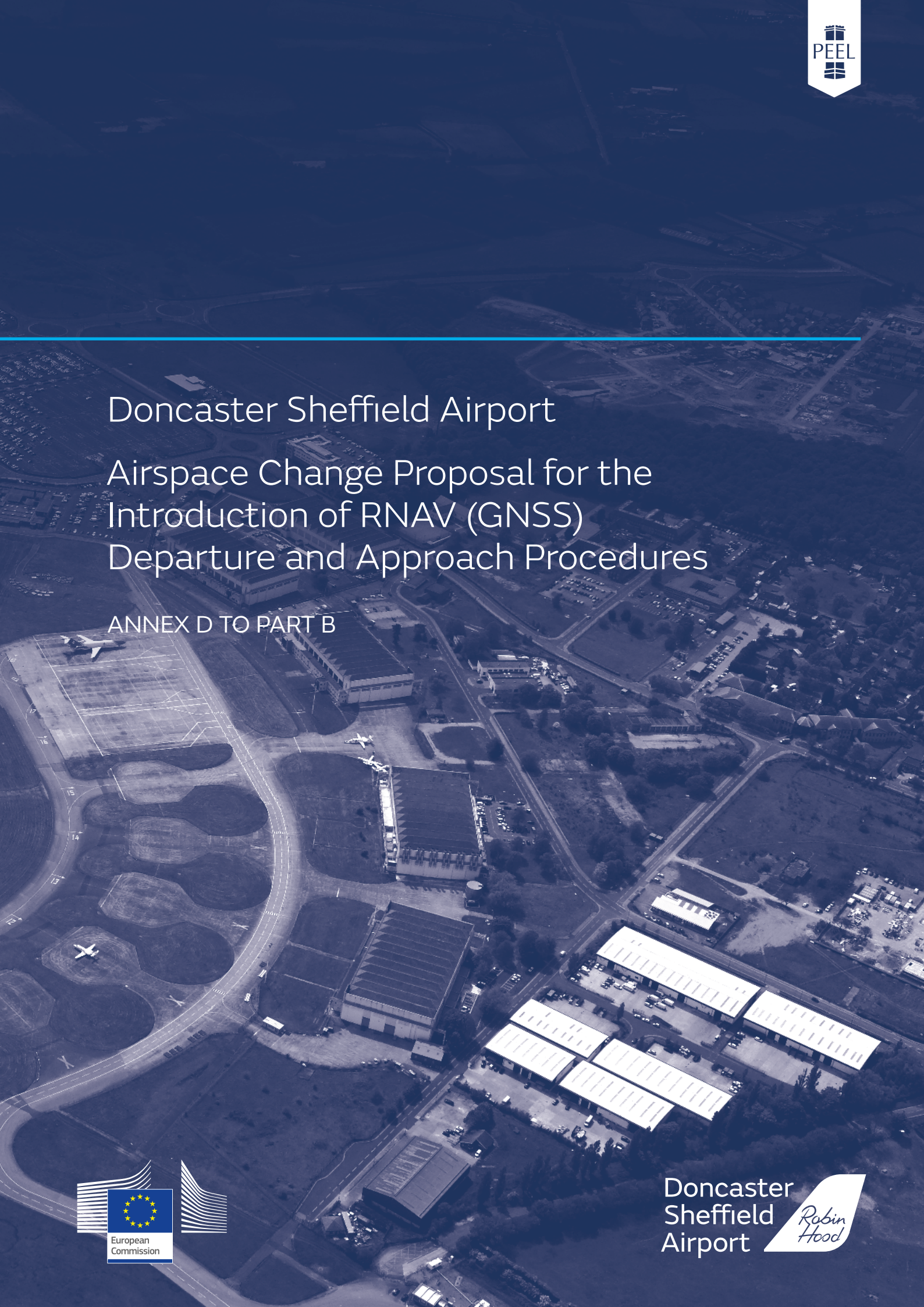


Doncaster Sheffield Airport

Airspace Change Proposal for the Introduction of RNAV (GNSS) Departure and Approach Procedures

ANNEX D TO PART B

PEEL

European Commission

Doncaster Sheffield Airport

Robin Hood

ANNEX D TO PART B:

Runway 02 Easterly Departure ROGAG 1B

Contents

1. Runway 02: Departures to the east (to ROGAG)

1.1. The proposed RNAV SID is referred to as the ROGAG 1B. Although the current ROGAG 02 is promulgated as a PDR and is therefore not charted, the proposed ROGAG 1B has followed the intent of the PDR. From a SID perspective, this is a new design as no SID existed to ROGAG off Runway 02.

