BIG/ BNN/ MID DVOR and WCO/ WOD NDB removal: STARs and Holds Documentation: Stage 4 Update and Submit

Step 4A Update Design

Step 4B Airspace Change Proposal V1.2

NATS Uncontrolled

Publication History

Issue	Month/Year	Change Requests in this issue
Issue 1.0	January 2020	Published and submitted to SARG
Issue 1.1	February 2020	Table 1 updated to reflect what was presented in the Assessment Meeting (Ref 2) Additional information provided in the Impact Assessment table Numbers of OCK-BNN stack swaps before and after SAIP AD5 implementation included in the description of the BNN 1D STAR impact assessment Engagement evidence included as a reference (Ref 7)
Issue 1.2	February 2020	Table 2 updated to include new waypoint OSDEB. Referenced AIP document updated to reflect latest version. Reference to OKESI 1Z removed – this is no longer a STAR to be implemented. Cost of system adaptation added to Airspace and Infrastructure table on Page 18. Engagement with Northolt and Oxford Airports noted in Section 7.2 and captured within updated engagement evidence document (Ref 7).

1. Step 4B Contents

2. Introduction

The intent of this document is to summarise and satisfy the requirements of CAP1616 Stage 4: update design and submit airspace change proposal to the CAA. The CAA reference is ACP-2019-07, and the link to the CAA progress page is here.

NATS operates 46 DVORs around the UK which are going through the first batch of rationalisation as part of NATS' DVOR Rationalisation Programme. This is due to the DVORs operating well beyond their design life and no longer being needed due to RNAV5 (Area Navigation - 5NM) mandated Air Traffic Service (ATS) routes. This extended period of use has also created continued and unnecessary maintenance costs; as well as impacting upon airport development work prevented by safeguarding the navaids.

Within the UK, there are several enroute Instrument Flight Procedures (IFPs) which are dependent on these radio navigation aids (navaids). As a number of them are scheduled to be removed from service, the enroute IFP definitions require updating so that they no longer reference the navaids scheduled to be removed. En-route dependencies on DVR & LYD DVORs were removed in June 2018; SAM, OCK & GWC DVORs in May 2019; GAM DVOR in June 2019, New Galloway NDB in September 2019 and BIG DVOR in November 2019. The en-route dependency removals for Glasgow (GOW) and Turnberry (TRN) DVORs have also been approved, with an implementation date of 28th February 2020.

This airspace change proposal is primarily focussed on enroute IFPs, in the UK AIP, which use the Westcott (WCO) NDB and Bovingdon (BNN) DVOR as a materially important navaid. The scope is not solely limited to Standard Terminal Arrival Routes (STARs) and their associated holding patterns dependent on WCO and/or BNN but will also remove the final en-route dependencies on the Woodley (WOD) NDB, the Biggin Hill (BIG) DVOR and the Midhurst (MID) DVOR; where NATS is the primary air navigation services provider (ANSP).

As described in Section 8.2.1 below, there are several methods in which a STAR/ hold navaid dependency can be removed. As such, each STAR and hold has been evaluated in order to determine the most appropriate method in which to remove the dependency from the WCO/ WOD NDBs and BNN/BIG/MID DVORs. This method improves the overall network connectivity, reduces duplication and accounts for the current usage levels.

3. Executive Summary

In support of the DVOR Rationalisation Programme, NATS has identified all AIP en route references to, and dependencies on, the WCO/ WOD NDBs and BNN/BIG/MID DVORs. In order to remove the IFP dependencies from these navaids, a list of seven design principles have been created which have been used to assess the design options against.

The Design Principle (DP0) with overriding priority is that the airspace change must "maintain or enhance the current level of safety". The Design Principle (DP1) driving this change is that none of the proposed technical changes would result in a change to flight behaviours. The remaining Design Principles are focussed on techniques which could be used to remove the dependencies, such as IFP replication or truncation.

As described in the Stages 2-3 multi-gateway documentation (Ref 3), four separate design options were developed in order to remove the en-route IFP dependencies from the BIG/ BNN/ MID DVORs AND WCO/ WOD NDBs.

The first considered option, of doing nothing (Option 0), would retain all of the current STARs and holds unchanged from today's AIP definition. Option 1 would replicate each IFP with a BIG/ BNN/ MID DVOR or WCO/ WOD NDB dependency, exactly as defined today. Option 2 would evaluate each IFP individually - as used in

practice - using replication, truncation or a technical amendment where appropriate. Finally, Option 3 would completely remove each IFP with a BIG/ BNN/ MID DVOR or WCO/ WOD NDB dependency.
The design principles mentioned above were used to qualitatively assess each of the four options [Ref 3]. This process reduced the four options down to one, known as Option 2, which is the preferred concept option presented here. Consultation regarding DVOR rationalisation was undertaken in 2009. Due to the technical nature of the changes which will not result in changes to flight paths, no further consultation has been required.

This proposal also contains several administrative changes to other STARs which appear on the same charts, but which are not impacted by the BIG/ BNN/ MID DVOR or WCO/ WOD NDB removal. These changes are included as we are also taking the opportunity to re-designate UK STARs in line with ICAO with each deployment.

4. Current Airspace Description

The current enroute IFPs dependent on the BIG/ BNN/ MID DVORs and WCO/ WOD NDBs, are associated with Birmingham, Heathrow, London City, Luton, Southend, and Stansted Airports. There are also several additional IFPs which - although not dependent on any of these navaids - feature on the same chart or affect the same Sector Groups. This proposal provides the opportunity to update and re-designate them.

These have all been summarised in Table 1 below and the relevant charts can be found in the Stages 2-3 multi-gateway document [Ref 3].

Associated Airport	Current IFP	Current Routing	Dependency
Birmingham	GROVE 1A STAR	*BUZAD - DTY - HON - OSKOT - GROVE*	No – same chart as BIG and WCO *(although BUZAD is/was 'defined' on BIG & DTY VOR radials and this is shown on the chart it is a unique waypoint with its own Lat/Long published on a RNAV5 ATS Route (T420) and therefore is **not** dependent on BIG DVOR)*
Birmingham	GROVE 1B STAR	*WCO - HON - OSKOT - GROVE*	No – same chart as BIG and WCO *(please note that this was incorrectly noted as being dependent on WCO NDB in the Assessment Meeting slides [Ref 2]. The procedure is dependent on HON DVOR – it's only 'dependency' on WCO is that it uses the name WCO and commences at WCO which is not on the UK ATS Route network.)*
Birmingham	GROVE 1C STAR	*BUZAD - OLNEY - WELIN - HON - OSKOT - GROVE*	No – same chart as BIG and WCO *(even though BUZAD is/was 'defined' on BIG & DTY VOR radials and this is shown on the chart it is a unique waypoint with its own Lat/Long published on a RNAV5 ATS Route (T420) and therefore is **not** dependent on BIG DVOR)*
Birmingham	OLIVE 1B	*WCO - OSKOT - OLIVE*	No – but commences at WCO
London City	JACKO 1A STAR	*KENET - WCO - BOMBO - BKY - BRAIN - CLN - JACKO*	No – but passes through WCO and is already RNAV
London Gatwick	DELBO Hold	N/A - Hold	No – same chart as WILLO 3B which is being amended by this proposal
London Gatwick	ASTRA 2B STAR	*KIDLI - WOD - ASTRA*	No – passes through WOD and will be defunct once WILLO 3B STAR is RNAV'd
	TIMBA 1D STAR	*MID - MAY - LARCK - TIMBA*	Yes – dependent on MID. Omitted from previous airspace changes in error.

Associated Airport	Current IFP	Current Routing	Dependency
London Gatwick			
London Gatwick	WILLO 3B STAR	*KIDLI - MID - HOLLY - WILLO*	Yes – dependent on MID and affects the same sector controllers as the BNN STARs
London Heathrow	BNN 1B STAR	*NUGRA - TOBID - WCO - BNN*	Yes – dependent on BNN and passes through WCO
London Heathrow	BNN 1C STAR	*DTY - WCO - BNN*	Yes – dependent on BNN and passes through WCO
London Heathrow	BNN 1D STAR	*KENET - BNN*	Yes – dependent on BNN
London Heathrow	BNN 1E STAR	*LAM - DONNA - BNN*	No – features on the same chart as BNN and WCO
London Heathrow	BNN 4A STAR	*HON - TOBID - WCO - BNN*	Yes – dependent on BNN and passes through WCO
London Heathrow	BOVVA 1B STAR	*NUGRA - TOBID - WCO - BOVVA*	No – same chart as WCO and only for use when BNN is u/s. This will become defunct when the BNN STARs are RNAV'd.
London Heathrow	BOVVA 1C STAR	*DTY - WCO - BOVVA*	No – same chart as WCO and only for use when BNN is u/s. This will become defunct when the BNN STARs are RNAV'd.
London Heathrow	BOVVA 1D STAR	*KENET - BOVVA*	No – same chart as WCO and only for use when BNN is u/s. This will become defunct when the BNN STARs are RNAV'd.
London Heathrow	BOVVA 1E STAR	*LAM - DONNA - BOVVA*	No – same chart as WCO and only for use when BNN is u/s. This will become defunct when the BNN STARs are RNAV'd.
London Heathrow	BOVVA 4A STAR	*HON - TOBID - WCO - BOVVA*	No – same chart as WCO and only for use when BNN is u/s. This will become defunct when the BNN STARs are RNAV'd.
London Heathrow	BOVVA Hold	N/A - Hold	No – only for use when BNN is u/s. This is now defunct after the BNN Hold was RNAV'd in November 2019 by SAIP AD5. *(please note that this was missing from the Assessment Meeting slides [Ref 2])*
London Heathrow	DTY Hold	N/A - Hold	No – features on the same chart as WCO but will be removed as part of this proposal. *(please note that this was missing from the Assessment Meeting slides [Ref 2])*
London Heathrow	HON Hold	N/A - Hold	No – features on the same chart as WCO
London Heathrow	OKESI Hold	N/A – Hold	No - the OKESI Hold is published as an RNAV Hold in ENR3.6 however, no actual Instrument Flight Procedure has ever been created for it
London Heathrow	WCO Hold	N/A - Hold	No – features on the same chart as WCO

