DVOR Rationalisation
Removal of Enroute Dependencies
Trent (TNT) DVOR

DVOR TNT Holds and STARs
CAP1616 Stage 2 Gateway

V2

NATS Public

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1.1	May 2021	Annex H: Engagement Evidence updated, links updated
2.0	July 2021	New submission following gateway rejection, containing: • Justification for RNAV1 selection • Clarity around removal of SLPs • Clarity around how RNAV5 traffic will be provisioned • Traffic numbers provided for in-scope STARs • Amendment to initial proposal around improved utilisation of the KEGUN Hold • Flight Levels of TNT & KEGUN Holds added • Amendment of Design Principle Evaluation matrix • Option 2 Design Principle Evaluation updated • Options Appraisal updated • Option 2 Cost/ Benefit Analysis updated • Summary table updated • Further engagement evidence with Liverpool airport added • Links updated

Contents

1. Introduction

This document continues the CAP1616 process started with the Statement of Need (DAP1916) submitted in July 2020 (Ref 3). The intent of this document is to summarise and satisfy the requirements of CAP1616 Stage 2. The CAA reference is ACP-2020-020, the link to the CAA progress page is here.

This proposal is limited to removing the dependency of enroute instrument flight procedures in the UK AIP from the Trent (TNT) DVOR. Hence this proposal is focused on Standard Terminal Arrival Routes (STARs) and Holding procedures which refer to TNT as a conventional navaid in the enroute environment, where NATS is the primary Air Navigation Service Provider (ANSP). There is one amendment to an ATS route as part of this proposal.

This proposal contains the relevant changes to remove the dependency on TNT from these STARs and Holds. Design Principles have been developed (Ref 4) which are focused on best removing the enroute 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 TNT 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.

2.2 Airspace change design options

The design options considered to remove the enroute dependencies from the TNT DVOR, 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/altering them in a considered manner.
Option 3 – Remove all existing STARs and Holds that refer to or use the TNT DVOR.

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

"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)."

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

Speed Limit Points (SLPs) will be removed from the procedures. Where an existing waypoint is co-incident with the current SLP, the speed restriction shall be coded at the waypoint. Otherwise, the speed restriction shall be coded into the hold, or new waypoints introduced to enable coding. ATC will continue to issue tactical speed clearances as required.

By replicating the STARS in scope using RNAV1, this will cater to the PBN equipage of >90.2% of the arrivals into the stakeholder airports (Q3 2019 figures), see Table 1:

Airport	STAR	Planned Arrivals on in-scope STARS		RNAV5 %	Calculated Number of RNAV5 equipped aircraft on in-scope STARs	
		Total	Per STAR		Total	Per STAR
EGNX	WAL 1E	6372	1519	4.01	256	61
	AMPIT 1E		4853			195
EGGP	KEGUN 2A	2625	69	9.8	257	7
	KEGUN 2B		717			70
	KEGUN 1D		1839			180
	KEGUN 2C	See Note 1.				
	TIPOD 2F	See Note 2.				
	TIPOD 2G					
	TIPOD 2H					
	TIPOD 1J					
EGCC	DAYNE 2A	45025	27073	2.44	1099	661
	DAYNE 1B		17952			438

Table 1: Total No of Arrivals filing an in-scope STAR and the calculated number of RNAV 5 equipped arrivals on each procedure. Number of arrivals sourced from Central Flow Management Unit (CFMU) flight-planned data from year 2019, all values are rounded to the nearest integer.

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 whilst this is coincident with the STAR,
- Once the STAR deviates from the ATS route, aircraft will follow a series of DCTs (as detailed in the SRD) coincident with the STAR, terminating at the holding fix.
- ATC will tactically manage these aircraft, providing Heading/ Level/ Speed clearances as necessary.

This provision will be published in the relevant sections of the airfield AIP AD 2.22.

The holding patterns are to be dual designated RNAV 1/ 5, ensuring that RNAV 5 aircraft remain catered for within the airspace.

In support of the eventual removal of the TNT DVOR, this proposal will RNAV replicate the relevant holds serving East Midlands (ROKUP), Liverpool (TIPOD and KEGUN) and Manchester (DAYNE) Airports. The KEGUN hold will have availability extended H24. As a standard direct-entry hold procedure, significantly less complex than that published today when joining the existing conventional hold, no adverse operational impact as a result of the change is anticipated. The hold is continuously radar monitored, however, historic radar data has shown

[1] Due to low levels of traffic this star will no longer be required (31 filed in 2019).
[2] Due to the proposed change to the KEGUN hold, the TIPOD STARs that route via KEGUN will no longer be required.

that aircraft very rarely hold at KEGUN or TIPOD (<1% of 2019 traffic). Liverpool ATC confirm they have no objections to the revised availability of the KEGUN hold.