1.2. ROGAG is a position in the Route Network (on eastbound ATS Route L603) in the region of Bardney (east of Lincoln). It is specified by NATS En-Route Limited (NERL) as the position at which aircraft departing from DSA to the east must join the Route Network.

1.3. The existing ROGAG 02 PDR uses the GAM VOR (situated on Retford (Gamston) aerodrome) as the ground-based navigational aid to define the route to ROGAG. The GAM VOR is being withdrawn by NATS in 2019 in accordance with agreed CAA Policies (see Part A of the Consultation Document)

1.4. Approximately 105 departing aircraft used the ROGAG 02 PDR within the period June to July 2016, encompassing a busy summer period.

1.5. Figure 1 shows historic tracks of aircraft departing from Runway 02 on the ROGAG 02 PDR over the June and July period. It also depicts (in magenta) the intended nominal ground track of the PDR. The tracks end at the point the aircraft pass 7,000 feet amsl. Individual aircraft differ in climb performance; not all lines, therefore, end at the same distance from take-off.

1.6. It can be seen in Figure 1, there is a substantial difference between the intended track of the PDR shown in magenta and the actual tracks of departing aircraft depicted in green. Almost all tracks turn well inside the intended ROGAG 02 PDR track (magenta line). PDRs are not designed and charted in the same manner that SIDs are, as a consequence, PDRs are subject to being flown by interpretation rather designed intent. It is evident from the NTK data that the PDR interpretation was consistent but just not as per the route intent. Differences in aircraft performance have created a wide swathe of tracks (in green).

1.7. Furthermore, most departing aircraft will have, historically, been using an "RNAV overlay" interpretation of the PDR in their navigation database to guide the navigation of the aircraft. It is not possible, within navigation database coding principles to code a "double conditional" (e.g. "either/or, whichever is later") instruction. Thus, as the database coding depends on the "interpretation" of the procedure by the database coder, and is not externally regulated, the emphasis has probably been put on the altitude element of the instruction rather than the lateral position element.