Associated Airport	Current IFP	Current Routing	Dependency
London Luton/Stansted	ASKEY 1B STAR	*KATHY - HAZEL - WOD - WCO - BOMBO - BKY - BUSTA - ASKEY*	Yes – dependent on WCO. This will become defunct when the LOREL STARs are RNAV'd.
London Luton/Stansted	ASKEY 2L STAR	*KENET - WCO - BOMBO - BKY - BUSTA - ASKEY*	Yes – dependent on WCO. This will become defunct when the LOREL STARs are RNAV'd.
London Luton/Stansted	ASKEY 5A STAR	*WCO - BOMBO - BKY - BUSTA - ASKEY*	Yes – dependent on WCO. This will become defunct when the LOREL STARs are RNAV'd.
London Luton/Stansted	LOREL 1B STAR	*KATHY - HAZEL - WOD - WCO - BOMBO - BKY - BUSTA - LOREL*	Yes – dependent on WCO
London Luton/Stansted	LOREL 2L STAR	*KENET - WCO - BOMBO - BKY - BUSTA - LOREL*	Yes – dependent on WCO
London Luton/Stansted	LOREL 5A STAR	*WCO - BOMBO - BKY - BUSTA - LOREL*	Yes – dependent on WCO
London Luton/Stansted	BOMBO Hold	N/A - Hold	No – appears on the same chart as WCO *(please note that this was missing from the Assessment Meeting slides (Ref 2))*
London Southend	SPEAR 1A STAR	*KENET - WCO - BOMBO - BKY - BRAIN - MAYLA - SPEAR*	Yes – dependent on WCO
London Southend	BOMBO Hold	N/A – Hold	No – appears on the same chart as WCO *(please note that this was missing from the Assessment Meeting slides (Ref 2))*
London Southend	SPEAR Hold	N/A - Hold	No – appears on the same chart as WCO

Table 1: Current IFPs associated with the DVOR/ NDB which are being amended/withdrawn

4.1 Structures and Routes

The full technical notes and associated charts for each of the above current IFPs, listed in Table 1, can be found in the following references:

- Birmingham IFPs – Slides 9-10 of the Assessment Meeting slide pack (Ref 2)
- London City IFPs – Slide 11 of the Assessment Meeting slide pack (Ref 2)
- London Gatwick IFPs – Slides 12-15 of the Assessment Meeting slide pack (Ref 2)
- London Heathrow IFPs – Slides 16-19 of the Assessment Meeting slide pack (Ref 2)
- London Luton and Stansted IFPs – Slides 20-22 of the Assessment meeting slide pack (Ref 2)
- London Southend IFPs – Slides 23-24 of the Assessment Meeting slide pack (Ref 2)

4.2 Airspace usage and proposed effect

The proportions of aircraft, including fleet mix and operators, using the IFPs related to this project would not change as an outcome of the proposed changes. The proposed connectivity remains entirely unchanged due to RNAV5 replication of the STARs; therefore, the usage would remain the same as today. There would be no change to pilot or controller behaviour, and no change to lateral or vertical traffic dispersion, nor any impact to

adjacent IFPs. Therefore, the airspace capacity, usage and current operation will remain unchanged from today.

4.3 Operational efficiency, complexity, delays and choke points

There are no specific issues relating to operational efficiency, complexity, delays or choke points associated with any of the IFPs related to this project, to be solved by this airspace change proposal.

4.4 Safety issues

There are no specific safety issues associated with any of the IFPs related to this project, to be solved by this airspace change proposal. Ensuring the safety of the proposed changes is a priority for NATS. NATS has a dedicated safety manager for the DVOR project who ensures that the safety representatives from SARG have oversight of the safety assurance process. Section 10 contains further details on the safety assessment for this proposal.

4.5 Environmental issues

There are no specific environmental issues associated with any of the IFPs related to this project, to be solved by this airspace change proposal.

5. Statement of Need

The Statement of Need V5 (DAP1916 ref 3409) [Ref 1] submitted in July 2019 summarises the proposed changes in support of removing the en-route dependency from the BIG/ BNN/ MID DVORs and WCO/ WOD NDBs planned in 2019. This has been included in Appendix Section 15.2 below.

6. Proposed Airspace Description

6.1 Objectives/ requirements for Proposed Design

The primary objective for this Airspace Change Proposal is to remove any en-route IFP dependencies from the WCO NDB and BNN DVOR. NATS also plans to RNAV replicate the remaining WILLO 3B STAR (not included with the previous BIG deployment of November 2019) and the TIMBA 1D STAR. In making these changes the en-route dependency will be removed from the WCO & WOD NDBs and BNN, MID & BIG DVORs.

This will be achieved by replicating the current procedures using RNAV5 procedures. Where procedures already have an RNAV5 specification, we are proposing to simply re-designate them in line with ICAO naming policy. The en-route flight procedures under consideration are all STARs, en-route holding patterns, and terminal holding patterns, where BIG/ BNN/ MID DVOR or WCO/ WOD NDB is still material to their definition.

These changes are in support of the NATS DVOR Rationalisation Programme which aims to reduce dependence on ground infrastructure without reducing en-route services.

The CAA's PBN STAR Replication Policy for Conventional STAR Replacement [Ref 6] has been used as a basis for this proposal. It defines PBN STAR replication as a PBN redesign of an existing conventional STAR from the commencement of the STAR in the ATS en-route network to the termination point without introducing any change to existing track patterns over the ground. It would also allow a simple RNAV5 to RNAV1 conversion; however, this is out of the scope of this project.

This proposal has been used as an opportunity to review the relevance of the existing procedures and their details. As such, methods such as introducing truncations where an existing ATS route already forms the initial section of a STAR have been explored and considered, in line with the STAR replication policy mentioned above.

6.2 Proposed New Airspace/ Route Definition and Usage

There is no predicted change to current connectivity or flight behaviour as a consequence of this airspace change proposal; the proposed changes are technical changes. This means that there would be no change to pilot or controller behaviour (apart from designation changes), and no change to lateral or vertical traffic dispersion, nor any impact to adjacent IFPs. The proposed changes will also not alter route usage or traffic mix within the associated airspace.

A full summary of all the proposed changes and associated impacts can be found in Appendix Sections 15.3 to 15.9 below. This details the impact assessment of the IFPs where the WCO NDB and BNN & MID DVORs are material to the procedure, or they feature on the same chart as the BIG/ BNN/ MID DVOR or WCO/ WOD NDB. These are summarised below:

- Birmingham: GROVE 1A, GROVE 1B, GROVE 1C and OLIVE 1B STARs;
- London City: JACKO 1A STAR;
- London Gatwick: DELBO Hold; ASTRA 2B, TIMBA 1D and WILLO 3B STARs;
- London Heathrow: 5 BNN and 5 BOVVA STARs; BOVVA, DTY, HON, OKESI and WCO Holds;
- London Luton and Stansted: ASKEY/ LOREL 1B, ASKEY/ LOREL 2L and ASKEY/ LOREL 5A STARs and BOMBO Hold;
- London Southend: SPEAR 1A STAR; BOMBO and SPEAR Holds

This document includes a full list of all IFPs: their current connectivity, the proposed connectivity and the impact of each proposed change. Some of the proposed changes are re-designations of STARs (already RNAV5) in line with ICAO policy. Charts and technical notes on the IFPs can be found in the assessment meeting slide pack (Ref 2); and the impact assessment in the Stages 1-3 multi-gateway document (Ref 3).

The proposed changes will not change the connectivity of the procedures from today, due to RNAV5 replication; with or without appropriate truncation. Where truncations are being proposed, appropriate starting points for the STAR have been identified to ensure that there is no impact to connectivity. This means no change to route usage or traffic patterns over the ground. Sections 15.3 - 15.9 below summarise the impact assessment of all STARs, Holds and ATS Routes which are part of this proposal.

