UK Civil Aviation Authority

UK Guidance for Operators/Pilots RNAV Substitution

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Chapter 1

Introduction

Methods of navigating in UK airspace, like those in Europe and elsewhere, are changing. The means of navigation within the airspace is moving from a network of ground-based radio navigation aids such as Doppler VOR (DVOR), DME and NDB, to one defined by Performance-based Navigation (PBN) whereby reliance is made on use of area navigation techniques requiring a certified airborne navigation capability. In many respects, the global standards and requirements for both airborne equipment and flight crew qualification have evolved to the point of PBN fast becoming the everyday norm, whereas UK airspace still contains routes and procedures predicated on traditional ground-based radio navigation aids. Some airspace has already transitioned to PBN e.g., ATS routes, but many UK airports are still heavily dependent on ground-based radio navigation aids, especially for Standard Instrument Departures (SIDs).

Whilst PBN exploits the performance available from Global Navigation Satellite Systems (GNSS) and their augmentations, certain ground-based radio navigation aids will continue to play a significant part in the UK navigation infrastructure. In the event of loss of GNSS, the UK is developing a Minimum Operational Network (MON) to provide a means of supporting contingency procedures.

During this transition period there will inevitably be a continued dependency on conventional instrument flight procedures.

The programme for the modernisation of the UK airspace is being deployed over a medium to long-term timeframe. The use of FMS/RNAV system provides an alternate means of primary navigation on conventionally defined instrument flight procedures in the interim, pending the introduction of permanent PBN procedures. These systems rely upon use of either a “fix” or an FMS Coded Overlay to apply a technique referred to as RNAV substitution.

RNAV Substitution can have significant operational benefits:

- reduced light crew workload;
- common operating procedures across a range of routes and instrument flight procedures can be employed by flight crew; and
- full functionality of modern navigation displays is maintained thereby improving situational awareness.

This operational guidance is applicable to RNAV Substitution within UK airspace by UK operators/pilots in support of any applicable UK Regulation which will always take primacy.

Therefore, UK Operators/pilots must remain compliant with:

- all applicable requirements of UK Regulation (EU) No. 965/2012 Air Ops, for example; Instrument Data Equipment (IDE);
- the aircraft's AFM; and
- the aircraft's MEL.

UK aerodrome operators and ANSPs should refer to CAP1781 for guidance on their requirements relating to RNAV Substitution.

Third Country Operators (TCOs) may use this guidance within UK airspace subject to acceptance by their Regulating Authority.

Chapter 2

Definitions

Area navigation system

A navigation system is either an RNP system or an RNAV System depending on its performance capabilities[1].

Fix

A geographical position determined by visual reference to the surface, by reference to one or more radio navigation aids, by celestial plotting, or by another navigational device.

Note: Fix is the generic name for a geographical position and may alternatively be referenced as a fix, waypoint, intersection, reporting point, etc.

Fix Substitution

Use of an area navigation system or equipment to substitute a Fix defined by a ground-based navigation aid.

FMS Coded Overlay

A generic term used to describe an airborne navigation system data base coding in accordance with ARINC Specification 424[2] (or equivalent) provided by a Navigation Data Provider, representing a conventionally defined instrument flight procedure, that may be stored in a Flight Management System (FMS) or Area navigation system.

The FMS Coded Overlay provides lateral and vertical navigation guidance which has the appearance of an RNAV/RNP procedure.

Note: The FMS Coded Overlay is neither State approved or assessed for obstacle protection nor is it standardised across the different navigation data providers.

RNAV Substitution

Is the ability to use the FMS/RNAV system instead of conventional radio navigation aids

Note: RNAV Substitution depends on a coding of the conventional procedure into the navigation data base whereas it has not been originally designed with that intention. Consequently, there are limitations associated with RNAV Substitution and required operating procedures, in order to maintain the equivalent level of safety.

[1] ICAO Doc 9613 Edition 5, Performance-based Navigation (PBN) Manual

[2] Industry standard – ARINC Specification 424 – Navigation System Database

RNAV System

A navigation system which permits aircraft operation on any desired flight path within the coverage of station-referenced navigation aids or within the limits of the capability of self-contained aids, or a combination of these. An RNAV system may be included as part of an FMS.

Chapter 3

General Requirements

An operator/pilot may fly conventional procedures using the FMS/RNAV system for primary navigation without monitoring the raw data of the radio navigation aids designated by the conventional procedure, provided that the scope, limitations, operational criteria and procedures, and training defined within this CAP for the use of RNAV Substitution, are complied with.

UK operators/pilots are expected to have made the appropriate amendments to relevant parts of their Operations Manual detailing procedures and flight crew training pertinent to the use of RNAV Substitution. Utilising their Management System, operators should manage associated risks in implementing RNAV Substitution operations.

