# CAA conclusions in respect of modification requirements relating to Route 4 RNAV 1 SIDs and correction requirements relating to Route 4 Conventional SIDs

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This report is further to:

- CAA decision in August 2013 regarding the Gatwick airspace change introducing RNAV 1 SIDs at Gatwick Airport; and
- Stage 7 PIR conclusions dated 28 September 2015, 10 October 2015 and CAP 1346

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SECTION 1

# Why we are publishing this report now

1. In August 2013 the CAA approved the implementation of RNAV 1 SIDs (Standard Instrument Departures) at Gatwick Airport.

2. In November 2013 RNAV 1 SID procedures were permanently introduced at Gatwick airport.

3. Following a year of operation, the CAA commenced its Post Implementation Review (PIR) of the new RNAV 1 SIDs in November 2014. The CAA's summary conclusions of that PIR were published on 28 September 2015 with additional summary conclusions published on 1 October 2015 and 10 October 2015. The CAA's detailed report on those conclusions was published on 11 November 2015: Changes to Gatwick departures 2013.

4. This report uses terminology specific to the aviation industry which may not be well known to or understood by everyone reading it. In the detailed PIR report dated 11 November 2015, Chapter 3, we provided factual information and explanation in order to make our report understandable. We recommend readers of this document read again Chapter 3 before reading this document.

5. The CAA's conclusions in respect of the Route 4 RNAV 1SIDs required the following:

   *"**Route 4:** The stated aim of introducing an RNAV 1 SID design the effect of which was to result in actual aircraft tracks that replicate the nominal track of the existing conventional SID has not been achieved to an acceptable standard. It is considered that replication to an acceptable standard may be capable of being achieved. Therefore, GAL is required to modify its design to achieve the stated aim set out above. The CAA will provide you with the technical recommendations in relation to this route under separate cover. The CAA requires GAL's modified design to be submitted to it as soon as possible but no later than 20 November 2015."*

6. On 1 October 2015 the CAA provided GAL with a number of technical recommendations to assist GAL and their procedure design organisation in working on that modification requirement.

7. The CAA's PIR conclusions also required the following (published on 10 October 2015):

   *"It was a requirement of the original decision that:*

   - *GAL carried out a review of the existing conventional SIDs; and*

- *GAL submitted a revised proposed design to SARG IFP for approval by 31 January 2014.*

*This work has not been completed.*

*It is also an ICAO requirement, as set out in CAP 785, Section 4, paragraph 1.2 that all IFPs are reviewed on a 5-yearly basis. The 5-year review of these conventional SIDs is now overdue.*

*The work carried out by the CAA when conducting the PIR has hi-lighted the urgency that this work is carried out without delay. One reason for this is that the RNAV 1 SIDs are designed to replicate the nominal track of the conventional SID and any reviews to the design of the conventional SIDs that are necessary must be taken into account when preparing modified designs to Routes 2, 4 and 5 as required by the CAA in its letter dated 28 September 2015.*

*GAL is therefore required to take the following steps:*

*1. Route 4*

*Review the conventional SIDs and submit a revised design to SARG IFP within 3 months. …"*

## Route 4 RNAV 1 SIDs

8. A modified RNAV 1 Route 4 RNAV 1 SID design to meet the CAA's modification requirement was published on GAL's website on 24 March 2016 and submitted to the CAA for consideration. On 23 May 2016 the CAA published its agreement that the modified design be implemented on 26 May 2016 and that specified data be collected for 6 months.

9. The modified design was first flown on 26 May 2016 and has continued to be the published RNAV 1 SID in the intervening period.

10. GAL made the CAA aware it was considering the feasibility of whether an additional RNAV 1 SID re-design or modification could be developed to be utilised in strong wind conditions to better achieve the objectives of the overall modification requirements published by the CAA in September 2015. We advised GAL in May 2016 that if an appropriate RNAV 1 SID design and air traffic control procedures could be developed, GAL should submit that design for use in strong wind conditions to the CAA as part of the RNAV 1 SIDs PIR modification requirement process. In fact no strong wind option has been submitted to the CAA for further consideration and this option is not being pursued (see below).

## Route 4 Conventional SIDs

11. After progressing a number of designs, GAL submitted a corrected design for Route 4 conventional SIDs to the CAA in March 2017. This report also contains our conclusions in respect of that design.

12. Throughout the period since the PIR was first published, our airspace change webpage has been kept up to date with progress on these issues.

## The purpose of this report and what it contains

13. This report contains the CAA's conclusions in respect of Route 4's

- RNAV 1 SIDs modification requirements; and
- Conventional SIDs correction requirements

14. In particular this document contains the CAA's decision (and reasons) whether

1. To confirm as permanent the modified Route 4 RNAV 1 SIDs or remove them from the UK AIP;
2. To confirm that the corrected Route 4 Conventional SIDs satisfactorily address the review requirement set out in the August 2013 decision and the 10 October 2015 PIR requirement set out above.
3. Next steps by GAL

15. This report and its Annexes also contain:

- The data that CAA has received and taken into account in reaching our conclusions and decision in this report
- The CAA's analysis of that data
- The CAA's reasons for the decisions we have made.

SECTION 2

# Executive Summary of CAA Decisions

## Route 4 RNAV 1 SIDs

16. The CAA has decided the modified Route 4 RNAV 1 SIDs (SID chart attached at Annex A) achieve a satisfactory replication of the nominal track of the corrected conventional SID. The CAA has therefore decided to confirm the RNAV 1 SID designs currently published in the UK AIP as permanent.

## Route 4 Conventional SIDs

17. The CAA has decided to approve the corrected conventional SID design (SID chart attached at Annex C)

18. Our conclusions have been shared with GAL ahead of the formal publication of this report in order that GAL could:

- Check for any factual inaccuracies
- Confirm they would give a number of public undertakings with respect to future work they would carry out.

19. The CAA has noted the following public undertakings to be given by GAL:

1. GAL will provide information to communities on the corrected conventional SID for Route 4 and explain why it has to be corrected and how it will align with the existing NPR.
2. With the objective of providing meaningful respite, GAL will consider options for a second RNAV 1 SID (with a similar design to the modified RNAV 1 design in Segments 1 and 2) but with a modified eastbound track similar to the original RNAV 1 design). Such design will consider modifications to prevent "ballooning"[1] in all but the strongest south to south-westerly wind conditions). As well as engaging with local communities when investigating this option, GAL will liaise with DfT in respect of the NPR for this Route (and associated compliance monitoring swathe) and its impact on considering another RNAV 1 SID along this route.
3. GAL will consider the potential for obtaining respite by alternating or switching a proportion of Route 4 departures onto another route. GAL shall consult with NATS to determine whether SID offloading onto other routes is feasible, given the network of overlapping flightpaths in the southeast of

1 i.e. wide dispersion of the aircraft tracks outside (in this case to the west of) the nominal track.

England. GAL will also need to take into account the effect on local communities affected by the other routes[2].

4. GAL will consult with Heathrow and NATS to investigate the withdrawal of the published Heathrow to Gatwick positioning-flight SID.

5. GAL will work with DfT to investigate the possibility of clarifying AIP entry Gatwick Aerodrome 2.21: Noise Abatement Procedures sub paragraphs 8 and 9 and the notes that apply to that entry in order to resolve the potential for confusion of that UK AIP Entry regarding definition of the NPR, the vectoring altitude restriction (4000ft) and the air traffic control operational procedures regarding flights directly over Horley.

6. GAL will use reasonable endeavours to ensure their operators comply with noise abatement procedures. As a priority, GAL will require that:

   a) where flights, as a consequence of applying a specific speed profile such as Noise Abatement Departure Procedure 1 (NADP 1), result in excursions on the inside of the NPR swathe, GAL will require the relevant operators to ensure that their SOPs are designed to maintain track conformance, within the NPR monitoring swathe and amend the AIP entry to reflect this.

   b) where flights extend outside of the NPR monitoring swathe, particularly on days experiencing strong south to south-westerly winds, GAL will require the relevant operators to ensure that their SOPs are designed to maintain track conformance, within the NPR monitoring swathe.

7. GAL will undertake to provide information on the ATIS[3] on south to south-westerly winds (GAL to determine the threshold with the Gatwick Flight Operations Performance and Safety Committee (FLOPSC).



2 The DfT is currently consulting on its Airspace Policy. It is considering the introduction of a new form of change to airspace arrangement and the process that will need to be followed before one can take place. DfT refers to these as Tier 2 changes. Tier 2 changes are some changes to air traffic control operational procedures. It is possible that any decision in respect of this option may be a Tier 2 change and require the CAA to approve the change.

