Renaming & Removing Outstanding Enroute IFP dependencies on ground-based NAVAIDs

Phase 1 Holds and STARs
CAP1616 Stage 2 Gateway

V1.1

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Action	Position	Date
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Issue	Month/Year	Change Requests in this issue
Issue 1.0	Aug 2021	Submitted to the CAA
Issue 1.1	Aug 2021	Grammatical errors corrected. STAR connectivity added to the Annexes C-F Following guidance from the CAA: • Para 2.5 updated to clarify SLP use • Table 1 caption expanded to clarify RNAV1/5 traffic split is calculated, therefor the sum of the calculated aircraft might not equal the total planned aircraft for these STARs • Following the removal of the proposed LIFFY 1L STAR from this document, para 2.12 has been updated to reflect that the TIPOD Hold can no longer be dual designated. • The TIPOD 1E STAR replication revised to produce two new RNAV1 STARs as opposed to 1 new STAR. • The TIPOD 4A replication revised removing the creation of an RNAV5 STAR (LIFFY 1L).

Contents

1. Introduction

1.1 This document continues the CAP1616 process started with a Statement of Need (SoN) submitted in December 2020. Following the Assessment meeting on the 21st April 2021 a revised SoN was submitted, V3 (Ref 2).

1.2 The intent of this document is to summarise and satisfy the requirements of CAP1616 Stage 2. The CAA reference is ACP-2020-101, the link to the CAA progress page is here.

1.3 This proposal is limited to redesignating any en-route procedures remaining in the UK Aeronautical Information Publication (AIP) following the NATS DVOR Rationalisation Program and removing any remaining dependencies on ground-based Navigation Aids (NavAids) using PBN replication. Hence this proposal is focused on the TIPOD and MIRSI Holds and the following 11 STARs:

- MIRSI 1A, 3B, 2C and 2D;
- TIPOD 4A, 2B, 1C, 1D and 1E;
- BRI 1C;
- CDF 1C.

1.4 There are no changes to ATS routes as part of this proposal.

1.5 This proposal contains the relevant changes required to remove the remaining dependencies on ground-based NavAids of these remaining 13 procedures. Design principles have been developed (Ref 4) which are focused on best removing the en-route DVOR dependencies whilst ensuring the changes are safe and do not result in changes to flight behaviour. This document will identify:

- option concepts for replacing current connectivity relevant to ground-based NavAids with RNAV procedures;
- an evaluation of those option concepts against the Design Principles;
- a full list of the specific changes.

2. Stage 2 Develop and Assess

Step 2A Options Development

2.1 CAA's PBN STAR Replication Policy (V2) was published in Mar 2018 and was used as the 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 enroute network to the termination point with the intention of retaining the existing route and track over the ground (para 5.4). Para 5.5 of the same policy makes assumptions that replication ensures procedures follow the same path over the ground as the existing conventional procedure, as closely as possible. This means that there would be no change to pilot or controller behaviour (apart from technical designation changes), and no change to lateral traffic position.

Airspace change design options

2.2 The design options considered to remove the remaining en-route dependencies from ground-based NavAids, were limited to the following:

Option 0 – Do nothing. Retain all the STARs and Holds unchanged from today's AIP definition.
Option 1 – Using the CAA policies, replicate all relevant STARs and Holds using RNAV, exactly as defined in the AIP without considering any practicalities.
Option 2 – Examine the use of existing STARs and Holds from a practical point of view, re-evaluate how they are used and how the network may be improved by rationalising/truncating/replicating them in a considered manner.
Option 3 – Remove all existing STARs and Holds that refer to or use ground-based NavAids.

2.3 On-going engagement throughout the DVOR project – with relevant airfields and ATC Development and procedure teams at NATS – has determined that, using PBN design criteria, replicate the remaining conventional STARs serving Liverpool and Manchester Airports to the RNAV1 specification where able. This is in accordance with CAA Policy published on the CAA website regarding STAR replication the affected STARs will be replicated using RNAV1 specification:

"Either on an opportunity basis e.g., the introduction of a new airspace design or co-incident with the next Instrument Flight Procedure (IFP) review, those STARs currently promulgated using the RNAV 5 specification, will be re-designed using the RNAV 1 specification in compliance with Part-AUR.PBN.2005 (4)."

2.4 As these procedures are replications of current conventional procedures there is no requirement for ensuring separation from other ATS Routes/STARs.

2.5 Where Speed Limit Points (SLPs) are not defined by existing waypoints, they will be removed from the procedures or new waypoints introduced to enable coding. These will be reviewed prior to the formal ACP submission. Speed restrictions shall be coded into the holds/ entry procedures ensuring aircraft adhere to appropriate speeds whilst flying the procedure as designed. ATC will continue to issue tactical speed clearances as required.

2.6 Eight STARs (four serving Manchester airport and four serving Liverpool airport) will be RNAV1 replicated and extended to incorporate descent planning levels where able.

2.7 One STAR serving Liverpool airport, will be extended and split to producing two new RNAV1 STARs, both incorporating important descent planning levels.

2.8 By replicating these relevant STARs using RNAV1 will cater to the PBN equipage of >91.2% (Q3 2019 figures) of the arrivals for 2019 into the stakeholder airports see Table 1:

Airport	STAR	Planned Arrivals on relevant STARs		RNAV5 %	Calculated Number of RNAV5 equipped aircraft on relevant STARs	
		Planned Total	Planned Per STAR[1]		Total	Per STAR
Liverpool	TIPOD 4A	9676	2064	9.8	948	202
	TIPOD 2B		3594			352
	TIPOD 1C		432			42
	TIPOD 1D		61			6
	TIPOD 1E		3525			345
Manchester	MIRSI 1A	30903	14542	2.44	754	355
	MIRSI 3B		11633			284
	MIRSI 2C		437			11
	MIRSI 2D		4291			105

Table 1: Number of aircraft filing a relevant STAR inbound to Manchester and Liverpool airports in 2019 and the calculated number of non-compliant (RNAV5) aircraft. Number of arrivals sourced from Central Flow Management Unit (CFMU) flight planned data from year 2019. All calculated values are rounded to the nearest integer and as such the total number of flights for the calculated columns might not equal the planned flights totals.

