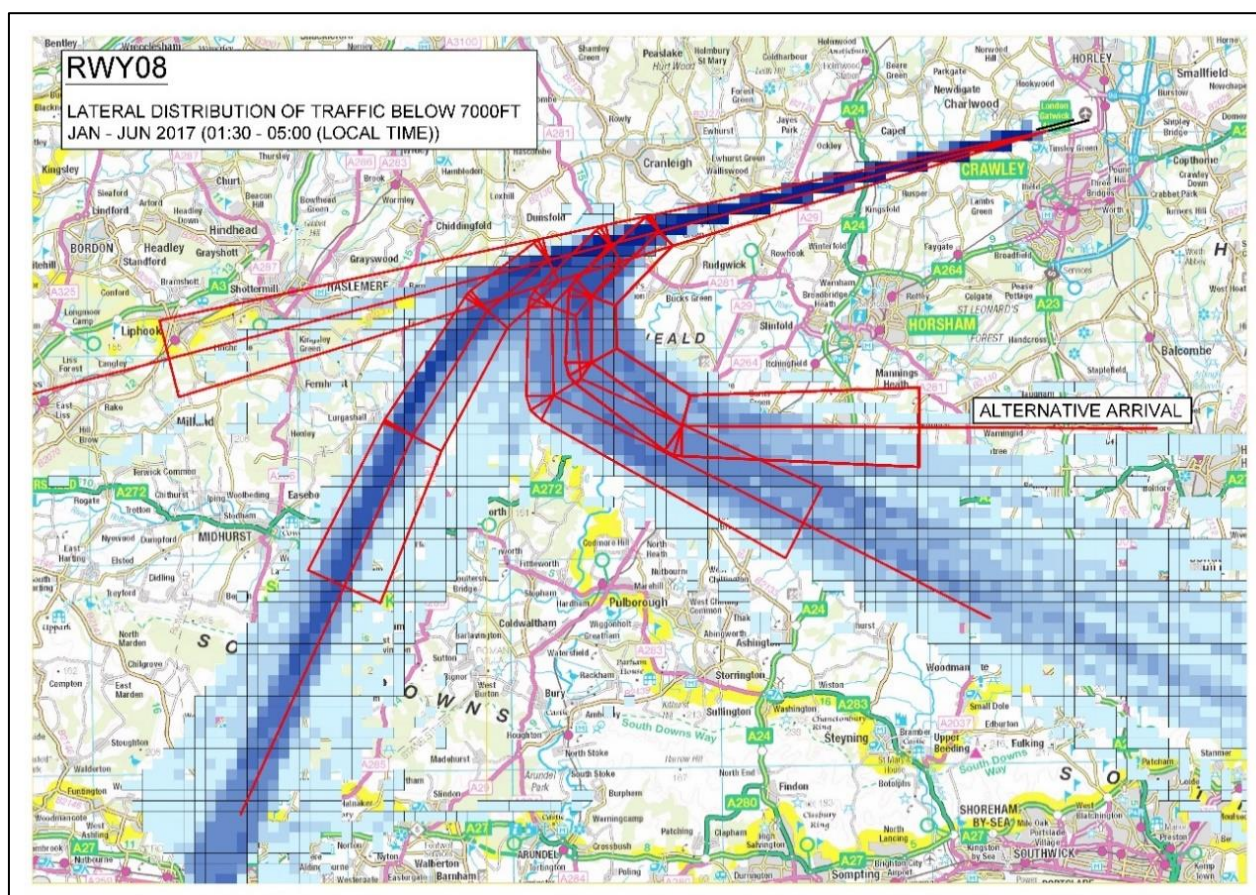


Figure 3: Alternative Arrival Swathe – Easterlies

The approach transitions have been designed to lie wholly within these arrival swathes.

### Starting Altitude

As part of the planning for the RNN Trial, several technical workshops were held to review the proposed approach transitions, discuss potential airspace issues and constraints and better understand ATC and Airline trial procedures. At the first technical workshop there was a discussion about the starting altitude of the approach transitions. It was agreed that although it may be possible to commence from a higher altitude in some directions, it would be impracticable due to airspace constraints and would complicate the operation considerably.

FL070 was initially chosen as the preferred starting altitude however, in low pressure conditions, FL070 is not an available level, as it is not separated from 6000ft. It was therefore agreed the procedure should start from 6000ft but the first waypoint will be defined as not below 6000ft to allow aircraft to maintain a higher altitude than 6000ft and descend gradually. This will ensure that the aircraft can fly the optimum vertical profile into the procedure.

The starting altitude of the straight-in approach transitions has been designed at 5000ft as this reflects where aircraft currently establish on the inbound track to the landing runway at night.

### Connection to Existing Procedures

A starting altitude of 6000ft/5000ft means that the approach transitions will begin at a point in space and will not connect to the Gatwick STARS. The disconnect between the STARS and the approach transitions will be clearly identified in the AIP Supplement and ATC have agreed that they will provide

clearance as early as possible. The supplement will also advise which approach transition aircrews are to expect based on their STAR. This methodology was agreed with airline and flight planning representatives at the technical workshops.

It is expected that ATC will clear aircraft to the start of the relevant approach transition well in advance of the end of the STAR. In the event that ATC cannot provide sufficient notice to the crews, they will be vectored onto final approach as per current operations, therefore not participating in the trial.

#### **RWY08L/RWY26R**

The approach transitions to RWY08L/RWY26R will connect to the RNAV (GNSS) approach procedures and will terminate at the existing IFs (MEBIG (RWY08L) & ARPIT (RWY26R)).

#### **RWY08R/RWY26L**

The approach transitions to RWY08R/RWY26L will connect to the ILS/DME approach procedures. The current ILS/DME approach procedures do not have an intermediate segment as aircraft are currently vectored onto the Localiser course. To ensure the aircraft have sufficient distance to decelerate and carry out any configuration changes necessary before the final approach segment, an intermediate approach segment of 1.5NM has been provided between the location of the new IF and the existing FAF on the ILS/DME procedures.

A trial version of the ILS approach charts will be produced and included in the ILS Trial supplement which will show the intermediate approach segment and IF. The trial ILS chart will have the designator Y (e.g. ILS/DME Y RWY 08R) for ATC clearance purposes to distinguish it from the current ILS procedure, which would be re-titled ILS/DME Z RWY 08R.

Each transition will terminate at the newly created IF.

#### **Length of Approach Transitions**

A 2006 Industry Code of Practice report states: *“During the night quota period (2330-0600) all inbound to Heathrow, Gatwick and Stansted, irrespective of weight or type of approach, are to be given descent clearance from Minimum Stack level at a distance from touchdown which ensures that inbound are no lower than 6000ft when 20 track miles from touchdown”.*

20NM/6000ft results in a descent gradient of 4.9% based on a threshold crossing height (TCH) of 50ft. The length of the straight-in approach transitions that have a starting procedure altitude of 5000ft have been calculated using this descent gradient. 5000ft was chosen for the straight-in transitions because to have used a 6000ft point would have resulted in a re-distribution of traffic.