3 ATIS: ATIS is an Automated Terminal Information Service used by airports to continually notify essential aerodrome weather information and runway in use and any other information required by the pilots.

SECTION 3A

# The RNAV 1 modification design work carried out by GAL to meet our requirement dated 28 September 2015 and steps taken by airlines operating from Gatwick

20. The Route 4 RNAV 1 SIDs involve a take-off towards the west, an immediate 180 degree wrap-around turn to the north and east, and finally an eastbound straight ahead section. We have split our analysis into these 3 segments.

21. In order to achieve our modification requirements, GAL and its approved procedure design organisation evaluated particular design options and submitted a modified design to the CAA which used different design criteria to that which was used in the original RNAV 1 design. The following is an explanation of what the re-design was aiming to achieve in order to meet our modification requirements.

22. The design criteria are such that it permits aircraft to initiate the turn at the same point as the conventional SID (this position is the IWW DME distance 2.3NM in the conventional design and is known as KKW02 in the RNAV 1 design). The turning point of KKW02 is based on a flyover waypoint which means the aircraft flies to this position and then commences the 180-degree turn towards the east. The aircraft then intercepts4 a course to the next waypoint known as KKE09, (known in design terms as a Course-to-Fix (CF) leg), then a Track-to-Fix design to the next waypoint KKE11, and further waypoints thereafter. (An explanation of RNAV 1 terminology is set out in Annex D).

23. Using the approved SID navigation data-base coding table data published as required by the CAA in the AIP, the SID design is coded by individual aircraft operators' respective navigation data-base coding houses, and then loaded into aircraft Flight Management System (FMS) (the aircraft on -board navigation computer system). The result is that different airlines' aircraft are individually coded to fly the RNAV 1 SID on take off and the aircraft will fly the SID on auto pilot without requiring intervention from the pilots unless and until the pilot receives an instruction from air traffic control to depart from the SID. The desired end result of this design using a flyover waypoint at KKW02 and a CF to KKE09 was to achieve a more accurate replication of the corrected conventional SID in particular around the first 180-degree turn.



4 i.e. picks up

24. With respect to the eastbound track, after the aircraft reaches KKE09, the modified design routes to way-point KKE11, then KKE15[5] to achieve a more optimal modification.



5 KKE15 is located west of the A22 near south Godstone beyond the end of the NPR monitoring swathe and is just stated for geographical reference only.

SECTION 3B

# The Conventional SID corrective design work carried out by GAL to meet our requirement dated 10 October 2015

25. GAL carried out its corrective design work in a number of stages. This included an iterative process agreeing with CAA the extent of the corrective design work necessary to meet the terms of our PIR requirements referred to in Section 1. GAL and its APD was advised that the design submission would need to address the following:

- Speed restrictions to be applied in the initial turns,
- The easterly track to be aligned with the existing NPR.
- The coordinates and Nav AID Radial/Distance of fix "ACORN" will need to be amended as a consequence of realigned easterly track.

26. GAL's design submission (v5) was in March 2017. It is this corrected conventional SID design which has been assessed by the CAA and is the subject of this report.

27. The design of the corrected Route 4 conventional SID maintains the 1st turn commencing at DME I-WW D 2.3. A speed restriction of max 220KIAS has been introduced for the turn to ensure better compliance within the NPR swathe as aircraft intercept the amended DET VOR radial. This speed will be maintained until DET VOR DME D29 where the aircraft can increase speed to a max of 250KIAS below FL100 (Flight level 100). The easterly track has been aligned with the centreline of the existing NPR so that the DET VOR Radial to intercept becomes R259°M (R258.18 + 0.7 magnetic variation).

28. The commencement of the first turn after departure and the amended easterly radial are coincident with those of the currently published modified Route 4 RNAV 1 SIDs.

## Charts of modified and corrected designs

29. The CAA charts for the modified Route 4 RNAV 1 SID, the extant conventional SID, and the corrected conventional SID are provided at Annex A, Annex B and Annex C.

## CAA's decision

30. CAA's decision in respect of our requirements relating to the Route 4 conventional SID is set out in Section 8 of this document.

SECTION 4

# Data reviewed by CAA when considering our decision

31. The data we required GAL to collect and provide to us after 6 month of operation of the modified RNAV 1 SID for Route 4 was set out in our letter to GAL dated 23 May 2016 (available on our website). As a result we have considered the following:

**1a. Track plot data gathering requirements over 6 months (26 May-26 November 2016)**

GAL has provided data over 6 months to illustrate the tracks flown by aircraft using the revised Route 4 RNAV 1 design. The CAA has reviewed all this data. Data for July 2016 (selected as a representative month) is provided with this report as Attachments [6] and includes:

- Track dispersion plots up to 3900ft.
- Track dispersion plots up to 4000ft.
- Track density diagrams.[7]
- Altitude band track dispersion plots for a selected week in July in the bands:
  - 4000-5000ft
  - 5000-6000ft
  - 6000-7000ft.
- Daily track dispersion plots for each month.
- Meteorological data (METAR) for each day (forecast weather[8] for different times of the day)

Note: during analysis, the CAA subsequently acquired forecast 2000ft and 5000ft winds for particular days to correlate data relating to strong south to south-westerly winds.



6 The complete set of data provided by GAL for the whole 6 month review period will be made available on the CAA Website.

7 Note: explanations of what track dispersion plots and track density diagrams show are detailed in Annex D.

8 We use weather forecasts produced for any day, time or altitude as evidence or data of the actual weather on any day or at any time or altitude when carrying out our analysis.

- Track dispersion plots for aircraft types for a selected week for each month to demonstrate track dispersion achieved by particular aircraft types, including notes of specific flights indicating certain flight parameters acquired from Mode S data gathered by Gatwick Flight Tracking systems.
- Track dispersion plots for individual airlines and aircraft types to demonstrate track dispersion achieved by particular airlines and aircraft types, including notes of specific flights indicating certain flight parameters acquired from Mode S data gathered by Gatwick Flight Tracking systems.

**1b Track dispersion plots showing tactical vectoring in the area of Horley – November 2016 – February 2017.**

**1c Further track dispersion plots for: 19, 20 & 24 August 2016, 12, 17, 21, & 22 November 2016, and daily plots for February 2017 to highlight data to highlight airline and aircraft type track-keeping performance in strong wind days.**

**1d Aircraft track data for 1996, 2001 & 2006.**

**2. Air Traffic Control operational data from Gatwick ATC and London Terminal Control (LTC) at Swanwick.**

**3. Aircraft operators' operational data from airlines operating from Gatwick.**

Copies of correspondence from GAL to certain aircraft operators seeking explanations of why departure tracks appeared to be at variance to the intended design of the RNAV 1 SID.

**4. Complaints/Feedback from members of the community and local community organisations including some Parish Councils.**

GAL maintained a Route 4 blog keeping stakeholders accessing the blog up to date on the work they were carrying out in respect of Route 4. This blog linked to a dedicated e-mail address to receive feedback and complaints. We publicised the link to GAL's dedicated e-mail address on our website.

We required that

- All this data was presented to us in a form specified by us in our letter dated 23 May 2016; and
- GAL produce to CAA postcode plots of people making complaints/providing feedback.

**5. Details on number of aircraft movements and changes over time.**

SECTION 5

# Summary of the work carried out by the CAA to analyse the data and to determine whether the modified RNAV 1 SIDs meet the objective of our requirements.

32. The overall objective of our analysis is to determine whether the RNAV 1 SID designs achieve the outcome of our requirements. Where the data indicates aircraft are not achieving the tracks anticipated by the modification requirements, we have analysed the data to understand whether in our view this is due to the SID design or other factors.

33. The CAA has examined all the data provided by GAL. We have analysed month by month track performance data; we have examined the daily track performance data and correlated this with weather data to determine what meteorological conditions may cause aircraft to fly a wider turn than was anticipated from the revised RNAV 1 SID design.

34. We have also been able to investigate specific airline and aircraft type track keeping performance by the major individual airlines. This has proved extremely beneficial in order for us to see the variance in track keep performance by similar types operated by different airlines, and from the exchange of correspondence between GAL and certain operators, we could see that there can be some variance in how some operators were flying the departure procedures.

35. Where we sought clarification on issues, we have engaged GAL to either provide further clarification on various points and asked it to seek any clarifications with operators and air traffic control providers concerned.

36. We have examined complaint and feedback data submitted to GAL which was subsequently provided to the CAA as required in the data collection set of requirements, as well as complaints and feedback data submitted to the CAA.

