DVOR / DME / NDB Rationalisation:

Guidance for the use of RNAV Substitution

CAP 1781

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Civil Aviation Authority
Aviation House
Beehive Ring Road
Crawley
West Sussex
RH6 0YR

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Enquiries regarding the content of this publication should be addressed to: airspace.policy@caa.co.uk

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Chapter 1

Introduction

The CAA Guidance for the Use of RNAV Substitution has been produced in support of a programme of airspace modernisation in the UK. The CAA's Airspace Modernisation Strategy (CAP1711) was published on the 17th December 2018. NATS[1] has embarked on proposals for significant airspace changes in the Scotland, the North of England and the South East (London Terminal Manoeuvring Area) of England, and aerodromes are developing complementary plans providing connectivity with the Network.

A key enabler to airspace modernisation in UK airspace is the ICAO concept of Performance-based Navigation (PBN) with attendant reliance on Area Navigation (RNAV) techniques. Prior to the UK exit from the EU on 31 December 2020, industry was preparing to respond to significant policy and regulatory requirements affecting aerodromes and ANSPs, that necessitated major airspace changes.[2] These changes, whilst not directly aligned with EU regulations, took the same direction of travel in terms of airspace modernisation and moves towards an Exclusive use of PBN. The Government of the UK has retained elements of EU regulations but has indicated a desire to establish a UK Air Traffic Management (ATM) regulation that will enshrine future UK objectives for airspace, including PBN – see Chapter 3.

With RNAV, the reliance on satellite-based navigation positioning and a reduced dependency on conventional ground-based navigation aids such as DVOR, NDB and DMEs, has an impact on the numbers of such facilities that NATS requires to retain, for its future navigation infrastructure.

[1] NATS Holdings Ltd, the biggest air navigation services provider in the UK, provides air traffic control services through two principal subsidiaries: NATS (En Route) plc (called NERL) and NATS (Services) Ltd (called NSL), which provides air traffic services on a commercial basis. This strategy document concerns NERL only, and not the commercial work of NSL. NERL is the sole provider of air traffic control services for aircraft flying 'en route' in UK airspace and provides some air traffic control services in the eastern part of the North Atlantic, as well as providing a combined approach function (London Approach) for five London airports.

[2] EU regulations

Commission Implementing Regulation (EU) 2017/373 – laying down common requirements for providers of air traffic management/air navigation services and other air traffic management network functions and their oversight

Commission Implementing Regulation (EU) No 716/2014 - Pilot Common Project (PCP)

Commission Implementing Regulation (EU) 2018/1048 - PBN IR

In 2009, NATS consulted on a DVOR Minimum Operational Network (MON) comprising 19 en-route DVORs. CAA have since approved the decommissioning of 27 en-route DVORs and the removal of all en-route NDBs. DME facilities will be optimised for geometry and coverage. The dependency of aerodrome procedures on en-route ground-based navigation aid facilities has evolved over time and the decommissioning of these facilities has implications on the support of terminal procedures.

This Guidance may be applicable to certain sponsors[3] where Instrument Flight Procedures, based on conventional navigational aids (DVORs, DMEs and NDBs), are proposed to be removed by NATS (En-Route) plc (referred to as NERL throughout this document), through the NATS Rationalisation Programme, or are desired to be permanently removed/decommissioned for reasons beyond the control of the affected aerodrome.

This Guidance is not intended allow use of RNAV Substitution unless there is evidence and a written statement that other avenues have been explored. There are significant safety mitigations that are required and therefore this Guidance may not be applicable to all sponsors.

The Guidance, if the conditions are satisfied, will allow the CAA to approve an aerodrome to notify customer airlines and other users[4] that RNAV Substitution shall be used for a limited time period. This Guidance will not exempt aerodromes from other Legislative requirements.

This Guidance applies to the use of a suitable RNAV system as the Primary Means of Navigation when a DVOR, DME or NDB are out-of-service or removed for longer than 6 months and the pilot can use the RNAV or Flight Management System (FMS) to fly an overlay of the conventional procedure, without monitoring the underlying navigation aid. The term used within this Guidance is, RNAV Substitution.

For the purposes of RNAV Substitution in UK airspace, the CAA has assumed that, as a minimum, an RNAV 1 qualification (airworthiness approval and operational authorisation), is required. Given that the conventional procedures at risk are all terminal airspace procedures, this performance and functional assignment is deemed sufficient for the purposes of supporting RNAV Substitution.

General Requirements and Guidance to operators/pilots on the use of RNAV Substitution has been developed separate from this Guidance and is published in

[3] Sponsor – Aerodrome licence holder or representative from an Aerodrome acting on the Licence holder's behalf, or an ANSP, who proposes a new design, changes to, or withdrawal of an IFP. (CAA)

[4] Users of the aerodrome or in some limited cases other interested parties where it could reasonably be assumed that the aerodrome making the application could have foreseen use.

CAP 1926[5]. This Guidance (within CAP 1781) is therefore only applicable to the providers of air traffic management/air navigation services (ATM/ANS).

This Guidance only refers to the radio ground-based navigation aid being removed. It is not intended to cover temporary outages such as planned/unplanned short-term outages due to maintenance and or unexpected unserviceability periods.

Every such application of RNAV Substitution must be approved by the CAA and annotated on the procedure chart in the UK Aeronautical Information Publication (AIP). RNAV Substitution is intended to maintain existing tracks over the ground for an agreed period, during which the affected airspace is being redeveloped (CAP 1616 Airspace Change Process refers). It should be stressed that it is not an alternative to a fully compliant PBN procedure predicated on RNAV or RNP navigation specifications e.g., RNAV 1 or RNP 1, and as required by the Airspace Modernisation Strategy (AMS) e.g., either replication of a conventional procedure or a totally new track over the ground.

The Second Edition of CAP 1781 introduces a new section in Chapter 3 detailing the Retained UK PBN Regulations Post EU Exit. In Chapter 5, reference has been made to replacement of a SID with an Omnidirectional Departure procedure and in Chapter 6, the Miscellaneous Notes have been revised to clarify the status of Preferred Departure Routes (PDR) and Standard Departure Routes (SDR).

[5] CAP1926: General Requirements and Guidance Material for the use of RNAV Substitution (caa.co.uk)

Chapter 2

Purpose and scope

This Guidance assumes that in an ideal situation, airspace changes would have been introduced ahead of the radio ground-based navigation aid decommissioning, thereby implementing RNAV or RNP procedures and removing the route and procedure dependency on the conventional navigation aids.

This should be the first resort, unless the sponsor can demonstrate to the CAA that this would be detrimental (e.g., safety, environmental or economic) ahead of planned airspace redevelopment or demonstrated that this cannot be implemented for another reason of significance.

All options should be explored by a sponsor, before application can be made for the use of RNAV Substitution, and evidence provided of such to the CAA. The flowchart explaining introduction of RNAV substitution step by step including other options to be considered, is detailed in Chapter 5.

Note: The flowchart list of options are not exhaustive and individual aerodromes may have specific options available that others do not.