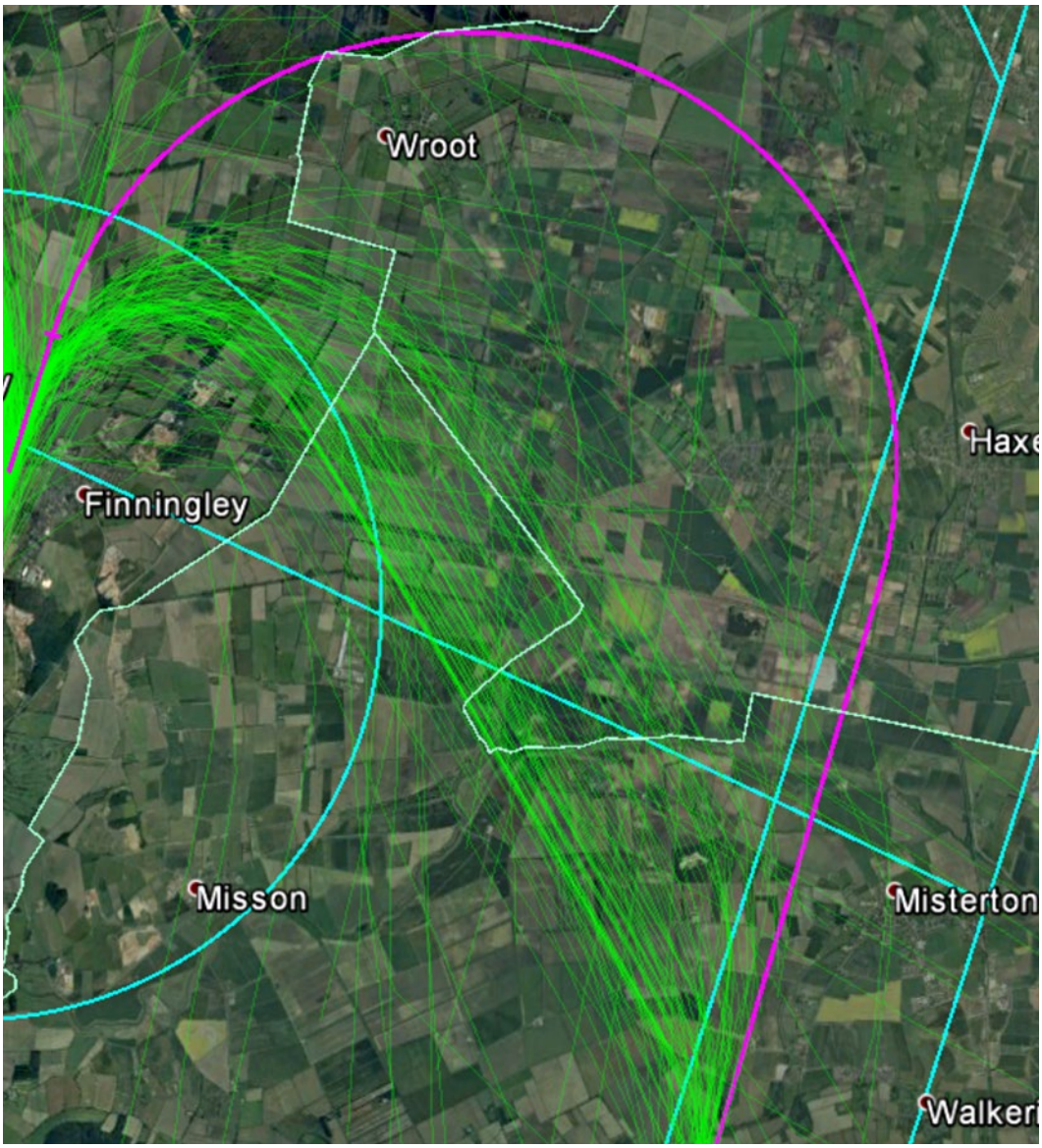


Figure 1: Runway 02 – ROGAG 02 and historic departure tracks for the period June-July 2016 via ROGAG

2. The ROGAG 1B SID procedure

2.1. The procedure is described as follows:

Climb straight ahead to CNN04, right to CNE07, right to CNE11, left to CNS22, left to CNS29 – ROGAG

2.2. A schematic diagram of the SID is shown in Figure 2 below and diagrams of the SID overlaid on Google Earth are shown at Appendix A1 and Appendix A2.

2.3. A variety of procedure design angles of bank[01] were considered to achieve the first two turns within regulatory requirements and the optimum track over the ground for the first turn was sought from an environmental perspective.