New RNAV1 STARs serving these airports will be introduced to replace the current conventional procedures. The new STARs will be named based on their starting waypoints in line with ICAO requirements. These replications will conform as closely as possible to the current conventional procedures, using RNAV1 design criteria.

This proposal will extend some STARs (serving East Midlands, Liverpool, and Manchester Airports) back to existing waypoints in order to provide flight plannable options and retain or improve important descent planning restrictions. These STARs will also be RNAV1 replicated and re-named as per their starting waypoints.

To maintain descent planning Levels, three new STARS will be introduced to connect to (U)Y124, L15, Q38 and Q36. These replications will conform as closely as possible to the current conventional procedures, using RNAV1 design criteria.

An existing ATS Route, (U)M868, will be revised to remove unnecessary co-incidence with (U)N57.

The KEGUN 2C STAR will be withdrawn due to under-utilisation (31 filed flight plans in 2019). Aircraft can file PEDIG (Y53) to NANTI, to join the KEGUN 2A STAR.

Finally, STARs associated with TIPOD (serving Liverpool Airport) for arrivals via KEGUN will be withdrawn, due to introduction of H24 KEGUN STARs. Whilst the project does not seek to enable fuel savings, it is recognised that withdrawing the TIPOD arrivals from S/SE could enable fuel savings by removing additional track mileage. All of the above proposed changes are detailed fully in Annexes C-F.

East Midlands, Liverpool, and Manchester 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.

2.3 Stakeholder Engagement

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 enroute dependencies from the TNT DVOR, 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.

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.

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 East Midlands, Liverpool and Manchester 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.

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.

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

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 (Ref 4) are included in Annex A for reference. As covered fully in the Stage 1B document, the Design Principles for this TNT DVOR submission have been developed to ensure that they are still relevant; as a consistent set has been used throughout the DVOR Programme.

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 flight behaviour	N/A – either met or not met	None of the proposed changes would result in a change to flight 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 enroute dependencies on the TNT DVOR through appropriate design changes; including removing unnecessary references to the TNT DVOR which are not material to the procedure and rationalising rarely used STARs.	Not all enroute dependencies on the TNT are removed	N/A – either met or not met	All enroute dependencies on the TNT DVOR 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 define 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

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

See the submitted Stage 1 Assessment Meeting slide pack (Ref 1) for further details on the procedures which reference the TNT DVOR 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 the TNT DVOR 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 the TNT DVOR 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.			

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

This option would replace all dependant procedures identified in the Assessment Meeting slide pack (Ref 1) 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. 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 the TNT DVOR. 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/altering them in a considered manner.

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. ATC currently issue the KEGUN STARs during daytime hours (outside of the published hours), and safety is maintained through radar monitoring. This will continue to be the case with the KEGUN STARs published H24. Procedures can be simplified depending on actual usage today. Therefore, this Design Principle would be satisfied.			
Design Principle 2: No change to flight behaviours			MET
Summary of qualitative assessment 2019 radar data indicated that all aircraft arriving on the in-scope STARs, once past KEGUN, were being tactically vectored towards the airfield. Therefore, the publication of the KEGUN STARs on a H24 basis, will not result in an increased number of aircraft holding at KEGUN, or have an impact on flight behaviours. There are no other practical changes to connectivity and therefore, no other changes 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 an TNT dependency are replicated; thus, removing the enroute dependencies on the TNT DVOR. Therefore, this Design Principle would be satisfied. For example, this enables the Manchester DAYNE 1B STAR to be RNAV replicated which removes the current dependency on the TNT DVOR.			
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 Liverpool KEGUN 2B STAR to be RNAV replicated and extended back to an existing waypoint, thus retaining the important descent planning restriction.			

3.3 Option 3 – Remove all existing STARs and holds that refer to or use the TNT DVOR.

This option removes each STAR and Hold with a TNT dependency and replaces *TNT DVOR/DME* with *TNT DME*. This table evaluates this option against the five Design Principles:

Option 3			REJECT
Description of option			
Remove all existing IFPs for which the TNT 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 the TNT DVOR 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.			

3.4 Summary – Options Development

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

3.5 *Option 0: Do Nothing – Retain all the STARs and Holds unchanged from today's AIP definition.* This does not achieve the removal of dependencies from the TNT DVOR. **Rejected.**

3.6 *Option 1: Using the CAA policies, replicate STARs/ Holds using RNAV, exactly as defined in the AIP without considering any practicalities* – this achieves the removal of dependencies from the TNT DVOR 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.**

3.7 *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/altering them in a considered manner.* This achieves the removal of dependencies from the TNT DVOR; alongside providing the opportunity to improve upon the current airspace and procedures such as introducing an important descent planning level. **Accepted and progressed.**

3.8 *Option 3: Remove all existing STAR and Holds that refer to or use the TNT DVOR.* This would technically remove the dependencies from the TNT DVOR; however, it removes STARs and Holds that are used and needed by aircraft today and going forward. **Rejected**

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 from the TNT DVOR. 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 from the TNT DVOR 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. Aircraft currently filing the TIPOD STARs, arriving from the south, could benefit from a reduction in planned track mileage by filing the KEGUN STARs. However, the actual fuel uplift is very difficult to quantify. Whilst there is an established relationship between distance flown and the amount of fuel uplift, this proposal will not impact the actual distance flown or vertical profile.