If it can be shown that these options are not practical or possible, and to introduce airspace change at this stage is undesirable (economically and socially) and could result in nugatory work, including stakeholder consultation, then the sponsor should examine the Guidance to determine if the aerodrome (including the ANSP as appropriate) could apply its use.

The underlying safety requirements supporting this Guidance have been developed by NATS and are provided in a separate cover document (NATS' Example Safety Approach)[6]. This document identifies the safety assurance activities and safety requirements that should be considered if approval is sought for the use of the RNAV substitution option.

[6] NATS Example Safety Approach is published in conjunction with the CAP1781 (this document) and can be found on the CAA Website as CAP 1781b.

Chapter 3

Airspace Modernisation

One of the aims of the Airspace Modernisation Strategy[7] is to make airspace more efficient – saving time and fuel and reducing emissions. Key to achieving this is improving the accuracy of where aircraft fly by using the Performance based Navigation (PBN) capability of aircraft that places much greater reliance on satellite navigation although ground-based navigation aids will still be retained for resilience and contingency purposes.

The UK airspace air traffic management structures require modernisation to accommodate the increasing demand for commercial air travel whilst safely accommodating increasing demands for airspace access from other users. The Airspace Modernisation Strategy sets out a shared objective between the Civil Aviation Authority and the Department for Transport for modernising airspace which is to deliver quicker, quieter and cleaner journeys and more capacity for the benefit of those who use and are affected by UK airspace.

The highly accurate navigation capabilities of modern aircraft, utilising both ground and space navigational aids provides an opportunity to address the capacity issues of the airspace whilst making best use of the aircraft operators investment.

PBN provides the basis for future global navigation capability as defined in the ICAO Global Air Navigation Plan (GANP) and defined in Airspace System Block Upgrade (ASBU) programme, with airline operators keen to utilise the technology on their aircraft fleets.

European Regulatory Requirements Linked to PBN

European legislation containing requirements for airspace usage (AUR) dates from 2014 with the publication of Commission Implementing Regulation (EU) No 716/2014 on the establishment of the Pilot Common Project (PCP supporting implementation of the European Air Traffic Management Master Plan. The PCP included mandates for the deployment of key ATM Functionalities (AF) or technologies, one of which, AF#1, described the deployment of PBN in high density TMAs as from 24 January 2024. Within the UK, the PCP applied to London Heathrow, London Gatwick, London Stansted and Manchester airports.

In 2018, Commission Implementing Regulation (EU) 2018/1048 was published laying down airspace usage requirements and operating procedures concerning PBN – the PBN IR. This regulation is more far reaching and applies to all Instrument Runway

[7] Airspace Modernisation Strategy (CAP1711) published in December 2018.

Ends (IRE), Arrival and Departure procedures and to ATS routes for en-route operations. The Annex to the regulation includes a new Subpart PBN and EASA has published Guidance Material (GM), supporting the regulation.

The PBN IR aims to provide the impetus for all EASA aerodromes and providers of ATM/AMS to deploy PBN as a safer alternative to non-precision approach procedures, deliver a consistent approach to PBN deployment in en-route, terminal and airport operations whilst ultimately using PBN as sole means of navigation by 2030.

The PBN IR also legislates for an "Exclusive use of PBN" by 06 June 2030, whereupon providers of ATM/ANS shall not provide their services using conventional navigation procedures. Therefore, it is incumbent on those providers to develop transition plans to include the removal of all dependencies through rationalisation of conventional navigation aids and procedures.

The European Commission recognised that the PCP required updating and that for PBN, it overlapped with the PBN-IR. Commission Implementing Regulation (EU) 2021/116 was published on 01 February 2021 establishing the Common Project One and repealing the PCP. CP1, as it is known, has no specific requirements for PBN, although an RNAV capability is required in support of free route airspace.

Retained UK PBN Regulations Post EU Exit

The UK has only retained elements of EU ATM regulations that were in force on 31 December 2020. This includes the former SESAR Pilot Common Project (PCP). Whereas the Government of the UK consulted with industry, and it was anticipated that the retained PCP legislation would be repealed bringing forward a UK variant of CP1, this has not come into effect. Therefore, the retained UK Regulation – UK Reg (EU) No 716/2014[8] (the UK Pilot Common Project Regulation) still includes mandates for the deployment of PBN in high density TMAs, although the date is now from 31 December 2027.

The UK Pilot Common Project Regulation still applies to London Heathrow, London Gatwick, London Stansted and Manchester airports. The above airports are required to comply with the requirement as follows:

"Enhanced Terminal Airspace using RNP-Based Operations consists of the implementation of environmentally friendly procedures for arrival/departure and approach using PBN in high-density TMAs, as specified in the following navigation specifications:

[8] law-716-2014-pilot-common-project-march-2022-version.pdf (caa.co.uk)

- SIDs and STARs using the RNP 1 specification with the use of the Radius to Fix (RF) path terminator
- Required Navigation Performance Approach with Approach Procedure with Vertical guidance (RNP APCH with APV)

Enhanced Terminal Airspace using RNP-Based Operations includes:

- RNP 1 SIDs, STARs and transitions (with the use of the Radius to Fix (RF) attachment)
- RNP APCH (Lateral Navigation/Vertical Navigation (LNAV/VNAV) and Localiser Performance with Vertical guidance (LPV) minima".

Whereas the Government of the UK retained those elements of the EU PBN IR that were in force on 31 December 2020, this only addresses PBN Transition Plans, RNP APCH at non-instrument runway ends and en-route operations AT or ABOVE FL150. The retained EU legislation may be found in AUR Performance Based Navigation UK Reg (EU) No 2018/1048 (the UK PBN Regulation)[9].

Guidance Material (GM)[10] is published on the CAA web site addressing guidance to Articles 5 and 6 of the regulation and to AUR.PBN.2005 of the Annex.

Note: GM1 AUR.PBN.2005(1) & (3) have been deleted as they relate to EGNOS and SBAS, neither of which now apply to the UK.

Industry will have to wait until a clearer picture of UK ATM legislation emerges, reflecting both the current AMS initiatives (#7/8 and 14) and the refreshed strategy moving towards ICAO aligned elements, implementation priorities and expansion of AMS to address all aspects of UK controlled and uncontrolled airspace. Whatever form of legislation for PBN is developed, the goals of AMS will most likely be aligned with the European Regulations and it is entirely realistic to expect an Exclusive use of PBN in UK airspace in the 2030 timeframe.

[9] law-2018-1048.pdf (caa.co.uk)

[10] AMC/GM to AUR (caa.co.uk)

Chapter 4

Identification of DVORs, DMEs and NDBs at risk

In line with changes of technology and new regulatory requirements, arising both from national and international legislation, the project to remove NERL's en route dependency on navigation aids was developed in consultation with the CAA and was approved by a UK National Air Traffic Management Advisory Committee (NATMAC) formal consultation in August 2008 and October 2009.