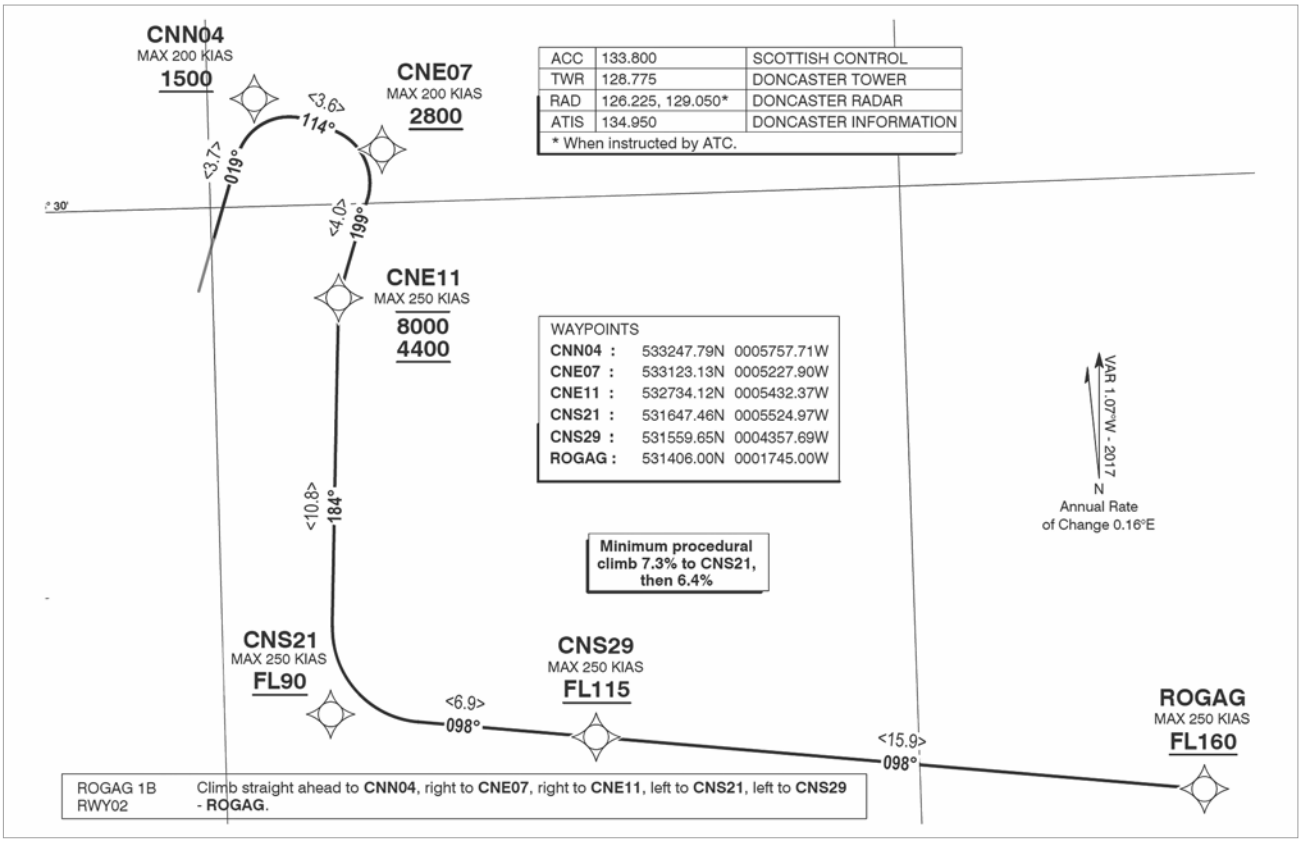


Figure 2: Schematic of ROGAG 1B SID

01 The procedure design angle of bank does not require that aircraft actually fly at that angle of bank. The parameters for which bank angles can be used in design are specified in PANS-OPS. Aircraft may not actually fly at that angle of bank but the aircraft FMS will ensure that the bank angle used by the aircraft will take account of the actual speed of the aircraft and other factors and will ensure that the aircraft remains within the safe flight parameters specified for the aircraft and that it adheres closely to the nominal designed flight path.

2.4. Vertical constraints

2.4.1. The specified minimum vertical profile of the proposed SID has two objectives:

- The SID climb gradient aims to cross the DSA airspace boundary (CNS22) at or above FL90 allowing for containment within controlled airspace. As a result of slightly extended track mileage to the south before the easterly turn, the minimum climb gradient can be reduced to 7.3% allowing for containment within the airspace for those aircraft under maximum weight tolerances.

- The SID vertical profile must ensure that departing aircraft do not penetrate the Scampton Restricted Area (R313) when it is active. R313 extends up to an altitude of 9500ft[02]. The minimum climb gradient requirement, after CNS22, is 6.4% and this facilitates aircraft increasing speed above FL100[03]. An agreement with the relevant stakeholders, the requirement to be at FL115 or above at 2NM before the lateral boundary of R313, would ensure that the vertical buffer against the restricted airspace is met[04] under all anticipated conditions of atmospheric pressure. An agreement would allow for coordination in those instances where aircraft are unable to maintain the required rate of climb or where pressure differences result in the flight level conversion being at an altitude lower than that of the upper limit of R313.

  Note: Further reference to the ROGAG Airspace Proposal in Part B, Section 3 highlights elements to the SID proposal.

02 The upper limits of such airspace restrictions are always expressed as an altitude notwithstanding that this is above Transition Altitude. The Flight Level specifications in the SID ensure that under all pressure conditions the airspace restriction will be avoided by at least the minimum required vertical buffer.

03 UK Airspace has defined speed restrictions that are lifted above FL100. When an aircraft increases speed, the rate of climb normally reduces to maintain efficiencies. The reduced climb gradient allows for the expected reduction in the rate of climb in this area.