37. We conducted a "gate analysis"[9] of vertical profiles of departing aircraft as they pass Beare Green, KKE09 (just west of the A217) and KKE11 (east of Salfords railway station).



9 A gate analysis uses radar data (in this case taken from Gatwick Airport's noise and track-keeping system) to plot the height of aircraft above the ground passing through a theoretical "gate" drawn as a line across the ground on a map.

38. We have used the expertise within the CAA from the instrument flight procedure regulator, the performance based navigation technical adviser, the CAA's environmental research specialist, the CAA case officer for the project and the consultation regulator to provide expert opinion on the data provided to the CAA.

SECTION 6A

# CAA Analysis and Conclusions: CAA analysis of Aircraft Movements Data (number of flights)

39. We have used two sets of data provided by the CAA's Environmental Research & Consultancy Department (ERCD) to illustrate changes in the number of aircraft movements for each summer period (June to September) from 2012 onwards. In Tables 1 to 3, the movement figures have been extracted from radar data for the period from 16 June to 15 September (inclusive), because this reflects the busiest period of the year.

40. Table 1 shows that traffic has increased by nearly 10,000 movements.[10]

These tables show the numbers of departures on Route 4, and its usage as a percentage. It provides useful background context and shows the changes in the number of aircraft using Route 4 since 2012.

**Table 1.** Summary of Gatwick summer operations

| Summer period | Total movements (fixed-wing only) | Count of westerly departures | Count of Route 4 departures | Route 4 as % of westerly departures | Departure runway modal split (%) |
|---|---|---|---|---|---|
| 2012 | 72,890 | 31,363 | 13,670 | 44% | 14 E / 86 W |
| 2013 | 74,927 | 25,924 | 11,128 | 43% | 31 E / 69 W |
| 2014 | 77,140 | 24,214 | 9,528 | 39% | 37 E / 63 W |
| 2015 | 79,835 | 29,584 | 11,762 | 40% | 26 E / 74 W |
| 2016 | 82,582 | 34,886 | 13,420 | 38% | 15 E / 85 W |

Note: in the last column E refers to easterly operations (Runway 08) and W refers to westerly operations (Runway 26).

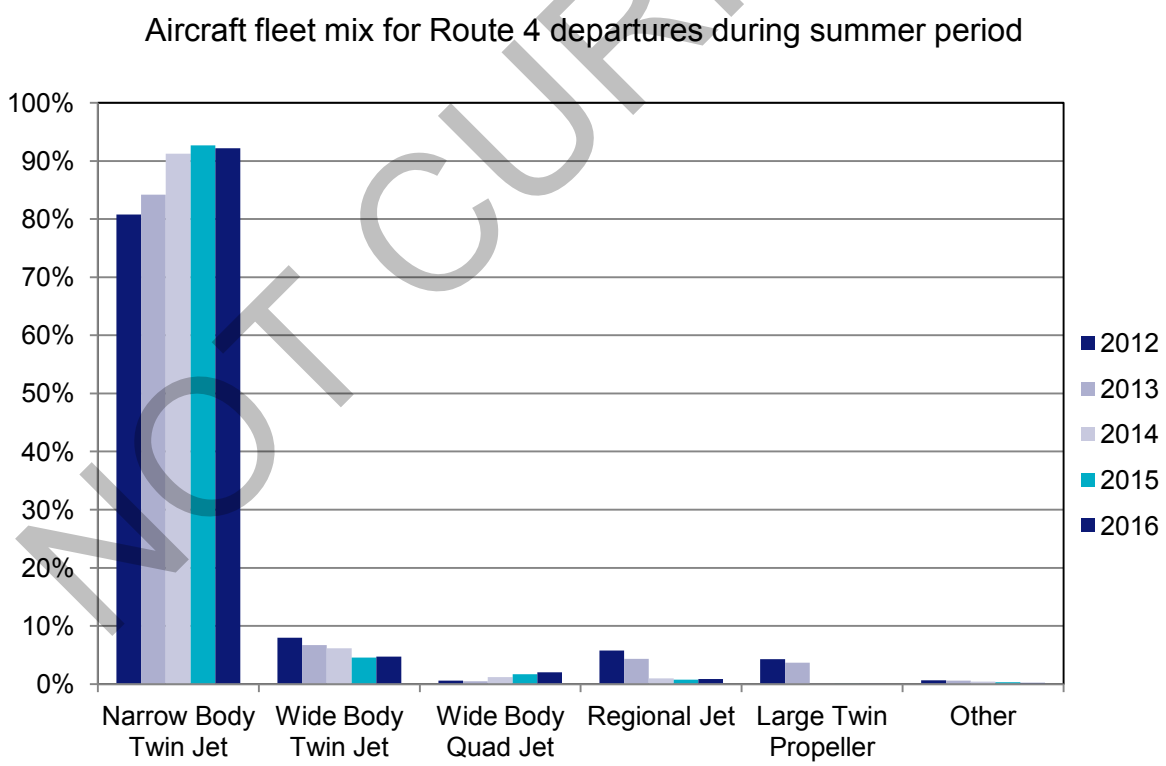
10 The number of traffic movements is not a feature or aspect of airspace design or a term of our approval of a change to it. The number of aircraft movements does however affect the impact of a particular airspace design.

**Table 2.** Aircraft fleet mix for Route 4 departures during summer period.

| Aircraft Type | 2012 | 2013 | 2014 | 2015 | 2016 |
|---|---|---|---|---|---|
| Narrow Body Twin Jet | 80.8% | 84.2% | 91.3% | 92.7% | 92.2% |
| Wide Body Twin Jet | 8.0% | 6.7% | 6.1% | 4.6% | 4.7% |
| Wide Body Quad Jet | 0.6% | 0.5% | 1.2% | 1.7% | 2.0% |
| Regional Jet | 5.7% | 4.3% | 1.0% | 0.7% | 0.8% |
| Large Twin Propeller | 4.3% | 3.7% | <0.1% | <0.1% | <0.1% |
| Other | 0.6% | 0.6% | 0.4% | 0.3% | 0.2% |



**Table 3.** Aircraft Fleet mix



41. Observations from this data

- There has been a steady increase in traffic numbers at GAL over this period. This is likely to be a factor in residents' experience of aircraft noise in the same period;
- The fluctuations in runway usage in the period are likely to be largely a result of prevailing wind direction. In the period, the proportion of westerly departures has ranged from 63% of departures (2014) to 86% (2012). These variations will have affected the number of aircraft using Route 4, which is a westerly departure, in the period;
- The proportion of Route 4 departures as a percentage of all westerly departures has remained relatively steady, ranging from a low of 38% (in 2016) to a high in of 44% (in 2012);
- These factors will have affected the numbers of aircraft that have used Route 4 in this period. For example, there is an increase of summer traffic from 9,528 flights in 2014 to 13,420 in 2016, an increase of 41% in three years.

SECTION 6B

# CAA Analysis and Conclusions: CAA Aircraft Track Analysis

42. In this section we review and assess the pattern of aircraft track location and dispersion/ concentration occurring since the introduction of the modified RNAV 1 SID in May 2016.

## CAA Assessment of Modified Route 4 RNAV 1 SID (Implemented on 26 May 2016)

43. In Annex D, we have completed an assessment of the modified Route 4 RNAV 1 SID implemented on 26 May 2016. The assessment refers to track dispersion and track density diagrams provided by GAL. These may be viewed as attachments to the main report. In Annex D, we have included a guide to interpret the various diagrams included with this report and described how we have conducted our assessment of the modified Route 4 RNAV 1 SID.

## How we analysed the Route 4 RNAV 1 SID track diagrams

44. For analysis purposes, we have divided the analysis of the track location and dispersion/concentration of the modified RNAV 1 SID design into three segments:

- Segment 1 is from take off to approximately the Rusper / Newdigate minor road, i.e. the initial “straight-out” segment, before the turn.
- Segment 2 is from approximately the Rusper / Newdigate minor road to a position just to the west of the A217 between Horley and Reigate, i.e. the 180$^{o}$ turn
- Segment 3 is from a position just to the west of the A217 between Horley and Reigate extending eastwards, i.e. the eastbound track after the turn.

45. The CAA reviewed 6 months of traffic dispersion plots from 26 May to 26 November 2016. The CAA has concluded that the traffic patterns displayed for July 2016 are consistent with the traffic patterns for the other months since May 2016. For the purposes of this report therefore, we are referring to the Gatwick track dispersion plot from July 2016 as this has proved to be the busiest month for Route 4 movements since implementation of the revised RNAV 1 SID on 26 May 2016. During July 2016, it should be noted that Runway 26 (from which Route 4 departs) was used for 30 days of the month due to the prevailing westerly winds.