4.4 There are no costs or benefits which could be easily monetised due to this enroute proposal.

4.5 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. TNT Option 2 Cost/ Benefit Analysis

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	Relevant procedures are being replicated in a manner which means there are no changes to lateral or vertical tracks, so no impact on noise or quality of life
Communities	Air quality	N/A	No changes below 1,000ft.
Wider society	Greenhouse gas impact	Monetise and quantify	Relevant procedures are being replicated in a manner which means there are no changes to lateral or vertical tracks, so no impact. Removal of the TIPOD STARs for EGGP arrivals via KEGUN, would facilitate a flight-planned track mileage reduction of approximately 18 miles. Actual flight behaviours will not change
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	Relevant procedures are being replicated in a manner which means there are no changes to lateral or vertical tracks, so no impact. Removal of the TIPOD STARs for EGGP arrivals via KEGUN, may facilitate a flight-planned track mileage reduction. However, the actual fuel uplift is very difficult to quantify, as actual flight behaviours will not change
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. Removal of the en-route dependency enables decommissioning of the DVOR (once airfields have removed their dependencies i.e. SIDs). This will yield an annual cost saving of circa £10,000 per DVOR (TNT).
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.

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

End of Step 2B

6. Summary

6.1 This document details the STARs and Holds where the TNT DVOR is 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 a number of procedures which will conform as closely as possible to the current conventional procedures, using RNAV1 design criteria.

6.3 Some minor administrative changes to STARs and a Hold 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. Three new STARs will be introduced by extending an existing STAR back to three separate waypoints, in order to maintain important descent planning restrictions.

6.5 The proposed connectivity remains entirely unchanged due to RNAV1 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 TNT DVOR enroute dependencies and rationalisation of the network, as summarised in Table 2 below:

Ref	Airport	Type	Procedure	TNT DVOR	Proposed Changes
1	EAST Midlands	STAR	WAL 1E	Dependent	RNAV1 Replicated Rename WAL 2E
2	EAST Midlands	STAR	AMPIT 1E	Dependent	RNAV1 Replicated Rename AMPIT 2E Extend and create 3 additional STARS
3	EAST Midlands	Hold	ROKUP	Dependent	RNAV1/5 Replicated
4	Liverpool	STAR	KEGUN 2A	Dependent	RNAV1 Replicated Rename LESTA 1L
5	Liverpool	STAR	KEGUN 2B	Dependent	RNAV1 Replicated Extend back to existing waypoint ELVOS Rename ELVOS 1L
6	Liverpool	STAR	KEGUN 1D	Non- dependent	RNAV1 Replicated Extend back to existing waypoint OKTEM Rename OKTEM 1L
7	Liverpool	STAR	KEGUN 2C	Dependent	Withdrawn
8	Liverpool	STAR	TIPOD 2F	Dependent	Withdrawn
9	Liverpool	STAR	TIPOD 2G	Dependent	Withdrawn
10	Liverpool	STAR	TIPOD 2H	Dependent	Withdrawn
11	Liverpool	STAR	TIPOD 1J	Non- dependent	Withdrawn
12	Liverpool	Hold	KEGUN	Non- dependent	RNAV1/5 Replicated H24 availability
13	Liverpool	Hold	TIPOD	Dependent	RNAV1/5 Replicated
14	Manchester	STAR	DAYNE 2A	Dependent	RNAV1 Replicated Extend back to existing waypoint ELVOS Rename ELVOS 1M
15	Manchester	STAR	DAYNE 1B	Dependent	RNAV1 Replicated Rename LESTA 1M
16	Manchester	Hold	DAYNE	Dependent	RNAV1/5 Replicated