2.9 For aircraft not suitably equipped to fly a RNAV1 STAR there will be a provision to flight-plan a route which is coincident with the new RNAV1 procedure. This will be achieved by:

- Following the ATS route while this is coincident with the STAR,
- Once the STAR deviates from the ATS route, aircraft will follow a series of Directs (DCTs) (as detailed in the SRD) coincident with the STAR, terminating at the holding fix.
- ATC will continue to tactically manage these aircraft, providing Heading/ Level/ Speed/ Holding instructions as necessary.
- In the event of a Radio Communications Failure (RCF) aircraft will be expected to follow the procedures detailed in the UK AIP AD2.22.

2.10 This provision will be published in the relevant sections of the airfield AIP AD2.22.

2.11 The two remaining STARs serving Bristol airport (BRI 1C) and Cardiff airport (CDF 1C) will be replicated to the RNAV5 specification. This specification has been chosen to be consistent with the specification of the STARs previously replicated for these airports during the BCN DVOR ACP (ACP-2019-69).

2.12 The TIPOD hold serving Liverpool airport will be RNAV1 replicated. Non-RNAV1 equipped aircraft (~3 per day in 2019 flying a relevant STAR), will, where required be tactically held by ATC. Radar data indicates that only two aircraft in total (RNAV1 equipped and non-equipped) flying a relevant STAR entered the hold at TIPOD in August 2019. This can therefore be considered to have a negligible impact on capacity.

2.13 The MIRSI hold serving Manchester airport will be RNAV1 replicated. Non-RNAV1 equipped aircraft (~2 per day in 2019 flying a relevant STAR), will, where required be tactically held by ATC. August 2019, radar data indicated that only 37 aircraft in total (RNAV1 equipped and non-equipped) flying an relevant STAR entered the hold at MIRSI. This equates to ~1 non-equipped aircraft holding throughout August and can be considered to have a negligible impact on capacity.

2.14 These 13 procedures will be re-named based on their starting waypoints and will conform as closely as possible to the current conventional procedures.

2.15 All of the above changes are detailed fully in Annexes C- F

[1] Some STARs are over estimated as aircraft have filed to join partway along a STAR at a common point. E.g. an aircraft joining a TIPOD STAR at WAL could join any of the coincident the TIPOD 1C, 1D or 1E STARs, however most will join the TIPOD 1C

2.16 Liverpool Manchester, Bristol and Cardiff Airports have been engaged with regarding this proposal and the changes to the relevant Hold and STARs (evidence of engagement with the airports is detailed in Annex H). The proposed changes are supported by the airports.

Stakeholder Engagement

2.17 As part of Stage 2, CAP1616 requires change sponsors to develop a comprehensive list of Design Options, which are tested with the same group of stakeholders who were engaged with during Stage 1. However, as covered in the Stage 1B Design Principles document (Ref 4), the Design Principles for this submission were constructed around how best to remove the remaining enroute dependencies on ground-based NavAids, alongside ensuring the changes are safe and do not result in any changes to flight behaviour. NATS had previously taken part in a (CAA-led) consultation with the National Air Traffic Management Advisory Committee (NATMAC) on DVOR rationalisation; prior to the introduction of CAP1616 and the requirement to seek feedback on Design Principles.

2.18 Alongside the Design Principles, the Design Options have been developed to provide different methods in which the en-route dependencies can be removed from a DVOR, whilst ensuring no changes to flight behaviours. The Design Options have been used consistently across the numerous DVOR submissions as they achieve the same outcome, although they are always reviewed to ensure relevance. We therefore conclude that there is no need to re-consult with the NATMAC members, nor any additional stakeholders, as there will not be any impact upon them.

2.19 However, as part of this Airspace Change Proposal and as per previous submissions, NATS has been in contact with relevant airfields which use the STARs and associated Holds we plan to RNAV, specifically Liverpool, Manchester, Bristol and Cardiff Airports. The aerodrome sections of the AIP for the affected airfields will need to be updated which this engagement has allowed us to inform them of. The proposed changes have been designed to be invisible from an airport's perspective so there are no other impacts anticipated. Annex H provides a summary of the engagement activity for these procedures.

2.20 Previous DVOR removal proposals have proposed three Design Options: in summary, to do nothing; to replicate all procedures; and lastly, to examine all procedures and improve where appropriate (rationalise/ truncate/ replicate). These Design Options were accepted by the CAA. NATS was later requested to add an additional option to all future submissions, whereby all procedures with a dependency are removed; thus, removing the DVOR dependency. The CAA acknowledged that this Design Option would not meet the Design Principles; however, it is included for completeness.

2.21 The Design Options have therefore been developed so they can be applied to each of the individual DVOR submissions and have evolved following guidance from the CAA. As mentioned above, appropriate engagement has previously been completed with NATMAC members and the relevant airports; and airports will be fully briefed when their AIP pages are required to be updated.

3. Step 2A Options Development: Design Principle Evaluation

3.1 This section evaluates the performance of all 4 Design Options with respect to each of the five Design Principles. The Design Principles developed during Stage 1B are included in Annex A for reference. As covered fully in the Stage 1B document (Ref 4), the Design Principles for this Phase 1 STAR DVOR submission were reviewed to ensure that they are still relevant; as a consistent set has been used throughout the DVOR Programme.

3.2 The below assessment criteria have been used to determine whether each Design Option has met; partially met; or not meet each of the seven Design Principles.

Design Principle	Description	Assessment Criteria		
		Does not meet	Partially meets	Met
DP1 Safety	The proposed airspace change must maintain or enhance the current level of safety	Unlikely to pass a safety case due to major safety issues from proposed changes	Issues identified that would require a robust safety case e.g. workload, IFP (flyability), new hazards	No significant safety issues identified
DP2 No change to flight behaviour	None of the proposed technical changes to definitions of STARs/Holds would result in a change to actual flight behaviours –laterally, vertically or in dispersal	Proposed change(s) would result in a change to flights behaviour	N/A – either met or not met	None of the proposed changes would result in a change to flights behaviour
DP3 PBN Specification	The proposed airspace change will yield maximum safety and efficiency benefits by using an appropriate standard of PBN	No RNAV replications are made as part of the proposal; or, adequate justification is not provided for the proposed changes	N/A – either met or not met	Conventional procedures are replaced with RNAV versions. Proposed changes fully consider and justify the chosen PBN specification
DP4 Remove DVOR Dependencies	Remove en-route dependencies on ground-based NavAids through appropriate design changes; including removing unnecessary references to ground-based NavAids which are not material to the procedure and rationalising rarely used STARs.	Not all enroute dependencies on ground-based NavAids are removed	N/A – either met or not met	All enroute dependencies on ground-based NavAids are removed
DP5 Airspace Optimisation	Where appropriate, the proposed airspace will facilitate an optimised airspace design. Including: • Use PBN Replication –replacing conventional STARs/ Holds with RNAV STARs/ Holds; • Using CAA STAR Truncation Policy, when applied logically to STARs with many common segments, can result in the withdrawal of unnecessary duplicate STARs; • Minor changes to a STAR which currently cannot be flown as it is formally defined for legacy reasons – these changes reflect what would actually happen in practice; • Extend or split a current STAR to allow important Descent Planning levels to be formally incorporated in the STAR description.	Procedures are not individually evaluated for potential application of this DP; therefore, no technical changes are made	Procedures are individually evaluated for potential application of this DP, but no appropriate technical changes are made	Procedures are individually evaluated for potential application of this DP, and minor changes are made, with justification provided