46. It should also be noted that on certain days, strong winds prevailed from the south west. All daily data plots are available on the CAA website which will demonstrate the effects of stronger winds from the south to south-west. These daily plots were used to draw conclusions in respect of the track design and strong wind days.

## Our analysis of the Modified Route 4 RNAV 1 SID

47. Our detailed assessment of the aircraft track data available to us is set out in Annex D. This section of the report is a summary only of that assessment and Annex D should be read in full in order to review our detailed assessment. In our assessment in Annex D Table 1, we describe what has occurred since implementation of the modified Route 4 RNAV 1 SIDs on 26 May 2016. We provide a description of:

- In column 4, if concentration or dispersion was expected from the RNAV 1 SID design, what the expected traffic pattern would be from the corrected conventional SID.
- In column 5, a description of the comparison of the vertical profile of the modified RNAV 1 SID with the nominal track of the corrected conventional SID design.
- In column 6, a qualitative description of the track-keeping of the modified RNAV 1 SID (traffic pattern) and comparison to the nominal track of the corrected conventional SID design.
- In column 7[11], a qualitative comparison of modified RNAV 1 SID traffic pattern with:
  1. Traffic pattern from original RNAV 1 SID.
  2. Traffic pattern from extant conventional SID.
- In columns 8, 9 and 10, we then indicate if the expected track keeping has been achieved (i.e. is the design achieving its aim, if the SID is flown correctly by the operators, and whether the environmental impact is as expected, based on the traffic patterns described in column 6).

To note: when viewing the diagrams provided with the report, we have included the available diagrams of the extant conventional SID density plots pre change in 2013 in a similar format to that shown in the PIR report. We have also included the track dispersion and track density plots of the conventional SID flown in 2013. There is a slight change in how GAL were able to illustrate traffic patterns before the change in November 2013, and

11 Although we recognised that replication of either of these SIDs was not the aim of the modified RNAV SID, we considered that understanding how the traffic pattern arising from the modified RNAV SID compared to previous traffic patterns was helpful to fully understand the impacts of the modified RNAV 1 SID.

thereafter, and indeed in the traffic samples for 2016, a slightly different scaling has been used so when doing an electronic comparison using a change of slide or page number (by flicking back and forwards between slides), the diagrams show a slight shift in the pictures displayed. There is nothing we can do to eradicate this.

48. Our descriptions in Annex D Table 1 are a: 'say what we see' description of where aircraft are flying. We refer to geographical locations which should be visible on the diagrams to help readers understand how we have described the traffic patterns.

## Segment analysis

49. This section is a summary of the assessment reflected in full in Annex D. Please refer to Annex D for our full analysis. In the three segments we make the following observations and conclude with our assessment:

### Segment 1 (from take off to approximately the Rusper / Newdigate minor road).

50. After departure, aircraft are flying straight ahead until the first waypoint at KKW02; there is no difference between the nominal track of either the extant conventional SID, the original RNAV 1 SID, or the nominal track of the corrected conventional SID. For this reason, and the fact that this segment is "straight-out", the traffic pattern for each SID design is very similar. Therefore, the CAA concludes that the design of this segment of the modified Route 4 RNAV 1 SIDs has achieved a satisfactory replication of the nominal track of the corrected conventional SID and therefore the design of segment 1 of the modified Route 4 RNAV 1 design has satisfactorily achieved our modification requirements.

### Segment 2 (from approximately the Rusper / Newdigate minor road to a position just to the west of the A217 between Horley and Reigate).

51. After the turn at KKW02, aircraft are commencing the turn at this flyover waypoint. The aircraft turn through an approximate 180 degree turn towards the east, onto a course to intercept the track to the next waypoint at KKE09.

52. Aircraft flying the modified RNAV 1 SID tend to vary in speed at this first waypoint due to the aircraft type, speed profile of the aircraft at this stage of departure, the weight of the aircraft (including passenger loading, cargo loading and fuel carried), the outside air temperature and the wind conditions. Because of this variability, and the fact that the turning radius of each individual type of aircraft will vary, in the context of describing how the traffic pattern is flown, some similar types of aircraft may achieve a certain amount of consistency in track keeping around the turn, but some aircraft are likely to fly a different track around the turn. The effect of this is that the design of this SID was expected to result in an overall dispersion

of aircraft around the turn compared with the more concentrated traffic pattern experienced with the initial RNAV 1 design implemented in 2013 which used fly by waypoints and TF path terminators for the turn guidance.

53. Having viewed the individual breakdown of aircraft track-keeping performance diagrams by aircraft types, it is apparent that some B737-800 types with a certain operator appear to fly the RNAV 1 SID along the published nominal track and hence have a very good track keeping performance, whereas, some other B737-800 aircraft types and operators have flown the departures with a wider turn. Because the same aircraft types exhibit different aircraft tracks in this segment, we have concluded that this is not a consequence of the airspace design.

54. Nonetheless we analysed the data available to us to investigate the reasons for the tracks that were flown. The reasons for the difference are many and vary with and between aircraft type and operators.

55. Due to their standard operating procedures (SOPs), operators will fly the turn at different speeds and will manage the effects of tailwinds in the turn differently; this along with the use of different flight management systems, results in a degree of variation in track-keeping performance even across aircraft of similar types in the same weather conditions.

56. It was also apparent that some types of aircraft have been consistently flying the inside radius of the turn which has resulted in more flights directly over[12] Newdigate than would have been expected. As discussed in more detail below, we have concluded that one cause is variant operator (airline) standard operating procedures (SOPs) within the same operator, as well as between different operators. For example, some aircraft flying with the same airline flew a completely different departure profile in respect to the speed after the first turn. In one instance we discovered that one particular operator permitted its crews to fly different noise abatement departure procedures which meant that some crews flew a very slow departure (well below the designed departure maximum speed for the procedure, but well within the safe limits for the aircraft), and other crews would fly the SID adhering to the designed nominal track and maximum speed profile of the SID. Whilst aircraft flying a slower speed is a safe method of operating, it does not ensure the flight tracks achieved will be fully contained within the NPR monitoring swathe. We therefore considered this warranted particular examination (see more below).

12 Whenever we use the phrase 'flights directly over' or similar in this document, we mean our review of the track diagrams showed that some flights had flown directly over that town or village (i.e. directly overhead) as shown in the maps provided by GAL .

57. During our analysis of the track data we noted that an operator was turning too early. Following investigation by GAL, the airline discovered that there had been an error in the database coding, so once identified, this was corrected (discussed in more detail below).

58. We also noted that in certain calm or light wind conditions, most aircraft remained within the NPR monitoring swathe all the way around the turn[13]. See for example, 5 and 20 July. This is also apparent on calm or light wind days during the remaining 5 months.

59. In contrast, in certain strong wind conditions from the southwest, without pilot intervention, a tailwind in the turn resulted in aircraft having an increased groundspeed in the turn, which meant that the turning radius of aircraft around the turn would increase. This had the effect of widening the turn which meant that the tracks showed some aircraft flying outside the NPR monitoring swathe as they flew around the turn (see plots for 1, 9, 10, 11, 20 July 2016). This is also evident on individual days in other months in the data collection period, for example on 12, 17, 21, 22 November, and in the sample from 17-23 February 2017[14] (when a storm occurred throughout the UK). This observation led GAL to investigate whether a different SID design could be used in strong wind conditions. This, together with the outcomes of GAL's investigation, is covered in more detail in Annex E.

60. Having examined and considered the large amount of track keeping data provided, we have concluded that the traffic pattern flown around Segment 2 has resulted in dispersion around the turn, and in the main, traffic remains within the NPR monitoring swathe except for those occasions when a strong wind from the south to south-west prevails. In comparison to the track dispersion achieved by the extant conventional SID, because of a 220 KIAS speed restriction around the first turn in the modified RNAV 1 design, from an NPR monitoring swathe containment perspective, there has been a slight improvement compared with the extant conventional SID, although it is recognised that in strong wind conditions, aircraft will still fly wider turns around this 180 deg turn. This is no different to any other



13 Data from complaints /feedback indicates that that some stakeholders consider that aircraft should be able to fly completely within the NPR monitoring swathe at all times. This is not a correct assumption, as in certain conditions (as described above), aircraft may fly wider or tighter turns resulting in flight outside the NPR monitoring swathe. As set out in more detail in the CAA's PIR report dated 11 November 2015, aircraft may be vectored off SIDs at any time by air traffic controllers in order to achieve a more expeditious routeing for an individual aircraft expect that they will not do so until the vertical upper limit of an NPR (usually4000 ft amsl, but sometimes lower) has been reached. After this height aircraft can and will be vectored by air traffic controllers on a case by case basis.