Chapter 4

Scope and Limitations

Applications of RNAV substitution are used to:

- determination of aircraft position relative to or distance from:
  - a Very High Frequency Omnidirectional Radio range (VOR);
  - a Marker;
  - a DME fix; or
  - a named fix defined by a VOR radial or Non-Directional Beacon (NDB) bearing and DME distance;
- navigation to or from a VOR, or NDB,;
- holding over a VOR, NDB, or DME fix;
- flying an arc based upon DME;
- fly an overlay of a conventional departure, arrival, approach or route except as lateral guidance in the final approach segment of an instrument approach procedure;
- fly a procedure where the chart contains a note requiring a particular type of conventional navaid, e.g. “ADF required”

RNAV substitution shall not be applied to any route or procedure where RNAV substitution has been indicated as “not authorised” in the UK Aeronautical Information Publication (AIP) entry or by NOTAM.

A number of DVORs that have been identified for removal as part of the UK’s DVOR Rationalisation Programme will be decommissioned and will no longer be available to support the operation of aircraft. These DVORs will still be published in the UK AIP, thereby enabling coding houses to maintain coded overlays for the affected conventional instrument flight procedures in support of RNAV Substitution. The AIC “Y – Promulgation In The UK AIP Of RNAV Substitution To Conventional Procedures Dependant On Ground Based Navigation Aids Targeted For Removal” lists the DVORs that are removed and is periodically updated. Operators/Pilots should maintain their awareness of these affected conventional aids when creating their contingency procedures to ensure in the event of a loss of GNSS capability, the remaining on-board equipment shall allow safe navigation.

For the Initial, Intermediate and Missed Approach segments of an Instrument Approach Procedure (IAP), the entire procedure must be coded as an overlay procedure, from which it may be selected from the navigation data base and executed.

Additional information regarding the validation of procedures and the use of radio navigation aids is provided in the Quality Assurance Manual for Flight Procedure Design (Doc 9906), Volume 5 - Validation of Instrument Flight Procedures; and the Performance-based Navigation (PBN) Manual (Doc 9613).

Chapter 5

Operational Criteria

The FMS/RNAV system installation in the aircraft shall be certified for either RNAV 1 or RNP 1 or Advanced RNP.

RNAV substitution shall be restricted to operators/pilots authorised for either RNAV 1, RNP 1 or Advanced RNP.

The operator/pilot shall establish and document:

- a policy for the use of RNAV Substitution. Depending on its operational constraint(s), the operator/pilot may decide to limit the use of RNAV Substitution to particular cases;
- standard operating procedures to be used by the flight crew when utilising the FMS/RNAV system for substitution, complying with any procedures and/or limitations developed by the aircraft manufacturer in its documentation (Aircraft Flight Manual (AFM), Quick Reference Handbook (QRH), etc.);
- contingency procedures in the event of loss of GNSS capability for whatever reason, and
- training for the use of RNAV substitution. The training programme (see Chapter 7) shall, as a minimum, include the scope, limitations, operational criteria and procedures defined within this CAP. Such training shall be extended to support staff, as applicable.

The operator/pilot shall ensure that the Minimum Equipment List (MEL) is updated to include operating limitations associated with the FMS/RNAV system and any other related system.

The operator/pilot shall verify that conventional radio navigation aids intended to be substituted are coded in the FMS/RNAV system database, so that they can be used as a waypoint.

The operator/pilot shall verify that the conventional procedure intended to be flown is coded in the FMS/RNAV system database. Depending on the complexity of the conventional procedure e.g., several conventional radio navigation aids involved in the path definition with several turning points, a flyability check may be considered necessary.

Chapter 6

Operating Procedures

The pilot-in-command is responsible for:

- ensuring that in the event of the loss of GNSS capability, the remaining on-board equipment shall allow safe navigation;
- applying pre-flight procedures associated with GNSS use e.g., Receiver Autonomous Integrity Monitoring (RAIM) check, if applicable;
- if RNAV is based on DME/IRS, carry out a navigational accuracy check before commencing the procedure;
- checking that the navigation database is current;
- ensuring that any procedures and waypoints used are retrieved from the navigation database;
- verifying waypoint sequence, reasonableness of track angles, and distances of any coded overlay procedure;
- apply appropriate procedures to confirm distances where the use of RNAV Substitution is used to replace offset DME with a zero-range indication, associated with an IAP;
- ensuring that FMS/RNAV system and the GNSS systems are operational; and
- complying with any limitation on RNAV Substitution in the AFM and other manufacturer’s documentation.

Chapter 7

Pilot Training

The pilot, as a minimum, shall be trained in:

- the limitations of RNAV Substitution;
- the operator's policy and operating procedures; and
- contingency procedures to continue safe navigation in the event of loss of GNSS capability.