Table 2: 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

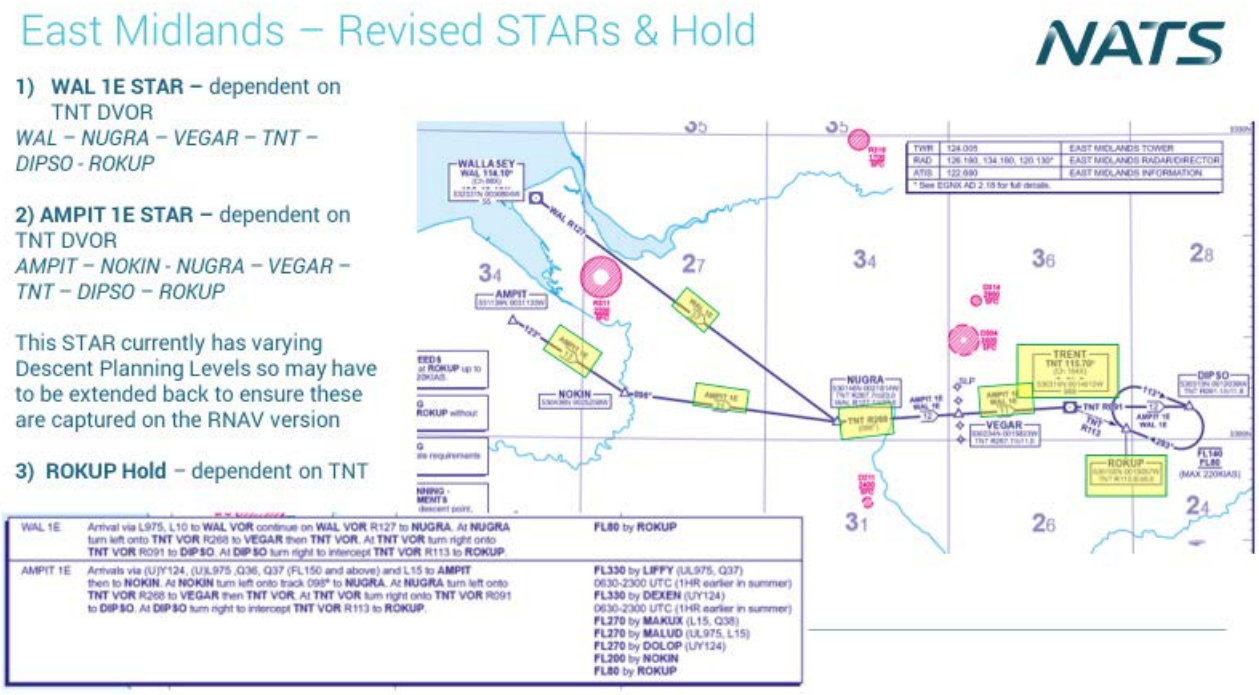
Design Principle	Description
DP1 Safety	The proposed airspace change must maintain or enhance the current level of safety
DP2 No change to flight behaviour	None of the proposed technical changes to definitions of STARS/ Holds would result in a change to actual flight behaviours – laterally, vertically or in dispersal
DP3 PBN Specification	The proposed airspace change will yield maximum safety and efficiency benefits by using an appropriate standard of PBN
DP4 Remove DVOR Dependencies	Remove enroute dependencies on the TNT DVOR through appropriate design changes; including removing unnecessary references to the TNT DVOR which are not material to the procedure, and rationalising rarely used STARs
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 define 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

9. Annex B: Design Option 2: Procedure Detail

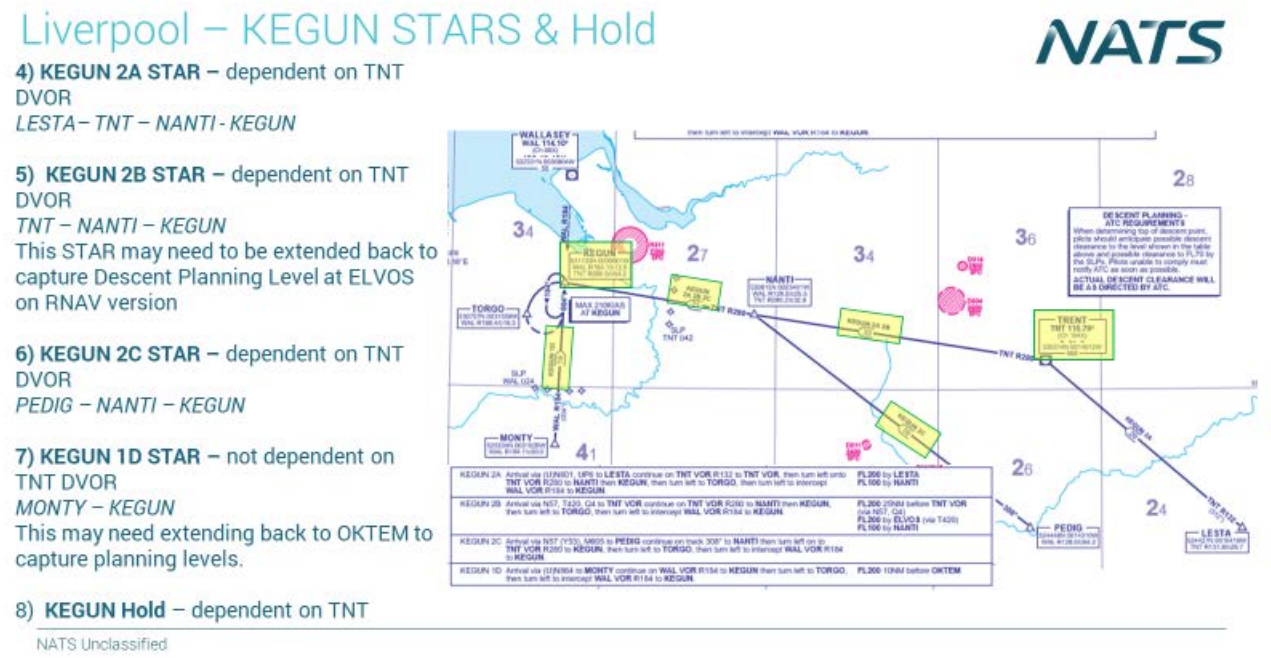
This section demonstrates the proposed changes for Design Option 2. The below screenshots show the current procedures and have been taken from the Assessment Meeting Slides [Ref 1].