14 Data requested outside the PIR data collection period in order for us to investigate a particular issue relating to air traffic control vectoring in the vicinity of Horley

departure in the UK which involves a turn of this nature or what happened at Gatwick airport before the RNAV designs were implemented.

61. When comparing the track-keeping performance (measured by reference to containment within the NPR monitoring swathe) of this modified RNAV 1 SID to the original RNAV 1 design, the result is that the main traffic pattern in this segment has improved.

62. As an illustration of the improved track-keeping performance around this turn, the CAA's ERCD provided an approximate summary of the proportion of aircraft below 4000ft that flew beyond the limit of the NPR monitoring swathe. For the period from 1 May to 30 November, the proportion was:

- 6% of aircraft in 2013
- 36% of aircraft in 2015
- 9% of aircraft in 2016.

63. The increase in 2015 represents the period during which the original RNAV 1 SID was in operation.

64. The corrected conventional SID is designed to, and will have the effect of, bringing the nominal track of the conventional SID back to that SIDs approved position, where it had been before, and therefore the NPR centreline will be aligned with the conventional SID as the NPR was designed to have been.

65. Having considered all the factors pertaining to the track-keeping performance achieved, the CAA concludes that the traffic pattern resulting from the design of this segment shows improvement associated with the adherence to the NPR monitoring swathe around the first turn, indicating that the design of this segment has successfully modified the RNAV 1 SID design to replicate the nominal track of the corrected conventional SID, and therefore the design of segment 2 of the modified Route 4 RNAV 1 design has satisfactorily achieved our modification requirements.

## Segment 3 of the SIDs is from a position just to the west of the A217 between Horley and Reigate extending eastwards.

66. After the 180-degree turn in Segment 2, many aircraft converge towards the NPR, (that is towards the nominal track of the corrected conventional SID) to establish on the SID by waypoint KKE09. Others (and we estimate from our review of the data, the majority) do not[15] which in our view is a result of having been vectored off

15 The majority of departures towards the east (i.e. including those using Route 4) are vectored to maintain separation from other traffic departing from other airports in the London area, or from traffic arriving into the London airports, as well as positioning the departing traffic from other traffic at higher altitudes

the SID onto a more expeditious routeing for that aircraft by air traffic control when they have reached an altitude of 4000ft or above. In order to assess whether the modified RNAV 1 SID has satisfactorily achieved our modification requirements it is necessary to assess the track data of aircraft that appear to us to have remained on the SID.

67. KKE09 is just to the west of the A217 routeing from Horley to Reigate. Assuming the aircraft remain on the SID at this point, after KKE09, the tracks show aircraft route to the next waypoint on the SID (KKE15 – just to the east of the railway line at Salfords) which is also on the nominal track of the corrected conventional SID and therefore the NPR, then further to the east of KKE15 and beyond.

68. The aircraft track data shows that aircraft remaining on the modified Route 4 RNAV 1 SID converge back towards the nominal track of the corrected conventional SID and/or NPR centreline demonstrating that the modified RNAV 1 SID achieves a satisfactory replication with the nominal track of the corrected conventional SID and become concentrated as they pass Sidlow and cross the A217; after the A217, a high percentage of aircraft appear to continue along the SID, although it is apparent that a significant number of aircraft disperse to the south and east having been vectored by ATC.

69. The traffic pattern of concentration and dispersion is very similar to that displayed by both the extant conventional SID and the initial RNAV 1 design with two key differences:

    1. Whilst both SIDs show a degree of concentration of traffic that remains on the SID, the modified RNAV 1 SID shows a greater degree of concentration than the original conventional SID.

    2. The revised traffic pattern is displaced further south with the main concentration along the NPR. This displacement is approximately 800-1000m to the south of the extant conventional SID.

70. During our analysis we noted potential for confusion between the noise abatement procedures, published in the Gatwick entry of the AIP Annex F which permit departures to be vectored as soon as they have reached 4000ft (Gatwick QNH i.e. 4000ft amsl), and the statement that after taking-off the aircraft shall avoid flying directly over Horley and Crawley. This is discussed in more detail below (Section 6C).

71. Having considered all the material available, the CAA concludes that the traffic pattern resulting from the design of this segment has been what was expected, and has resulted in a partial dispersion in the early phase of this segment (albeit reducing as aircraft progress further east), followed by a convergence to a more concentrated traffic pattern on the nominal track of the SID as departures pass Sidlow and the A217.

72. We observe that the eastbound track has been displaced south towards the nominal track of the corrected conventional SID/NPR, when compared with both the track of the extant conventional SID in this segment, and the original RNAV 1 design of 2013, (which were respectively aligned on (1) the northern extremity of the NPR monitoring swathe and (2) north of and outside the NPR monitoring swathe).

73. The design of this segment has successfully modified the RNAV 1 SID design to replicate the nominal track of the corrected conventional SID, and therefore the design of segment 3 of the modified Route 4 RNAV 1 design has satisfactorily achieved our modification requirements.

## Observations from the aircraft track data based on the names and locations of local communities, villages and towns and as compared to the NPR compliance monitoring swathe

In this section we are describing the changes which have occurred in relation to the NPR monitoring swathe. View this diagram in the slide show (Annex G) insert link to relate to the descriptions below.

**The dispersion up to 4000ft in relation to the NPR monitoring swathe.**

**Before the change:**

In the dispersion plot of the conventional SID track data up to 4000ft (Slide 4 – Conv SID July 2013), a small proportion of aircraft fly outside the monitoring swathe as they fly around the turn towards the east. As can be seen, some aircraft fly directly over South Holmwood towards Leigh.

**After the original RNAV 1 SIDs were implemented:**

In Slide 5, the diagram showing RNAV 1 departures in June 2014 shows a greater proportion of RNAV 1 departures flying outside the NPR monitoring swathe heading towards South Earlswood.

**After the modified RNAV 1 SIDs were implemented:**

In Slide 6, the diagram showing the modified RNAV 1 SID departures in July 2016 shows a widespread dispersion of departures all the way across the NPR monitoring swathe as they turn towards the east. Some aircraft turn tight and fly to the east of the swathe extremity in the turn, and some aircraft are flying to the outside of the western extremity of the monitoring swathe and continue to fly directly over and close to South Holmwood.

We have examined a number of additional diagrams showing daily plots, and individual airline and aircraft type plots and we have drawn the following conclusions:

Aircraft outside of the monitoring swathe on the inside of the turn may be turning early for weather avoidance, may have a less than 5700kg all up weight and therefore do not have to comply with the NPR requirements, or in some cases had the procedure coded up incorrectly and have inadvertently turned too early. In this case GAL has engaged the operator, and we understand that issue has been resolved. One other airline is flying the procedure at low airspeeds, and as a consequence turning tightly directly over and close to Newdigate. GAL is currently engaged with the operator to resolve this issue (our previous comments refer). See Section 10: GAL Undertakings, Number 6

On the outside of the NPR monitoring swathe we discovered, as highlighted in the strong wind section, some aircraft are flying outside the western extremity of the monitoring swathe. This could be a result of strong winds from the south west when the aircraft increases ground speed and is unable to turn any tighter.

We have reviewed a number of track plots, and it is evident from these plots that on particular days in July 2016, it was more noticeable that aircraft flew to the outside of the monitoring swathe on these particular days: Annex H

In contrast, on days when there was a wind from the north-west, or light winds, the majority of aircraft can be seen to be contained within the monitoring swathe as can be seen on these particular days: Annex I

**The concentration in relation to the NPR monitoring swathe.**

View these diagrams in Annex J (density plot comparison diagrams):

In the track density plots of the conventional SID showing the concentration (Slide 4 – Conv SID July 2013), a small proportion of aircraft are flying outside the monitoring swathe below 4000ft as they fly around the turn towards the east. As can be seen, some aircraft fly directly over South Holmwood towards Leigh, but the main concentration of departures are within the swathe, albeit across the western half as they are midway around the turn. This SID had a designed speed restriction of not above 250KIAS around the turn which remains until the end of the SID. On turn completion, the main concentration of aircraft as they head eastbound are on the inside of the northern extremity of the monitoring swathe routing towards the vicinity of South Earlswood. However, there is a small proportion of aircraft outside the swathe as they fly past Leigh. Once at 4000ft or above, there is no restriction on when aircraft may be vectored by ATC.

In Slide 5, the diagram showing RNAV 1 departures in June 2014, the main concentration of RNAV 1 departures flying outside the NPR monitoring swathe directly over or close to South Holmwood, then completing the turn heading towards South Earlswood, but vectoring is evident and widespread towards Earlswood and north of Horley. These aircraft are expected to be above 4000ft AMSL.