In addition, the length of intermediate approach segment has been added to the 20NM to allow operators to fly a level segment prior to the FAF, if required.

#### **Speed Restrictions**

The approach transitions have been designed at 250kts IAS where possible. Several approach transitions have speed limits applied to reduce the RF radius and ensure the approach transitions are wholly contained within the arrival swaths. Any speed limits are clearly marked on the approach transition charts and in the coding tables.

#### **RF Radius**

PANS-OPS states that the minimum RF turn radius shall not be smaller than:

- a) 2 x RNP value of the inbound and outbound segments.



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b)  $\frac{1}{2}$  AW of the inbound and outbound segments.

The  $\frac{1}{2}$  AW for RNP-1 in arrival or departure phase of flight (<30NM from the ARP) is 2.5NM. This is greater than 2 x RNP (2NM) and has been used as the minimum turn radius for all approach transitions.

### Waypoint Names

5LNC waypoints have been allocated to the starting and finishing waypoints of each approach transition. All waypoints were allocated using the ICARD system and have been approved by ICAO for use in the trial.

All other waypoints have been assigned tactical waypoint names. The naming convention of these is AAXNN where:

- AA - The last 2 letters of the aerodrome ICAO Location Indicator.
- X - T (Trial)
- NN - A numeric code from 00 to 99.

The numeric codes 08 and 26 have not been used.

### Approach Transition Naming Convention

Currently there is no criteria in 'ICAO Annex 11 – Air Traffic Services' governing the identification of approach transitions. The naming convention to be used was discussed at a number of Technical Workshops and the agreed format was:

- AAAAA - A basic indicator which will be the starting waypoint.
- N - A numeric code signifying the validity of the approach transition. 1 as it is the first iteration.
- X - A runway indicator. The indicators used are the same indicators used as per the Gatwick SIDs. Z for RWY08R and X for RWY26L. As there are no RNAV SIDs from RWY08L and RWY26R, the letters Y (RWY08L) and W (RWY26R) were chosen.

### Route Separation

ATC are responsible for streaming arrivals onto the start of the relevant approach transition with adequate longitudinal spacing between arriving pairs. Arrivals will not be established on adjacent approach transitions at the same time and therefore the transitions do not require lateral separation from each other.

### IFP Validation

The Gatwick RNN Trial Approach Procedures will be ground validated in accordance with 'ICAO Doc 9906 – Quality Assurance Manual for Flight Procedure Design – Volume 5 – Validation of Instrument Flight Procedures and DAP Policy Statement - Validation of Instrument Flight Procedures (June 2009)'.

The purpose of ground validation is to:

- 1) Evaluate flyability.
- 2) Evaluate database coding and accuracy.

- 3) Verify that waivers/mitigations for deviations from design criteria do not compromise safety.
- 4) Where permitted by the simulator, evaluate any other factors (such as wind, temperature and barometric pressure) that may be pertinent to the safety of the procedure.

The IFP validation process, including pre-flight validation, simulator evaluation and the production of the validation report, was undertaken by Trax.

In order to accurately evaluate the flyability and database coding of the procedures, two separate ground validations are to be conducted; an initial validation in an Airbus A320 simulator and a final validation in a Boeing B787 simulator.

#### The Initial Validation

The Airbus A320 initial validation, supported by easyJet, took place at their training facility on the 13th September 2019. This initial validation was aimed to test the overall flyability of the procedures and to assess the ability for the crew and FMC to manage the disconnect between the end of the STAR and the start of the Approach Transitions. No issues were found but several minor recommendations were made by the validation pilot. These recommendations have been incorporated into the final designs detailed within the IFP Design submission.

The final validation is being supported by Norwegian Air Shuttle and is expected to take place mid to late October 2019 in a B787-900 simulator.

#### Final Validation Plan

The validation of each procedure will begin at approximately FL80+ and will continue until approaching the Final Approach Fix (FAF). One procedure will be flown in its entirety from the start of the Approach Transition through to the end of the Missed Approach. In addition, we will assess the ability for the crew and FMC to manage the disconnect between the end of the STAR and the start of the Approach Transitions to ensure acceptability to the Boeing aircraft.

All procedure validation flights will be conducted during daylight hours in visual meteorological conditions (VMC), which allow the flight to be carried out with a flight visibility of not less than 8KM, and in sight of the surface throughout the flight validation of the procedure. Each of the 16 procedures will be flown once in normal meteorological conditions. One procedure to each runway end will also be flown in more challenging meteorological conditions to test the flyability of the procedure, particularly the RF leg. The procedure chosen for this is the one with the tightest turn onto the final approach track.

The following table details the conditions in which the procedures will be flown:

Temperature	Reference Weight	Wind Speed & Direction	Comment
20°C QNH 1013	61,000kg	30kt tailwinds at 5000ft 10kt surface headwind	All 16 procedures
05°C QNH 999	61,000kg	60kt crosswinds at 5000ft 20kt surface headwind	1 procedure to each runway end

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Final coding tables and draft charts have been supplied by Cyrrus Ltd. These incorporated the recommendations from the initial validation. Each chart shows a graphical layout and textual description of the procedure, waypoint location, waypoint type, speed constraints and altitude constraints. As part of the ground validation, the charts will be assessed to determine the accuracy of the content and ensure the crews can interpret the content correctly. In addition, the proposed names of each ICARD waypoint will be assessed as to their suitability.

A full validation plan will be submitted to the CAA as part of the IFP submission pack.

### Simulator Database Coding

All 16 procedures will be coded into a customised navigation database using ARINC 424 path terminators to define the specific nominal tracks, which are defined by waypoint location, waypoint type, path terminator, speed constraint, altitude constraint and course.

The navigation database for the Airbus simulator was supplied by LIDO. The navigation database for the Boeing simulator will be supplied by Honeywell Data Services.

Coding tables of each procedure were provided by Cyrrus Ltd.

### Simulations and Reporting

The Primary Flight and Navigation Displays will be filmed to provide detailed validation evidence. In addition to this, photographs of the FMS display will be taken during each session for further evidence and a simulator validation report will be completed and signed by the validating pilot.

Validation Reports and associated evidence will be produced upon completion of the ground validation activities and submitted to the CAA. This is expected to be early November 2019.

## Section 4: Environmental Assessment

### Introduction

This section contains an environmental assessment to show the expected impact of the trial in accordance with the requirements of CAP 1616.

For a trial longer than 90 days yet shorter than 12 months that affects traffic distribution below 7,000, CAP 1616 (Edition 2, November 2018, Page 134, B88) states certain information must be prepared by the change sponsor and used to engage with those affected. These requirements are outlined below alongside explanation for how the criteria is met.