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.*

East Midlands – WAL 1E and AMPIT 1E STARs and ROKUP Hold



Liverpool – KEGUN STARs 2A, 2B, 2C, 1D and Hold



Liverpool – TIPOD STARs 2F, 2G, 2H, 1J & Hold

Liverpool – TIPOD STARS & Hold

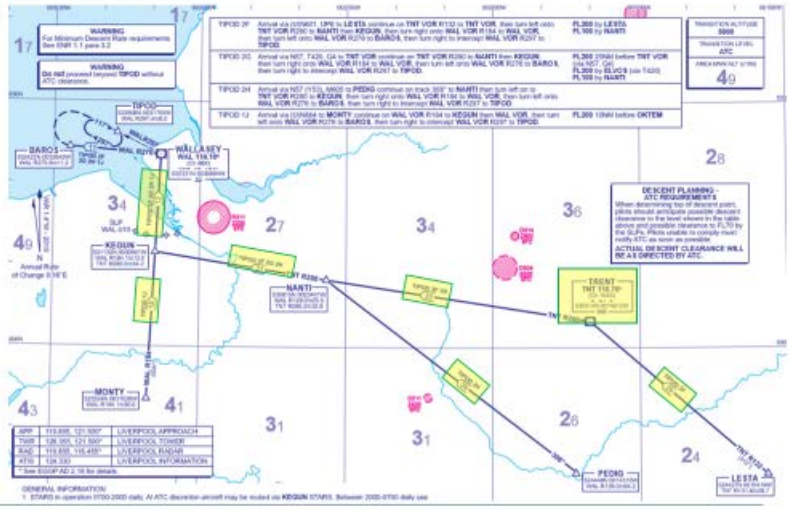
9) TIPOD 2F STAR – dependent on TNT DVOR
LESTA – TNT – NANTI – KEGUN – WAL – BAROS - TIPOD

10) TIPOD 2G STAR – dependent on TNT DVOR
TNT – NANTI – KEGUN – WAL – BAROS – TIPOD

11) TIPOD 2H STAR – dependent on TNT DVOR
PEDIG – NANTI – KEGUN – WAL – BAROS - TIPOD

12) TIPOD 1J STAR – not dependent on TNT DVOR
MONTY – KEGUN – WAL – BAROS – TIPOD

13) TIPOD Hold – not dependent on TNT



NATS Unclassified

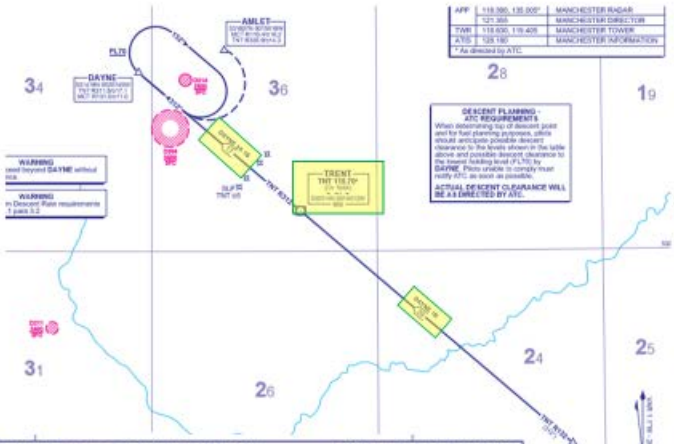
Manchester – DAYNE STARs & Hold

Manchester – DAYNE STARs & Hold

14) DAYNE 2A STAR – dependent on TNT DVOR
TNT – DAYNE
This STAR may need to be extended back to capture Descent Planning Level at ELVOS on RNAV version