This consultation outlined the proposed rationalisation of the UK DVOR infrastructure down from the current 46 DVORs to 19 and removal of the 10 en-route NDBs operated by NATS. As each of the navigation aids that are to be withdrawn are taken out of service and decommissioned the conventional procedures that reference the navigation aid will no longer be valid and replacement procedures that are independent of the navigation aid will need to be in place In some cases where a DVOR is collocated with a DME, the DME may also be removed or relocated.

If a sponsor wishes to consider use of this RNAV Substitution guidance as an alternative to a replacement procedure, prior approval from the CAA must be obtained.

The NATS En-route procedures such as STARs and Holds that are predicated or make reference to a navigation aid that is to be removed, will either be deleted or replaced with suitable RNAV procedures ahead of the navigation aid being decommissioned – termed the removal of NATS dependency. However, those procedures that are owned by Airports that are impacted by the rationalisation programme, will also need to have their dependency removed.

As stated by the CAA in its Decision on modifications to NATS (En route) plc. licence in respect of reporting and Specified Services CAP 1253, published in January 2015: "A rationalised DVOR backbone capability will be retained to provide a contingency and operational resilience for RNAV-5 reversionary provision, until at least 2030."

Details of this undertaking were approved by the CAA at the start of the rationalisation project and have been communicated to all parties over the last ten years through forums such as the NATMAC and ICAMS - Industry Coordination for the AMS, formally the Future Airspace Strategy Industry Implementation Group (FASIIG).

NATS Formal Notice – UK NAVAIDS Rationalisation Project

NATS issued a Formal Notice letter on 12 October 2018 to the following airports:

Birmingham Airport

Bournemouth International Airport

Brighton City Airport

Bristol Airport Ltd

Cambridge International Airport

Cardiff Airport

Coventry Airport

Cranfield Aerodrome

Denham Aerodrome

Doncaster Sheffield Airport

Duxford Aerodrome

East Midlands Airport

Edinburgh Airport

Glasgow Airport Ltd

Glasgow Prestwick Airport Ltd

Guernsey Airport

Heathrow Airport Ltd

Leeds Bradford Airport

Liverpool John Lennon Airport

London Biggin Hill Airport

London City Airport

London Elstree Airfield

London Gatwick Airport Ltd

London Luton Airport

London Oxford Airport

London Southend Airport

London Stansted Airport Ltd

Lydd Airport

Manchester Airport

Ports of Jersey Ltd - Jersey Airport

RAF Northolt

Redhill Aerodrome

Retford (Gamston) Airport

Rochester Airport

Southampton International Airport Ltd

TAG Farnborough Airport

Formal Notice

This letter constituted a formal notification to impacted airports for removal of dependencies on NERL's navigation aids.

Whereas at least one year's notice is required, NERL is giving a longer notice period in recognition of the potential challenges that such removal of dependencies may bring.

NERL will remove its remaining en route navigation aid dependencies by 2021. All affected aerodromes/airports are required to have removed all dependencies from the following navigation aids by December 2022 at the latest:

DVORs		NDBs
Barkway	London	Burnham
Biggin Hill	Lydd	Chiltern
Bovingdon	Manchester	Epsom
Brecon	Mayfield	Henton
Brookmans Park	Midhurst	New Galloway
Daventry	Ockham	Westcott
Detling	Perth	Whitegate
Dover	Southampton	Woodley
Gamston	Turnberry	
Glasgow	Trent	
Goodwood		
Lambourne		

Next steps

NERL provided the following advice:

If an airport or group of airports wishes to rely on a navigation aid beyond December 2022, it may be possible for NERL to delay decommissioning and continue its support infrastructure on a reasonable endeavours' basis under reasonable commercial arrangements.

NERL in the same Formal Notice reminds airports of the following terms:

Please note that, unless a signed agreement with NERL is in place by 01 December 2022, the navigation aids will be decommissioned thereafter.

Who are the affected stakeholders?

Aerodromes with Textual Data and/or Charts Related to the Aerodrome notified in the UK AIP and ATC procedures dependent on use of DVOR/DME/NDB facilities.

Commercial and non-commercial operators using those Aerodromes.

Military Airfields and No 1 Aeronautical Information Documents Unit (No 1 AIDU) – En-Route Supplements (ERS), British Isles and North Atlantic (BINA).

Airspace users outside of the Aerodromes that would otherwise use the navigation facility information for a variety of purposes, including:

- Training
- For navigation in IMC conditions outside of controlled airspace
- As an aid to VFR navigation
- As a means to avoid airspace infringement

Third party navigation data and chart providers.[11]

UK Aeronautical Information Service Provider (AISP) – publication of Amendments and Supplements to UK AIP, VFR charts and depiction of navigation facilities on 1:500,000 and 1:250,000 charts.

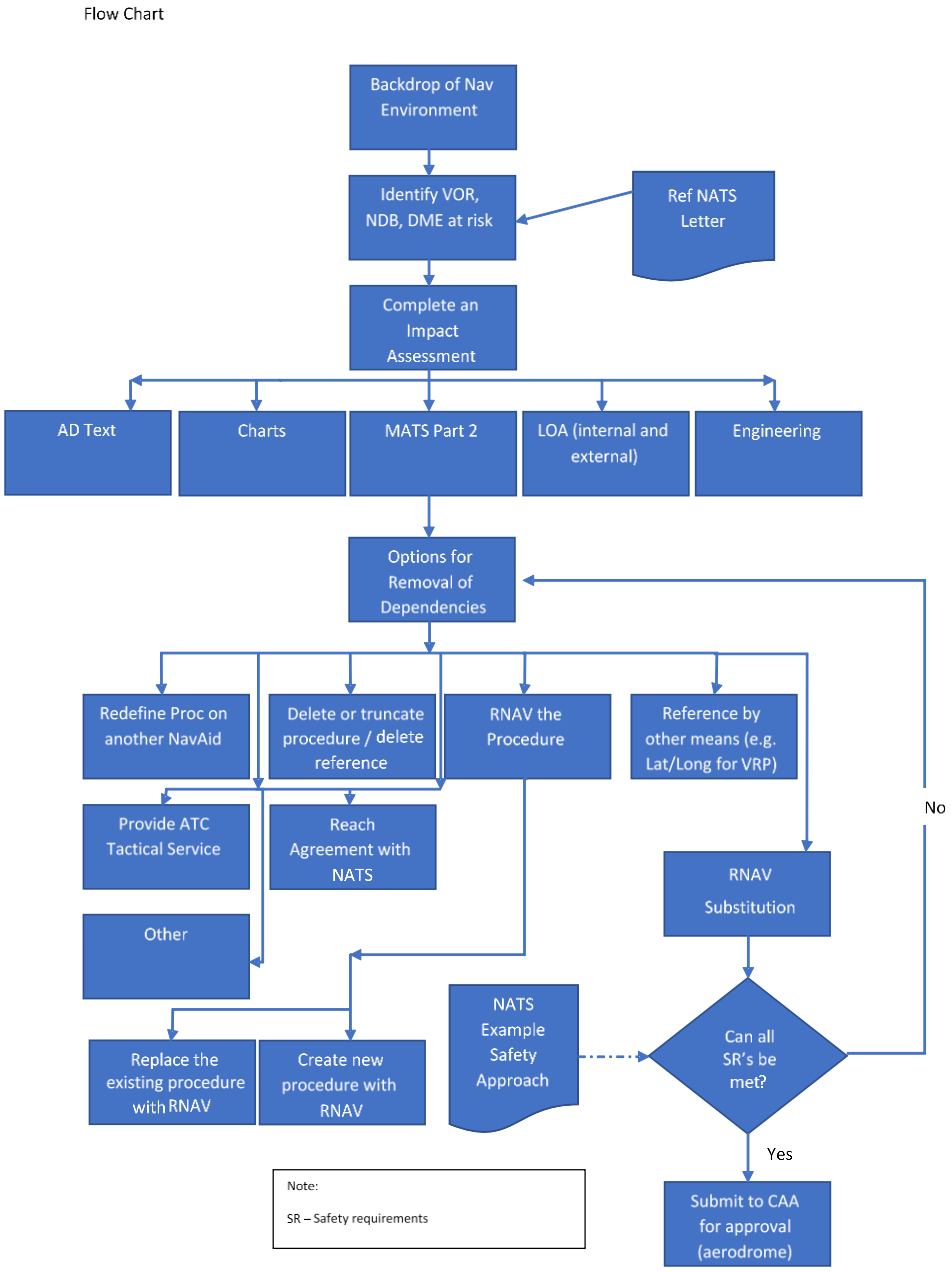
CAA – resourcing the agreement of Aerodrome mitigation strategies and amended ATC procedures.