The modified RNAV 1 SID was designed to better replicate the corrected conventional SID and thereby address the greater than expected impact of the tracks flying outside the NPR monitoring swathe around the turn, and displace the main eastbound concentration back towards the NPR; the following diagram will illustrate how this has been addressed.

In Slide 6 and 7, the diagrams for June and July 2016 departures show the dispersion and concentration impacts of the modified RNAV 1 SID departures. After the first turn at KKW02, there is a widespread dispersion of departures across the NPR monitoring swathe as they turn towards the east. Compared to the initial RNAV 1 design, the modified design of 2016 was designed to achieve dispersion around the turn, then once the turn was completed, the design was such that aircraft would converge back to the NPR by position KKE09 – just before the A217 unless radar vectoring instructions were provided by ATC for the purpose of separating departures from other traffic and enabling further climb as soon as possible. Some aircraft are flying to the outside of the western extremity of the monitoring swathe and continue to fly directly over or close to South Holmwood, similar to the conventional SID (in Slide 4 – June 2014) but not as much as was evident with the initial RNAV 1 SID design. Dispersion is therefore achieved across the monitoring swathe which was the one of the aims of the modified RNAV 1 SID. Towards the end of the turn, aircraft converge back to the NPR as they approach the A217 (KKE09), dispersion reduces, and the trend becomes more of a concentration as aircraft pass between Leigh and Nalderswood. Once aircraft reach the railway line at Salfords there is a noticeable concentration along the SID, although widespread vectoring is evident towards Earlwood and the northern area of Horley.

SECTION 6C

# CAA Analysis and Conclusions: Details of any operational issues arising from Gatwick ATC and London Terminal Control at Swanwick

74. GAL was required to advise if any operational issues were raised by Gatwick ATC and London Terminal Control centre at Swanwick.

75. From data provided, no issues were raised by either unit.

## Vectoring resulting in flights directly over Horley

76. The highest number of complaints submitted by members of the public to GAL, in the six month monitoring phase from 23 May 2016, came from the Horley area; these came from 695 individuals (4858 complaints/pieces of feedback) which was 37% of the total complaints. (A detailed analysis of the complaints/feedback data is set out below and in Annexes E, K & L.) This data caused us to request further operational data from GAL to enable us to investigate these complaints and to establish the implications for our assessment of the modified airspace design.

77. When viewing the altitude band plots, and density plots, it was evident that some aircraft were being vectored and as a result flying directly over Horley. Vectoring was evident in the density plots and in the 6000-7000ft altitude band plots during: June, July, August, September; in October and November vectoring was not as prevalent as in the first 4 months.

78. GAL examined the nature of the vectoring of flights directly over Horley which is carried out by NATS air traffic controllers at Swanwick. In the Gatwick noise abatement procedures (Note No 9) it states that after taking off the aircraft shall avoid flying directly over the congested areas of Horley and Crawley, and in Note 8 the procedures state that when aircraft have reached an altitude of 4000ft, they may be vectored by ATC and these aircraft are deemed not to have departed from the NPR. This apparent potential for confusion is subject to ongoing discussions between GAL and the DfT.

79. GAL advised the CAA that after the modified RNAV 1 SID design was implemented in May 2016, the levels of vectored traffic leaving Route 4 and flying directly over Horley increased from historical levels of approximately 1-3% to a high of 9%. GAL recognised that this was an issue and has advised that it is working closely with NATS to address this, through a controller education programme. As a result, the number of flights directly over Horley has progressively declined since the issue was first identified. GAL has advised the CAA that for comparison the first two weeks of September 2016 flights directly

over Horley were measured at 7% but the first two weeks of December 2016 were less than 1%. GAL has advised the CAA that they will continue to work with NATS to monitor the numbers of flights directly over Horley.

80. From the details below in Table 4, it can be seen that there has been a reduction in the relative number of flights directly over Horley since November 2016. The area of Horley is highlighted on the diagrams provided by GAL. "Overflight" is defined by GAL as any tracks indicating where they fly directly over this highlighted area.

**Table 4.** Route 4 departures and Horley area overflights.

| Period | No of Route 4 departures | Flights directly over Horley | Percentage of overflight |
|---|---|---|---|
| 4-10 Nov 16 | 630 | 40 | 6% |
| 25 Nov-1Dec 16 | 232 | 09 | 4% |
| 9-15 Dec 16 | 567 | 04 | 1% |
| 6-12 Jan 17 | 821 | 09 | 1% |
| 20-26 Jan 17 | 176 | 00 | 0% |
| 3-9 Feb 17 | 377 | 06 | 2% |
| 17-23 Feb 17 | 918 | 08 | 1% |

SECTION 6D

# CAA Analysis and Conclusions: Route 4 RNAV 1 SID Operational Issues (that is, issues for or with airlines operating/departing from Gatwick Airport)

81. During the 6 month assessment of the revised RNAV 1Route 4 SIDS, GAL was requested by the CAA to collect track keeping data. In some cases GAL used the track keeping data gathered to liaise with the airlines and operators where deviations to the expected flight tracks were found. In these cases the airline/operator in question were requested by GAL to provide an explanation for the deviations.

82. A large proportion of the track deviations relate to deviations on the outside of the turn after the first waypoint KKW02. As the aircraft turns north to intercept the track to KKE09 the data we analysed shows the groundspeed of the aircraft which deviated from the NPR compliance monitoring swathes is in excess of 220Kts. The SID is published with a maximum 220KIAS speed restriction to try and ensure NPR compliance in various wind conditions. Many of these instances occurred when the reported METAR showed either a southerly or south westerly wind.

83. A summary of the data observed and the analysis conducted with the operators is set out in Annex K.

84. The data shows that the majority of airlines and aircraft manage to maintain good track adherence to the nominal track of the modified RNAV 1 SID and therefore the nominal track of the corrected conventional and NPR compliance.

85. Looking at the assessment period from June to November 2016 as a whole, overall it can be seen that with respect to the airlines/operators that were on occasions not operating within compliance monitoring swathe of the NPR, the majority of the airlines/operators have improved the track adherence in the various wind conditions that have been experienced at Gatwick as this period progressed. Nevertheless, while the south westerly and southerly winds do increase the likelihood of deviation to the west and north west of the turn onto the easterly track, the evidence would suggest there is still some work to be completed by those airlines/operators that still fly out to the north west of the turn and those they are persistently cutting the corner by maintain a minimum speed in the turn. (See Section 10: GAL Undertakings, Number 6)

86. Where deviations from the NPR monitoring swathe were evident from the flight track data, GAL requested explanations from the operators. The outcome of this engagement appears to have led to changes to the operator's Standard Operating

Procedures (SOPs) ensuring flight crew awareness of the issues and enforcing procedures to maintain track conformance. This work is ongoing with some operators to try to ensure better track adherence within the NPR swathe.

87. In conclusion, GAL has provided evidence that the majority of operators have been consistently remaining within the NPR swathe (excluding times of stronger southerly winds), which demonstrates that the SID as coded is flyable. To achieve this some operators have amended their SOPs to fly the SID to ensure consistency in track adherence within the NPR swathe. (See Section 10: GAL Undertakings, Number 6).

SECTION 6E

# CAA Analysis and Conclusions: RNAV 1 SID design for Route 4 in strong winds

88. After implementation of the modified RNAV 1 Route 4 SIDs, GAL began to investigate the impact strong wind days had on aircraft tracks and to consider whether the design of the RNAV 1 SIDs was a cause of those impacts. This is why GAL advised the CAA that it was considering whether it should progress an alternative RNAV 1SID design for use only on strong wind days.

89. GAL has concluded that it will not progress such an RNAV 1 SID design.

90. We have concluded that the impact on aircraft tracks of strong south to south-westerly wind days is not caused by the RNAV 1 SID design but by operational practices adopted by aircraft operators and the normal impacts of strong wind which introduce a tailwind component and further impact on aircraft turn performance.

91. The reasons for our conclusions are discussed in detail in Annex E.

SECTION 6F

# CAA Analysis and Conclusions: Complaints/Feedback from non-industry stakeholders

92. As described in more detail in Section 4, as part of the data-collection process, GAL facilitated a process whereby stakeholders for example, residents) could submit details of noise complaints or feedback arising from the modified RNAV 1 SID design.

93. This process enabled residents to submit their feedback to GAL which was then reviewed and analysed by GAL. Responses (16,964 emails) were received from 1,863 different email addresses in addition to a small number of postal correspondence items[16].