Option 0 – Do nothing. Retain all the STARs and Holds unchanged from today's AIP definition.

3.3 See the submitted Stage 1 Assessment Meeting slide pack (Ref 3) for further details on the procedures which reference or are dependent on ground-based NavAids on their charts and which would remain as they are, for this option. The table below presents an evaluation of this option against the five Design Principles.

Option 0			REJECT
Description of option			
This is the current scenario. No change to existing AIP definitions of STARs or Holds.			
Design Principle 1: Maintain or enhance the current level of safety			MET
Summary of qualitative assessment No change from today; the level of safety is maintained. Therefore, this Design Principle would be satisfied.			
Design Principle 2: No change to flight behaviours			MET
Summary of qualitative assessment No change to lateral/vertical track patterns. Therefore, this Design Principle would be satisfied.			
Design Principle 3: PBN specification	NOT MET		
Summary of qualitative assessment Procedures are not individually evaluated for potential application of this DP; therefore, no RNAV replications would take place under this Design Option. Does not remove any enroute flight dependency from ground-based NavAids and this Design Principle would not be satisfied.			
Design Principle 4: Remove DVOR dependencies	NOT MET		
Summary of qualitative assessment Procedures are not individually evaluated and therefore all existing enroute dependencies on ground-based NavAids would remain and this Design Principle would not be satisfied.			
Design Principle 5: Airspace optimisation	NOT MET		
Summary of qualitative assessment Procedures are not individually evaluated for potential application of this DP. Therefore, no proposed changes to optimise the airspace would take place under this Design Option and this Design Principle would not be satisfied.			

Option 1 - Using the CAA policies, replicate STARs/ Holds using RNAV, exactly as defined in the AIP without considering any practicalities.

3.4 This option would replace all dependant procedures identified in the Assessment Meeting slide pack (Ref 3) as RNAV procedures. This table evaluates this option against the five Design Principles:

Option 1			REJECT
Description of option			
All IFPs would be replicated exactly as defined in the current AIP. No account would be taken of actual usage, route segment duplication, or other factors.			
Design Principle 1: Maintain or enhance the current level of safety			MET
Summary of qualitative assessment Conventional IFPs replicated as RNAV procedures. The level of safety is maintained or slightly improved due to increased precision. No potential safety issues identified. Therefore, this Design Principle would be satisfied.			
Design Principle 2: No change to flight behaviours			MET
Summary of qualitative assessment No practical change to connectivity therefore, no change to lateral/vertical track patterns. Therefore, this Design Principle would be satisfied.			
Design Principle 3: PBN specification			MET
Summary of qualitative assessment This Design Option would purely replicate procedures like for like using an appropriate PBN specification; including route segment duplications etc. Therefore, this Design Principle would be satisfied.			
Design Principle 4: Remove DVOR dependencies			MET
Summary of qualitative assessment Conventional procedures are replicated under this Design Option, which removes the enroute dependencies on ground-based NavAids. Therefore, this Design Principle would be satisfied.			
Design Principle 5: Airspace optimisation	NOT MET		
Summary of qualitative assessment Asides from replicating conventional procedures as they are currently defined under this Design Option, procedures are not evaluated for potential further airspace optimisation opportunities. Therefore, this Design Principle would not be satisfied.			

Option 2 - Examine the use of existing STARs and Holds from a practical point of view, re-evaluate how they are used and how the network may be improved by rationalising/truncating/replicating them in a considered manner.

3.5 This option evaluates the usage of each procedure individually and creates opportunity bespoke to specific procedures. See Annexes C-F below for the detailed proposed change for each of the procedures under this option. This table evaluates this option against the five Design Principles:

Option 2			ACCEPT and PROGRESS
Description of option			
Examine the use of existing IFPs from a practical point of view, re-evaluate how they are used and how the network may be improved by rationalising/truncating/replicating them in a considered manner.			
Design Principle 1: Maintain or enhance the current level of safety			MET
Summary of qualitative assessment IFPs replicated as RNAV procedures with an appropriate PBN specification proposed. The level of safety is maintained or slightly improved due to increased precision. Procedures can be simplified depending on actual usage today. No potential safety issues identified. Therefore, this Design Principle would be satisfied.			
Design Principle 2: No change to flight behaviours			MET
Summary of qualitative assessment No practical change to connectivity therefore, no change to lateral/vertical track patterns. Therefore, this Design Principle would be satisfied.			
Design Principle 3: PBN specification			MET
Summary of qualitative assessment This Design Option would evaluate current IFPs and propose RNAV replication where relevant, including an appropriate specification. Therefore, this Design Principle would be satisfied.			
Design Principle 4: Remove DVOR dependencies			MET
Summary of qualitative assessment This Design Option would evaluate current IFPs and propose that conventional procedures with a ground-based NavAid dependency are replicated; thus, removing the enroute dependencies on ground-based NavAids. Therefore, this Design Principle would be satisfied. For example, this enables the Bristol BRI 1C STAR to be RNAV replicated which removes the current dependencies on the CPT DVOR and BRI NDB.			
Design Principle 5: Airspace optimisation			MET
Summary of qualitative assessment This Design Option would evaluate current IFPs and where appropriate, propose changes which would facilitate an optimised airspace design. Therefore, this Design Principle would be satisfied. For example, this enables the MIRSI 1A STAR to be RNAV replicated and extended back to an existing waypoint, OKTEM, thus retaining the important descent planning restriction.			

Option 3 – Remove all existing STARs and holds that refer to or use the ground-based NavAids.