[11] Data services providers in and out of the scope of UK Reg (EU) 2017/373 (the UK ATM Provision of Services Regulation) pertaining to Part-DAT certification. law-2017-373-25-january-2022-version.pdf (caa.co.uk)

Chapter 5

Preparatory steps to be undertaken before application to the CAA for use of RNAV Substitution

The flow chart below outlines the steps that should be taken in making an assessment of options for removal of dependency on the conventional navigation aid at risk.



Note: Redefinition, or truncation, or a new RNAV procedure or referencing a procedure to other means will require the sponsor to engage with a CAA Approved Procedure Design Organisation (APDO).

Complete an Impact Assessment

Sponsors who may wish to consider applying for the use of RNAV Substitution techniques in lieu of DVOR/DME/NDB information, should undertake a comprehensive impact assessment for each navigation aid that is affected. This assessment should be specific to the ATM operation.

An Example Safety Approach is provided in CAP 1781b as a companion document to this guidance; this illustrates a method for capturing the safety information required for the impact assessment.

The CAA will expect as a minimum the following aspects to be included in the impact assessment.

General

- Review of UK AIP to identify any references to the Navigation aid being removed that may impact the Aerodrome or adjacent aerodrome.
- The review must include the textual part of the UK AIP and not solely the Instrument flight procedure charts.
- Review all local procedures and instructions to identify any references to the navigation aid being removed
- A check of the date of the last 5-year periodic review of the IFPs. If the review date is due or within 2 years of being due the IFPs will need the 5-year periodic review to be completed by a CAA APDO in accordance with CAP 785 Volume I and II. The RNAV Substitution approval cannot be for longer than the time the 5-year periodic review is still valid, unless substantiated and approved by the CAA.

Specific Considerations

AD Text

- AD 2.19 Radio Navigation and Landing Aids
- AD 2.20 Local Traffic Regulations
- AD 2.21 Noise Abatement Procedures including Noise Preferential Routes (NPR)
- AD 2.22 Flight Procedures
- Procedures for Inbound Aircraft, including procedures via Airways
- Procedures for Outbound Aircraft, including Standard Departure Routes (SDR), Preferred Departure Routes (PDR) and procedures via Airways
- Radio Communication Failure (RCF) Procedures
- VFR Flight Procedures

Note: SDR, PDR and RCF procedures are not typically coded in the FMS navigation data base. Initial Approach Procedures without radar control are typically coded.

Charts Related to Aerodromes

The area of the UK AIP to be assessed is as follows:

AD 2 EGXX 1

AD 2 EGXX 2-X

AD 2 EGXX 3-X

AD 2 EGXX 4-X

AD 2 EGXX 5-X

AD 2 EGXX 6-X

AD 2 EGXX 7-X

AD 2 EGXX 8-X

Examples of instrument flight procedures potentially impacted, include:

- Departure procedures (SIDs)
- Initial approach procedures
- ILS Missed approaches or an RNAV Approach with a conventional Missed Approach including low level holds
- CTR local flying and entry/exit procedures
- Helicopter routes in CTRs
- Helicopter crossing operations
- Air Traffic Control Surveillance Minimum Altitude Charts (ATCSMAC)[12]

RNAV procedures apart from RNAV IAP with conventional missed approach, Standard Departure Routes and Preferred Departure Routes are out of scope.

ATC Procedures

- MATS Part 2: Sponsors should consider interactions with other ATC Units[13] and parent ATSU when undertaking this part of the impact assessment.
- Impact on adjacent States
- ATC Letters of Agreement (LoA)

Other Stakeholders

Sponsors should consider all interactions with local airspace users including how the affected navigation aid may be used in local airspace management including prevention of airspace infringements.

[12] CAP 777: ATC Surveillance Minimum Altitude Charts in UK Airspace Policy and Design Criteria (caa.co.uk)

[13] Sponsors should include Military Units as appropriate UK Mil AIP | Home (mod.uk)

It is NERL's responsibility to consider the impact on other stakeholders not directly using the aerodrome services. The CAA considers the sponsor to have local knowledge and expertise regarding their local airspace management and all pertinent information should be made available to NERL. The CAA will expect the sponsor to provide evidence of this engagement as part of the approval submission.

Options for Removal of Aerodrome Dependencies on Navigation Aids at Risk

Having conducted an in-depth impact assessment, the sponsor is faced with considering how to remove the route and procedure dependency on the conventional navigation aid at risk. As discussed in Chapter 2, in an ideal situation the sponsor should be bringing forward an airspace change implementing either RNAV or RNP procedures, ahead of the navigation aid decommissioning.

The CAA will expect, as a minimum, the following options to be considered as part of this process:

Redefine the Procedure on an Alternative Navigation Aid

Where other suitable Navigation aids are available it may be possible to redefine, the procedure using alternatives to the aid being withdrawn. In selecting this option, sponsors need to be aware of the long-term plans for the alternative aid and any requirements to comply, including transition plans for the PBN IR and performance requirements such as Designated Operational Coverage (DOC) requirements.

Delete or Truncate the Procedure / or delete reference to navigation aid or replace a SID with an Omnidirectional Departure procedure

Where procedures are rarely flown or exist for specific circumstances that may no longer apply it may be appropriate to remove the procedure from the UK AIP.

Note: If the procedure is part of an RCF procedure, it cannot be removed without alternative procedures being proposed and approved.