The location of the WCO and WOD NDBs would stay the same however, the description would be amended to remove the NDB references. Similarly, the description for the BIG, BNN and MID DME/ DVORs would be updated to denote the DVOR removal, but the location would not change. These changes would not introduce any changes to traffic patterns. As mentioned above - in Section 4 - this proposal also contains a number of administrative changes which are included in order to rationalise the overall ATS network in a logical manner.

The relevant airspace structures, and related AIP sections, which are associated with the STAR, Hold and administrative changes, are listed in Table 2 below.

Airspace Structure	Comment	AIP Section
Area Navigation (RNAV) routes	All affected RNAV routes amended by this ACP to be included in this section, alongside ATS route administrative changes	ENR 3.3
En-route Holding	BOVVA and DTY Hold descriptions will be removed; and BOMBO, DELBO, HON, OKESI, SPEAR and WCO Hold	ENR 3.6

	descriptions will be amended	
Radio Navigation Aids & Waypoints	BNN, BIG, MID, WCO & WOD will be amended. OSDEB, PUFAX, YOHDA and ZOPHI will be added	ENR 4
Enroute charts	Charts amended to reflect changes to ATS Routes	ENR 5 and 6
Aerodrome AIP changes	Individual airport charts, coding tables and text updated to reflect ATS Route, STAR and Hold changes	To be completed one we have the AIP changes

Table 2: Current Relevant Airspace Structures associated with Administrative Changes

The summary of the proposed changes is that changing the procedures will not alter the traffic patterns or route usage, due to the truncation replication of STARs and the associated appropriate revision or addition of ATS routes.

Further technical information on the proposed designs can be found in a Word document summarising the draft AIP changes alongside the sections where these need to occur (Ref 4), alongside the PDG design report (Ref 5)

7. Impacts and Consultation

7.1 Net impacts summary for proposed route

Category	Impact	Evidence
Safety/Complexity	No impact on safety or complexity	See Section 4.4 and Section 10
Capacity/Delay	No impact on capacity/ usage or delay	See Sections 4.2 and 4.3
Fuel Efficiency/ CO_2	No impact, there will be no change to lateral or vertical tracks, nor to impact adjacent IFPs	See Section 7.7
Noise – Leq/ SEL	No impact, this is a Level 2C[1] change	See Section 7.8
Tranquillity, visual intrusion (AONBs & National Parks)	No impact, this is a Level 2C change	See Section 7.8
Local Air Quality	No impact, this is a Level 2C change	See Section 7.8
Other Airspace Users	No impact, no changes to volume or classification of CAS	See Sections 7.3 to 7.6

7.2 Units affected by the proposal

The following airports have been engaged throughout the project (Ref 7):

- Birmingham Airport
- Gatwick Airport
- Heathrow Airport
- London City Airport
- Luton Airport
- Northolt Airport
- Oxford Airport
- Southend Airport
- Stansted Airport

The airports have been fully briefed on the proposed changes and the justification behind why the en-route DVOR dependencies are being removed (Ref 7). Whilst the procedures impacted by this change are published in the various aerodrome sections of the AIP, the procedures themselves are of little interest to the airports and are not impacted by obstacles at those airports. Consequently, the proposed changes are effectively invisible from an airport perspective, aside from the AIP changes described below.

The proposed changes will alter nomenclature in the aerodrome AIP pages for the above airports. There will also be a few minor technical amendments such as STAR truncations/ rationalisations. There are no other impacts anticipated for airports or relevant operations; the scope of these changes is just for en-route procedures. The changes are purely technical changes which will not lead to any material change to the

[1] The CAA agreed that this proposal falls under the airspace change process as a Level 2C proposal. This is a proposal which reflects the current use of airspace concerned and does not alter traffic patterns below 7,000ft. The Government's Air Navigation Guidance states that below 7,000ft is the maximum height at which noise is a priority for consideration; therefore, noise analysis has not been completed for this proposal.

current operation. Airports will complete their own airspace change proposals to remove dependencies for airport-specific local procedures, such as SIDs and approaches.

However, in order to provide full transparency, NATS has engaged with the above airports which will need to have their AIP sections amended in support of the changes within this ACP. Appropriate airport representatives have been informed about these changes prior to submission of the ACP. Assuming approval of this approval, the affected airports will then be advised, and permission sought to amend their sections of the AIP.

If this proposal is approved, the CAA will also organise appropriate coordination with ICAO prior to implementation.

7.3 Consultation

A CAA-led consultation was held with the National Air Traffic Management Advisory Committee (NATMAC) in 2009, with a NATMAC Informative produced on 7th October 2010. Airlines were broadly supportive, with the NATS reduction in expenditure regarded as a significant benefit.

7.4 Military impact and consultation

Northolt Airport, a military unit, has been informed about technical changes to its AIP pages as a consequence of the proposed changes. However, the changes are purely technical changes which will not lead to any material change to the current operation.

7.5 General Aviation airspace users impact and consultation

No General Aviation/ VFR airspace user stakeholders identified as being impacted by the proposed changes.

7.6 Commercial air transport impact and consultation

There would only be technical changes for commercial air transport such as nomenclature and RNAV5 route replication. There would be no impact to connectivity or flight behaviour, as there would be no change to lateral or vertical tracks, nor to impact adjacent IFPs.
No commercial air transport/ IFR stakeholders were identified as being impacted by the proposed changes; other than the nomenclature changes mentioned.

7.7 CO_2 environmental analysis impact and consultation

There would be no change in fuel, CO_2 or greenhouse gases and emissions as a result of the proposed changes because there would no change to lateral or vertical tracks, or to impact adjacent IFPs. Fuel uplift changes are unlikely to occur. The actual fuel uplift is difficult to quantify, however there is an established relationship between distance flown and the amount of fuel uplift. As this proposal will not impact the distance flown, we can deduce that the fuel uplift should not change.

This aligns with the design principle (DP1) which is driving this change, of ensuring that none of the proposed technical changes to IFP definitions result in any change to actual flight behaviours.

7.8 Local environmental impacts and consultation

There would be no change in environmental impacts, such as noise or tranquillity, as a result of the proposed changes because there would be no change to lateral or vertical tracks, nor any impact to adjacent IFPs.

This aligns with the design principle (DP1) which is driving this change, of ensuring that none of the proposed technical changes to IFP definitions result in any change to actual flight behaviours.

7.9 Economic impacts

There are no predicted economic changes, nor any costs or benefits which could be monetised, as a result of the proposed changes. The development of this airspace change proposal has not been informed by any economic constraints or opportunities.

8. Analysis of Options

8.1 Airspace Change Design Options

In order to remove the en-route IFP dependencies on the BIG/ BNN/ MID DVORs and WCO/ WOD NDBs NATS developed four potential design options to adapt the UK airspace. These are known as Option 0 – do nothing, Option 1, Option 2 and Option 3. They are also summarised in the Stages 1-3 multi-gateway document (Ref 3).

The first considered Option 0 - of doing nothing - would retain all the current STARs, Holds and ATS Routes unchanged from today's AIP definition. Options 1, 2 and 3 involve making changes to today's AIP definition. Option 1 would replicate each STAR, Hold and ATS Route with a BIG/ BNN/ MID DVOR or WCO/ WOD NDB dependency, exactly as defined today. Option 2 would individually evaluate each STAR, Hold and ATS Route as used in practice and consider how the network may be improved by rationalising/ truncating/ replicating/ extending them in a considered manner. Finally, Option 3 would remove all existing STARs, Holds and ATS routes that refer to or use the BIG/ BNN/ MID DVOR or WCO/ WOD NDB.

8.2 Design Options Assessment

8.2.1 Design Principles

Design principles have been created in order to assess the four potential options. They have been constructed around the general objectives for this airspace change proposal: removing the en-route dependencies from the relevant DVORs and NDBs and reviewing the existing procedures. For example, this ACP is proposing to withdraw several STARs after concluding that they are not needed once other STARs have been replicated to an RNAV5 specification. Similarly, to ensure vital Descent Planning levels are included on the RNAV versions of STARs, some will be extended, or new STARs established – neither of these will alter the lateral track or vertical profile from what is flown today.

A toolbox analogy was used to describe potential methods of removing the en-route dependencies from the BIG/ BNN/ MID DVOR or WCO/ WOD NDB, with each tool having a function, in combination with others when appropriate. This analogy has been used to construct the design principles around. The overriding design principle (DP0), with the highest priority, for this airspace change is that the proposed airspace change must "maintain or enhance the current level of safety". The design principles for this proposal are summarised below:

Design Principle	Description
DP0 Safety	The airspace change must maintain or enhance the current level of safety
DP1 Flight behaviour	None of the proposed technical changes to the definition of STARs/ Holds would result in a change to actual flight behaviours – laterally, vertically or in dispersal.
DP2 Admin	Remove unnecessary references to the BIG/ BNN/ MID DVOR or WCO/ WOD NDB which are not material to the procedure
DP3 Withdraw	Some STARs are rarely used, some do the same job, some have segments in common with other STARs (see DP5 Truncate)
DP4 Replicate	PBN replication – replace conventional STARs/Holds with RNAV STARs/Holds
DP5 Truncate	Draft STAR Truncation Policy, awaiting formal publication by CAA ISP, used here as agreed with CAA. When applied logically to STARs with many common segments, can result in withdrawal of unnecessary duplicate STARs (DP3). When the final arrangement is decided, the truncated conventional STAR is always RNAV-replicated (DP4)
DP6 Technical	Minor changes to a STAR/ Hold which currently cannot be flown as it is formally defined, for

amendment	legacy reasons – these changes always reflect what would actually happen in practical terms.