- “65 dBA  $L_{\max}$  footprints that illustrate the loudest and most frequent types of aircraft that will be participating in the trial
- 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)
- information on the expected frequency (both absolute and as a percentage of total traffic) and timing of flights participating in the trial
- operational diagrams that illustrate the estimated overflight swathe of trial traffic, up to 7,000 feet.”

Each criteria are addressed in the following sections and we have proposed to amendments to some of them. In addition, two other sections are provided:

- Recorded noise analysis – an additional analysis we have undertaken
- Status of noise monitor placement

### 65 dBA $L_{\max}$ footprints

CAP 1616 (Page 125) specifies the use of N65 contours for day flight noise assessments and N60 contours for night flights. The 60dBA footprint was therefore used instead of 65 dBA for the trial assessment.

It should be noted that  $L_{\max}$  60dB footprints are larger than  $L_{\max}$  65dB footprints so will illustrate any expected effects over a larger area. The 60dB  $L_{\max}$  modelling is contained in in **Annex K**.

The modelling is illustrative because current noise models are not accurate at the ranges that the trial will deliver benefits (up to 20NM from the airport) and only a few sample aircraft were selected. Nevertheless, it shows that trial aircraft should deliver a significantly smaller 60dB  $L_{\max}$  footprint than outlier aircraft. The reduction in footprint size between a trial-like and outlier aircraft ranged from 4% to 41%.

This analysis was based on tracks of real aircraft that were input to a noise model. The noise model also calculated footprints for ‘hypothetical’ trial arrivals. These were based on standard profiles in the model and were between 10% and 38% smaller than the outlier arrivals.

As noted above, the analysis is not statistically significant but illustrates that a noise benefit may be achievable from the trial.

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### Equivalent footprints that illustrate where the trial traffic would otherwise have flown

The pre-trial traffic distribution is shown in **Annex I** and repeated below in Figure 4. The map shows where trial traffic would otherwise have flown if the trial did not proceed. Note that the distribution will vary as traffic patterns change (eg more flights from Europe compared to Africa).



Figure 4: Arrivals heatmaps for Jan-Jun 2017 01:30-05:00 (local time), traffic below 7,000 ft

Regarding the vertical profile, flights flying the higher route close to those planned for the trial were compared to lower flights representing outliers in current traffic patterns. This was to demonstrate that the higher PBN route is quieter than current routes. The results of this can be found in **Annex K**.

### Information on the expected frequency and timing of flights participating in the trial

Nightly averages derived from arrivals data<sup>11</sup> from 2017-2019 were analysed to determine the expected frequency and timing of flights during the trial period. Table 1 below shows the average arrivals per month for each month from 2017, as well as the maximum arrivals in any one night. A full data summary is available in Annex J.

<sup>11</sup> Data taken from the airport database 'IDAHO'

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	2017		2018		2019	
	Average	Max	Average	Max	Average	Max
Jan	1.8	6	1.6	4.0	2.3	5
Feb	2.2	7	1.8	9.0	3.4	6
Mar	1.9	6	3.4	18.0	3.5	7
Apr	6.0	13	6.1	11.0	6.7	13
May	10.9	22	13.9	34.0	12.8	24
Jun	15.1	26	18.4	40.0	18.1	29
Jul	18.3	33	21.3	41.0	N/A	N/A
Aug	17.5	33	21.3	43.0	N/A	N/A
Sep	16.7	38	16.2	26.0	N/A	N/A
Oct	9.5	21	10.7	20.0	N/A	N/A
Nov	1.5	8	2.6	5.0	N/A	N/A
Dec	1.8	6	1.6	4.0	N/A	N/A

Table 1: Average and maximum number of arrivals per night for each month between Jan 2017 - Jun 2019

The trial was originally planned for January to June but has since been delayed until March to September. Table 2 shows the differences in total flights from both these periods for 2017-2019, noting July to September data is not yet available for 2019.

	2017	2018	2019
Jan-Jun	1146	1372	1412
Mar-Sep	2640	3081	-

Table 2: Total number of flights Jan-Jun and Mar-Sep in 2017-2019. Note 2019 data for Jul-Sep is not yet available.

The distribution of total arrivals across the 01:30-05:00 local period was assessed as demonstrated for 2018 data below (Figure 5). This also displays the total amount of arrivals per month March to September.



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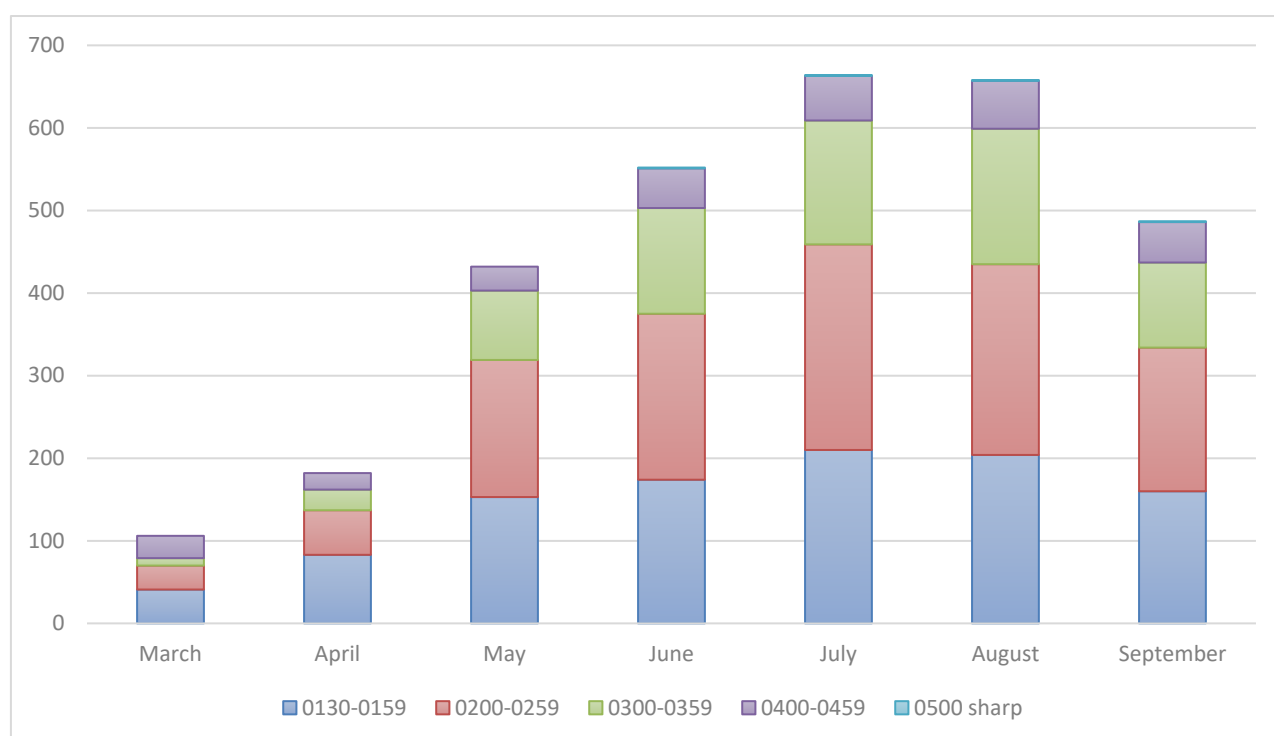


