Safety and Airspace Regulation Group

23 March 2018

Policy Statement

POLICY FOR REPLICATION OF CONVENTIONAL SIDS, STARS AND HOLDS USING PBN

1 Introduction

1.1 The U.K. Airspace Modernisation strategy recommends airport arrival and departure procedures are promulgated using Performance Based Navigation rather than conventional navigation techniques.

1.2 Replication of existing conventional arrival and departure procedures, including holding, is viewed as the most relevant methodology for many procedures; where there is no requirement to introduce new procedures.

1.3 Replication of existing procedures enables the rationalisation of ground infrastructure; taking into consideration the CAA Policy:

"Policy for Changes to the UK Ground Navigation Infrastructure", August 2010.

1.4 Deployment of PBN departure procedures can improve Noise Preferential Route (NPR) track adherence; proving consistency and repeatability of the nominal track.

2 Background

2.1 In recent years a number of airports and ANSPs have been considering deployment of PBN arrival and departure procedures to replace existing conventional procedures without changing the nominal conventionally designed route. UK conventional procedures were used criteria developed to accommodate now obsolescent commercial aircraft types and had very different performance capabilities from today's fleet of aircraft.

2.2 Consequently, track-keeping on existing conventional SIDs[1] within NPR parameters may result in deviations from the NPR at a number of airports (notably associated with the first turns). This can be a result of modern aircraft types utilising a Flight Management System to fly conventional SIDs (effectively using RNAV overlays)[2] without any formally designed speed restrictions, and as a result, departing aircraft may not adhere to the NPR specification.

2.3 The CAA is aware that many aircraft operators use bespoke 'RNAV coded' overlays of published conventional arrival and departure procedures. These have been produced by their data-base coders and chart provision companies, and there is evidence to

[1] The CAA believes these SIDs were designed at 185 kts.

[2] Procedures which are not formally designed as RNAV 1 procedures with appropriate path terminators and associated RNAV data bases.

suggest variance in track-keeping at a number of UK airports where these 'informal' overlaid procedures are used**. This is an unregulated process, to which the CAA has no input or oversight.**

2.1 It is for this reason that sponsors are now seeking to replace conventional designs with formally designed PBN compliant designs; not bespoke RNAV overlays.

3 Scope

3.1 This policy statement describes the technical considerations when:

- Replicating the conventional SID nominal track using PBN
- Replicating the conventional STAR existing track, including any conventional Hold facility associated with the arrival procedure, using PBN
- Introducing a PBN STAR to an existing conventional holding facility.

4 Definitions

4.1 Instrument Flight Procedure (IFP) is defined in Civil Aviation Publication (CAP) 393[3] 'Air Navigation: The Order and Regulations"[4] as:

"Instrument Flight Procedure (IFP) – A standard instrument arrival (STAR), an instrument approach procedure (IAP), or a standard instrument departure (SID), or an Omni-directional departure"

4.2 The variants of an IFP are further described below. Sources are in brackets after each:

- **Instrument Approach Procedure (IAP)** – A series of predetermined manoeuvres by reference to flight instruments, with specified protection from obstacles, from a specified point to a point from which a landing can be completed and thereafter, if a landing is not completed, to a position at which holding or other obstacle clearance criteria apply. The IAP includes the Missed Approach Procedure. (CAP393 'Air Navigation: The Order and Regulations'[5)]
- **Standard Instrument Arrival (STAR)** – A designated IFR[6] arrival route linking a significant point, normally on an ATS route, with a point from which a published IAP can be commenced. (ICAO - Annex 11 'Air Traffic Services')

Note: In the United Kingdom, a STAR terminates at the aerodrome holding fix; which may not be coincident with an IAP. Aircraft are vectored from the holding procedure to the IAP or an **Arrival Transition** is published to provide a promulgated route from the holding procedure to the IAP.