The seven design principles summarised above have been detailed fully in the Stages 1-3 multi-gateway document (Ref 3), which includes a contextual example of each design principle being put into practice.

8.2.2 Options Assessment using the Design Principles

The four options outlined in Section 8.1 above were assessed against the following seven design principles:

- Design Principle 0: maintain or enhance the current level of safety
- Design Principle 1: no change to flight behaviours
- Design Principle 2: administrative change
- Design Principle 3: withdraw unnecessary STARs
- Design Principle 4: replicate using RNAV replication policies
- Design Principle 5: truncate original STAR then replicate the remainder
- Design Principle 6: technical amendment

The four design options were qualitatively assessed against each design principle to evaluate whether the principle had been met, partially met or not at all. The first Option 0 - of doing nothing - did not meet any of the design principles except for DP0 and DP1: maintain/ enhance the current level of safety and introduce no changes to flight behaviours. Option 0 therefore does not achieve the removal of the DVOR/ NDB dependencies nor improves the network in any way; and has therefore been rejected.

Option 1 - replicating each STAR/ Hold - fully met three design principles: maintain/ enhance the current level of safety; introduce no changes to flight behaviours and replicate using RNAV replication policies. However, it only partially met DP2 of withdrawing unnecessary STARs; and did not meet any of the final three design principles. Although Option 1 removes the DVOR/ NDB dependencies, it does not improve the network connectivity; does not account for current usage levels and it leaves route duplication in place. Therefore Option 1 has also been rejected.

Although Option 3 removes the DVOR/ NDB dependencies - as a consequence of removing all IFPs and ATS Routes - it does not fully meet any of the seven design principles; offering no network improvements but significant disruption. Option 3 was therefore rejected.

Option 2 involves an individual evaluation of each STAR, Hold and ATS Route. As this option focussed on a flexible approach for removing the DVOR dependencies, it was able to fully meet all of the proposed design principles.

The conclusion of this assessment was to reduce the number of design options to one, known as Option 2 which best meets all of the design principles. This option removes the DVOR/ NDB dependencies whilst also improving the overall network connectivity, reducing duplication and taking into consideration the current usage levels. A full summary of the above options assessment can be found in Section 4 of the Stages 1-3 multi-gateway document (Ref 3).

8.2.3 Removal of en-route dependencies

This proposal will amend the procedures dependent on the Westcott (WCO) Non-directional Beacon (NDB) and Bovingdon (BNN) Doppler Very High Frequency Omni-directional Radio Range (DVOR)/ Distance Measuring Equipment (DME)[2]. This will facilitate the eventual removal of the en-route dependency on WCO NDB & BNN

[2] DME and DVORs are types of radio navigation technology used by aircraft to determine their position

DVOR. In so-doing it also removes the en-route dependency on the Woodley (WOD) NDB, the Biggin Hill (BIG) DVOR and the Midhurst (MID) DVOR. However, the MID DME will remain in the en-route environment.

Following a meeting between the CAA/ NATS, it was agreed that where a 5 Letter Alpha Numeric Code (5ANC) on a UK STAR is published, it should be amended to a 5LNC to comply with ICAO Annexes relating to the use of waypoints for ATC purposes. The waypoints on en-route STARs should be designated as unique 5LNCs for ATC purposes such as speed limiting points or tactical short cuts; allowing controllers and pilots to easily pronounce them.

Unlike 5ANCs, the use of 5LNCs also allows them to be published in ENR4.4, Name-code Designators for Significant Points, of the Aeronautical Information Publication (AIP). We have therefore taken the opportunity to mark a number of Speed Limiting Points (SLPs) on the proposed RNAV versions of the current Conventional STARs and these are detailed in this document in the appropriate section. These codes – OSDEB, PUFAX, YOHDA and ZOPHI - have been reserved and approved by ICAO Paris.

9. Airspace Description Requirements

	The proposal should provide a full description of the proposed change including the following:	Description for this proposal
a	The type of route or structure; for example, airway, UAR, Conditional Route, Advisory Route, CTR, SIDs/ STARs, holding patterns etc.	STARs, en-route/ terminal holding patterns and ATS Routes - see Section 6.
b	The hours of operation of the airspace and any seasonal variations	Unchanged from today.
c	Interaction with domestic and international en-route structures, TMAs or CTAs with an explanation of how connectivity is to be achieved. Connectivity to aerodromes not connected to CAS should be covered	This proposal would not have any impact on current connectivity - see Section 6.2 and Appendix Sections 15.3 to 15.9. These sections describe how truncated and removed STARs will have ATS Route/ DCT connectivity equivalent to the lateral track and vertical profile published today,
d	Airspace buffer requirements (if any). Where applicable describe how the CAA policy statement on 'Special Use Airspace – Safety Buffer Policy for Airspace Design Purposes' has been applied.	N/A – this proposal does not change any existing/ introduce new buffers.
e	Supporting information on traffic data including statistics and forecasts for the various categories of aircraft movements (passenger, freight, test and training, aero club, other) and terminal passenger numbers	This proposal would have no impact on airspace usage - see Sections 4.2 and 6.2.
f	Analysis of the impact of the traffic mix on complexity and workload of operations	This proposal would have no impact on the traffic mix - see Sections 4.2 and 6.2.
g	Evidence of relevant draft Letters of Agreement, including any arising out of consultation and/or airspace management requirements	N/A – this proposal does not change any existing/ introduce new LoAs; cross-border elements are not impacted.
h	Evidence that the airspace design is compliant with ICAO Standards and Recommended Practices (SARPs) and any other UK policy or filed differences, and UK policy on the Flexible Use of Airspace (or evidence of mitigation where it is not)	STAR replication policy and PANS-OPS compliance – see design report [Ref 5].
i	The proposed airspace classification with justification for that classification	No change to existing airspace classification.
j	Demonstration of commitment to provide airspace users equitable access to the airspace as per the classification and where necessary indicate resources to be applied or a commitment to provide them in line with forecast traffic growth. 'Management by exclusion' would not be acceptable	N/A - this proposal does not change any existing/ introduce new airspace user access.
k	Details of and justification for any delegation of ATS	No change to the delegation of ATS.

10. Safety Assessment

10.1 There is an overriding safety design principle for the proposed changes which states that safety should be at least maintained - or improved - as an impact of the changes.

10.2 The safety of the IFP changes has been assured by NATS Design who have worked alongside the CAA SARG IFP Regulator.

10.3 Prior to implementation, NATS will also undertake a formal Hazard Analysis in order to prove that the proposed changes are safe to be implemented into the operational environment.

10.4 The Option 2 concept would take full account of existing usage and connectivity needs. It would ensure that all IFPs are designed by an APD, as regulated by CAA SARG.

10.5 There would be a qualitative improvement in safety because each remaining IFP would use improved navigation specifications and be defined in an official manner. Today's conventional IFPs are known to be flown using FMS overlays, which are not state-regulated in the same way.

10.6 Where STARs have been truncated as part of this proposal, we have ensured that appropriate/ safe connectivity is still provided; by identifying common route segments which can be used. These will also be assessed as part of the safety hazard analysis, mentioned above in 10.3.

10.7 Where STARs have been extended and/or new STARs established as part of this proposal, we have ensured that appropriate/ safe connectivity is still provided; by identifying common route segments which can be used. These will also be assessed as part of the safety hazard analysis, mentioned above in 10.3.

10.8 Where IFPs have been withdrawn as part of this proposal, we have ensured that appropriate/ safe connectivity is still provided and that there are no impacts. We have used historical flight data to assess usage (summarised in Sections 15.3 and 15.6 below).

10.9 Therefore, there would be a positive impact on safety whilst also improving the overall network connectivity. This is dependent on the satisfactory completion of the hazard analysis.

11. Operational Impact

	An analysis of the impact of the change on all airspace users, airfields and traffic levels must be provided, and include an outline concept of operations describing how operations within the new airspace will be managed. Specifically, consideration should be given to:	Evidence of compliance/ proposed mitigation
a	Impact on IFR general air traffic and operational air traffic or on VFR General Aviation (GA) traffic flow in or through the area	No impact to air traffic (technical changes only) - see Sections 7.5 - 7.6.
b	Impact on VFR operations (including VFR routes where applicable);	No impact on VFR operations - see Section 7.5.
c	Consequential effects on procedures and capacity, i.e. on SIDs, STARs, and/or holding patterns. Details of existing or planned routes and holds	No impact on procedures or capacity (technical change only) - see Section 6.2.

d	Impact on aerodromes and other specific activities within or adjacent to the proposed airspace	No impact on aerodromes or other relevant activities – see Section 7.2.
e	Any flight planning restrictions and/or route requirements	No impact – technical changes only.