04 As specified by the CAA in their Special Use Airspace – Safety Buffer Policy for Airspace Design Purposes (22 August 2014).

3. Differences between the ROGAG 02 PDR and the ROGAG 1B SID

3.1. Diagrams showing the proposed ROGAG 1B overlaid on the actual tracks of aircraft operating on the previous ROGAG 02 are shown in Appendices A1 and A2.

3.2. The current and proposed departure routes are depicted in Appendix A1 and the differences are apparent. The intent of the original PDR design routed aircraft over Wroot, Haxey and Westwoodside. The ROGAG 1B SID design has taken these communities into consideration and rather than route overhead has displaced the SID route to avoid overflying the communities.

3.3. Appendix A2 shows the impact of the interpreted PDR (NTK green swathe) versus the intended route with the proposed SID (in yellow). The NTK tracks flew impacted the communities of Blaxton and Finningley quite extensively with aircraft turning earlier than intended. The earlier right-hand turn after departure of the ROGAG 02 PDR is not designable to PANS-OPS criteria, and due to the immediate impact to Blaxton and Finningley, was not desirable.

3.4. The intent of the proposed ROGAG 1B SID is to avoid, as far as practicable, the communities to the north and east of DSA. The initial departure leg was extended in order to route north of Wroot, an earlier turn would have resulted in aircraft passing far closer. The second turn on the route is intended to keep aircraft routing clear of Westwoodside and Haxey before turning south. The turn towards ROGAG is delayed in order to allow the aircraft to gain sufficient height to be contained within controlled airspace.

3.5. It is seen from the diagram in Appendix A2 that the route of the proposed ROGAG 1B SID procedure is a hybrid of that which was intended by the PDR and that which has been flown. The aim has been to reduce as much as possible those communities affected by aviation noise as described above.

4. Other options considered

4.1. Do nothing:
This option cannot be considered as the current ROGAG 02 PDR is predicated on the GAM VOR, which is being withdrawn. The PDR, without the ground-based navigational aid, cannot be flown.

4.2. Replicate the existing ROGAG 02 PDR with a SID:
This option is feasible but as described in the above section, impacts the communities of Wroot, Westwoodside and Haxey. Replicating in this instance is not seen as the optimal solution for environmental reasons.

4.3. Radical New Design:
Various options were considered but due to limiting factors for the environment and limitations in PANS-OPS design criteria resulted in a hybrid of the various elements. Considerations for the new design had to take into account the obstacle clearance requirements after departure before allowing a turn to the east. The departure heading could not extend to far so as to limit impact to the SSSI area of Hatfield Moors. The resultant turns considered whether the route could be sustained either south or north of Wroot and allowing the next turn south within sufficient distance as to allow aircraft to stabilise and commence the next turn to avoid directly overflying Westwoodside and Haxey.

5. Environmental assessment

5.1. The nominal route of the proposed SID reflects a hybrid of the current PDR, NTK data (representing where aircraft truly fly) and the various option developed to keep within the scope remaining clear of communities. The more predictable and repeatable design will improve overall efficiencies in terms of noise where the selected design has attempted to avoid flying directly over communities.

5.2. The Airport Noise Contours are specific to each runway rather than each individual SID and are therefore detailed in Part A Section 4.