In some cases, it may be possible to truncate the procedure such that it either starts after the navigation aid being withdrawn or completes before it.

Alternatively, a deleted procedure may be replaced by the introduction of an Omnidirectional Departure procedure.

Truncation, deletion and replacement with Omnidirectional Departures will require the Airspace Change Process to be followed.

Replace the conventional procedure with PBN

- Replicate an existing procedure using RNAV[14] design criteria
- Design a new procedure using RNAV[15] design criteria

Reference by Other Means

Traditionally some items such as VRPs and Reporting Points have included a VOR radial and distance in their definition as an aid to navigation. Subject to agreement by the CAA, where the item is defined by other means and the VOR radial and distance are an additional part of the definition then the VOR reference can be deleted. Where the item is only defined using the VOR radial and distance it may be possible to redefine it as a Lat/ Long.

Provide ATC tactical Service

For some procedures it may be possible for ATC to provide a tactical service (including terrain clearance) as an alternative to aircraft using the procedure. In these instances, the Airspace Change Process may still apply.

Reach an Agreement with NERL

If an aerodrome or group of aerodromes decides that all the other options for removal of dependencies are impractical and they wish to rely on a navigation aid which is due to be withdrawn beyond the December 2022 deadline it may be possible for NERL to delay decommissioning and continue its support of that navigation aid on a reasonable endeavours basis under commercial arrangements agreed between NERL and the aerodrome or group. This option would not be possible for those navigation aids expected to have safeguarding issues in the period beyond 2022.
Note: This is not an exhaustive list and individual aerodromes may have specific options available that others do not.

Summary

Once complete, the Impact Assessment, detailing all of the dependencies for the respective conventional navigation aid to be decommissioned, should be submitted to the CAA for review and acceptance.

If it can be shown that having explored all available options, none are practicable and that in the context of wider airspace modernisation to introduce an airspace change at this stage is economically and socially undesirable and could result in nugatory work, including

[14] SID/STAR/Holding Replication Policy: http://publicapps.caa.co.uk/modalapplication.aspx?catid=1&pagetype=65&appid=11&mode=detail&id=7548

[15] CAP1616: Airspace change: Guidance on the regulatory process for changing the notified airspace design and planned and permanent redistribution of air traffic, and on providing airspace information (caa.co.uk)

stakeholder consultation, then it may be possible for the sponsor to consider applying for the use of RNAV Substitution.

The Example Safety Approach provided in CAP 1781b presents an illustration of the safety requirements that should be considered if approval is to be sought for the use of the RNAV Substitution option.

Note: The RNAV Substitution option is not without additional work and will require resources to establish and maintain the temporary arrangements, until an airspace change with PBN procedures can be fully implemented.

Chapter 6

Application for the use of RNAV Substitution

Having made a case for selecting the use of RNAV Substitution as the means of mitigation, the sponsor will be required to develop the necessary evidence items in support of a request to the CAA for approval.

The sponsor is recommended to undertake the following steps:

- Ensure that all of the Safety Requirements have been met.
- Engage with their operators and other aviation stakeholders, including local general aviation clubs – if applicable, to ensure that all are aware of the planned change and are able to use the routes/procedures. If the operator cannot use RNAV substitution, what scope exists for offering a tactical service to that operator? The engagement is not that which CAA would expect to see as part of a formal ACP consultation, but the CAA may wish to see evidence that engagement has taken place.
- Ensure that where RNAV Substitution is to be applied, the affected conventional instrument flight procedures have undergone a recent 5-year periodic review.
- Submit an Airspace Change Proposal in accordance with CAP 1616 including the proposed changes to the UK AIP and including textual and chart changes.
- Establish a plan to monitor the tracks for conventional routes and procedures both pre and post implementation of RNAV Substitution, i.e., before and after decommissioning of the navigation aid. The CAA will expect the airport to demonstrate that tracks have not changed.

Note: Sponsors should coordinate the introduction of the changes to the UK AIP AD2 section with NATS AIS, and over the actual switch-off date, with NATS NERL.

Note: The decommissioning of a given en-route navigation aid facility may have impact on multiple airports and require the introduction of RNAV Substitution through multiple ACPs. Their approval and introduction of changes across multiple airport entries in the UK AIP, will also have to be coordinated.

Ensuring all of the Safety Requirements have been met

The Example Safety Approach published as CAP 1781b presents a generic safety argument supported by a set of safety requirements. Sponsors must develop their own safety argument supported by safety requirements to enable the top-level claim that the use of RNAV substitution is acceptably safe for a specific conventional procedure.

The Example Safety Approach may be used as a template for an airport's own safety argument and supporting requirements, but there is not a formal requirement to do so; airports may choose to develop their own safety approach in line with local circumstances.

However, it should be noted that if an airport seeks to use alternative, locally derived requirements, it is recommended that discussion is held with the CAA to determine whether the alternative will be acceptable.

If suitable requirements cannot be identified, or if any of the identified safety requirements cannot be met, the sponsor should revisit the available options specified in Chapter 5.

Note: The CAA has received information from the three major navigation data providers concerning use of certain ARINC 424 Path Terminator types defined by the navigation aid as applied in coded overlays - see Example Safety Approach Safety Requirement (SR 9). The Path Terminators in question include CF, FA, FD, CD, CR, VR, VD and AF. The navigation data providers have assured the CAA that the majority of FMS do not use the actual DME (or VOR) for any Path Terminator construction. It is their understanding that the RNAV/RNP equipment use the DME position to compute a fixed location to construct the flight path. In other words, a waypoint is inserted, from which turn radius, speed and other predictions, and distances or bearings from a Latitude/Longitude may be defined in the data base. The CAA appreciates that with three major navigation data providers and multiple avionics manufacturers with potentially a significant number of different coding solutions for a conventional procedure, it would be impracticable to assure 100% implementation of every single combination of coding and FMS. The CAA is satisfied with the assurances provided and therefore does not require sponsors to check individual coding solutions and accepts that SR 9 is satisfied, subject to the need for post-implementation monitoring of track keeping – see below.

Engagement with Operators and Airspace users

In gathering data for compliance with the Safety Requirements, sponsors should engage with airspace users through appropriate mechanisms e.g., Flight Operations or airline working group, or directly with operators concerned and/or local flying clubs.

Note: Operators and airspace users should be made aware of the extended time period to which RNAV Substitution could be applied.

The aim of any engagement is to ascertain, through reasonable endeavours, whether:

- They have qualification to at least the RNAV 1 navigation specification, requiring airworthiness approval of equipment/aircraft and operational authorisation e.g., Air-OPS or equivalent.
- They can comply with CAP 1926, General Requirements and Guidance Material for the use of RNAV Substitution.
- The operators have coded overlays in their navigation database for the procedures under consideration of this RNAV Substitution guidance

Sponsors should take into consideration the setting of requirements for new operators to the aerodrome. This should address awareness of the application of RNAV Substitution, and the CAA General Requirements and Guidance Material published in CAP 1926.