12. Supporting Infrastructure/ Resources

	General requirements	Evidence of compliance/ proposed mitigation
a	Evidence to support RNAV and conventional navigation as appropriate with details of planned availability and contingency procedures	N/A – current RNAV5 coverage is demonstrably adequate
b	Evidence to support primary and secondary surveillance radar (SSR) with details of planned availability and contingency procedures	Traffic uses the same regions as today in a similar manner from a surveillance point of view. Demonstrably adequate for the region.
c	Evidence of communications infrastructure including R/T coverage, with availability and contingency procedures	Traffic uses the same regions as today in a similar manner from a comms infrastructure point of view. Demonstrably adequate for the region.
d	The effects of failure of equipment, procedures and/or personnel with respect to the overall management of the airspace must be considered	Existing contingency procedures, based on the conventional navigation DVORs and NDBs, would no longer be required and will be withdrawn. RNAV replication removes the dependency from the DVORs and NDBs. Other existing contingency procedures and management protocol will continue to apply as today.
e	Effective responses to the failure modes that will enable the functions associated with airspace to be carried out including details of navigation aid coverage, unit personnel levels, separation standards and the design of the airspace in respect of existing international standards or guidance material	As above (12d).
f	A clear statement on SSR code assignment requirements	No change to SSR code allocation.

g	Evidence of sufficient numbers of suitably qualified staff required to provide air traffic services following the implementation of a change	No training or additional qualifications required.

13. Airspace and Infrastructure

	General requirements	Evidence of compliance/ proposed mitigation
a	The airspace structure must be of sufficient dimensions with regard to expected aircraft navigation performance and manoeuvrability to fully contain horizontal and vertical flight activity in both radar and non-radar environments	As today - no proposed changes to the airspace structure (technical changes only). See Section 6.2.
b	Where an additional airspace structure is required for radar control purposes, the dimensions shall be such that radar control manoeuvres can be contained within the structure, allowing a safety buffer. This safety buffer shall be in accordance with agreed parameters as set down in CAA policy statement 'Safety Buffer Policy for Airspace Design Purposes Segregated Airspace'. Describe how the safety buffer is applied, show how the safety buffer is portrayed to the relevant parties, and provide the required agreements between the relevant ANSPs/ airspace users detailing procedures on how the airspace will be used. This may be in the form of Letters of Agreement with the appropriate level of diagrammatic explanatory detail.	As today - no proposed changes to the airspace structure (technical changes only).
c	The Air Traffic Management system must be adequate to ensure that prescribed separation can be maintained between aircraft within the airspace structure and safe management of interfaces with other airspace structures	As today - no proposed changes to the existing airspace structure (technical changes only).
d	Air traffic control procedures are to ensure required separation between traffic inside a new airspace structure and traffic within existing adjacent or other new airspace structures	As today – no proposed changes to the existing ATC procedures.
e	Within the constraints of safety and efficiency, the airspace classification should permit access to as many classes of user as practicable	As today - no proposed changes to existing airspace classifications.
f	There must be assurance, as far as practicable, against unauthorised incursions. This is usually done through the classification and promulgation	As today– no proposed changes to airspace classification or volume.
g	Pilots shall be notified of any failure of navigational facilities and of any suitable alternative facilities available and the method of identifying failure and notification should be specified	Existing contingency procedures would continue to apply.
h	The notification of the implementation of new airspace structures or withdrawal of redundant airspace structures shall be adequate to allow interested parties sufficient time to comply with user requirements. This is normally done through the AIRAC cycle	No proposed new structures and all changes will be promulgated via the AIRAC cycle. The cost of implementation for the change and adaptation of systems is estimated to be approximately £65,000.

i	There must be sufficient R/T coverage to support the Air Traffic Management system within the totality of proposed controlled airspace	No change from today's Controlled Airspace. R/T coverage demonstrably adequate as per current day.
j	If the new structure lies close to another airspace structure or overlaps an associated airspace structure, the need for operating agreements shall be considered	No proposed new structures.
k	Should there be any other aviation activity (low flying, gliding, parachuting, microlight site, etc.) in the vicinity of the new airspace structure and no suitable operating agreements or air traffic control procedures can be devised, the change sponsor shall act to resolve any conflicting interests	No proposed new airspace structures.

	ATS route requirements	Evidence of compliance/ proposed mitigation
a	There must be sufficient accurate navigational guidance based on in-line VOR/DME or NDB or by approved RNAV derived sources, to contain the aircraft within the route to the published RNP value in accordance with ICAO/ Eurocontrol standards	RNAV5 navaid coverage is demonstrably adequate. DME/ DME coverage is adequate and demonstrated in the coverage plots in Reference 5.
b	Where ATS routes adjoin terminal airspace there shall be suitable link routes as necessary for the ATM task	As today – there are no new link routes required as part of this proposal.
c	All new routes should be designed to accommodate P-RNAV navigational requirements	Confirmed - RNAV5 will be used.

	Terminal airspace requirements	Evidence of compliance/ proposed mitigation
a	The airspace structure shall be of sufficient dimensions to contain appropriate procedures, holding patterns and their associated protected areas	As today - no proposed changes to the airspace structure.
b	There shall be effective integration of departure and arrival routes associated with the airspace structure and linking to designated runways and published instrument approach procedures (IAPs)	As today - no proposed changes to the airspace structure.
c	Where possible, there shall be suitable linking routes between the proposed terminal airspace and existing enroute airspace structure	As today - the amended STARs will end in the same locations as they do currently.
d	The airspace structure shall be designed to ensure that adequate and appropriate terrain clearance can be readily applied within and adjacent to the proposed airspace	As today - no change to the airspace structure.

e	Suitable arrangements for the control of all classes of aircraft (including transits) operating within or adjacent to the airspace in question, in all meteorological conditions and under all flight rules, shall be in place or will be put into effect by the change sponsor upon implementation of the change in question (if these do not already exist)	As today - no change to the airspace structure.
f	The change sponsor shall ensure that sufficient visual reference points are established within or adjacent to the subject airspace to facilitate the effective integration of VFR arrivals, departures and transits of the airspace with IFR traffic	As today - no change to visual reference points.
g	There shall be suitable availability of radar control facilities	As today - no change to radar control facilities.
h	The change sponsor shall, upon implementation of any airspace change, devise the means of gathering (if these do not already exist) and of maintaining statistics on the number of aircraft transiting the airspace in question. Similarly, the change sponsor shall maintain records on the numbers of aircraft refused permission to transit the airspace in question, and the reasons why. The change sponsor should note that such records would enable ATS managers to plan staffing requirements necessary to effectively manage the airspace under their control	As today - there are no proposed changes to the airspace structure.
i	All new procedures should, wherever possible, incorporate Continuous Descent Approach (CDA) profiles after aircraft leave the holding facility associated with that procedure	As today – no new procedures.

	Off-route airspace requirements	Evidence of compliance/ proposed mitigation
	There are no proposed changes to off-route airspace structures	

14. Environmental Assessment

	Theme	Content	Evidence of compliance/ proposed mitigation
a	WebTAG analysis	Output and conclusions of the analysis (if not already provided elsewhere in the proposal)	N/A – no foreseeable change in CO_2 or greenhouse gas emissions. See Section 7.7.
b	Assessment of noise impacts (Level 1/M1 proposals only)	Consideration of noise impacts, and where appropriate the related qualitative and/or quantitative analysis If the change sponsor expects that there will be no noise impacts, the rationale must be explained	N/A – this is a Level 2C change.
c	Assessment of CO_2 emissions	Consideration of the impacts on CO_2 emissions, and where appropriate the related qualitative and/or quantitative analysis If the change sponsor expects that there will be no impact on CO2 emissions impacts, the rationale must be explained	N/A – no foreseeable change in CO_2 or greenhouse gas emissions. See Section 7.7.
d	Assessment of local air quality (Level 1/M1 proposals only)	Consideration of the impacts on local air quality, and where appropriate the related qualitative and/or quantitative analysis If the change sponsor expects that there will be no impact on local air quality, the rationale must be explained	N/A – this is a Level 2C change
e	Assessment of impacts upon tranquillity (Level 1/M1 proposals only)	Consideration of any impact upon tranquillity, notably on Areas of Outstanding Natural Beauty or National Parks, and where appropriate the related qualitative and/or quantitative analysis If the change sponsor expects that there will be no tranquillity impacts, the rationale must be explained	N/A – this is a Level 2C change.
f	Operational diagrams	Any operational diagrams that have been used in the consultation to illustrate and aid understanding of environmental impacts must be provided	See the Assessment meeting slide pack (Ref 2) No foreseeable change to environmental impacts, as covered in Section 7.7.
g	Traffic forecasts	10-year traffic forecasts, from the anticipated date of implementation, must be provided (if not already provided elsewhere in the proposal)	No foreseeable changes to capacity or usage - see Section 4.3.
h	Summary of environmental impacts and conclusions	A summary of all of the environmental impacts detailed above plus the change sponsor's conclusions on those impacts	No foreseeable environmental impact - see Section 7.7.