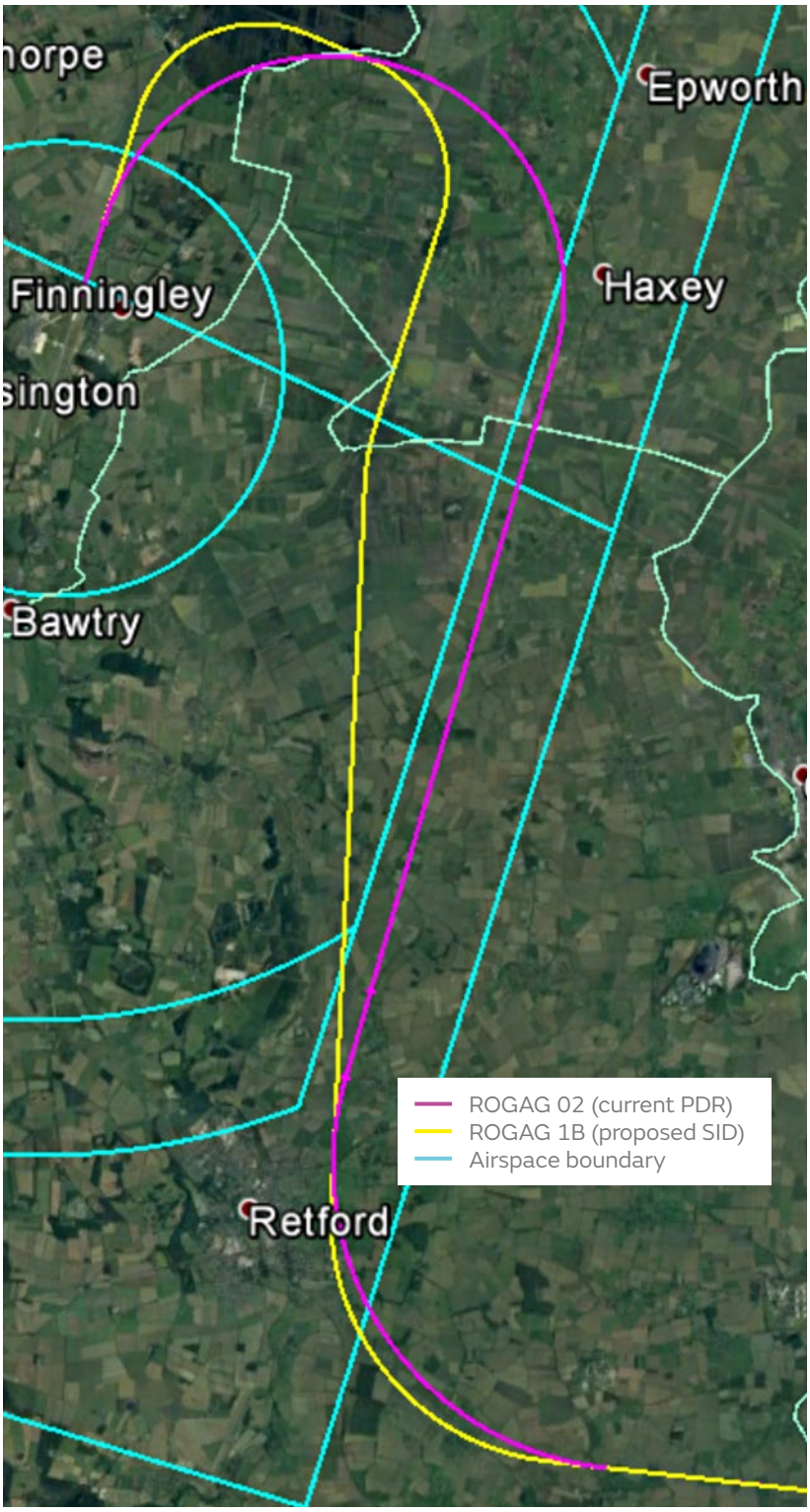
5.3. It is anticipated that the speed limits for the initial turns of the SID (not above 200 Knots-Indicated Air Speed (KIAS))[05], will reduce the spread of aircraft tracks around the initial segment of the SID, thereby reducing the number of people affected by departing aircraft on this route.

5.4. The Chart at Appendix A3 shows the 80 and 90 dB(A) departure footprints of both SIDs. The area and population affected within these footprints does not change against the population counts. It must be further noted that the departure footprint for the ROGAG 02 was based on an average track of a wide swathe of aircraft, i.e. in reality, more people were impacted than the theoretical average footprint.