Instrument Flight Procedure (IFP) 5-Year Periodic Review – Guidance to sponsors

The CAA is keen that the use of RNAV Substitution is seen as being time-limited and therefore have linked that approval to the 5-year periodic review of Instrument Flight Procedures (IFP).

Sponsors should note that despite the adoption of RNAV Substitution for a given conventional procedure, it is essential that the affected procedure is "locked-down". Furthermore, UK Reg (EU) No 139/2014 laying down requirements and administrative procedures related to aerodromes (the UK Aerodromes Regulation)[16] and CAA CAP 785 Volume II still apply in respect of ensuring that the IFPs are safeguarded against the latest aerodrome surveyed data and magnetic variation updates.

The CAA advise that a 5-year review of all affected procedures be completed and approved ahead of the application for the use of RNAV Substitution.

Note: It may be possible to utilise a recent 5-year review if the sponsor can demonstrate that the use of RNAV Substitution will be terminated before the next review is due.

The IFP will be reviewed as a conventional IFP by a CAA Approved Procedure Design Organisation (APDO) as part of the 5-year Review.

True Tracks from the 5-year Review will indicate to AIS which magnetic source is applied to the respective segments of the IFP. Following RNAV Substitution approval, the magnetic variation updates will not be applied by AIS to the UK AIP charts.

Maintenance of the conventional IFP will continue to safeguard against the aerodrome obstacle survey.

Submission to the CAA

Prior to submission of an application for the use of RNAV Substitution, sponsors should engage with the Authority in order to seek early approval of the Impact Assessment and their consideration of the options listed within Chapter 5.

Early engagement and the formal submission should be made to Airspace Change Account Manager within Airspace, ATM & Aerodromes (AAA) of Safety and Airspace Regulation Group (SARG).

CAP 1616 Implications

Any changes to the UK AIP are considered by the CAA as falling within the scope of an Airspace Change Proposal (ACP) and evaluated in accordance with CAP 1616. The level

[16] law-139-2014-aerodromes-reg-publication-version-20220216.pdf (caa.co.uk)

of change will be assessed as part of the review of Statement of Need and the scale of impact.

In the case of RNAV Substitution, having considered factors including the safety argument element, the scale of changes to the UK AIP for a single conventional navigation aid and the duration with which the provisions may remain in place, the CAA believes that a Level 2C change is be more appropriate.

A Level 2C change is typically a change which reflects, the current use of the airspace, or the removal of established airspace structure (such as Standard Instrument Departure truncation) and which does not alter traffic patterns below 7,000 feet (above mean sea level).

The ACP process can still be scaled, and sponsors should discuss the scope of the process with the CAA, when presenting their Statement of Need.

When submitting their ACP, sponsors should include proposals for establishing the baseline for track keeping and continued monitoring of performance, post implementation of navigation aid decommissioning – see below.

The CAA has provided guidance on promulgation of UK AIP changes in APPENDIX A and provided sample chart amendments in APPENDIX B.

If the sponsor requires any further advice, this should be requested at the pre-approval engagement stage with the Authority.

Pre and Post Implementation Monitoring of Track Keeping

The approval for a sponsor to use RNAV Substitution in lieu of radiating conventional navigation aids, is based on the premise that the aircraft tracks over the ground will remain unchanged following the decommissioning of the navigation aid. Ahead of any approval from the CAA and that of the decommissioning of a navigation aid, the sponsor will be required to demonstrate that they have a set of baselined ground tracks. This would typically be evidence derived from the continuous monitoring as part of an established noise monitoring programme. Following decommissioning, the CAA would expect the sponsor to be able to demonstrate to the CAA that the ground tracks have not changed. This would typically be accomplished through a monitoring programme, to be agreed with the CAA.

Where the procedure coded overlay uses ARINC 424 Path Terminators, defined by the navigation aid – see Example Safety Approach Safety Requirement (SR 9), any detected anomalous path behaviours should be investigated to determine whether it is due to the application of RNAV Substitution. Alternative coding solutions may be required in order to re-establish pre- navigation aid decommissioning track performance.

Miscellaneous Notes – Guidance to the sponsor

Review of the ATSMAC (Air Traffic Surveillance Minimum Altitude Chart)

- If the ATSMAC is identified within the Impact Assessment as requiring amendment or review, this should be noted in the evidence submitted for Use of RNAV Substitution. CAP 777 and ICAO Doc 8168 (PANS OPS Volume 2) compliance will still apply. Appropriate documentation should be submitted to the CAA.

Preferential Departure Routes (PDR) and Standard Departure Routes (SDR) are not considered as being part of the Instrument Flight Procedures (IFP) family. These procedures have not been designed or obstacle assessed using PANS-OPS design criteria nor are they periodically reviewed as per the IFP safeguarding and Periodic Review process and requirements defined by the CAA.

PDR and SDR are typically not available as coded overlay procedures within a generic navigation data base, and are therefore considered out of scope of RNAV Substitution and the guidance in this CAP.

Aerodromes with PDR and SDR should investigate all possible and available options including but not limited to reliance on different navaids or implementation of Omnidirectional Departures or PBN Standard Instrument Departures (SIDs), to ensure their operations will remain safe. To implement any new departure procedures, a sponsor would need to go through the Airspace Change Process (as detailed in CAP 1616).

Advice on the application of Omnidirectional Departures can be found in CAP 778 (Policy and Guidance for the Design and Operation of Departure procedures in UK Airspace).

Instrument approach procedures with a final approach track predicated on VOR or NDB e.g., VOR/DME, NDB/DME, are out of scope of this guidance.

CAA advice to sponsors is that any truncation of procedures should be completed ahead of the application for the use of RNAV Substitution.

Conditional Actions

Data services providers –Jeppesen, Lufthansa Systems FlightNav, NAVBLUE

In order to maintain track keeping as on today's conventional procedures, the Data service providers have agreed to maintain their coding in accordance with Data Quality Requirements (DQR), whereby, any proposed changes will first be agreed with the sponsor and the CAA.

CAA

CAA has raised Data Quality Requirements (DQR) with each of the major navigation data providers, in order to control the changes to FMS coded overlays captured within this guidance.

NERL

NERL have undertaken as part of their Licence to provide assumed coverage requirements for DME at the following altitudes:

- London TMA from 2000ft

  NERL's aim is to provide a DME infrastructure across the UK that will deliver a DME/DME fixing capability where reasonably practicable, and with coverage down to circa 2000ft in the London TMA specifically.

- Other identified Terminal Areas and Control Areas from 3000ft

  Minimum DME coverage should be for a single DME pair with acceptable geometry to be available at not greater than 2,760ft above the aerodrome elevation (for simplicity rounded to 3,000ft).

The DME/DME assessment is typically modelled on a given DME density and may vary according to the NATS DME Optimisation Project whereby facilities may be relocated.

Sponsors should contact NERL to obtain DME coverage for the appropriate infrastructure assessment under consideration. The sponsor should provide data to assure the CAA that DME coverage for each affected IFP is acceptable.