- The **Arrival Transition** is the PBN flight segment that links the Standard Arrival Route (STAR) to the runway final approach segment where a continuous path is described to that approach segment. Typically described in an aircraft Flight Management System (FMS) as a "via" it may include the Initial Approach and Intermediate Approach segments that would otherwise be described on a stand-alone IAP. (CAA -

3 CAP 785 "Requirements For UK Approved Instrument Flight Procedure Design Organisations"

: http://publicapps.caa.co.uk/modalapplication.aspx?appid=11&mode=detail&id=3965

4 CAP393 Air Navigation: The Order and Regulations: http://publicapps.caa.co.uk/modalapplication.aspx?appid=11&mode=detail&id=226

5 CAP393 Air Navigation: The Order and Regulations: http://publicapps.caa.co.uk/modalapplication.aspx?appid=11&mode=detail&id=226

6 IFR – Instrument Flight Rules

this Policy Statement)

- **Holding Procedure** - A predetermined manoeuvre which keeps an aircraft within a specified volume of airspace whilst awaiting further clearance. (CAP393)
- **Missed Approach Procedure** – The procedure to be followed if the approach cannot be continued. (ICAO Doc 8168: PANS-OPS Vol II)
- **Standard Instrument Departure (SID**) – A designated IFR departure route linking the aerodrome or a specified runway of the aerodrome with a specified significant point, normally on a designated ATS route, at which the en-route phase of a flight commences. (ICAO Annex 11)
- The **Departure Transition** is the PBN flight segment that links the SID to the en-route segment, where these are not linked.

5 Policy

PBN SID Replication

5.1 PBN compliant procedures that are intended to replace existing conventional SIDs with the intention of retaining, where practicable, the existing route and associated SID waypoints, shall be referred to as a replicated PBN SID.

5.2 A replicated PBN SID is defined as:

"The design of an RNAV or RNP procedure that follows the path over the ground of the nominal track of the existing conventional procedure as closely as possible".

Note: it is the path over the ground of the designed conventional procedure and not the nominal centreline of the associated NPR or the current traffic concentration.

PBN SID Replication Design Guidance

5.3 Further replication design guidance in relation to the development of instrument departure procedures is contained in CAP 778:

"Policy and Guidance for the Design and Operation of Departure Procedures"[7]

PBN STAR Replication

5.4 PBN compliant procedures that are intended to replace existing conventional STARs start from the commencement of the STAR in the ATS en-route network to the termination point (normally in the terminal environment) with the intention of retaining the existing route and track over the ground, shall be referred to as a replicated PBN STAR.

5.5 A replicated PBN STAR is defined as:

"The design of an RNAV or RNP procedure that follows the path over the ground of the existing conventional procedure as closely as possible".

The intention of a PBN STAR replication is to replicate the existing track of the conventional STAR as currently defined by existing navaids and intersections.

[7] CAP 778 Policy and Guidance for the Design and Operation of Departure Procedures: http://publicapps.caa.co.uk/docs/33/CAP778.pdf

5.6 The termination point of the STAR is normally the fix of the terminal hold associated with the IFR arrival procedure(s). For traffic arriving at aerodromes outside controlled airspace, a PBN STAR replication of an existing arrival procedure may apply to procedures which terminate at the relevant aerodrome terminal hold without any change to track over the ground

PBN STAR Replication Design Guidance

5.7 PBN STAR procedure replications are to be designed in accordance with extant RNAV/RNP design requirements.

5.8 As a minimum, ICAO RNAV 5 navigation specification is suitable for PBN STAR Replication.

5.9 Waypoint positioning is to replicate existing navaids and waypoints, with all turns as flyby waypoints unless a flyover waypoint is specifically required. Minimum separation distance between RNAV waypoints must be assured in accordance with RNAV / RNP design criteria.

5.10 A fleet analysis is required for RNAV 1 designs.

5.11 A fleet analysis is required for RNP designs, and a robust case is to be presented and fully justified using RNP criteria.

5.12 For the implementation of PBN STAR replication procedures, given that published levels within the procedure shall still be planned for, but actual descent is tactically directed by ATC, vertical performance requirements for descent planning purposes must still be achievable. Note: this would cater for Radio Communications Failure (RCF) scenarios.