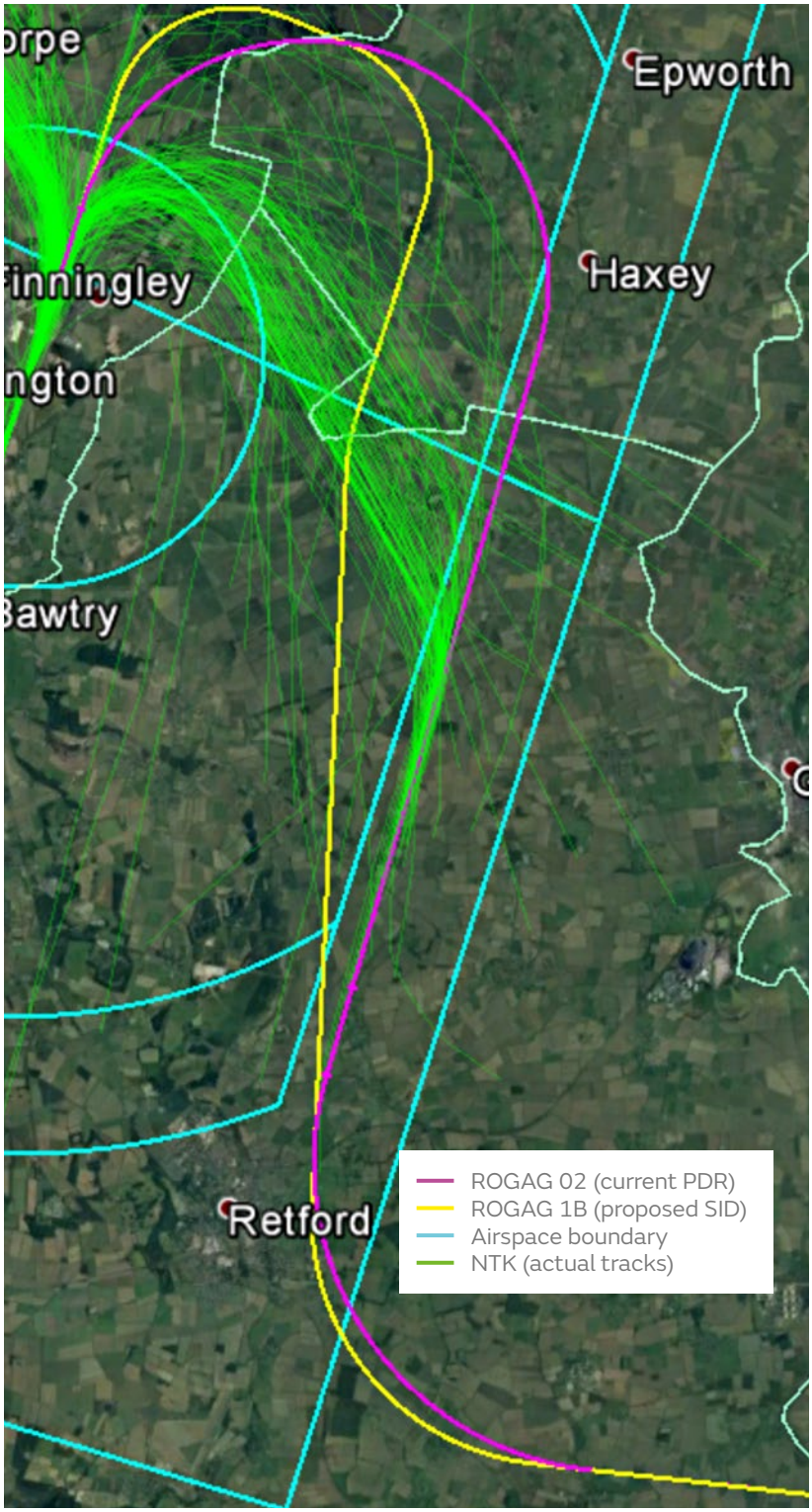
5.5. The introduction of RNAV SIDs with a navigation standard of RNAV-1 will result in improved repeatability of tracks in accordance with CAA policy and DfT guidance.

5.6. The impact of the proposed SID procedure should bring an overall environmental benefit to communities on the ground as well as to improved flight profiles.