3.6 This option removes any remaining STAR or Hold with a reference to, or a dependency on ground-based NavAids. This table evaluates this option against the five Design Principles:

Option 3			REJECT
Description of option			
Remove all existing IFPs for which the BCN DVOR is materially important.			
Design Principle 1: Maintain or enhance the current level of safety	NOT MET		
Summary of qualitative assessment The removal of these procedures would create a gap in the network. This would require all aircraft currently using the existing IFPs to be channelled into other, potentially busy flows/ sectors, which could greatly increase controller workload in those areas. This could create significant safety issues from such substantial changes. Therefore, this Design Principle would not be satisfied.			
Design Principle 2: No change to flight behaviours	NOT MET		
Summary of qualitative assessment Aircraft would not be able to use the current procedures, causing a significant change in flight behaviours to work around this. Therefore, this Design Principle would not be satisfied.			
Design Principle 3: PBN specification	NOT MET		
Summary of qualitative assessment Procedures are not individually evaluated for potential application of this DP. Therefore, no RNAV replications would take place under this Design Option and this Design Principle would not be satisfied.			
Design Principle 4: Remove DVOR dependencies			MET
Summary of qualitative assessment All en-route procedures with a dependency on ground-based NavAids would be removed; thus, removing all dependencies and therefore satisfying this Design Principle.			
Design Principle 5: Airspace optimisation	NOT MET		
Summary of qualitative assessment Procedures are not individually evaluated for potential application of this DP. Therefore, no proposed changes to optimise the airspace would take place under this Design Option and this Design Principle would not be satisfied.			

Summary – Options Development

3.7 Using the five Design Principles, we have evaluated the four concept Design Options, as summarised above.

- *Option 0: Do Nothing – Retain all the STARs and Holds unchanged from today's AIP definition.* This does not achieve the removal of dependencies on ground-based NavAids. Rejected.
- *Option 1: Using the CAA policies, replicate all relevant STARs and Holds using RNAV, exactly as defined in the AIP without considering any practicalities* – this achieves the removal of dependencies on ground-based NavAids and provides RNAV replication of existing conventional procedure. However, it does not allow additional network optimisations to be proposed such as improving network connectivity or withdrawing duplicate route segments. Rejected.
- *Option 2: Examine the use of existing STARs and Holds from a practical point of view, re-evaluate how they are used and how the network may be improved by rationalising/truncating/replicating them in a considered manner.* This achieves the removal of dependencies on ground-based NavAids; alongside providing the opportunity to improve upon the current airspace and procedures such as introducing an important descent planning level. Accepted and progressed.
- *Option 3: Remove all existing STARs and Holds that refer to or use ground-based NavAids.* This would technically remove the dependencies on ground-based NavAids; however, it removes STARs and Holds that are used and needed by aircraft today and going forward. Rejected

3.8 *Conclusion*: Design Option 2 concept best meets all five of the Design Principles. The shortlist comprises the Option 2 concept only. The other three design option concepts are therefore not progressed.

End of Step 2A

4. Step 2B Options Appraisal

4.1 The baseline (do nothing) option does not achieve the removal of dependencies on ground-based NavAids. The ratings for the baseline option against each of the Design Principles shows that whilst it maintains safety levels and creates no change to flight behaviours, it does not meet the remaining three Design Principles.

4.2 Following the Design Principle evaluation, we conclude that the following Design Option 2 could be used to remove the dependencies on ground-based NavAids in accordance with the Design Principles:

Examine the use of existing STARs and Holds from a practical point of view, re-evaluate how they are used and how the network may be improved by rationalising/truncating/replicating them in a considered manner.

4.3 There would be no change in fuel/ CO_2/ greenhouse gas emissions due to this proposal because there would be no change to lateral or vertical tracks. Fuel uplift changes are unlikely to occur. There are no costs or benefits which could be reasonably monetised due to this enroute proposal.

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

5. Phase 1 STARs Cost Benefit Analysis

5.1 The CAP1616 Appendix E cost/ benefit analysis is given below.

Group	Impact	Level of Analysis	Evidence
Communities	Noise impact on health and quality of life	N/A	As there are no proposed changes to lateral or vertical tracks there will be no impact on noise or quality of life nor will flights over Welsh quiet areas or any Area of Outstanding Natural Beauty be affected. NATS therefore contends that this proposal still falls under the airspace change process as a Level 2C proposal; and does not require noise analysis.
Communities	Air quality	N/A	No changes below 1,000ft.
Wider society	Greenhouse gas impact	Monetise and quantify	No proposed changes to lateral or vertical tracks so no impact
Wider society	Capacity/ resilience	Qualitative	No changes
General Aviation	Access	N/A	No changes
General Aviation/ commercial airlines	Economic impact from increased effective capacity	Quantify	No changes
General Aviation/ commercial airlines	Fuel burn	Monetise	No proposed changes to lateral or vertical tracks so no impact.
Commercial airlines	Training cost	N/A	N/A – there is not expected to be any airline training or associated cost.
Commercial airlines	Other costs	N/A	Updates to FMS and flight planning systems will be completed via the routine AIRAC updates. There are no other known costs which would be imposed on commercial aviation.
Airport/ Air navigation service provider	Infrastructure costs/benefit	Qualitative and quantitative	The cost of implementation of the change, adaptation of systems is estimated to be £65,000. Replication of the STARs will remove any remaining en-route dependencies on the UK ground-based navigation network.
Airport/ Air navigation service provider	Operational costs	N/A	N/A – this proposal would not lead to changes in operational costs.
Airport/ Air navigation service provider	Deployment costs	Qualitative and quantitative	N/A – this change would be introduced via briefings and bulletins for staff, with no additional training or simulation training/costs required.

5.2 **Conclusion**: There would be a positive impact on safety whilst also improving the overall network connectivity.

6. Summary

6.1 This document details the STARs and Holds where there are remaining dependencies on ground-based NavAids material to the instrument flight procedure. It describes the current connectivity; the method used to progress the change; and the proposed connectivity.

6.2 This proposal will RNAV replicate these procedures which will conform as closely as possible to the current conventional procedures, using RNAV1/ RNAV5 design criteria.

6.3 Some minor administrative changes to STARs and 2 Holds are included, in order to improve the consistency of charts within the AIP and to follow CAA/ ICAO guidance on the naming of STARs (i.e. changing the name to reference the start point of the STAR).