5.13 STAR naming convention for UK remains in accordance with the extant filed difference to ICAO against Annex 11 Appendix 3 paragraph 2.1.2:

5.14 In the United Kingdom, the basic indicator for standard arrival routes is the name or name- code of holding facility or fix where the arrival route terminates.

5.15 The proposed STAR replication is to be given an RNAV title and is to be designated in accordance with the Policy Statement for STAR designation[8]. The sponsor is to agree a STAR designator with the SARG Airspace Regulation Team.

5.16 The format for RNAV Charts is to comply with the agreed format between SARG IFP regulators and APDs. Sponsors should liaise appropriately with their APD to ensure the required data is provided to the APD for submission to SARG IFP with all design submissions.

5.17 A separate RNAV Chart will be required for all STAR replications. Depending on the rationale for change, a sponsor will have to consider the implications for change which involves airports with a large number of STARs where not all of the conventional STARs will be replaced at the same time. As it is not possible to combine conventional and RNAV STARs on the same chart, in this situation separate RNAV charts are required and subsequent page re-numbering of remaining charts is to be included with the change request to AIS.

PBN Hold replication

5.18 ICAO states that a hold does not form a part of a STAR although a holding facility may be established at the end of a STAR if required.

[8] http://publicapps.caa.co.uk/modalapplication.aspx?catid=1&pagetype=65&appid=11&mode=detail&id=5300

5.19 A replicated PBN Hold is required when:

- converting current conventional arrival procedures (STARS) to RNAV, or
- proposing a new RNAV STAR to an existing conventional hold.

5.20 This policy applies solely to those holds as described above and that will maintain:

- the same holding fix and direction of hold;
- a direct entry from the associated arrival route;
- maintain current inbound and outbound tracks and altitudes;
- are based on timing;
- will be subject to regular review as prescribed in ICAO Doc 8168, PANSOPS Vol II (current maximum period five years); and
- in circumstances where an existing conventional hold design does not meet the above criteria, a full RNAV hold design is required and be submitted to SARG IFP for approval.

PBN Hold Replication Design Guidance

5.21 When PBN STAR replication procedures are proposed, and an existing conventional hold at the STAR termination point is established, the hold will be re-designated in accordance with paragraph 5.20.

5.22 If there is a requirement to remove a dependency from a VOR, the existing conventional hold is to be re-designated as an RNAV Hold in accordance with paragraph 5.20.

5.23 If when a sponsor is considering a design for an RNAV hold a conventional hold cannot be re-designated in accordance with the conditions at paragraph 6.20, the change sponsor must liaise with the APD to determine any impacts on dimensions of existing controlled airspace. The APD should provide appropriate detail with the design submission to indicate the RNAV Hold is contained within existing controlled airspace (where appropriate). If there are any circumstances when an RNAV Hold is not wholly contained within existing controlled airspace, this issue is to be discussed with the SARG CO and an appropriate course of action determined.

5.24 The UK will adopt both the criteria for operations requiring and not requiring holding functionality but apply only DME/DME and GNSS tolerances as applicable following the guidance in PANS-OPS Vol II, Part III, Section 3, Chapter 7. DMEs that are used in the calculations are based upon their DOC as listed in the UK AIP.

5.25 This policy applies to terminal holds based on a single waypoint within 30 nm of the aerodrome reference point (ARP).

5.26 GNSS and DME/DME tolerances are based upon STAR/IF/IAF (normally <56 km/30 nm from the ARP) XTT and ATT for a given altitude or altitudes.

5.27 RNAV holding procedures are defined by the following and will be shown on the chart:

Essential Fields

- holding identification;
- geographical coordinates (Lat/Long to 1/100th of a second);
- the bearing of the inbound track to the waypoint (to 1/10th degree) relative to True North;
- the direction of the turn at the waypoint; and

- the end of the outbound track defined by timing.

Optional Fields

- maximum IAS (knots) (either ICAO or non-standard);
- an altitude or Flight Level. Minimum and maximum levels may be specified.