94. The CAA in turn analysed the complaints summarised by GAL, and this is outlined at Annex L.

95. In general terms we:

- Reviewed the summary of complaints to ensure they had been correctly categorised by GAL on terms of location;
- Identified those locations on the summary with the largest number of correspondents on a map;
- Compared those chosen locations with traffic patterns resulting from the modified RNAV 1 SID, the original RNAV 1 SID and the extant conventional SID.

96. Based upon that comparison, qualitatively assessed whether any unanticipated impacts of the modified RNAV 1 SID were revealed by considering those locations.

97. We made a detailed assessment of those locations that represented 90% of the correspondents. (Our detailed assessment is in Annex L). We note that we received complaints from locations that were experiencing less flights directly overhead than previously, as well as more.

98. In support of our analysis, we undertook a "gate analysis" of departing aircraft using Route 4, comparing the traffic samples for July 2013 (original conventional SID), July 2015 (original RNAV SID) and July 2016 (modified RNAV SID), in order

16 The CAA received some complaints and feedback direct. Please see Annex O for a description of how this data was fed into the data sent to and collated by GAL.

to consider any changes on altitudes and vertical profiles. This analysis and its conclusions are in Annex M.

99. We have taken into account the results of our analysis of all the complaints and feedback received when considering our decision.

100. Broadly, we concluded that the comments/feedback/complaints received were consistent with the traffic patterns we were expecting and observed when carrying out our aircraft track analysis. The general conclusions are:

- As would have been anticipated, the largest numbers of correspondents came from the most populated locations that have experienced an increase in noise levels since the implementation of the modified RNAV SID. A key factor in the increase in noise impact is the displacement of the traffic pattern in Segment 3 of the SID, i.e. the eastbound track after the turn.
- Less populated locations which are similarly affected by the displaced traffic pattern also generated correspondents, albeit on a much smaller scale.
- There were relatively few correspondents from those locations that are likely to be experiencing a decrease in noise impact.

101. In addition we noted that:

- Some correspondents had expectations of not being overflown or experiencing any aircraft noise at all, or
- Some correspondents appeared to be complaining or providing feedback in respect of aircraft that were not using Route 4.

SECTION 6G

# CAA Analysis and Conclusions: Data relevant to assessment of non-industry complaints and feedback

## 1. Aircraft noise

102. All of the locations identified via the summary of complaint data provided by GAL (Appendix G) are beyond the outer noise contour (57 dB LAeq) at Gatwick Airport. Whilst this does not mean that some individual residents outside this contour won't be annoyed by aircraft noise, the effects of noise would not be considered "significant" [17] in terms of community impacts.

103. Additionally, the changes in traffic numbers identified in Section 6A are also likely to have caused an increase in noise impacts for some locations.

104. That said, the pattern of traffic displayed as a result of the implementation of the revised RNAV 1 does indicate that some locations are likely to be experiencing an increase in noise impact when compared to the impacts during the original RNAV 1 SID or immediately prior to the airspace change proposal (i.e. the extant conventional SID), even though those increases would not be deemed to be significant. Further qualitative comment on the possible noise impacts broken down by location is outlined in Annex L (CAA Analysis of complaints submitted to GAL).

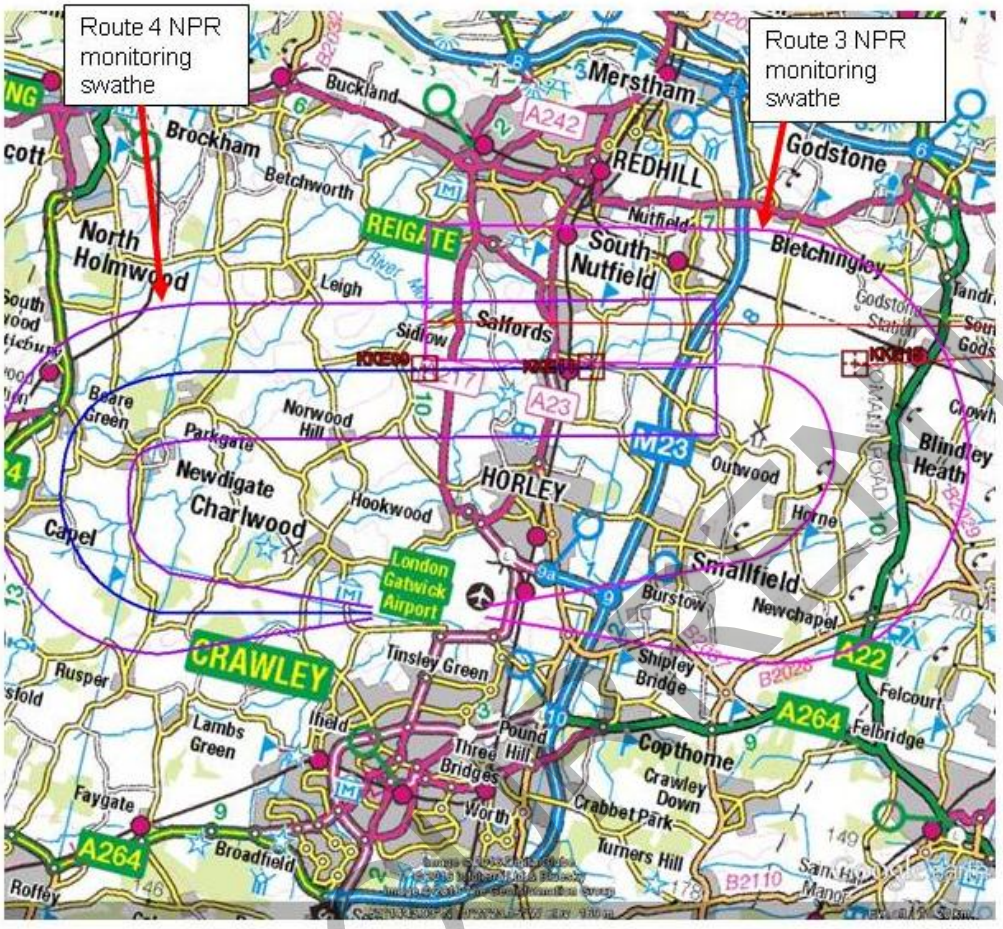
## 2. Route 4 and Route 3 "overlap"

105. One of the effects of the modified Route 4 RNAV 1 design is that it removes the issue which prevailed with the conventional SID departures (and the original RNAV 1 SID design) flying further to the north of the NPR as they headed towards the east, which meant that they would also fly directly over similar locations as the flightpath of the opposite direction Runway 08 westbound departures (Route 3) once they have completed the turn towards the west. The picture below in Fig 1 shows the relationship of the 2 NPRs for Route 3 and 4 and the Route 3 and Route 4 NPR swathes.



17 We set out our policy (and the government policy that informed it) on determining whether noise impacts or changes to them were significant and the reasons for that policy in our PIR report CAP 1346

**Fig 1.** Relationship between Route 3 and 4 NPR monitoring swathes.




106. The modified Route 4 RNAV 1 design now means that Runway 26 departures on Route 4 heading off to the east will be less likely to fly directly over the same track over the ground as the westbound Route 3 departures from Runway 08.

## 3. Heathrow to Gatwick positioning-flight SID

107. Following feedback from residents and MPs querying why departures cannot climb higher earlier, it has been identified that the published Heathrow to Gatwick positioning-flight SID creates an artificial procedural step for Route 4 departures.

108. Aircraft departing from Heathrow to land at Gatwick have to flight plan to follow this SID. In theory, this means that aircraft using this SID fly directly over Route 4 departures at 5000ft, which means Route 4 departures have an initial climb restriction of 4000ft to ensure the required separation standard of 1000ft between aircraft is maintained. In practice, the frequency of positioning flights is low; as soon as they are airborne, they are vectored by ATC when above the NPR restrictions regarding radar vectoring. This Heathrow SID should therefore be examined with a view to removing or modifying the complete Heathrow Mayfield

SID. This will need collaboration between and agreement from Gatwick, Heathrow and NATS.

109. An unrestricted climb profile to 5000ft or 6000ft could have the effect of raising the climb profile and hence raise the altitude of departures along the flight path of the Route 4 SID.

110. This may help to reduce noise impacts along the latter portion of Segment 2 and all of segment 3 by raising the altitude of part of the eastbound segment. Whether this is achievable will depend on the operational impacts to ATC units and will need careful analysis. It is not the role of the CAA to state whether such a modification is feasible – this is the responsibility of the ATC units concerned who remain responsible for the safe and efficient conduct of the interacting procedures.