15) DAYNE 1B STAR – dependent on TNT DVOR
LESTA – TNT - DAYNE

16) DAYNE Hold



DAYNE 2A	Arrival via N57/T420/O4 to **TNT VOR**, continue on **TNT VOR** R312 to **DAYNE**.	**FL200** by 25NM before **TNT VOR** (via N57, O4) **FL200** by **ELVOS** (via T420.) **FL80** by **DAYNE**
DAYNE 1B	Arrival via N601/UN601/UP6 to **LESTA**, continue on **TNT VOR** R132 to **TNT VOR**. At **TNT VOR** continue on **TNT VOR** R312 to **DAYNE**.	**FL200** by 25NM before **TNT VOR** **FL80** by **DAYNE**

NATS Unclassified

10. Annex C: Impact Assessment – East Midlands Procedures

For charts and technical notes, see the Assessment Meeting slide pack [Ref 1] 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
WAL 1E STAR	L10/L975/Q4: WAL – NUGRA – VEGAR – TNT – DIPSO – ROKUP	Satisfies DP1, DP2, DP3, & DP4 - no further changes proposed (DP5)	RNAV1 replication and re-designation	L10/L975/Q4: WAL – NUGRA – VEGAR – TNT – DIPSO – ROKUP Re-named as **WAL 2E**	The conventional STAR will be RNAV1 replicated and re-named. STAR to be re-named based on its starting waypoint *WAL* and the 'E' designator used to denote the destination airport (East Midlands), and numerically incremented The STAR will be replicated and created using RNAV design criteria to align as closely as possible with the existing routeing. RNAV5 Aircraft will follow a series of DCT's which replicate the route of the RNAV1 STAR and the ROKUP hold will be designated RNAV1/5
AMPIT 1E STAR	L15: AMPIT – NOKIN – NUGRA – VEGAR – TNT – DIPSO – ROKUP –	Satisfies DP1, DP2, DP3, & DP4 - no further changes proposed (DP5)	RNAV1 replication and re-designation AMPIT 1 E will also be extended backwards to 3 different waypoints and 3 new stars introduced.	L15: AMPIT – NOKIN – NUGRA – VEGAR – TNT – DIPSO – ROKUP Re-named as **AMPIT 2E** (U)Y124: DOLOP – AMPIT – NOKIN – NUGRA – VEGAR – TNT – DIPSO – ROKUP New STAR named as **DOLOP 1E**	The conventional STAR will be RNAV1 replicated and re-named. STAR to be re-named based on its starting waypoint *AMPIT* and the 'E' designator used to denote the destination airport (East Midlands), and numerically incremented Extending the STAR back to *DOLOP, MAKUX and MALUD* and creating 3 new STARS will provide flight plannable options and retain the important descent planning restrictions. The STAR will be replicated and created using RNAV design criteria to align as closely as possible with the existing routeing. RNAV5 Aircraft will follow a series of DCT's which replicate the route of the RNAV1 STAR and the ROKUP hold will be designated RNAV1/5

Current IFP	Current route connectivity/ STAR	Design Principle	How	Proposed route Connectivity/ STAR	Impact of proposed change on connectivity and flight behaviour
				L15/Q38: MAKUX – SOSIM – GIGTO – MALUD - AMPIT – NOKIN – NUGRA – VEGAR – TNT – DIPSO – ROKUP New STAR named **MAKUX 1E** Q36: MALUD – AMPIT – NOKIN – NUGRA – VEGAR – TNT – DIPSO – ROKUP New STAR named **MALUD 1E**	
ROKUP Hold	N/A	Satisfies DP1, DP2, DP3, & DP4 - no further changes proposed (DP5)	RNAV 1/5 replication	N/A	This Hold will be RNAV1/5 replicated, to match as closely as possible with the currently published conventional Hold.

11. Annex D: Impact Assessment – Liverpool Procedures

For charts and technical notes, see the Assessment Meeting slide pack (Ref 1) 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
KEGUN 2A STAR	(U)N601/UP6: LESTA –TNT – NANTI – KEGUN	Satisfies DP1, DP2, DP3, & DP4 - no further changes proposed (DP5)	RNAV1 replication and re-designation	(U)N601: LESTA –TNT – NANTI – KEGUN Re-named as **LESTA 1L**	The conventional STAR will be RNAV1 replicated and re-named. STAR to be re-named based on its new starting waypoint *LESTA* and the 'L' designator used to denote the destination airport (Liverpool). The STAR will be replicated and created using RNAV design criteria to align as closely as possible with the existing routeing. RNAV5 Aircraft will follow a series of DCT's which replicate the route of the RNAV1 STAR and the KEGUN hold will be designated RNAV1/5. Due to the Hard-coded level on the STAR DCT required between MOGLI and LESTA to capture UP6 traffic.
KEGUN 2B STAR	N57/T420/Q4: TNT – NANTI – KEGUN	Satisfies all 5 DPs	RNAV1 replication, STAR extension and re-designation	T420: ELVOS –TNT – NANTI – KEGUN Q4/N57s Re-named as **ELVOS 1L**	The conventional STAR will be RNAV1 replicated and re-named. Extending the STAR back to *ELVOS* will provide flight plannable options and retain the important descent planning restriction. The routeings via N57 and Q4 are subject to very low traffic volumes and are addressed with amendments to the SRD/RAD, enabling traffic to join ELVOS 1L at TNT STAR to be re-named based on its new starting waypoint *ELVOS* and the 'L' designator used to denote the destination airport (Liverpool).