Figure 5: Total number of flights per month arriving between 01:30-05:00 in Mar-Sep 2018

All flights that are appropriately equipped and approved will participate in the trial. Most flights arriving at Gatwick are able to fly the PBN transitions (they must be capable of RNP-1 with RF Legs). The airline survey (**Annex D**) showed that:

- Of the six airlines responding, four have the capability to fly the PBN transitions across their entire fleets.
- Of the remaining two, both have a mixed capability with some aircraft capable and others not. The only aircraft specifically identified in the survey that is not capable of flying the transitions is the Boeing 747.

During 2017 and 2018, there were only 17 and 10 Boeing 747 arrivals in the trial hours. This is demonstrated in Table 3 below, which breaks down the total 2017 night flight arrivals by aircraft family.

Overall, it is expected that almost all aircraft will participate in the trial. Aircraft that cannot participate in the trial will fly conventional procedures. They will be identified and treated separately in the recorded data.

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A/C Family	Night Arrivals
Other	5
Regional	6
B747	17
B767	20
A330	21
B777	48
B787	212
B757	421
B737	522
A320	1884
<b>Total</b>	<b>3156</b>

Table 3: Arrivals per month 0130-0500 by aircraft family Jan-Dec 2017

To further show the range of arrivals per night across the month, Table 4 below shows the number of busier nights (ie nights with greater than 15 or 20 arrivals during the trial hours) for the March-September 2017-2019 period. Busier nights can be caused by bad weather or ATC delays that cause flights to slip into the night period. On busier nights, NATS may suspend the trial if the arriving volume of traffic is not compatible with the safe conduct of the trial.

2017 'busier' nights								
	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
More than 15 arrivals	0	0	4	16	22	19	17	78
More than 20 arrivals	0	0	1	5	9	7	7	29
2018 'busier' nights								
More than 15 arrivals	1	0	9	20	24	23	11	88
More than 20 arrivals	0	0	7	8	12	12	6	45
2019 'busier' nights								
More than 15 arrivals	0	0	7	20	N/A	N/A	N/A	5
More than 20 arrivals	0	0	1	10	N/A	N/A	N/A	4

Table 4: Number of nights where there were more than 15 or 20 arrivals during Mar-Sep 2017-2018, and Mar-Jun 2019

The easterly/westerly modal split of the airport will not be affected by the trial. Historically, it is about 70/30 westerly/easterly but it can change depending on weather conditions. The statistics from recent years are given in **Annex J**.



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### Operational diagrams that illustrate the estimated overflight swathe of trial traffic

Figure 6 below shows the trial routes overlaid on the (non-trial) arrivals heatmap. Each route is shown with its overflight cone as defined by the CAA<sup>12</sup> in overview and then in detail.

Yellow routes to the main runway and blue routes are to the Northern runway. The edges of the overflight cones are in white.

The overflight cones show that a similar area of overflight will exist for trial aircraft as for non-trial aircraft.

In the figures after these, the easterly and westerly arrival routes are shown against a map background without the underlying heatmap or overflight cones.