6.4 This submission also includes a number of technical amendments:

- Eight STARs (four serving Manchester airport and four serving Liverpool airport) will be RNAV1 replicated using appropriate standards of PBN and extended to incorporate descent planning levels where able.
- Two STARs (one serving Bristol airport and one serving Cardiff airport) will be RNAV5 replicated.
- One STAR serving Liverpool airport, will be extended and split to produce two new RNAV1 STARs, both incorporating important descent planning levels.

6.5 The proposed connectivity remains entirely unchanged due to RNAV replication, with or without ATS route extensions:

- routes are unchanged
- connectivity is unchanged
- hence flight behaviours and traffic patterns over the ground are unchanged.

6.6 Annexes C-F below detail the IFP changes we are proposing to make in support of removing the remaining ground-based NavAids enroute dependencies and rationalisation of the network, as summarised in Table 1 below:

Ref	Airport	Type	Procedure	NavAid Dependency	Proposed Changes
1	Manchester	STAR	MIRSI 1A	WAL DVOR	RNAV1 replicated, extended back to existing waypoint OKTEM and re-named OKTEM 1M
2	Manchester	STAR	MIRSI 3B	WAL DVOR	RNAV1 replicated and re-named MALUD 1M.
3	Manchester	STAR	MIRSI 2C	WAL DVOR	RNAV1 replicated and re-named PENIL 1M.
4	Manchester	STAR	MIRSI 2D	WAL DVOR	RNAV1 replicated, extended back to existing waypoint MAKUX and re-named MAKUX 1M.
5	Manchester	Hold	MIRSI	WAL DVOR POL DVOR DME	RNAV replicated.
6	Liverpool	STAR	TIPOD 4A	Not Dependant	RNAV replicated, extended back to existing waypoint BOFUM (RNAV1), and re-named BOFUM 1L
7	Liverpool	STAR	TIPOD 2B	WAL DVOR	RNAV1 replicated and re-named PENIL 1L.
8	Liverpool	STAR	TIPOD 1C	WAL DVOR	RNAV1 replicated, extended back to LAKEY and re-named LAKEY 1L.
9	Liverpool	STAR	TIPOD 1D	WAL DVOR POL DVOR DME	RNAV1 replicated and re-named POL 1L.
10	Liverpool	STAR	TIPOD 1E	WAL DVOR	RNAV1 replicated, extended back to existing waypoints VEGUS and LIBSO to produce two new STARs. STARs will be named VEGUS 1L and LIBSO 1L.
12	Liverpool	Hold	TIPOD	WAL DVOR	RNAV replicated
12	Bristol	STAR	BRI 1C	CPT DVOR BRI NDB	RNAV5 replicated and re-named CPT 1B.
13	Cardiff	STAR	CDF 1C	CPT DVOR BRI NDB, CDF NDB	RNAV5 replicated and re-named CPT 1C.

Table 1: Summary of proposed changes

7. Conclusion

7.1 We have assessed that there are no foreseen adverse impacts of making the proposed changes described in the tables below (Annexes C-F) and conclude that making these technical changes to the procedures would not alter traffic patterns.

8. Annex A: Design Principles

Design Principle (DP)	Priority	Description
DP1- Safety	High	The proposed airspace change must maintain or enhance the current level of safety
DP2- No Change to Flight behaviour	High	None of the proposed technical changes to definitions of STARs/Holds would result in a change to actual flight behaviours –laterally, vertically or in dispersal
DP3- PBN Specification	High	The proposed airspace change will yield maximum safety and efficiency benefits by using an appropriate standard of PBN
DP4- Remove DVOR Dependencies	High	Remove en-route dependencies on ground-based NavAids through appropriate design changes; including removing unnecessary references to ground-based NavAids which are not material to the procedure and rationalising rarely used STARs.
DP5- Airspace Optimisation	Medium	Where appropriate, the proposed airspace will facilitate an optimised airspace design. Including: • Use PBN Replication –replacing conventional STARs/ Holds with RNAV STARs/ Holds; • Using CAA STAR Truncation Policy, when applied logically to STARs with many common segments, can result in the withdrawal of unnecessary duplicate STARs; • Minor changes to a STAR which currently cannot be flown as it is formally defined for legacy reasons –these changes reflect what would actually happen in practice; • Extend or split a current STAR to allow important Descent Planning levels to be formally incorporated in the STAR description

10. Annex B: Design Option 2- Procedure Detail

This section demonstrates the proposed changes for Design Option 2. The below screenshots show the current procedures and have been taken from the Assessment Meeting Slides (Ref 3).

Option 2: *Examine the use of existing STARs and holds from a practical point of view, re-evaluate how they are used and how the network may be improved by rationalising/truncating/replicating them in a considered manner.*

Manchester – MIRSI STARs – 1A, 2B[2], 2C, 2D and Hold

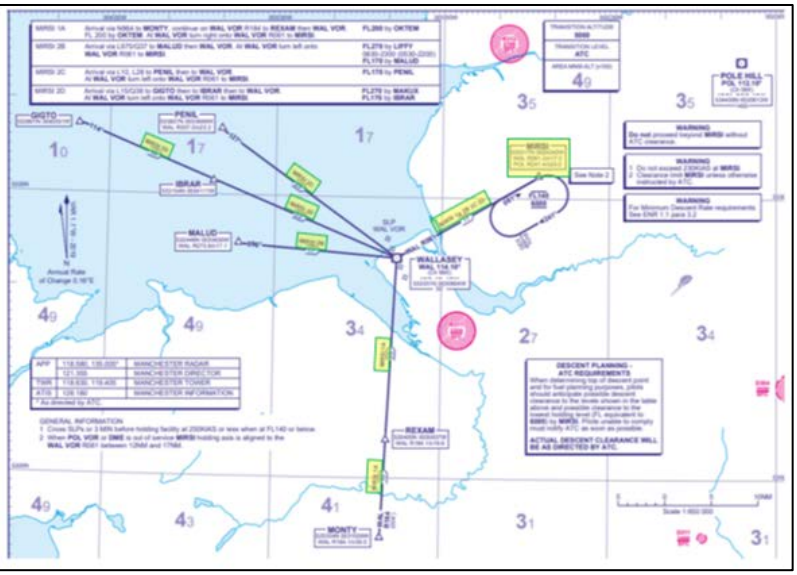
1) MIRSI 1A STAR
(SLP defined by WAL)
MONTY - REXAM - WAL – MIRSI