5.28 Appropriate 5LNC and intersections with an alphanumeric name in accordance with the policies for 5LNC allocation[9] and the Use and Allocation of RNAV Waypoints[10] . When new RNAV waypoints are required, a validation check of co-ordinates is required in accordance with the SARG Policy Statement 'New or Amended Information & Data Referenced to the WGS84 Ellipsoid'[11]. This validation request is to be submitted with the PBN Replication application.

5.29 Proposals for PBN replication designs also require a Validation Plan as per the Policy Statement: 'Validation of Instrument Flight Procedures'[12].

5.30 Depending on the complexity of the PBN replication of arrival and departure procedures, a double AIRAC promulgation may be required.

6 Supporting Documentation

6.1 The processes for approval of Airspace Procedure designers are described in the CAP 785:

"Requirements for UK Approved Instrument Flight Procedure Design Organisations"

6.2 Responsibilities in relation to the development and maintenance of IFPs is described in the Policy Statement:

"Policy Clarifying Responsibilities Regarding the Development of, or Changes to, Instrument Flight Procedures".

6.3 Further guidance in relation to the development of instrument departure procedures specifically is contained in CAP 778:

"Policy and Guidance for the Design and Operation of Departure Procedures"[13].

6.4 The process for development and changes to IFPs will be in accordance with CAP1616:

"CAA Guidance on the Application of the Airspace Change Process".

7 Airspace Regulation Point of Contact

Civil Aviation Authority
Airspace Regulation
Safety and Airspace Regulation Group
CAA House
45-59 Kingsway
London
WC2B 6TE

---

9 http://publicapps.caa.co.uk/docs/33/SignificantPointAndRouteDesignatorPolicy.pdf

10 http://publicapps.caa.co.uk/docs/33/DAP_RNAVWaypointPolicyStatement.pdf

11 http://publicapps.caa.co.uk/docs/33/SARG_WGS84_Jan2015.pdf

12 http://www.caa.co.uk/application.aspx?catid=33&pagetype=65&appid=11&mode=detail&id=4484

13 CAP 778 Policy and Guidance for the Design and Operation of Departure Procedures: http://publicapps.caa.co.uk/docs/33/CAP778.pdf

Telephone: 020 7453 6510 Email:
airspace@caa.co.uk

Annexes:

A. Application Requirements

ANNEX A TO
SARG POLICY STATEMENT
PBN REPLICATION
POLICY DATED 02
January 2018

PBN IFP APPLICATION REQUIREMENTS

1. Sponsors are to complete and submit Form DAP 1916 to SARG via airspace@caa.co.uk. The application should include the following information:

   - Target implementation AIRAC date.
   - New STAR Designator proposal as per ICAO STAR naming convention
   - New 5LNCs required (list 5LNCs reserved), including validated co-ordinates as per SARG Policy Statement.
   - DME/DME coverage (to ensure DME coverage is provided; confirm evidence has been supplied by the APD).
   - Confirmation that there is no change to RCF, or insert details if applicable.
   - Confirmation that interacting ATS Routes/SIDs/STARs are not affected.
   - Confirm any changes to airspace containment (SID/STAR or hold).
   - Confirmation chart agreed with APD prior to submission (provide copy with submission).
   - Confirmation that the associated conventional hold is proposed to be re-designated in accordance with paragraph 6.20.

2. The sponsor's APD is to submit the PBN replication designs to SARG IFP.

3. As it is anticipated that no change in track over the ground results from PBN replication, there is no requirement to produce track density plots unless unusual circumstances prevail. In such cases the SARG Case Officer will notify the sponsor of any specific requirements arising during analysis of the application.

4. The time for SARG CO regulatory analysis cannot be prescribed and is dependent on other ongoing project work at time of submission. However, it is highly likely that a complete approval could be expected once the SARG IFP technical assessment has been completed.

5. The assessment and approval of PBN IFP replications will be carried as described in Article187 of CAP 393. For specific sponsors' target implementation dates, the sponsor should discuss options with SARG IFP and whether these desired implementation dates are achievable before submitting the procedure.

6. Impacts of re-designated conventional holds into RNAV holds and new RNAV holds on existing controlled airspace are to be detailed in Section 3 of the application.