SECTION 7

# Conclusion and decision to approve the modified Route 4 design

111. We have considered whether the tracks achieved by aircraft flying the modified RNAV 1 SID demonstrate that the modified RNAV 1 SID has satisfactorily achieved our aims (as set out in Section 1 of this report).

112. Based on our analysis of the track data discussed in Section 6 and illustrated in the Attachments to this report we have concluded that they do.

113. We have noted some deviation of tracks from the predominant traffic pattern in strong wind conditions and by some operators.

114. We have concluded that the deviation in strong wind conditions is no more than would occur in any other 180 degree turn and that this should not lead us to determine the modified RNAV 1 SID has not satisfactorily achieved our aims.

115. We have concluded that all aircraft types can successfully fly the modified RNAV 1 SID to achieve tracks which satisfactorily meet our aims. Where some operators' aircraft are not doing so, GAL has given an undertaking to ensure that those operators' operating decisions ensure their aircraft maintain track conformance within the NPR monitoring swathe. Because other operators flying the same aircraft are able to conform, we have concluded that the poor track conformance by some operators identified by our analysis should not lead us to determine that the modified RNAV 1SID has not satisfactorily achieved our aims.

116. GAL was required to collate complaints and feedback received since the modified RNAV 1 SID was implemented in May 2016 and November 2016. We have taken into account the results of our analysis of all the complaints and feedback received when considering our decision. We have considered that feedback and have investigated the possible reasons for the impacts described. We have concluded that there are some communities that are likely to be experiencing an increase in noise impacts as a result of a change in traffic patterns in Segments 2 & 3 of the modified RNAV 1 SID, and some communities are likely to be experiencing a decrease in noise impacts. We have therefore concluded that the noise impact of implementing the modified RNAV 1 SID is as expected.

117. Based upon all of the assessment and analysis contained within this report, we conclude that the modified RNAV 1 SID is a satisfactory replication of the corrected conventional SID design. Therefore the published Runway 26 Route 4 SIDs notified in the AIP are confirmed for permanent use. The CAA's airspace change process in respect of GAL's airspace change request dated 30 November 2012 (as amended 9 January 2013) in respect of the Route 4 SID has now concluded.

SECTION 8

# Conventional Route 4 SIDs corrections

118. The conventional SID has drifted over time such than the nominal track of the eastbound track (after the 180 degree turn to the east) has drifted away from the approved nominal track of the conventional SID (and coincidentally from the NPR which is aligned through Salfords railway station).

119. As a consequence, the eastbound track has to be corrected.

120. GAL has no option but to make corrections to the conventional SID to address magnetic variation changes. These changes are required by ICAO recommendations and practices (under the requirement for 5 yearly review of instrument flight procedures) and will have the effect of bringing the conventional SID back to the approved position, where it was had been before, and therefore the NPR centreline will be aligned with the conventional SID, as it was designed to have been.

121. The CAA has no option but to agree to changes which effectively and satisfactorily deal with this ICAO requirement.

122. GAL submitted an initial and second set of corrected conventional SID designs that were not accepted by the CAA. The third set of designs submitted by GAL to CAA in March 2017 satisfactorily correct the conventional SID design as required under the original CAA PIR review requirements.

123. Consequently, the CAA has decided that the correction to the conventional Route 4 SIDs submitted to the CAA in March 2017 will be approved and implemented by publication in the AIP with an effective date of 20 July 2017.

SECTION 9

# Potential considerations to reduce the impact on local communities

124. The CAA recognises that some locations are directly overflown more frequently as result of the modified RNAV 1 SID. Whilst carrying out our analysis necessary to assess whether the modified RNAV 1 SID design meets our requirements, we have considered whether there might be further steps that GAL can take to investigate ways to mitigate such impacts. We gave consideration to these whilst we carried out our assessment of the correction and modification that are the subject of this report. We have set out the possible areas of further investigation as we see them in Annex N of this report. We have concluded that these options should be examined by GAL and as we note later in Section 10 of this report GAL have undertaken to do so.

SECTION 10

# Gatwick Airport Ltd Undertakings

125. The CAA is recommending to GAL that it investigates possible designs to help to mitigate the impacts of noise in the locations under and adjacent to the Route 4 flight paths. This is not suggesting that any of these recommendations will guarantee a reduction in noise, but they are designed to highlight a number of considerations that GAL can investigate. When doing so we expect GAL to engage with local communities. GAL has agreed to provide undertakings to investigate a number of possibilities as set out below. GAL has also agreed to progress these undertakings with their Noise Management Board and to provide periodic updates on their progress in respect of these undertakings on their website.

126. Options for respite[18] from aviation noise of any kind remain untested. Where we state that GAL should consider the potential for having an alternative SID for use under specified conditions, we will not know the full impacts of those proposals until they are investigated further, with the potential that they may need to be trialled and tested before any benefit can be determined.

127. Any new SID (in addition to the modified RNAV 1 design which is the subject of this report) will require GAL to follow the airspace change process which will involve consultation with affected stakeholders.

128. Having now seen the impact of two RNAV 1 designs used for Route 4, GAL has a large data set which it can use to investigate the anticipated impacts of any new design of a SID which might be used in conjunction with the SID which is the subject of this report.

## GAL's Undertakings

129. GAL will provide information to communities on the corrected conventional SID for Route 4 and explain why it has to be corrected and how it will align with the existing NPR.



18 Where respite is used in general terms in this report, it is understood to mean where two or more versions of a route are designed and usage rotated in a predictable manner. In addition, runway alternation of multiple runways may also offer respite. Having predictability means that local communities can plan around known periods when each route will be inactive. However, simply moving traffic away from an area will not necessarily provide communities the respite they expect. The extent of the respite offered will depend on how far routes are moved and at what height the aircraft are.

130. GAL will provide information to communities on the corrected conventional SID for Route 4 and explain why it has to be corrected and how it will align with the existing NPR.

131. With the objective of providing meaningful respite, GAL will consider options for a second RNAV 1 SID (with a similar design to the modified RNAV 1 design in Segments 1 and 2) but with a modified eastbound track similar to the original RNAV 1 design). Such design will consider modifications to prevent "ballooning"[19] in all but the strongest south to south-westerly wind conditions). As well as engaging with local communities when investigating this option, GAL will liaise with DfT in respect of the NPR for this Route (and associated compliance monitoring swathe) and its impact on considering another RNAV 1 SID along this route.

132. GAL will consider the potential for obtaining respite by alternating or switching a proportion of Route 4 departures onto another route. GAL shall consult with NATS to determine whether SID offloading onto other routes is feasible, given the network of overlapping flightpaths in the southeast of England. GAL will also need to take into account the effect on local communities affected by the other routes.[20]

133. GAL will consult with Heathrow and NATS to investigate the withdrawal of the published Heathrow to Gatwick positioning-flight SID.

134. GAL will work with DfT to investigate the possibility of clarifying AIP entry Gatwick Aerodrome 2.21: Noise Abatement Procedures sub paragraphs 8 and 9 and the notes that apply to that entry in order to resolve the potential for confusion of that UK AIP Entry regarding definition of the NPR, the vectoring altitude restriction (4000ft) and the air traffic control operational procedures regarding flights directly over Horley.

135. GAL will use reasonable endeavours to ensure their operators comply with noise abatement procedures. As a priority, GAL will require that:

a) where flights, as a consequence of applying a specific speed profile such as Noise Abatement Departure Procedure 1 (NADP 1), result in excursions on the inside of the NPR swathe, GAL will require the relevant operators to ensure that their SOPs are designed to maintain track conformance, within the NPR monitoring swathe and amend the AIP entry to reflect this.



19 i.e. wide dispersion of the aircraft tracks outside (in this case to the west of) the nominal track.

20 The DfT is currently consulting on its Airspace Policy. It is considering the introduction of a new form of change to airspace arrangement and the process that will need to be followed before one can take place. DfT refers to these as Tier 2 changes. Tier 2 changes are some changes to air traffic control operational procedures. It is possible that any decision in respect of this option may be a Tier 2 change and require the CAA to approve the change.

b) where flights extend outside of the NPR monitoring swathe, particularly on days experiencing strong south to south-westerly winds, GAL will require the relevant operators to ensure that their SOPs are designed to maintain track conformance, within the NPR monitoring swathe.

**136.** GAL will undertake to provide information on the ATIS[21] on south to south-westerly winds (GAL to determine the threshold with the Gatwick Flight Operations Performance and Safety Committee (FLOPSC).

**Civil Aviation Authority**

**7 April 2017**



21 ATIS: ATIS is an Automated Terminal Information Service used by airports to continually notify essential aerodrome weather information and runway in use and any other information required by the pilots.