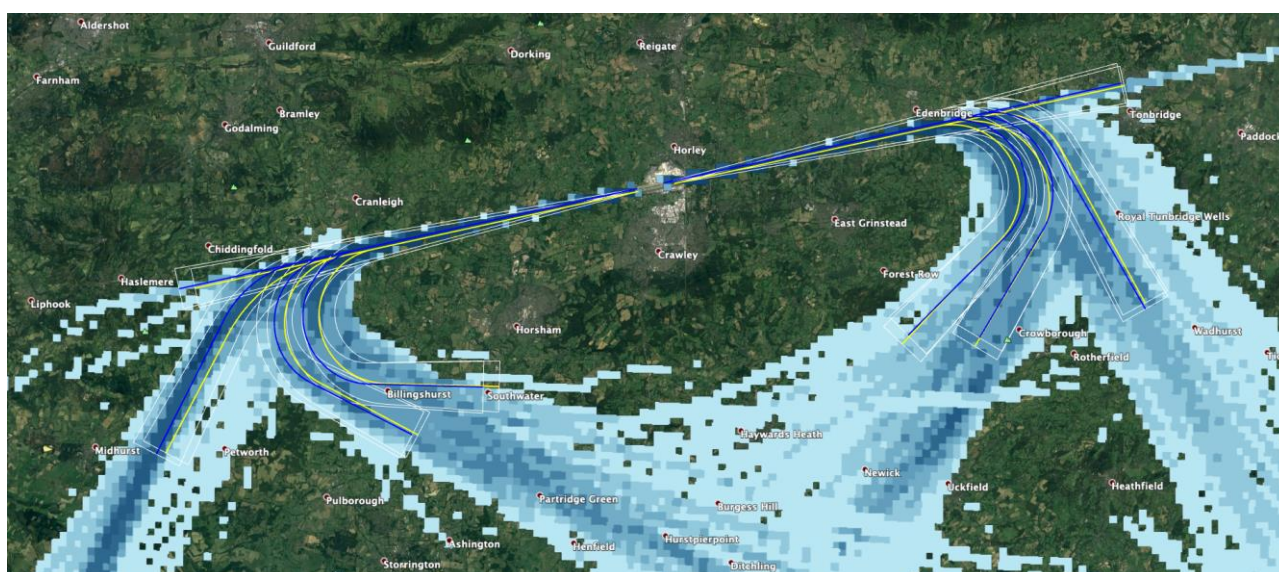


Figure 6: Trial tracks with overflight cones overlaid on current traffic

<sup>12</sup> CAP 1498, Definition of Overflight, 2017



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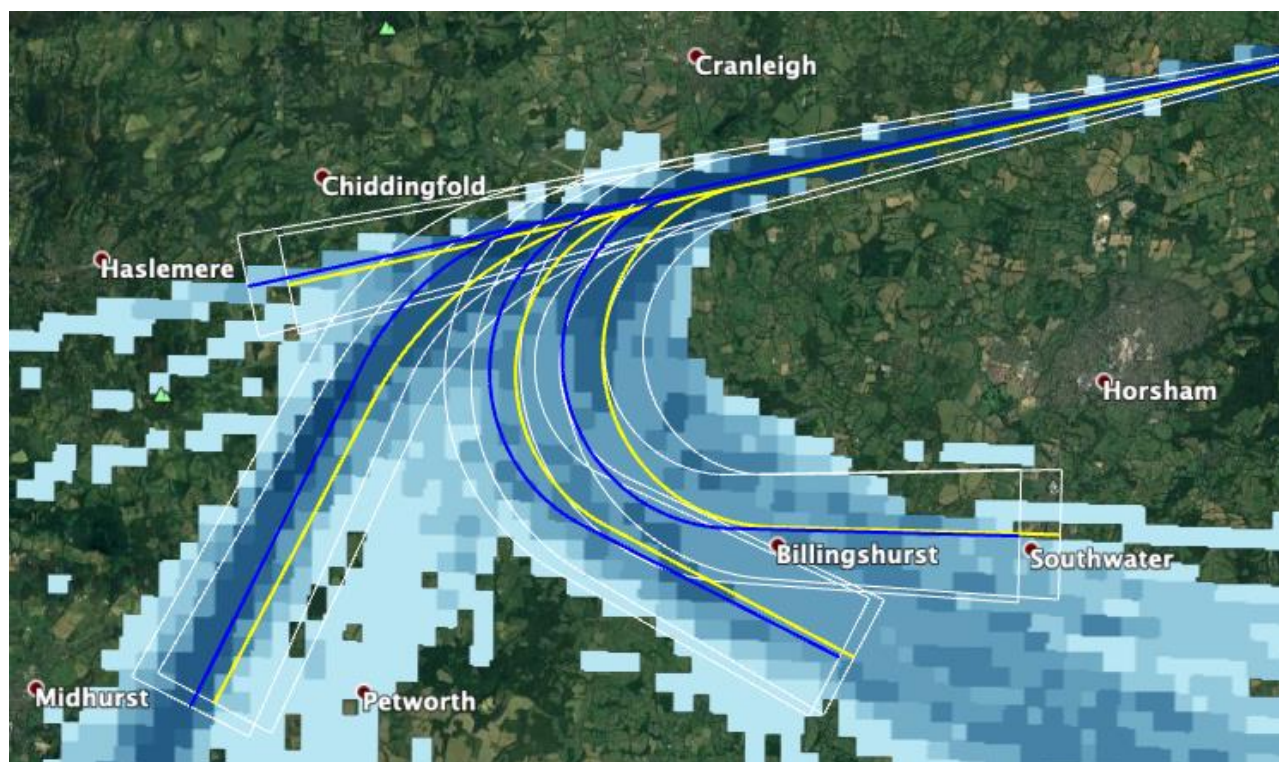