Local Airspace Users

The sponsor shall provide evidence of engagement with general aviation stakeholders at the sponsor's airport (where practicable), or which operate in the vicinity. This is in order to raise awareness of the removal of the navigation aid and seek to identify alternative mitigations where the removal could potentially affect the sponsor's operations through general aviation actions/interactions.

Chapter 7

Acknowledgements

The CAA is indebted to the NATS NERL Safety Team, NATS DVOR Rationalisation Team and the NATS NSL Team that supported Heathrow Airport Limited, prior to the COVID-19 pandemic. Their assistance and expert advice have been invaluable.

The CAA is also indebted to NATS AIS and the three major third-party Navigation Data Providers for their cooperation in assisting with the development of this Guidance and their support for the application of RNAV Substitution in UK airspace.

APPENDIX A

Promulgation of UK AIP Changes

Samples provided as part of this guidance:

CHARTING:

Title of the chart change:

CHART TITLE

To be added to the Chart Title: **RNAV SUBSTITUTION ONLY**

On the relevant chart, insert a Warning Box:

WARNING BOX

Example of a “Warning Box” to be included on the chart:

RNAV Substitution only due ABC VOR/DME Not Available.

Under General Information:

Add Note: RNAV Substitution Only – AIC REFERENCE refers, where REFERENCE is the current AIC version pertaining to DVOR/DME/NDB Rationalisation and the application of RNAV Substitution in lieu of radiating conventional navigation aids.

If there is no option to revert to using the conventional navigation aid (even as a contingency for a defined period of time), the Morse code can be removed from the chart as indicated in APPENDIX B.

Nothing else on chart changes, including symbols.

In AD Section:

Remove the entry for the navigation aid from the ENR 4.1 section and copy across, including frequencies, to the end of the table in AD 2.19.

In the Remarks column, replace the current text with “RNAV Substitution Only” LEGACY DATA. ABC VOR/DME NOT AVAILABLE FROM dd/mm/yyyy. See AIC REFERENCE refers.

AD 2.22 Flight Procedures, under Approach Procedures with Radar Control add new item at the end of the section: “RNAV Substitution in use at aerodrome (EGXX) AIC REFERENCE refers”. List the navigation aids affected and the impacted procedures with a Note that these procedures shall only be flown using FMS Coded Overlays.

Repeat within the Approach Procedures without Radar Control section.

Repeat within the Departures Procedures section.

NAVIGATION AID ATTRIBUTES

If there is no option to revert to using the conventional navigation aid (even as a contingency for a defined period of time), the Morse code can be removed from the UK AIP. The Frequency is retained as this is a more critical data element for ARINC 424 data strings. Without a frequency, the navaid is essentially no longer a navigation aid. In order to keep the navigation aid in the data base, along with the other data "as-is," the navigation data providers have to be able to trace the data back to a publication source. For this reason, the frequency associated with the navigation aid has to remain in table at the end of AD 2.19, as described above.

ALL references to the navigation aid in the UK AIP should be identified and amended accordingly.

In AD 2.24 Charts Related to an Aerodrome, reflect the applicable chart title changes.

Regarding the Initial Approach Procedures without Radar Control, the sponsor can remove the General Information Note which says: Procedure not suitable for RNAV coding[17].

Sample NOTAM text

At least two NOTAM should be issued, there may be more NOTAM required if there are specific issues identified by ATC or the sponsor, that need to be addressed separately.

- Trigger NOTAM as usual for AIRAC changes.

- The navigation aid outage:

  NOTAM Scope: Aerodrome ('A'): QNMAS/IV/BO/E/

  NOTAM FIELD E) ABC VOR/DME 123.45 MHZ NOT AVAILABLE

- Aerodrome RNAV Substitution NOTAM with a list of affected flight procedures:

  NOTAM Scope: Aerodrome ('A'): QPILT/I/NBO/A

[17] The justification for removal is that these procedures have been coded by the three navigation data providers.

NOTAM FIELD E) THE FOLLOWING CHARTS ARE RNAV SUBSTITUTION ONLY (FMS OVERLAY REMAIN UNCHANGED) DUE TO ABC VOR (VOR/DME) NOT AVAILABLE:

STANDARD DEPARTURE CHART >>CHART TITLE <<

MORE INFORMATION ABOUT RNAV SUBSTITUTION AVAILABLE AT: >>AIC REFERENCE <<<

The above NOTAM should be published alongside the AIRAC change to the UK AIP covering all affected sections of the UK AIP (including ENR navigation aids and charts). NOTAM should be published for 90 days and may be re-issued once but only if there is a justified concern that users may still not be aware of the change.

Please note that as a general rule the CAA and AISP do not intend to publish any changes via NOTAM for over 90 days or duplicate information already published correctly in one of the other Aeronautical Information products. Therefore, it is not a normal practice to publish a NOTAM (other than Trigger NOTAM) to advertise AIRAC Changes to the UK AIP. Taking into account the uncommon character of the change (navigation aid is not available but some charts and procedures associated with this navigation aid are still in use on a different basis), it is advisable to publish the additional NOTAM listing for all affected procedures and referring to the relevant AIC.

It is essential to allow sufficient time for the promulgation of changes. In practice this means that all changes must be approved and delivered to AIS approximately 3 months ahead of the end of the effective date of the change. The UK AIP Publishing Schedule is available on AIS website. The sponsor shall coordinate the issue of NOTAM with NERL to ensure sponsor NOTAM is not rejected.