15. Appendices

15.1 References

Ref No	Name	Hyperlink
1	BIG BNN MID WCO WOD Statement of Need, DAP1916 #3409	Link
2	BIG BNN MID WCO WOD CAP1616 Stage 1 Assessment Meeting Slide Pack V1.2	Link
3	BIG BNN MID WCO WOD CAP1616 Stages 1-3 Multi-Gateway V1.3	Link
4	AIP changes in support of DVOR rationalisation for BIG BNN MID WCO WOD (V5.0 Sep 2020)	Supplied alongside ACP
5	DVOR Rationalisation WCO & BNN NATS Procedure Design Report V2.0	Supplied alongside ACP
6	SARG Policy: Policy for the replication of conventional SIDs, STARs and Holds using PBN	Link
7	Airport Engagement Evidence V1.1	Link

15.2 Statement of Need V5 for BIG BNN MID WCO WOD ACP (DAP1916 ref 3409)

In order to facilitate the eventual removal of the Westcott (WCO) and Woodley (WOD) NDBs; and Bovingdon (BNN), Midhurst (MID) & Biggin Hill (BIG) DVORs, it is proposed to remove the en-route dependencies from these facilities. Any STARs that use these facilities and not changed by previous DVOR Removals will either be dis-established or made RNAV5 and designated by their start points in line with ICAO. Any alternate STARs & Holds will be removed.

In the event that the removal of the dependency requires truncation/ rationalisation of existing STARs, then any portions of STARs removed or rationalised will be replaced by an ATS Route or DCT.

The outer Holds at HON, DELBO as well as at OKESI for OCK arrivals will also be made RNAV and added to the relevant RNAV STAR Charts.

Finally, as part of this proposal, NATS will take the opportunity to re-designate other STARs that appear on the same chart.

This proposal will therefore remove the en-route dependency from the Biggin Hill, Bovingdon and Midhurst DVORs; and Westcott and Woodley NDBs. None of the above will result in a change of tracks over the ground or vertical profile at or below 7,000ft.

15.3 Impact Assessment – Birmingham STARs

See the redacted Stage 1 Assessment Meeting Presentation [Ref 2] for charts and technical notes (Slides 9 - 10). The AIP change document [Ref 4] and PDG final design report [Ref 5] contain further technical details.

Current IFP	Current route connectivity/ STAR	Design Principle	How	Proposed route Connectivity/ STAR	Impact of proposed change on connectivity/ flight behaviour
GROVE 1B STAR	DCT: *WCO - HON - OSKOT - GROVE*	4 Replication 6 Technical Amendment	Technical amendment - to commence at SILVA - and RNAV5 replication to become SILVA 1B	M183, Q41, Y321: ***SILVA*** *- **YOHDA** - HON - OSKOT - GROVE*	SILVA is 1.6nm west of WCO and provides the flight connectivity from the UK ATS Route Network. New waypoint YOHDA will also be added. This will improve connectivity and remove the need for DCTs to WCO. No predicted change to flight behaviour. The amended SILVA 1B STAR will be as closely aligned as possible to the original GROVE 1B STAR, using RNAV design criteria. The new STAR will be designated by its start point SILVA and assigned Identifier "B" for Birmingham to follow NATS established designation protocols.
GROVE 1C STAR	L10, L610, Q3, T420: *BUZAD – OLNEY – WELIN – HON – OSKOT – GROVE*	4 Replication 6 Technical Amendment	Technical amendment – extended back to HEMEL – and RNAV5 replication to become HEMEL 1B	L10, L610, Q3, T420: ***HEMEL*** *– BUZAD – WELIN –* ***PUFAX*** *– HON – OSKOT – GROVE*	The STAR will be extended to start at HEMEL; incorporating the important Descent Planning FL220 restriction currently published on the conventional STAR at HEMEL. There will also be the addition of new waypoint PUFAX whilst existing waypoint OLNEY will be removed from the STAR. The extended HEMEL 1B STAR will be as closely aligned as possible to the original GROVE 1C STAR using RNAV design criteria. No predicted change to flight behaviour. STAR designated by its start point HEMEL and assigned Identifier "B" for Birmingham to follow NATS established designation protocols.
GROVE 1A STAR	L10 (FL70-): *BUZAD - DTY - HON - OSKOT - GROVE*	3 Withdraw	Not required	Not required	Not required as this STAR is only for traffic at RFL70 or below and given the direction of flight this would be 6,000ft. As there is no traffic cruising at this level then there is no justification to retain this STAR. In the unlikely event that traffic wishes to cruise at that level then the UK DCT limit published in RAD Appendix 4 will be available to join what will become the HEMEL 1B/ SILVA 1B STAR at HON.

Current IFP	Current route connectivity/ STAR	Design Principle	How	Proposed route Connectivity/ STAR	Impact of proposed change on connectivity/ flight behaviour
OLIVE 1B STAR	DCT: *WCO - OSKOT - OLIVE*	3 Withdraw	Not required	Not required	There will be no requirement for this STAR once the GROVE 1B STAR is RNAV'd. This STAR is currently used when the HON DVOR is u/s. Due to ATC requirements and the unavailability of the CHASE Hold to the north of Birmingham when HON DVOR is u/s, the OLIVE 3A STAR from the south will be retained. Traffic routeing via SILVA when HON DVOR is u/s will be tactically vectored OLIVE or to DTY to join the OLIVE 3A.

15.4 Impact Assessment – London City STAR

See the redacted Stage 1 Assessment Meeting Presentation [Ref 2] for charts and technical notes (Slide 11). The AIP change document [Ref 4] and PDG final design report [Ref 5] contain further technical details.

Current IFP	Current route connectivity/ STAR	Design Principle	How	Proposed route Connectivity/ STAR	Impact of proposed change on connectivity/ flight behaviour
JACKO 1A STAR	Q63: *KENET - WCO - BOMBO - BKY - BRAIN - CLN - JACKO*	5 Truncate 6 Technical Amendment	Realign and truncate the STAR to route via/ commence at SILVA - to become SILVA 1C	DCT: ***SILVA*** *- BOMBO - BKY - BRAIN - CLN - JACKO*	Realign and truncate the STAR to route via/ commence at SILVA; and use a DCT to get from Q63 (KENET) to SILVA. The DCT will be permitted and restricted to allow traffic inbound EGLC to flightplan it. SILVA 1C will be created using RNAV design criteria to match as closely as possible the existing RNAV procedure. This STAR is used less than the nearby BEDEK 1C and is primarily for low level traffic (RFL230 and below). No predicted change to flight behaviour. The STAR will be designated by its start point SILVA and assigned Identifier "C" for London City to follow NATS established designation protocols.

15.5 Impact Assessment – Gatwick Holds and STARs

See the redacted Stage 1 Assessment Meeting Presentation [Ref 2] for charts and technical notes (Slides 12 – 15). The AIP change document [Ref 4] and PDG final design report [Ref 5] contain further technical details.

Current IFP	Current route connectivity/ STAR	Design Principle	How	Proposed route Connectivity/ STAR	Impact of proposed change on connectivity/ flight behaviour
DELBO Hold	N/A	4 Replicate	RNAV5 replication	N/A	The DELBO Hold has no current ATS Route Connectivity and is effectively a 'floating Hold' and only used tactically during periods of congestion within the London TMA. This will continue to be the case once the Hold is RNAV and as such, there will be no foreseeable change to flight behaviour.
TIMBA 1D STAR	Stack Swap STAR for traffic inbound Gatwick from the north and west: *MID - MAY - LARCK - TIMBA*	4 Replicate	RNAV5 replication to become **MID 1X**	N/A: *MID – ZOPHI – MAY – OSDEB – TIMBA*	The TIMBA 1D is a Stack Swap STAR that is very seldom flown as published with radar vectors being provided by ATC to get to TIMBA. This STAR was overlooked as part of LAMP 1A and SAIP AD1 ACPs. It has therefore been included in this proposal as it affects the same Sector Groups and helps remove the final en-route dependency on MID DVOR. No predicted change to flight behaviour. This STAR will be 'as directed by ATC' and not flight plannable. The 'X' Identifier will used to demonstrate an extraordinary STAR i.e. stack-swap or contingency to follow NATS established designation protocols.
WILLO 3B STAR	L151, N859: *KIDLI - MID - HOLLY - WILLO*	4 Replicate 6 Technical Amendment	RNAV5 replication to become **KIDLI 1G**	N859: *KIDLI - MID - **TUFOZ** - HOLLY - WILLO*	The KIDLI 1G STAR is for traffic inbound to Gatwick routeing from HON via N859. Waypoint TUFOZ - which was established on the BEDEK 1G STAR as part of the BIG DVOR submission in November 2019 - will be added as it the same point (SLP) for the KIDLI 1G. Same, no impact to connectivity. No predicted change to flight behaviour. STAR designated by its start point KIDLI and assigned Identifier "G" for Gatwick to follow NATS established designation protocols.
	– N/A	4 Replicate 6 Technical Amendment	Extension of current WILLO 3B and RNAV replication to become **DISIT 1G**	L151: DISIT - KIDLI - MID - **TUFOZ** - HOLLY - WILLO	Traffic inbound Gatwick RFL200+ from the north, shall route via DISIT as per the UK SRD. There is an important Descent Planning of FL200 level DISIT published on the current Conventional WILLO 3B which would be 'lost' by commencing the RNAV version at KIDLI. To ensure this is retained on the RNAV version, a new STAR will be established commencing at DISIT. As per the KIDLI 1G above, waypoint TUFOZ will be included in this STAR to denote the SLP. No predicted change to flight behaviour. STAR designated by its start point DISIT and assigned Identifier "G" for Gatwick to follow NATS established protocols.