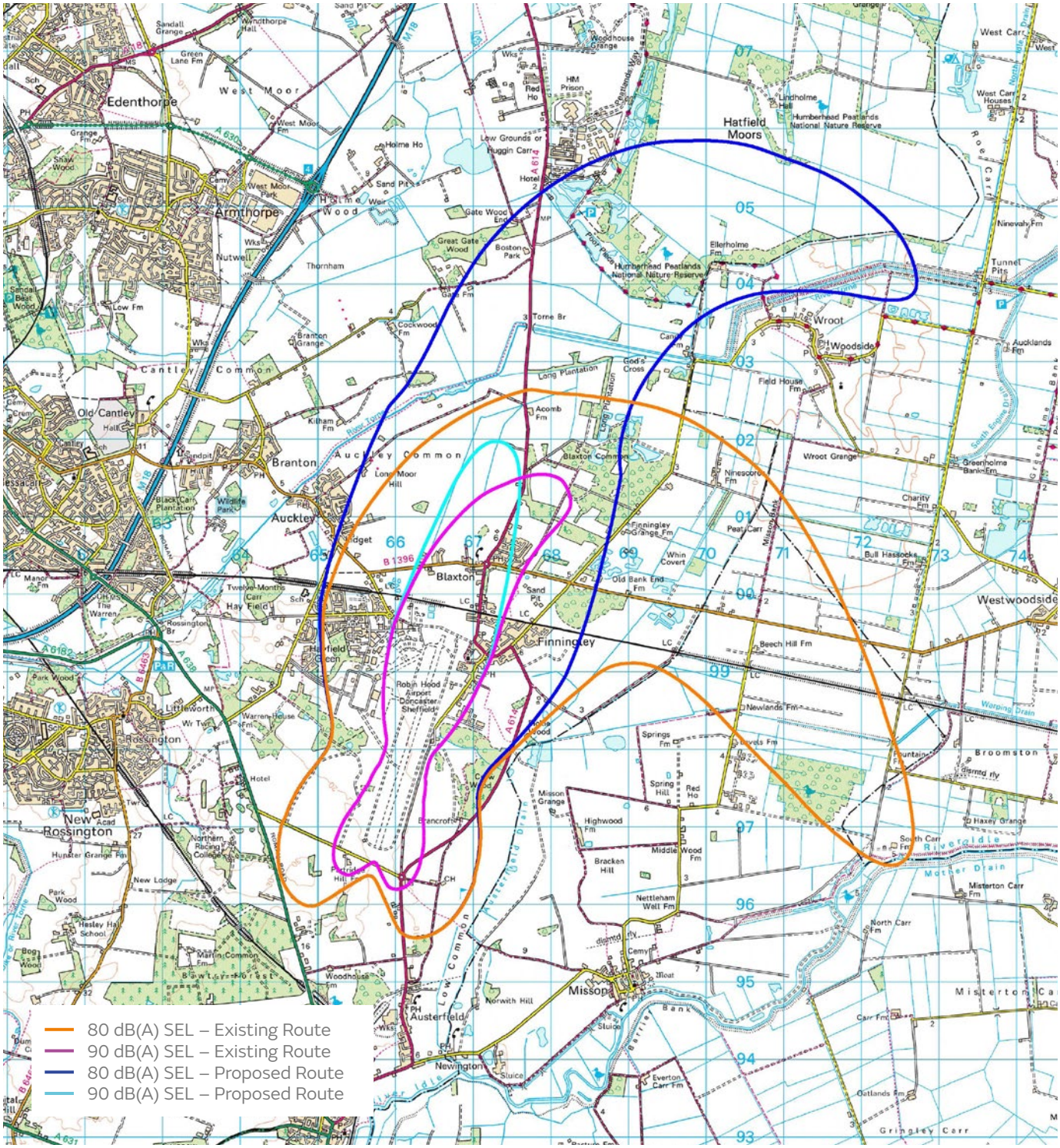
05 Indicated Airspeed is the airspeed shown on the flight-deck instrument. At sea level, and an atmospheric pressure of 1013.2 mb, and with no wind effect, the airspeed indicated is the true speed of the aircraft relative to the surface. As the aircraft climbs, the air density decreases and the indicated speed will be less than the True Air Speed (TAS). However, when it comes to controlling the aircraft, because the flight characteristics of the aircraft also alter with reduction in atmospheric density, the indicated airspeed is of greater importance than the true airspeed. This is why control speeds are given as KIAS (Knots-Indicated Airspeed, i.e. Nautical Miles per Hour).



Appendix A1:
Diagram of ROGAG 02 PDR and ROGAG 1B SID



Appendix A2:
ROGAG 1B SID and historic tracks of aircraft interpreting the ROGAG 02 PDR



Appendix A3: Departure Footprints for ROGAG 02 PDR and the ROGAG 1B SID

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Runway 02 Easterly Departure ROGAG 1B

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