Aeronautical Information Circular

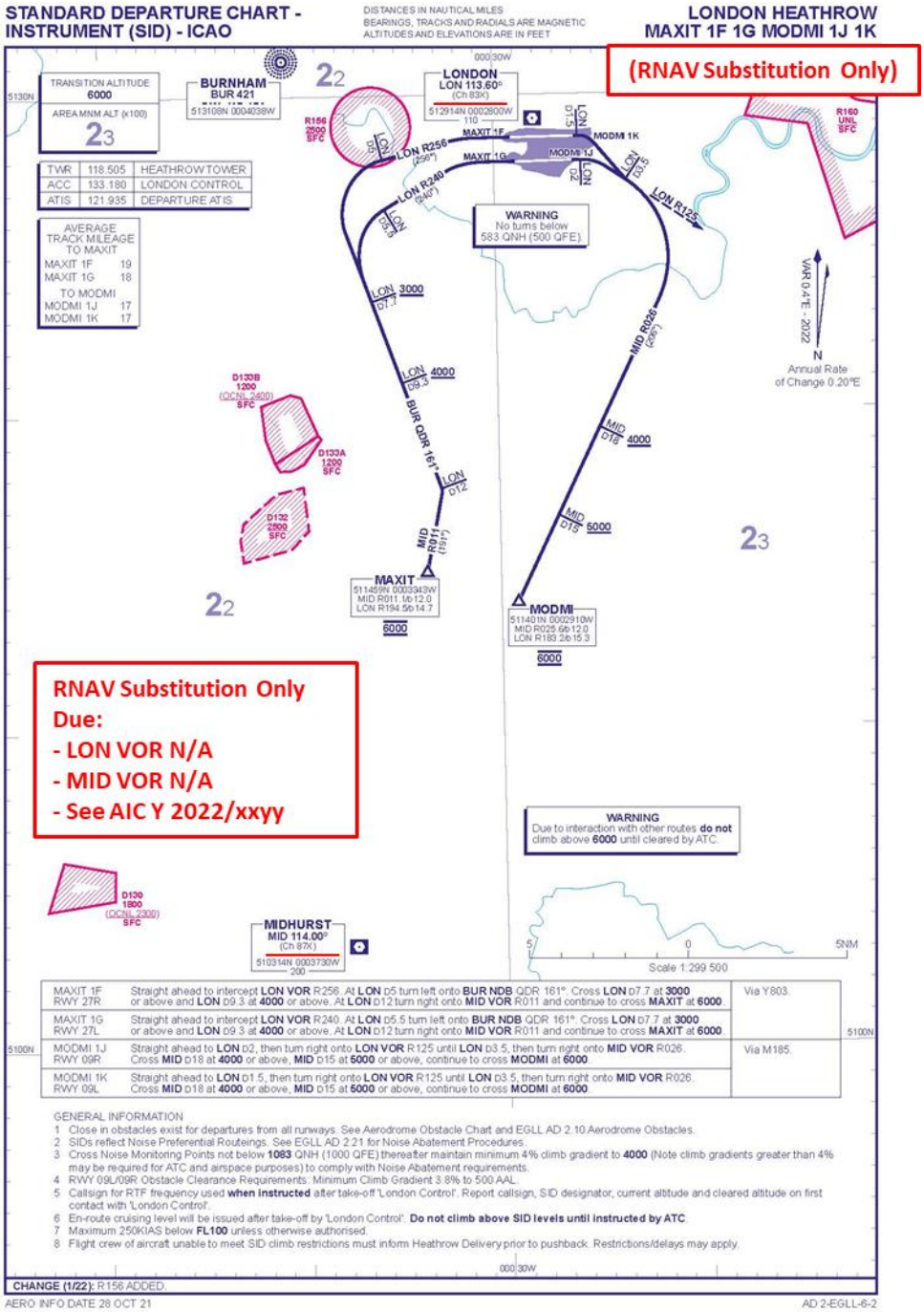
An AIC will be published by the CAA to describe "RNAV Substitution Only" and relevant changes to the Aeronautical Information products.

VFR chart

Chart amendment should be requested as part of the UK AIP Change Request. VOR/DME will be removed in the next edition of the chart. The Amendment service for VFR charts is available on the AIS website.

APPENDIX B

Sample Chart Amendments for Promulgation of UK AIP Changes



c) During TBS operations, RNAV (GNSS) final approach requests may be refused by Heathrow Director to ensure runway efficiency is maintained.

3 AERODROME SAFETY REPORTING

a) Aircraft operators are required to share with Heathrow any occurrence reports for reportable incidents which occur on the ground at Heathrow, or during the initial (take-off) or final (approach and landing) phases of flight to or from Heathrow.
b) Copies of Air Safety Reports or Mandatory Occurrence Reports filed by aircraft operators must be sent to the Aerodrome Safety and Assurance team at airside_safety@heathrow.com. Heathrow also encourages voluntary safety reports and observations as these may help to improve safety. Any such reports or observations should also be sent to the aforementioned address.

EGLL AD 2.24 CHARTS RELATED TO AN AERODROME

AERODROME CHART - ICAO
AD 2.EGLL-2-1
AIRCRAFT GROUND MOVEMENT/ALL TAXIWAYS CHART - ICAO
AD 2.EGLL-2-2
AERODROME CHART A380 GROUND MOVEMENT - ICAO
AD 2.EGLL-2-3
AIRCRAFT GROUND MOVEMENT/PARKING/DOCKING - TERMINAL 5 CHART - ICAO
AD 2.EGLL-2-4
AIRCRAFT GROUND MOVEMENT/PARKING/DOCKING - TERMINAL 4 CHART - ICAO
AD 2.EGLL-2-5
AIRCRAFT GROUND MOVEMENT/PARKING/DOCKING - TERMINAL 3 CHART - ICAO
AD 2.EGLL-2-6
AIRCRAFT GROUND MOVEMENT/PARKING/DOCKING - TERMINAL 1 and 2 CHART - ICAO
AD 2.EGLL-2-7
AIRCRAFT GROUND MOVEMENT/REMOTE DE-ICING AREAS LOCATION CHART - ICAO
AD 2.EGLL-2-8
GROUND MOVEMENT CHART - HOLDING AREAS for RUNWAY 27R - ICAO
AD 2.EGLL-2-9
GROUND MOVEMENT CHART - HOLDING AREAS for RUNWAY 27L - ICAO
AD 2.EGLL-2-10
GROUND MOVEMENT CHART - HOLDING AREAS for RUNWAY 09L - ICAO
AD 2.EGLL-2-11
GROUND MOVEMENT CHART - HOLDING AREAS for RUNWAY 09R - ICAO
AD 2.EGLL-2-12
LONDON CTR LOCAL FLYING AND ENTRY/EXIT PROCEDURES
AD 2.EGLL-3-1
HELICOPTER ROUTES in the LONDON CTR and LONDON/CITY CTR
AD 2.EGLL-3-2
HELICOPTER CROSSING OPERATIONS
AD 2.EGLL-4-1
ATC SURVEILLANCE MINIMUM ALTITUDE CHART - ICAO
AD 2.EGLL-5-1
ATC SURVEILLANCE MINIMUM ALTITUDE CHART TEXT
AD 2.EGLL-5-2
STANDARD DEPARTURE CHART - INSTRUMENT (SID) COMPTON 3F 3G 5J 4K - ICAO
AD 2.EGLL-6-1
STANDARD DEPARTURE CHART - INSTRUMENT (SID) MAXIT 1F 1G MODMI 1J 1K - ICAO
AD 2.EGLL-6-2
STANDARD DEPARTURE CHART - INSTRUMENT (SID) BROOKMANS PARK 7F 7G 6J 5K - ICAO
AD 2.EGLL-6-3
STANDARD DEPARTURE CHART - INSTRUMENT (SID) UMLAT 1F 1G ULTIB 1J 1K - ICAO
AD 2.EGLL-6-4
STANDARD DEPARTURE CHART - INSTRUMENT (SID) DET 2F 2G 1J 1K - ICAO
AD 2.EGLL-6-5
STANDARD DEPARTURE CHART - INSTRUMENT (SID) GOGSI 2F 2G GASGU 2J 2K - ICAO
AD 2.EGLL-6-6
STANDARD DEPARTURE CHART - INSTRUMENT (SID) MAYFIELD 3F 2G 2J 2K - ICAO
AD 2.EGLL-6-7
RNAV1 (DME/DME or GNSS) STANDARD ARRIVAL CHART - INSTRUMENT (STAR) OTMET 1H ROXOG 1H - ICAO

..1K (RNAV Substitution Only) – ICAO AD...