Figure 7: Trial tracks with overflight cones – Easterly arrivals detail

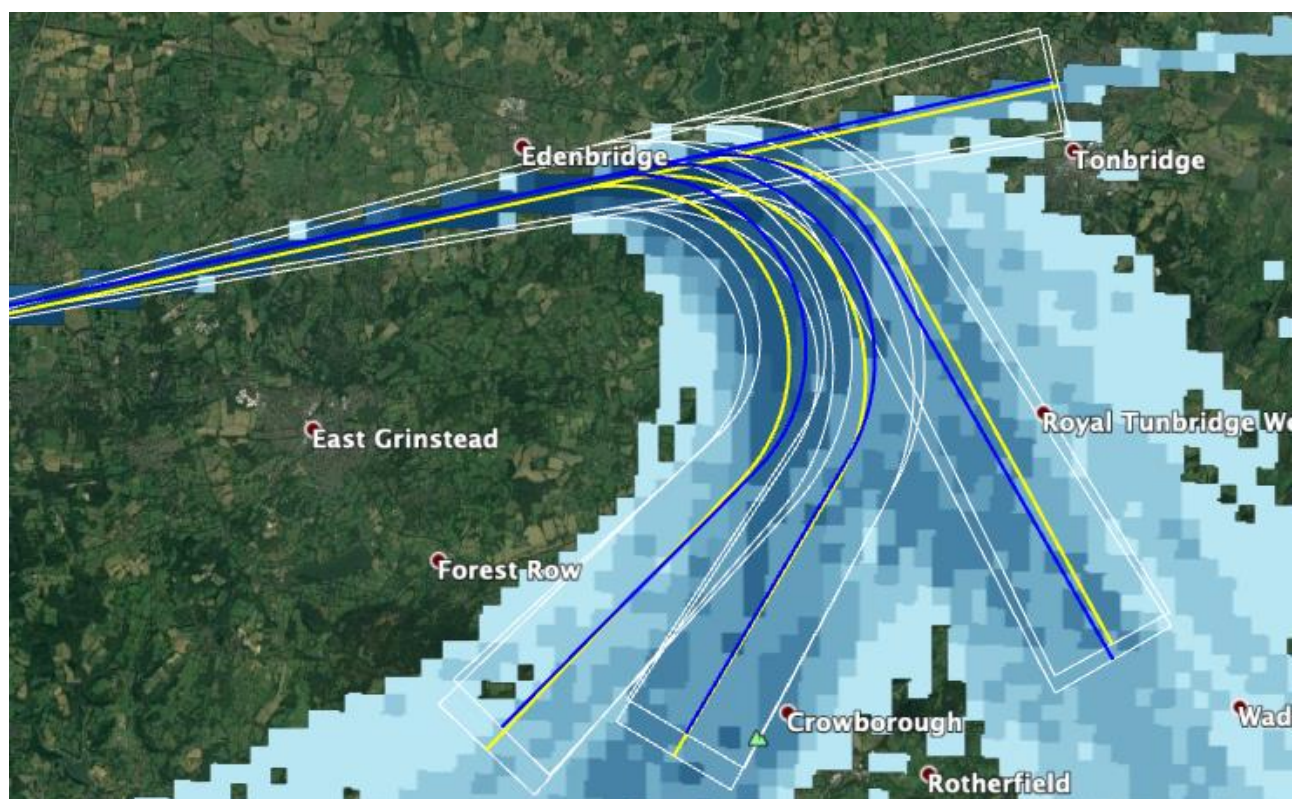


Figure 8: Trial tracks with overflight cones – Westerly arrivals detail



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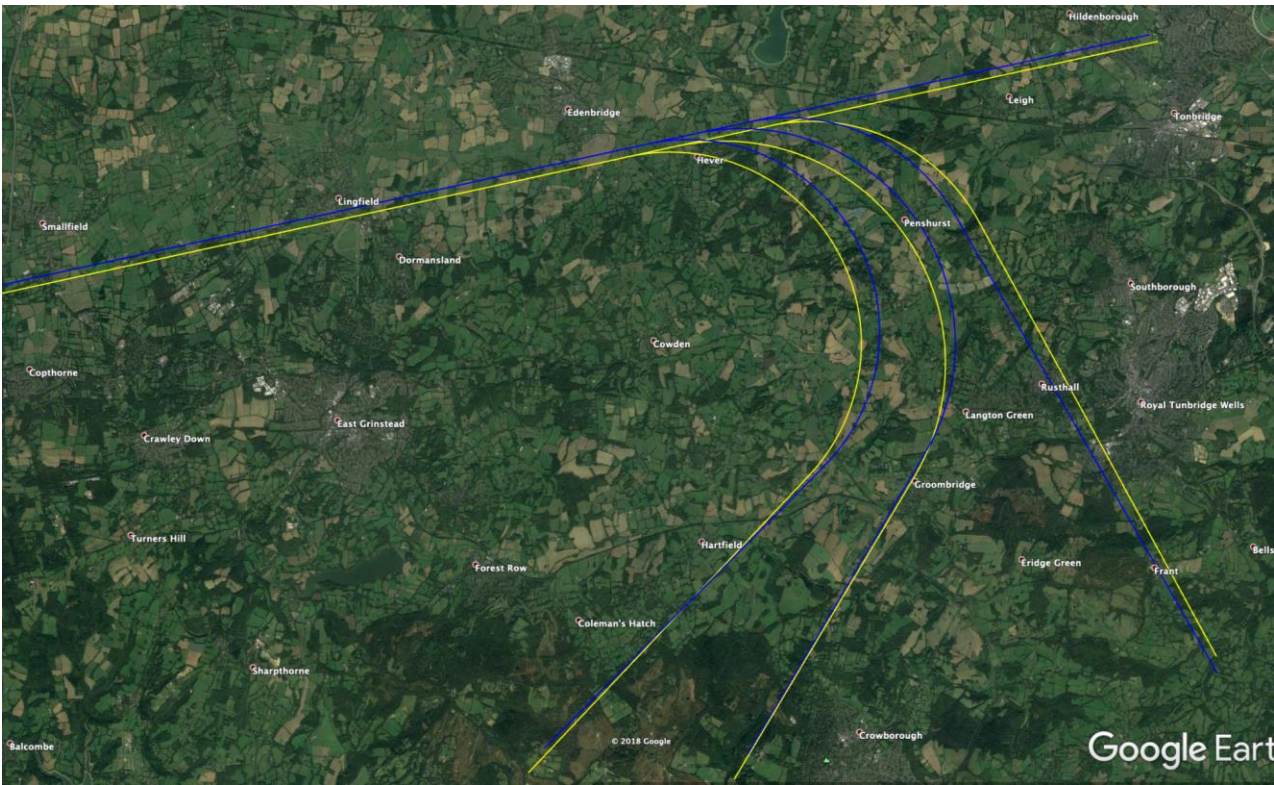


Figure 9: Westerly trial routes against a map background

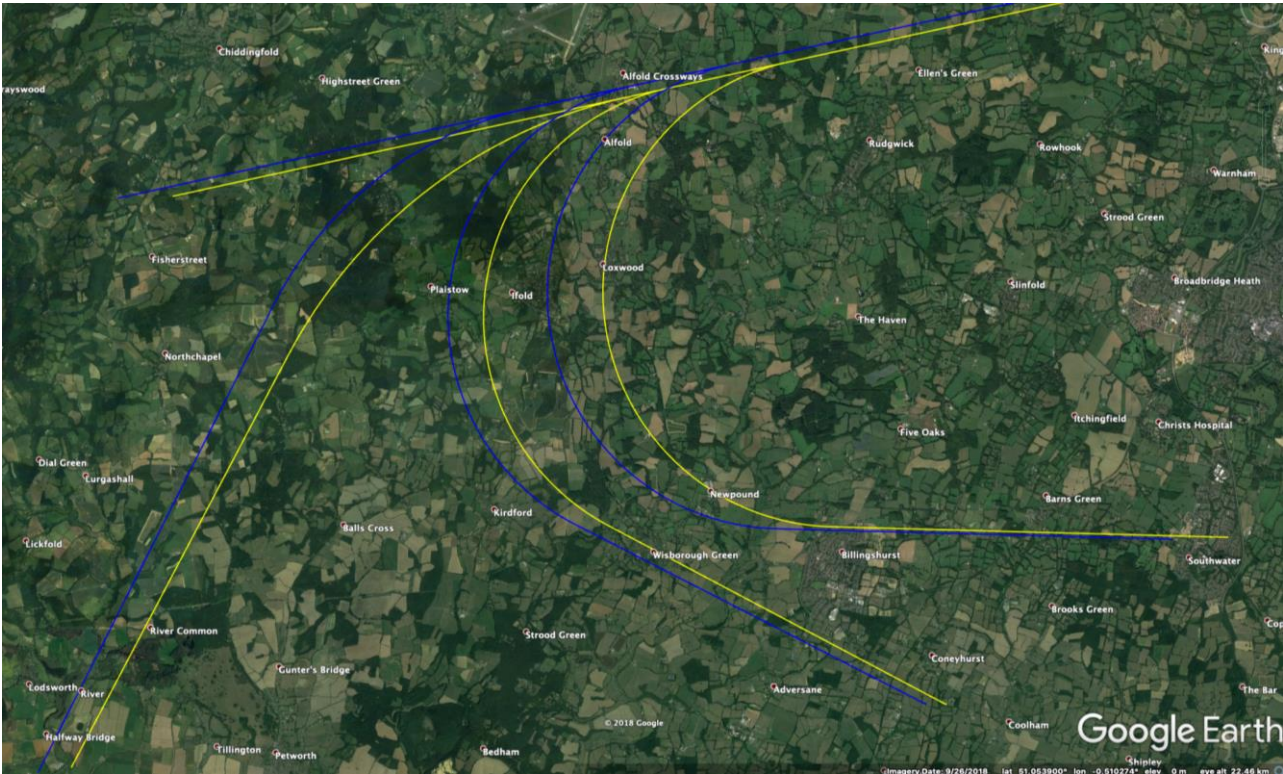


Figure 10: Easterly trial routes against a map background

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### Recorded noise analysis

Analysis of recorded noise from existing noise monitors is given in **Annex L**. The purpose of the analysis is to demonstrate the potential improvement offered by PBN in removing noisy outliers. The analysis shows that, when measured at noise monitors beyond 10NM from the runway, aircraft that are flying 'trial-like' profiles can be up to 18dB quieter than similar aircraft flying outlier profiles.

A similar analysis was undertaken on data recorded in 2017 for an academic study. The results were presented to the NMB and are given in **Annex O**. The results were used to estimate the trial success criteria and one of the graphs from **Annex O** is shown below to illustrate the analysis.