Current IFP	Current route connectivity/ STAR	Design Principle	How	Proposed route Connectivity/ STAR	Impact of proposed change on connectivity and flight behaviour
					The STAR will be replicated and created using RNAV design criteria to align as closely as possible with the existing routeing. RNAV5 Aircraft will follow a series of DCT's which replicate the route of the RNAV1 STAR and the KEGUN hold will be designated RNAV1/5
TNT Hold	N/A	Satisfies all 5 DPs	RNAV Replication of current ATC MOPS	TNT (Hold)	Introduction of a new RNAV1/5 hold replicating a current ATC MOPS for backup to the DAYNE/KEGUN hold. Currently, ATC can and do hold at TNT for both EGCC and EGGP arrivals, when DAYNE/KEGUN is either full, or bad weather prevents holding. Publishing this Hold in the AIP will improve safety when utilised. The hold will be created using RNAV design criteria (FL150 – 190) to align as closely as possible with the existing ATC MOPS.
KEGUN 1D STAR	(U)N864: MONTY – KEGUN	Satisfies all 5 DPs	RNAV1 replication, STAR extension and re-designation	(U)N864: OKTEM – GODPA – KEGUN Re-named as **OKTEM 1L**	The conventional STAR will be RNAV1 replicated and re-named. Extending the STAR back to OKTEM will provide flight plannable options and retain the important descent planning restriction. GODPA replaces SLP (WAL D24) STAR to be re-named based on its new starting waypoint *OKTEM* and the 'L' designator used to denote the destination airport (Liverpool). The STAR will be replicated and created using RNAV design criteria to align as closely as possible with the existing routeing.

Current IFP	Current route connectivity/ STAR	Design Principle	How	Proposed route Connectivity/ STAR	Impact of proposed change on connectivity and flight behaviour
					RNAV5 Aircraft will follow a series of DCT's which replicate the route of the RNAV1 STAR and the KEGUN hold will be designated RNAV1/5
KEGUN 2C STAR	N57(Y53)/M605: PEDIG – NANTI – KEGUN	Satisfies DP1, DP2, DP3, & DP4 - no further changes proposed (DP5)	Withdraw	N/A	Due to low levels of traffic (31 filed in 2019) this star will no longer be required. Aircraft will be able to flight plan a DCT NANTI and join LESTA 1L or ELVOS 1L STARs.
TIPOD 2F STAR	(U)N601/UP6: LESTA– TNT – NANTI – KEGUN – WAL – BAROS - TIPOD	Satisfies DP1, DP2, DP3, & DP4 - no further changes proposed (DP5)	Withdraw	N/A	Due to the proposed change to the KEGUN hold, the TIPOD 2F will no longer be required.
TIPOD 2G STAR	N57/T420/Q4: TNT – NANTI – KEGUN – WAL – BAROS – TIPOD	Satisfies DP1, DP2, DP3, & DP4 - no further changes proposed (DP5)	Withdraw	N/A	Due to the proposed change to the KEGUN hold, the TIPOD 2G will no longer be required.
TIPOD 2H STAR	N57 (Y53)/M605: PEDIG – NANTI – KEGUN – WAL – BAROS - TIPOD	Satisfies DP1, DP2, DP3, & DP4 - no further changes proposed (DP5)	Withdraw	N/A	Due to the proposed change to the KEGUN hold, the TIPOD 2H will no longer be required.
TIPOD 1J STAR	(U)N864: MONTY – KEGUN – WAL – BAROS – TIPOD	Satisfies DP1, DP2, DP3, & DP4 - no further changes proposed (DP5)	Withdraw	N/A	Due to the proposed change to the KEGUN hold, the TIPOD 1J will no longer be required.

Current IFP	Current route connectivity/ STAR	Design Principle	How	Proposed route Connectivity/ STAR	Impact of proposed change on connectivity and flight behaviour
KEGUN Hold	N/A	Satisfies DP1, DP2, DP3, & DP4 - no further changes proposed (DP5)	RNAV 1/5 specification, H24 availability	N/A	This Hold will be RNAV1/5 replicated, FL70 – 100. Based on the existing conventional KEGUN Hold position, available H24.
TIPOD Hold	N/A	N/A	N/A	N/A	Will not be utilised for the STARs being withdrawn through this ACP, but still required for STARs TIPOD 3A/2B/1C/1D/1E.