2) MIRSI 2B STAR
(SLP defined by WAL)
MALUD - WAL - MIRSI

3) MIRSI 2C STAR
(SLP defined by WAL)
PENIL - WAL – MIRSI

4) MIRSI 2D STAR
(SLP defined by WAL)
GIGTO - IBRAR - WAL – MIRSI

5) MIRSI HOLD



Liverpool – TIPOD STARs – 3A[2], 2B, 1C, 1D and 1E

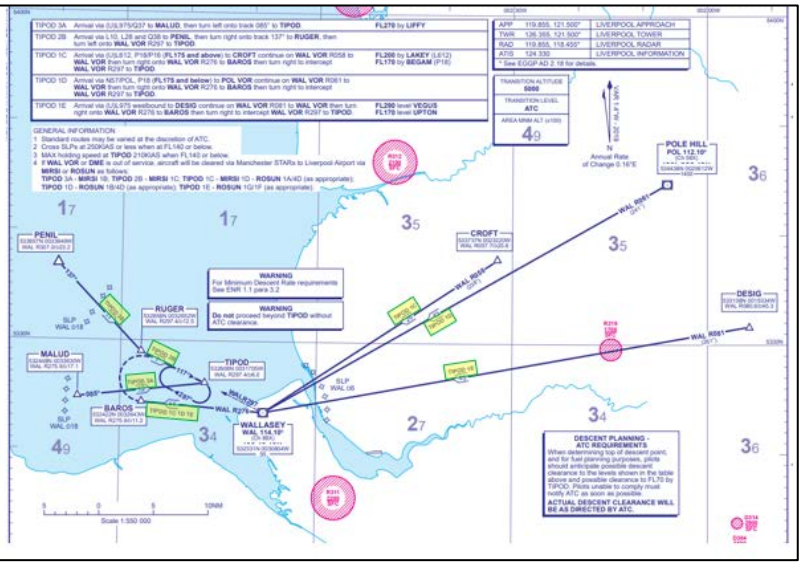
1) TIPOD 3A STAR
(SLP defined by WAL)
MALUD - TIPOD

2) TIPOD 2B STAR
(SLP defined by WAL)
PENIL - RUGER - TIPOD

3) TIPOD 1C STAR
(SLP defined by WAL)
CROFT - WAL - BAROS – Intercept WAL R297 to TIPOD

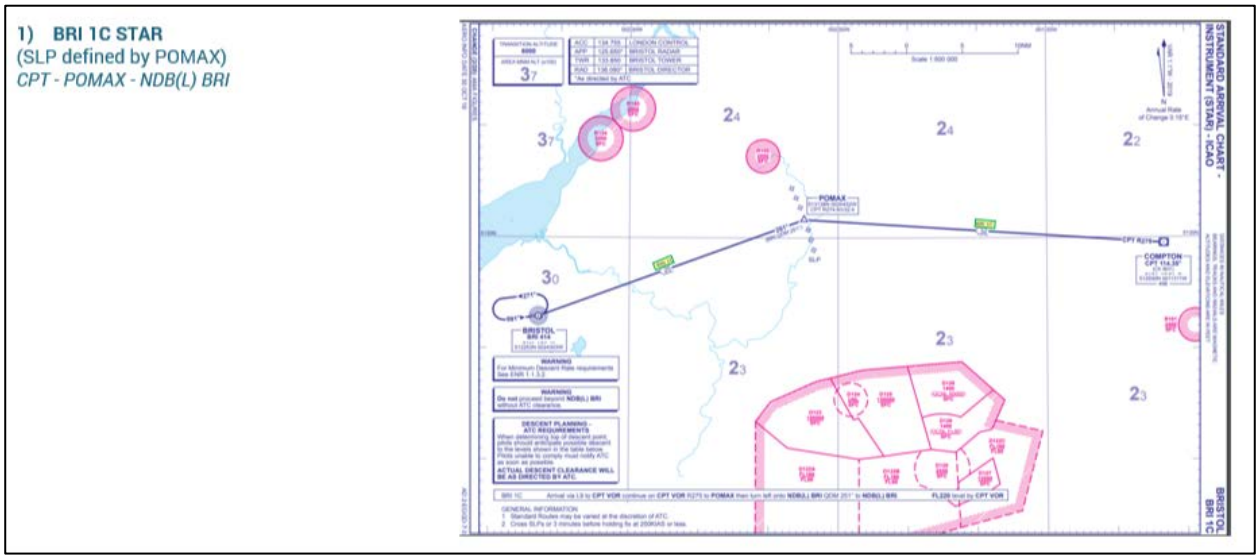
4) TIPOD 1D STAR
(SLP defined by WAL)
POL - WAL - BAROS – Intercept WAL R297 to TIPOD

5) TIPOD 1E STAR
(SLP defined by WAL)
DESIG - WAL - BAROS – Intercept WAL R297 to TIPOD

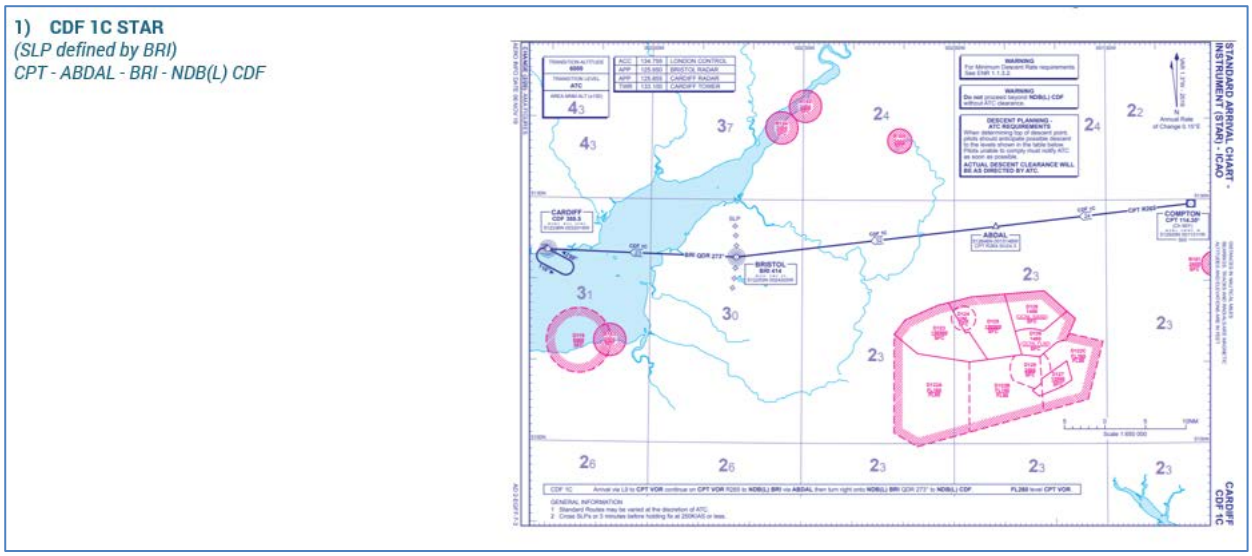


[2] Since the Assessment meeting, the TIPOD 3A and MIRSI 2B STARs have been up-numbered to TIPOD 4A and MIRSI 3B due to the extension of UK ATS routes Q36/Q37.