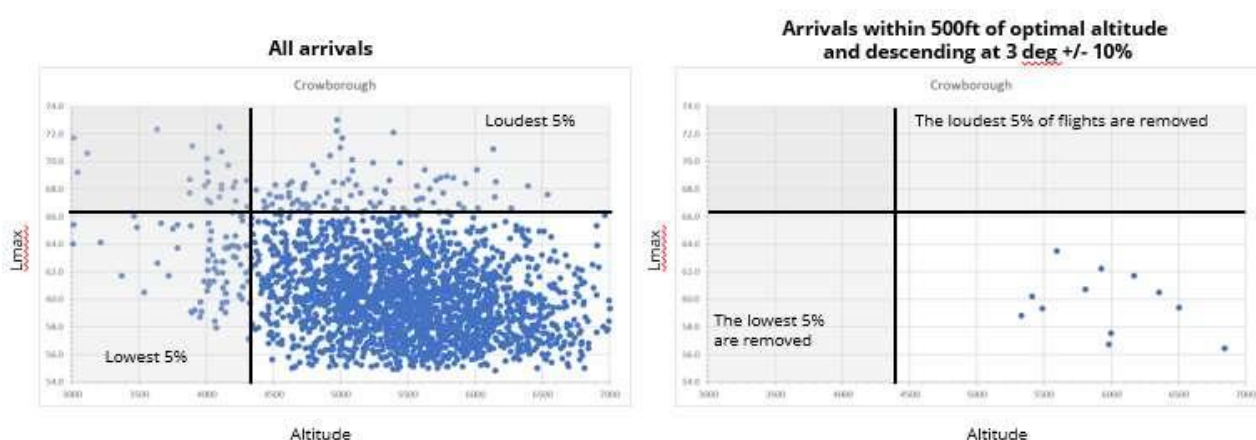


Figure 11: Example chart from Annex O showing removal of outliers

Both analyses are illustrative and not statistically significant because the 'trial-like' profile can only be estimated. Nevertheless, they show the potential benefit of PBN to remove noisy outliers.

### Mobile Noise monitor placement

Mobile Noise Monitor Terminals (NMTs) will be deployed to help gather trial data. These are in addition to Gatwick's existing NMTs.

The NMTs will be positioned to capture both the baseline (today's operation) and trial noise environment to allow a valid before/during comparison. Suitable locations have been identified for the placement of NMTs under the proposed routes to the east and west of the airport, and these NMTs are expected to be in place at the sites by the end of September.

The NMT locations will range from about 10 NM to 18 NM along the arrival tracks, to gather data at the start and the end of the procedure.

In total, there will be nine NMTs used for gathering RNN data. Two NMTs are existing NMTs and will appear on the NTK system website. Seven are being placed for the trial and will not. These will require manual data collection from each NMT, and the frequency of data collection is to be confirmed.

The NMTs will be placed under several routes with most emphasis on the likely busier routes to gather more data. NMTs will be placed at both easterly and westerly ends.



## Section 5: Safety Assessment

NATS will produce an ATC Procedure Safety Assessment (APSA) to assure the safety of its trial procedures. This will be shared directly with the CAA. In addition, the IFP procedure validation evidence will also be provided separately to the CAA.

## Section 6: Trial Procedures

### Introduction

The section describes the procedures developed for the trial.

Through RNN trial engagement, a number of safeguarding measures have been developed to mitigate concerns which were raised by community groups. In particular, procedures for trial monitoring and suspension, progress reporting and complaint handling have been developed and are described below.

### Operational Procedures

The trial will be initiated each night by the relevant ANSP, NATS. NATS has developed a draft internal trial procedure (Temporary Operating Instruction).

All aircraft that are capable of flying the transitions that arrive between 01:30-05:00 (local) during the trial period will be expected to participate in the trial, unless otherwise instructed by ATC. Pilots must inform ATC if they are unable to fly the trial procedures.

ATC will instruct pilots to use the most appropriate arrival route given the county of origin and considering any operational constraints and the runway in use. The distribution of traffic across the routes will be recorded and monitored during the trial.

The PBN procedures are applicable only to low volumes of traffic. If there is a high volume of traffic on a particular night, then NATS may suspend the trial and resume vectoring procedures. If NATS suspends the trial for any reason, then it will restart the trial at a later time.

Individual aircraft will not participate in the trial if they are not able to accept the PBN clearance or refuse the trial clearance from ATC. NATS will maintain a log of which aircraft participate in the trial.

In addition, a form has been drafted for pilots to complete after the aircraft has landed. This form is a template for airlines to use and it captures information about the pilot perception of the procedure to minimise noise. The draft has been reviewed by members of the FLOPSC. It is not expected that all airlines will implement this form as it is a voluntary procedure.

### Noise Complaints

Throughout the trial period, members of the public will have access to the normal platforms for the submission of noise complaints. A noise complaints procedure has been developed to support the trial (see **Annex N**).

As stated in the Annex, there are some conditions under which the CAA will undertake an investigation.

Individual complainants will not be responded to individually but additional information on the trial will be provided in the form of FAQs on the Gatwick website.

### Monitoring Trial Progress

The trial will be closely monitored by Gatwick Airport and regular engagement with stakeholders through the identified forums and through Gatwick's website, as identified in Section 1, will be undertaken.

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Fortnightly meetings will be held with members of the trial team to review and analyse the data from the trial.

Gatwick will produce a monthly report which will summarise details of the trial and its progress, including, but not limited to:

- Statistics on the number of aircraft participating in the trial and any suspensions of the trial.
- Noise data and measurement of the quantitative objectives.
- Noise complaints, including number and location of complaints.
- Any operational issues or safety concerns.

Once an initial sample of data is analysed, the trial will be suspended if it is found that there are safety concerns or if the objectives are unlikely to be met. Safeguarding requests following discussions at NMB are identified in the next section.

The monthly reports will be produced by Gatwick Airport, submitted to the CAA and published on the CAA Portal.

### Safeguarding

At the request of community groups through the NMB (see **Annex O**), Gatwick agreed to the following safeguarding conditions:

- The trial will not proceed if the noise impact assessment does not present the expected reduction in N60 events.
- The trial will be suspended if, once an initial sample of data is analysed, it is found that the objectives are unlikely to be met.
- The trial will be suspended to evaluate any safety concerns that are raised by operational staff.

The first bullet is addressed in the environmental assessment (Section 4) which shows the expected impact of the trial. The reductions in the 60dB  $L_{max}$  footprint and in recorded noise shown there gives confidence that the trial should give the reduction in noise outliers, such as N60 events.

### End of Trial Report

At the end of the trial, a Trial Report will be produced. This will summarise whether the objectives have been met and any key observations and findings of the trial. The report will include statistics on the aircraft participating, and environmental assessment of the trial impact. It will also be sent to the CAA and published on the CAA Portal.

# Section 7: Activities Undertaken

## Introduction

This section summarises the activities undertaken during the planning and preparation of the trial and how they meet the CAP1616 requirements.

## CAP1616 requirements

The figure below shows the activities undertaken by Gatwick Airport, in accordance CAP1616 for an airspace trial. Note that the timescales are not defined by CAP1616 but are specific to this trial.