ASTRA 2B STAR	L151, N859: *KIDLI - WOD - ASTRA*	3 Withdraw	Not required	Not required	There will be no requirement for the ASTRA 2B once the KIDLI 1G and DISIT 1G STARs are established as there will be no dependency on the MID DVOR.

15.6 Impact Assessment – Heathrow Holds and STARs

See the redacted Stage 1 Assessment Meeting Presentation [Ref 2] for charts and technical notes (Slides 16 - 19). The AIP change document [Ref 4] and PDG final design report [Ref 5] contain further technical details.

Current IFP	Current route connectivity/ STAR	Design Principle	How	Proposed route Connectivity/ STAR	Impact of proposed change on connectivity/ flight behaviour
BNN 1B STAR	Q36, Q38, (U)Y53: *NUGRA - TOBID - WCO - BNN*	4 Replicate	RNAV5 replication to become **NUGRA 1H**	Q36, Q38, (U)Y53: *NUGRA - TOBID - WCO - BNN*	The BNN 1B is for traffic inbound Heathrow RFL200+; this proposal would RNAV replicate and re-designate as NUGRA 1H. There would be no change to connectivity and no predicted change to flight behaviour. The STAR will be designated by its start point NUGRA and assigned Identifier "H" for Heathrow to follow NATS established designation protocols.
BNN 1D stack-swap STAR	This is a stack-swap STAR (OCK Hold to BNN Hold), and is not flight plannable: *KENET - BNN*	4 Replicate 6 Technical Amendment	Re-align to commence on P2 at BEDEK, route via CPT to BNN and RNAV5 replication to become **BEDEK 1Z**	*BEDEK - CPT - BNN*	The BNN 1D STAR commences at KENET; a legacy of when Heathrow arrivals into OCK routed via L9 through KENET. The 2006 West End airspace change - establishing airway Y3 (now ATS Route P2) - moved the primary route south through waypoint BEDEK but failed to move the Stack Swap STAR. Since 2009 the number of arrivals into OCK has increased considerably, requiring the Stack Swap to be used more. Traffic inbound OCK has a level restraint of FL140 at BEDEK however, when the BNN STAR is issued the restriction can disappear from the FMS as BEDEK is not on the STAR. This can cause the descent profile to change and cause greater workload both to ATC and Flight crews alike. By re-aligning the Stack Swap STAR to also commence at BEDEK, the descent profile will be retained - increasing predictability and reducing workload. Consequently, commencing at BEDEK will also enable this to be in the flightplan of over 98% of OCK arrivals, which the current

Current IFP	Current route connectivity/ STAR	Design Principle	How	Proposed route Connectivity/ STAR	Impact of proposed change on connectivity/ flight behaviour
					STAR is not. The lateral track to BNN from P2 is purely tactical and can happen as far west as OKESI or east as OCK itself (typically between these two points). The SAIP AD5 airspace change (07/11/19) was designed to reduce the number of Stack Swap STARs by tactically re-routeing them to BNN from the Shannon FIR boundary. However, there will still be occasions when OCK is unavailable (weather or is full) that will require the tactical switching to BNN. Flight plan data was queried to obtain the number of stack-swaps that occurred from OCK-BNN, before and after the SAIP AD5 implementation: From 01/01/19 – 06/11/19 there were 2,005 OCK-BNN stack swaps which equates to 6.48 per day. Between 07/11/19 – 31/01/20 (since SAIP AD5) there were 505 OCK-BNN stack swaps which equates to 5.94 per day. Acknowledging that the implementation date was still fairly recent, there has been a reduction in the average number of stack swaps since implementation. However, it is also worth considering that these figures were taken from winter months; there has likely been better use of AMAN by Shannon ACC; and the North Atlantic tracks may have been more north-about in these months meaning that flights don't come into OCK in the first place. These could have also had an impact on the number. The number of stack swaps will continue to be monitored as the introduction of the SAIP AD5 changes stipulated no more than 3,000 per annum. Consequently, this STAR will be 'as directed by ATC' and not flight plannable. It will be designated by its start point BEDEK with the "Z" Identifier used to demonstrate an extraordinary STAR i.e. stack-swap

Current IFP	Current route connectivity/ STAR	Design Principle	How	Proposed route Connectivity/ STAR	Impact of proposed change on connectivity/ flight behaviour
					or contingency.
BNN 1E stack-swap STAR	This is a stack-swap STAR (LAM Hold to BNN Hold), and is not flight plannable: *LAM – DONNA - BNN*	4 Replicate	RNAV5 replication to become **LAM 1Z**	*LAM - DONNA - BNN*	Stack Swap STAR used to get traffic from the LAM to the BNN Hold, when LAM is either full or during periods of bad weather. No predicted change to flight behaviour. This STAR will be 'as directed by ATC' and not flight plannable. It will be designated by its start point LAM and given the 'Z' Identifier used to demonstrate an extraordinary STAR i.e. stack-swap or contingency. This will also differentiate it from the LAM 1X and LAM 1Y STARs which stack swap traffic to BIG & OCK respectively.
BNN 4A STAR	L10, L15, L612: *HON - TOBID - WCO - BNN*	4 Replicate	RNAV5 replication to become **HON 1H**	L10, L15, L612: *HON - TOBID - WCO - BNN*	Replicate and re-designate as HON 1H. Same, no impact to connectivity. No predicted change to flight behaviour. STAR designated by its start point HON and assigned Identifier "H" for Heathrow to follow NATS established protocols
HON Hold	N/A	3 Withdraw 4 Replicate	RNAV5 replication for RH turn Withdraw LH Turn	Not required	The HON right-hand turn will be replicated and lowered to FL150 to ensure airspace containment. A Hold can only be published in one direction and on one axis; it must be unique or otherwise re-designated. Historically the Hold below FL195 was a left-hand pattern due to the lack of CAS to the west of HON. Previous airspace developments extended CAS to the west but didn't amend the hold to take advantage of it. Since modern DMSs can only accommodate one Hold at a given waypoint and that there is now airspace west of HON the left-hand Hold will be removed, and the right-hand Hold will be published from FL150 to FL410 Same, no impact to connectivity. No predicted change to flight behaviour.
OKESI Hold	N/A	6 Technical Amendment	RNAV5 replication as currently published in ENR3.6	N/A	The OKESI Hold is published as an RNAV Hold in ENR3.6 however, no actual Instrument Flight Procedure has ever been created for it. It was also previously referred to on the conventional OCK 2F STAR

Current IFP	Current route connectivity/ STAR	Design Principle	How	Proposed route Connectivity/ STAR	Impact of proposed change on connectivity/ flight behaviour
					which was RNAV replicated in May 2019, but with a conventional description. As such, the note had to be removed once the STAR was made RNAV which has caused confusion amongst operational and flight crew staff. Therefore, the OKESI Hold has been designed to RNAV design criteria and will have its own unique coding table. It will be added to the BEDEK 1H and BEDEK 1Z STAR charts as part of this proposal (as an outer Hold).
WCO Hold	N/A	3 Withdraw 6 Technical Amendment	RNAV5 replication for RH turn Withdraw LH Turn	Not required	The right-hand Hold became an RNAV Hold on 07/11/19 replicating the current published conventional WCO Hold up to FL150. Historically holding above FL150 had to be left-hand due to airspace containment issues but the CAS west of WCO has since grown, enabling containment. Furthermore, modern FMS have difficulty storing two holding patterns at the same waypoint which can also create ambiguity. This proposal therefore will remove the left-hand Hold at WCO (FL160+) and add 5 additional levels to the Right Hand RNAV Hold. Same, no impact to connectivity. No predicted change to flight behaviour.
BNN 1C STAR	M605: *DTY - WCO - BNN*	3 Withdraw	Not required	Not required	This STAR is for traffic FL70 and below of which there is very little. It was first established for traffic between East Midlands and Heathrow at FL70 (height of East Midlands SID) but has long fallen into disuse. The East Midlands SID now goes to FL90 and so would not tie up with the restrictions on this STAR. Also, if traffic wanted to go to Heathrow it would flight plan via *DTY - WCO* DCT published in RAD Appendix 4 and join the BNN4A STAR at WCO. There is therefore no justification to replace or replicate this STAR and it will be removed as part of this proposal.