Bristol – BRI 1C STAR



Cardiff – CDF 1C STAR



11. Annex C: Impact Assessment- Manchester Procedures

For charts and technical notes, see the Assessment Meeting slide pack (Ref 3) for the current IFPs.

Current IFP	Current route connectivity/ STAR	Design Principle	How	Proposed route Connectivity/ STAR	Impact of proposed change on connectivity and flight behaviour
MIRSI 1A STAR	*N864: MONTY – REXAM – WAL – MIRSI*	Satisfies all 5 DPs	RNAV1 replication	*N864: OKTEM – MONTY – REXAM – WAL – MIRSI* Re-named as **OKTEM 1M**	The conventional STAR will be RNAV1 replicated and extended back to existing waypoint OKTEM (along N864). Extending the STAR back to OKTEM will provide flight plannable options and retain the important descent planning restriction. New descent planning level, FL70 at MIRSI included. STAR to be re-named based on its new starting waypoint *OKTEM* and the 'M' designator used to denote the destination airport (Manchester). RNAV5 Aircraft will follow an ATS route or series of DCT's which replicate the route of the RNAV1 STAR and the MIRSI hold will be designated RNAV1.
MIRSI 3B STAR	*L975/Q37: MALUD – WAL – MIRSI*	Satisfies all 5 DPs	RNAV1 replication	*L975/Q37: MALUD – WAL – MIRSI* Re-named as **MALUD 1M**	The conventional STAR will be RNAV1replicated It is not possible to extend the STAR backwards to incorporate the descent planning level restriction at LIFFY and BOFUM owing to the associated timings. These will continue to be captured in the UK RAD. New descent planning level, FL70 at MIRSI included.

Current IFP	Current route connectivity/ STAR	Design Principle	How	Proposed route Connectivity/ STAR	Impact of proposed change on connectivity and flight behaviour
					STAR to be re-named based on its new starting waypoint *MALUD* and the 'M' designator used to denote the destination airport (Manchester). RNAV5 Aircraft will follow an ATS route or series of DCT's which replicate the route of the RNAV1 STAR and the MIRSI hold will be designated RNAV1.
MIRSI 2C STAR	*L10,L28: PENIL – WAL – MIRSI*	Satisfies all 5 DPs	RNAV1 replication	*L10,L28: PENIL – WAL – MIRSI* Re-named as **PENIL 1M**	The conventional STAR will be RNAV1 replicated. New descent planning level, FL70 at MIRSI included. STAR to be re-named based on its new starting waypoint *PENIL* and the 'M' designator used to denote the destination airport (Manchester). RNAV5 Aircraft will follow an ATS route or series of DCT's which replicate the route of the RNAV1 STAR and the MIRSI hold will be designated RNAV1.
MIRSI 2D STAR	*L15/Q38: GIGTO – IBRAR – WAL – MIRSI*	Satisfies all 5 DPs	RNAV1 replication	*L15/Q38: MAKUX – SOSIM – GIGTO – IBRAR – WAL – MIRSI* Re-named as **MAKUX 1M**	The conventional STAR will be RNAV1 replicated and extended back to existing waypoint MAKUX (along L15/Q38). Extending the STAR back to MAKUX will provide flight plannable options and retain the important descent planning restriction.

Current IFP	Current route connectivity/ STAR	Design Principle	How	Proposed route Connectivity/ STAR	Impact of proposed change on connectivity and flight behaviour
					New descent planning level, FL70 at MIRSI included. STAR to be re-named based on its new starting waypoint *MAKUX* and the 'M' designator used to denote the destination airport (Manchester). RNAV5 Aircraft will follow an ATS route or series of DCT's which replicate the route of the RNAV1 STAR and the MIRSI hold will be designated RNAV1.
MIRSI hold	*N/A*	Satisfies DP1, DP2, DP3, & DP4 - no further changes proposed (DP5)	RNAV1 replication	N/A	This Hold will be RNAV1 replicated, to match as closely as possible with the currently published conventional Hold. The RNAV Hold MIRSI will have a "MAX 210IAS" speed limit. The minimum level will be updated to FL60 from 6000 ft owing to the transition altitude being 5000 ft. RNAV5 aircraft when required will be issued holding instructions via ATC.

12. Annex D: Impact Assessment- Liverpool Procedures

For charts and technical notes, see the Assessment Meeting slide pack (Ref 3) for the current IFPs.

Current IFP	Current route connectivity/ STAR	Design Principle	How	Proposed route Connectivity/ STAR	Impact of proposed change on connectivity and flight behaviour
TIPOD 4A STAR	*(U)L975/Q37: MALUD – TIPOD*	Satisfies all 5 DPs	RNAV1 replication	*Q37: BOFUM – BAKUX – BAVUD – DONAX – MALUD – TIPOD* Re-named as **BOFUM 1L**	The conventional STAR will be RNAV1 replicated and extended back to BOFUM (along Q37). Extending the STAR back to BOFUM will provide flight plannable options and retain the important descent planning restrictions. New descent planning level, FL70 at TIPOD included. STAR will be re-named based on its new starting waypoint *BOFUM* and the 'L' designator used to denote the destination airport (Liverpool). RNAV5 Aircraft arriving through LIFFY via (U)L975 will follow the ATS route to MALUD before following by a series of DCT's which will remain coincident with the RNAV1 STAR
TIPOD 2B STAR	*L10,L28. Q38: PENIL – RUGER – TIPOD*	Satisfies all 5 DPs	RNAV1	*L10, L28. Q38: PENIL – RUGER – TIPOD* Re-named as **PENIL 1L**	The conventional STAR will be RNAV1 replicated New descent planning level, FL70 at TIPOD included. STAR to be re-named based on its new starting waypoint *PENIL* and the 'L' designator used to denote the destination airport (Liverpool). RNAV5 Aircraft will follow an ATS route or series of DCT's which replicate the route of the RNAV1 STAR.