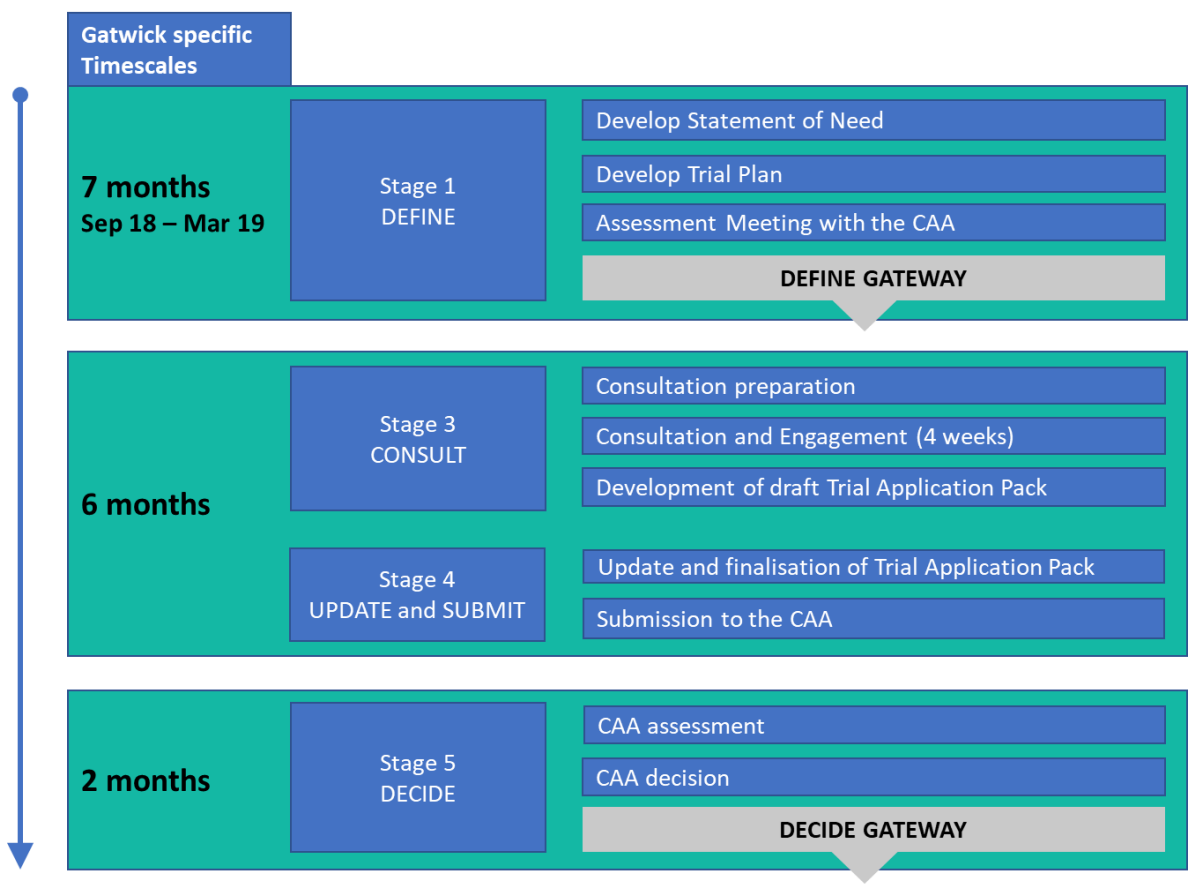


Figure 12. CAP1616 activities undertaken for the RNN trial

The following activities were also undertaken to support the trial development:

- Engagement with the NMB and industry stakeholders through NMB meetings and Technical Workshops.
- Route and procedure design, including high-level route analysis, IFP design, simulator database code production, IFP validation, development of the CAA submission package, CAA IFP approval, and AIP publication.



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- Noise monitor siting analysis and deployment.
- Noise modelling analysis to address CAP1616 environmental requirements.
- Hazard analysis and safety assessment.
- Development of trial procedures.

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### Gantt Chart

The following Gantt chart was used to monitor activity progress throughout trial planning and preparation.

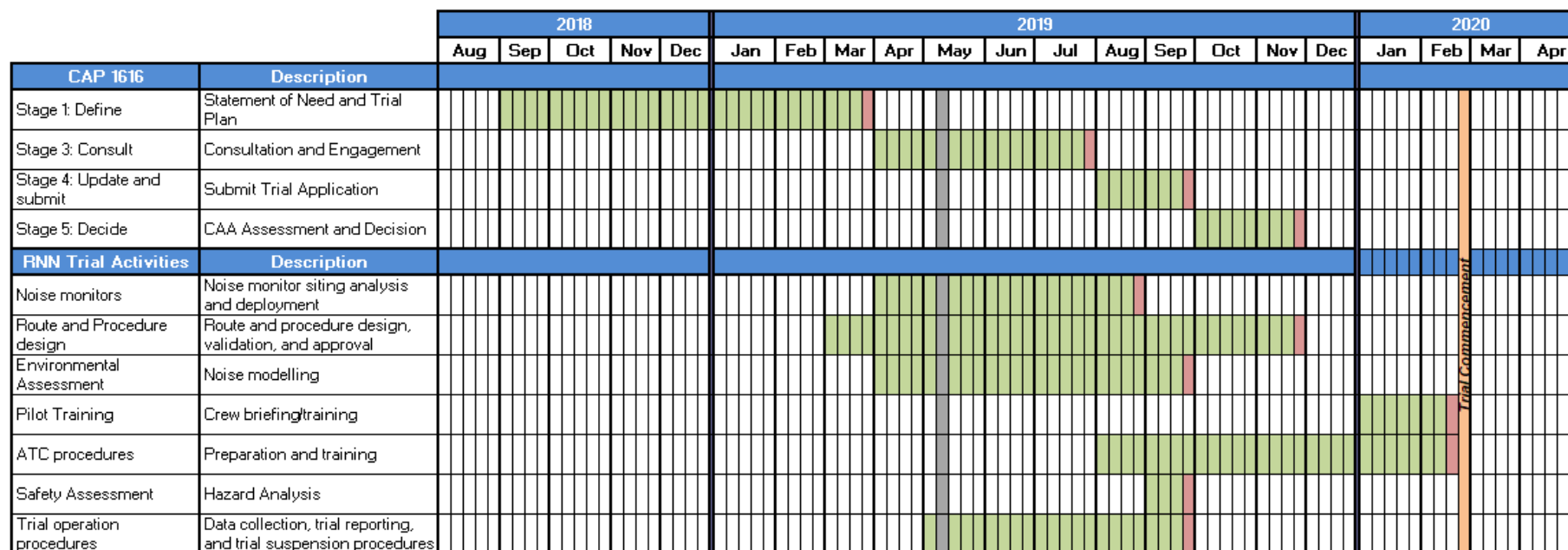


Figure 13. Trial planning Gantt chart