Current IFP	Current route connectivity/ STAR	Design Principle	How	Proposed route Connectivity/ STAR	Impact of proposed change on connectivity/ flight behaviour
					Flight plan data was used to show there were a total of 963 Heathrow arrivals which flew via DTY in 2019. Of these, only 15 flight planned via DTY – 7 from EGBB, 7 from EGNX and 1 from EGLL.
BOVVA 1B STAR	Q36, Q38, (U)Y53: *NUGRA - TOBID - WCO – BOVVA*	3 Withdraw	Not Required	Not Required	Withdrawn, redundant once the BNN 1B STAR is RNAV'd.
BOVVA 1C STAR	M605: *DTY - WCO - BOVVA*	3 Withdraw	Not Required	Not Required	Withdrawn for the same reasons as BNN 1C described above.
BOVVA 1D STAR	This is a stack-swap STAR and is not flight-plannable: *KENET - BOVVA*	3 Withdraw	Not Required	Not Required	Withdrawn, redundant once the BNN 1D STAR is RNAV'd.
BOVVA 1E STAR	This is a stack-swap STAR and is not flight-plannable: *LAM – DONNA - BOVVA*	3 Withdraw	Not Required	Not Required	Withdrawn, redundant once the BNN 1E STAR is RNAV'd.
BOVVA 4A STAR	L10, L15, L612: *HON - TOBID - WCO - BOVVA*	3 Withdraw	Not Required	Not Required	Withdrawn, redundant once the BNN 4A STAR is RNAV'd.
BOVVA Hold	N/A	3 Withdraw	Not required	Not required	To be withdrawn, as it will no longer be required now that the BNN hold has been RNAV'd by SAIP AD5 (07/11/19).
DTY Hold	N/A	3 Withdraw	Not required	Not required	The DTY right-hand Hold will be withdrawn alongside the BNN 1C STAR.

15.7 Impact Assessment – London Luton/ Stansted STARs

See the redacted Stage 1 Assessment Meeting Presentation [Ref 2] for charts and technical notes (Slides 20 - 22). The AIP change document [Ref 4] and PDG final design report [Ref 5] contain further technical details.

Current IFP	Current route connectivity/STAR	Design Principle	How	Proposed route Connectivity/STAR	Impact of proposed change on connectivity/ flight behaviour
LOREL 5A STAR	DCT: *WCO - BOMBO - BKY - BUSTA LOREL*	6 Technical Amendment	Realign the STAR to route via SILVA - to become **SILVA 1L**	DCT: ***SILVA** - BOMBO - BKY - BUSTA - LOREL*	The LOREL 5A was established to provide flight plannable connectivity to traffic departing Birmingham on WCO SIDs positioning to Luton/Stansted, as well as low level traffic from around the London TMA. In 2018 the Birmingham WCO 5D SID was dis-established and this traffic now routes on the UNGAP SID with a DCT to DTY to pick up the LOREL 1K STAR. It is proposed to re-align the STAR to commence at SILVA which is on the ATC route network whereas WCO is planned to be removed. The WCO 2Y SID will still be available and a DCT established to BOMBO to enable the flight plannable connectivity from the SID to the STAR. Equally the DTY 2Y SID is available for traffic to flight plan via the LOREL 1K STAR. The LOREL 1B is available for low-level traffic (FL170-) entering the UK via the ORTAC/ORIST area. It currently flight plans via L980 to KATHY. There's not a lot of traffic at these levels on this routeing and so it is proposed to use ATS Routes between *KATHY - HAZEL - WOD* and then M605 to get to SILVA to connect with the re-aligned STAR. The LOREL 2L is available for low-level traffic (FL230-) via KENET. Similarly, there is not a huge amount of traffic at these levels and so it is proposed to establish a DCT from KENET to SILVA to connect with the truncated and re-aligned STAR. No predicted change to flight behaviour. The STAR will be designated by its start point SILVA and assigned the Identifier "L" for LOREL.
LOREL 1B STAR	L980: *KATHY - HAZEL - WOD - WCO - BOMBO - BKY - BUSTA - LOREL*	5 Truncate 6 Technical Amendment	Realign and truncate the STAR to route via/ commence at SILVA - to become **SILVA 1L**	M605: ***SILVA** - BOMBO – BKY - BUSTA - LOREL*	
LOREL 2L STAR	Q63: *KENET - WCO - BOMBO - BKY - BUSTA - LOREL*	5 Truncate 6 Technical Amendment	Realign and truncate the STAR to route via/ commence at SILVA - to become **SILVA 1L**	DCT: ***SILVA** - BOMBO - BKY - BUSTA - LOREL*	
BOMBO Hold	N/A	4 Replicate	RNAV5 replication	N/A	Same, no impact to connectivity. No predicted change to flight behaviour.

Current IFP	Current route connectivity/STAR	Design Principle	How	Proposed route Connectivity/STAR	Impact of proposed change on connectivity/ flight behaviour
ASKEY 5A STAR	DCT: *WCO - BOMBO - BKY - BUSTA - ASKEY*	3 Withdraw	Not Required	Not Required	Withdrawn, redundant once the LOREL 5A STAR is RNAV'd.
ASKEY 1B STAR	DCT: *KATHY - HAZEL - WOD - WCO – BOMBO - BKY - BUSTA - ASKEY*	3 Withdraw	Not Required	Not Required	Withdrawn, redundant once the LOREL 1B STAR is RNAV'd.
ASKEY 2L STAR	DCT: *KENET - WCO - BOMBO - BKY - BUSTA - ASKEY*	3 Withdraw	Not Required	Not Required	Withdrawn, redundant once the LOREL 2L STAR is RNAV'd.

15.8 Impact Assessment – London Southend STARs

See the redacted Stage 1 Assessment Meeting Presentation [Ref 2] for charts and technical notes (Slides 23 - 24). The AIP change document [Ref 4] and PDG final design report [Ref 5] contain further technical details.

Current IFP	Current route connectivity/STAR	Design Principle	How	Proposed route Connectivity/STAR	Impact of proposed change on connectivity/ flight behaviour
SPEAR 1A STAR	Q63: *KENET - WCO - BOMBO - BKY - BRAIN - MAYLA - SPEAR*	5 Truncate 6 Technical Amendment	Realign and truncate the STAR to route via/ commence at SILVA – to become SILVA 1S	DCT: ***SILVA*** - *BOMBO - BKY - BRAIN - MAYLA - SPEAR*	Realign the STAR to route via SILVA and truncate it to begin at SILVA and use a DCT to get from Q63 (KENET) to SILVA. Waypoint SILVA is on the ATC route network whereas WCO is planned for removal. No predicted change to flight behaviour. STAR designated by its start point SILVA and assigned Identifier "S" for Southend to follow NATS established protocols.
BOMBO Hold	N/A	4 Replicate	RNAV5 replication	Not required	Same, no impact to connectivity. No predicted change to flight behaviour.
SPEAR Hold	N/A	4 Replicate	RNAV5 replication	Not required	Same, no impact to connectivity. No predicted change to flight behaviour.

15.9 Impact Assessment – ATS Route Re-designations

See the AIP change document [Ref 4] and PDG final design report [Ref 5] for further technical details.

Current Route Name	Current Route	Proposed Route Name	Proposed Route	Notes	Impact of proposed change on connectivity/ flight behaviour
L89	*GIBSO - BEGTO - AVANT*	Same – L89	*KATHY - HAZEL - WOD*	Eastbound only	The current L89 ATS Route will be re-designated as N16 (covered below). L89 will replace the DCT between *KATHY - HAZEL* (truncated portions of LOREL 1B STAR). It will prevent establishing another DCT between *HAZEL - WOD*. Established ATS Route M605 between WOD and SILVA will provide the final part of the connectivity to SILVA. RAD restricted to LOREL arrivals via KATHY only. Same, no impact to connectivity. No predicted change to flight behaviour.
N16	*GWC - OTSID - BIG - BPK - BKY*	Same – N16	*GIBSO - BEGTO - AVANT - GWC - OTSID - BIG - BPK - BKY*	Eastbound only	N16 will be extended via *AVANT - BEGTO* to GIBSO replacing L89 (as described above), and the *AVANT - GWC* DCT. This DCT was established in May 2019 (GWC DVOR deployment) after one of the non-RNAV1 STARs into Gatwick was truncated to begin at GWC. Although the DVOR Project did not extend N16 at the time; we can use L89 to route KATHY - HAZEL - WOD and N16 can be extended back to GIBSO via BEGTO to replace L89, as part of this ACP. By using these routes as proposed it negates the need to use up another ATS Route Designator from ICARD. Same, no impact to connectivity. No predicted change to flight behaviour. This will include the same directional specifications along the route (no change from today).

End of document