Current IFP	Current route connectivity/ STAR	Design Principle	How	Proposed route Connectivity/ STAR	Impact of proposed change on connectivity and flight behaviour
TIPOD 1C STAR	*(U)L612, P18/P16(FL175 and above): CROFT – WAL – BAROS – intercept WAL R297 to TIPOD*	Satisfies all 5 DPs	RNAV1	*(U)L612: LAKEY – VAMEB – OBUNI – CALDA – (P16): CROFT – WAL – BAROS – TIPOD* Re-named as **LAKEY 1L**	The conventional STAR will be RNAV1 replicated and extended back to LAKEY (along L612). Extending the STAR back to LAKEY will provide flight plannable options and retain the important descent planning restrictions. 210 KIAS speed limit introduced at BAROS to aid the entry into the hold. STAR will be re-named based on its new starting waypoints *LAKEY* and the 'L' designator used to denote the destination airport (Liverpool). P16 (FL175 and above) traffic will join the STAR at CROFT. RNAV5 Aircraft will follow an ATS route or series of DCT's which replicate the route of the RNAV1 STAR.
TIPOD 1D STAR	*N57/POL, P18 (FL175 and above): POL – WAL – BAROS – intercept WAL R297 to TIPOD*	Satisfies all 5 DPs	RNAV1	*N57/POL, P18 (FL175 and above): POL – WAL – BAROS –TIPOD* Re-named as **POL 1L**	The conventional STAR will be RNAV1 replicated. New descent planning level, FL70 at TIPOD included. 210 KIAS speed limit introduced at BAROS to aid the entry into the hold. STAR to be re-named based on its new starting waypoint *POL* and the 'L' designator used to denote the destination airport (Liverpool). RNAV5 Aircraft will follow an ATS route or series of DCT's which replicate the route of the RNAV1 STAR.

Current IFP	Current route connectivity/ STAR	Design Principle	How	Proposed route Connectivity/ STAR	Impact of proposed change on connectivity and flight behaviour
TIPOD 1E STAR	*(U)L975: DESIG – WAL – BAROS – intercept WAL R297 to TIPOD*	Satisfies all 5 DPs	RNAV1 RNAV1	*Y70: VEGUS – GOLES– DESIG – WAL – BAROS – TIPOD* Re-named as VEGUS 1L *(U)L975, L46, L90: LIBSO – FIZED – GOLES–DESIG – WAL – BAROS –TIPOD* Re-named as LIBSO 1L	The conventional STAR will be RNAV1 replicated and extended back to VEGUS (along L975/ Y70) and LIBSO (along (U)L975. Extending the STAR back to VEGUS and LIBSO will provide flight plannable options and retain the important descent planning restrictions. 210 KIAS speed limit introduced at BAROS to aid the entry into the hold. New descent planning level, FL70 at TIPOD included. STAR will be re-named based on its new starting waypoints *VEGUS and LIBSO* and the 'L' designator used to denote the destination airport (Liverpool). RNAV5 Aircraft will follow an ATS route or series of DCT's which replicate the route of the RNAV1 STAR.
TIPOD hold	*N/A*	Satisfies DP1, DP2, DP3, & DP4 - no further changes proposed (DP5)	RNAV1 replication	N/A	This Hold will be RNAV1 replicated, to match as closely as possible with the currently published conventional Hold. RNAV5 aircraft when required will be issued holding instructions via ATC. The RNAV Hold TIPOD will have a "MAX 210IAS" speed limit.

13. Annex E: Impact Assessment- Bristol Procedures

For charts and technical notes, see the Assessment Meeting slide pack (Ref 3) for the current IFPs.

Current IFP	Current route connectivity/ STAR	Design Principle	How	Proposed route Connectivity/ STAR	Impact of proposed change on connectivity and flight behaviour
BRI 1C	*L9: CPT – POMAX – NDB(L) BRI*	Satisfies all 5 DPs	RNAV5 replication	*L9: CPT – POMAX – BRI* Re-named as **CPT 1B**	The conventional STAR will be RNAV5 replicated to align with other STARs replicated in the BCN DVOR ACP. MAX 220 KIAS included at BRI. New descent planning level, FL70 at BRI included. STAR to be re-named based on its new starting waypoint *CPT* and the 'B' designator used to denote the destination airport (Bristol).

14. Annex F: Impact Assessment- Cardiff Procedures

For charts and technical notes, see the Assessment Meeting slide pack (Ref 3) for the current IFPs.

Current IFP	Current route connectivity/ STAR	Design Principle	How	Proposed route Connectivity/ STAR	Impact of proposed change on connectivity and flight behaviour
CDF 1C	*L9: CPT – ABDAL – BRI – NDB(L) CDF*	Satisfies all 5 DPs	RNAV5 replication	*L9: CPT – ABDAL – BRI – CDF* Re-named as **CPT 1C**	The conventional STAR will be RNAV5 replicated to align with other STARs replicated in the BCN DVOR ACP. MAX 220 KIAS included at CDF. New descent planning level, FL70 at CDF included. STAR to be re-named based on its new starting waypoint *CPT* and the 'C' designator used to denote the destination airport (Cardiff).

15. Annex G: List of References

Reference	Name	Hyperlink
1	DVOR CAA Airspace Change Progress Portal Page	Link
2	DVOR Phase 1 STARs Statement of Need	Link
3	DVOR Phase 1 STARs Assessment Meeting Slides	Link
4	DVOR Phase 1 STARs Design Principles	Link
5	DVOR Phase 1 STARs Engagement Evidence	Link

16. Annex H: Engagement Evidence

This section summarises the engagement activities in support of this ACP.

Stakeholder	Type of engagement	Date	Notes
Liverpool Airport	Telephone Email	August 2021	Telephone call to describe and discuss proposed changes Email follow up to confirm approval of changes
Manchester Airport	Telephone Email	August 2021	Telephone call to describe and discuss proposed changes Email follow up to confirm approval of changes
Bristol Airport	Telephone Email	August 2021	Telephone call to describe and discuss proposed changes Email follow up to confirm approval of changes
Cardiff Airport	Telephone Email	August 2021	Telephone call to describe and discuss proposed changes Email follow up to confirm approval of changes

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