12. Annex E: Impact Assessment – Manchester Procedures

For charts and technical notes, see the Assessment Meeting slide pack (Ref 1) 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
DAYNE 2A STAR	N57/T420: TNT – DAYNE	Satisfies all 5 DPs	RNAV1 replication, STAR extension and re-designation	*T420*: ELVOS – TNT – DAYNE Q4/N57 Re-named as **ELVOS 1M**	The conventional STAR will be RNAV5 replicated and re-named. Extending the STAR back to *ELVOS* will provide flight plannable options and retain the important descent planning restriction. The routeings via N57 and Q4 are subject to very low traffic volumes and are addressed with amendments to the SRD/RAD, enabling traffic to join ELVOS 1M at TNT STAR to be re-named based on its new starting waypoint *ELVOS* and the 'M' designator used to denote the destination airport (Manchester). The STAR will be replicated and created using RNAV design criteria to align as closely as possible with the existing routeing.
DAYNE 1B STAR	N601/UN601/UP6: LESTA – TNT - DAYNE	Satisfies DP1, DP2, DP3, & DP4 - no further changes proposed (DP5)	RNAV1 replication and re-designation	N601*: LESTA – TNT – DAYNE* Re-named as **LESTA 1M**	The conventional STAR will be RNAV5 replicated and re-named. STAR to be re-named based on its new starting waypoint *LESTA* and the 'M' designator used to denote the destination airport (Manchester). The STAR will be replicated and created using RNAV design criteria to align as closely as possible with the existing routeing.
DAYNE Hold	N/A	Satisfies DP1, DP2, DP3, & DP4 - no further changes proposed (DP5)	RNAV1/5 replication	N/A	This Hold will be RNAV1 and RNAV5 replicated, to match as closely as possible with the currently published conventional Hold.

Current IFP	Current route connectivity/ STAR	Design Principle	How	Proposed route Connectivity/ STAR	Impact of proposed change on connectivity and flight behaviour
TNT Hold	N/A	Satisfies all 5 DPs	RNAV Replication of current ATC MOPS	TNT (Hold)	Introduction of a new RNAV1 and RNAV5 hold replicating a current ATC MOPS for backup to the DAYNE hold. Currently, ATC can and do hold at TNT for both EGCC and EGGP arrivals, when DAYNE/KEGUN is either full, or bad weather prevents holding. Publishing this Hold in the AIP will improve safety when utilised. The hold will be created using RNAV design criteria (FL150 – 190) to align as closely as possible with the existing ATC MOPS.

13. Annex F: Route Revision

ATS Route Name	Current route	Proposed Route Name	Design Principle	How	Proposed route	Impact of proposed change on connectivity and flight behaviour
(U)M868	TNT – TIPIL – EVSON - ADELU	M868	Satisfies DP1, DP2, DP3, & DP4 - no further changes proposed (DP5)	RNAV5	TIPIL – EVSON - ADELU	(U)M868 will be truncated to remove the co-incidence with (U)N57 between TNT & TIPIL. Connectivity will be maintained via (U)N57 TNT - TIPIL

14. Annex G: List of references

Reference	Name	Hyperlink
1	*TNT DVOR CAP1616 Stage 1 Assessment Meeting Slide pack*	Link
2	*TNT DVOR Assessment Meeting minutes (redacted)*	Link
3	*TNT DVOR Statement of Need*	Link
4	*TNT DVOR Stage 1B Design Principles*	Link
5	*TNT DVOR Removal Engagement Evidence (redacted) V1.2*	Link

15. Annex H: Engagement Evidence

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

Stakeholder	Type of engagement	Date	Notes
East Midlands Airport	Email	Dec 2020	Email discussion of RNAV options and ROKUP/DIPSO Hold options.
	Email	May 2021	Email summarising proposed changes to relevant procedures; with approval.
	Teams call	May 2021	To discuss and seek approval of proposed changes to relevant procedures
Liverpool Airport	Teams call	Feb 2021	To discuss TNT removal options/procedure changes
	Teams call	Mar 2021	To discuss progress and timelines
	Teams call	May 2021	To discuss progress and timelines
	Email	May 2021	Email summarising proposed changes to relevant procedures; with approval.
	Email	Jul 2021	Email describing revised KEGUN Hold option, with approval.
Manchester Airport	Teams call	Feb 2021	TNT DVOR progress and timelines
	Teams call	Mar 2021	TNT DVOR update
	Teams call	Mar 2021	TNT DVOR project activities and expected timelines
	Email	May 2021	Email summarising proposed changes to relevant procedures; with approval.

End of document