

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

CAP 1531

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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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- C. [UK AIP chart – corrected conventional SID.](#)
- D. [Assessment of the Route 4 Modified RNAV 1 SID.](#)
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Attachments

Diagrams for July 2016:

1. [Track dispersion diagram - up to 4000ft](#)
2. [Track density plot diagram](#)
3. [Track dispersion diagram - altitude band 4000-5000ft](#)
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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 1 SIDs 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 routes².

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 ATIS³ on south to south-westerly winds (GAL to determine the threshold with the Gatwick Flight Operations Performance and Safety Committee (FLOPSC)).

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- 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 KKE15⁵ 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 weather⁸ 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.

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- 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.