Future Airspace Strategy Implementation: -
Manchester Terminal Manoeuvring Area (MTMA)
ACP-2019-77

Gateway Documentation:
Stage 2 Develop and Assess,
Step 2A Options Development:
Design Options and Design Principle Evaluation

NATS

Roles

Action	Role	Date
Produced	Airspace Change Expert NATS Airspace and Future Operations	January 2023
Approved	Manager Airspace Change Compliance & Delivery NATS Airspace and Future Operations	January 2023
Approved	Manager Airspace Delivery NATS Airspace and Future Operations	January 2023

Publication History

Issue	Month/Year	Changes in this issue
Issue 1.0	January 2023	Submitted to CAA for publication

Contents

References

1.	CAA Airspace Modernisation Strategy (CAP1711, First Edition)	Link
2.	Airspace Change Process (CAP1616, Fourth Edition)	Link
3.	All published documentation related to this airspace change proposal is available on the CAA Airspace Change Portal	Link
4.	Statement of Need	Link
5.	Design Principles	Link
6.	UK Airspace Change Masterplan (Iteration 2)	Link
7.	Performance-based Navigation (PBN): Enhanced Route Spacing Guidance (CAP1385, Second Edition)	Link
8.	Special Use Airspace - Safety Buffer Policy For Airspace Design Purposes (2014)	Link
9.	Policy For ‘Point Merge’ And ‘Trombone’ Transition Procedures (2015)	Link
10.	MTMA Design Options and Evaluation 2A: Stakeholder Engagement	Supplied direct to CAA

1. Introduction

1.1. This Airspace Change Proposal (ACP) is sponsored by NATS EnRoute Ltd. (NERL). Today's Air Traffic Services (ATS) route network has evolved over time and does not fully exploit modern navigation technology. The objective of this ACP is to modernise the route network within and surrounding the Manchester Terminal Manoeuvring Area (MTMA) airspace in accordance with the Civil Aviation Authority's (CAA's) Airspace Modernisation Strategy (AMS) using Performance Based Navigation (PBN). This seeks to provide capacity benefits through systemisation by reducing conflicts whilst also intending to provide a reduction in fuel burn and CO_2 emissions. The changes made within this ACP would only change flight paths at and above 7,000ft and are complementary to the airport sponsored ACPs associated with the Future Airspace Strategy Implementation (FASI) programme to modernise airspace in the region.

1.2. This document forms part of the document set required for the CAP1616 (Ref 2) airspace change process: Stage 2 Develop and Assess, Step 2A Options Development.

1.3. Its purpose is to define a comprehensive list of design options, and to provide stakeholders with a description and high-level evaluation of those design options.

1.4. We re-engaged our representative stakeholder groups, identified during the Stage 1 Design Principles development, to involve them in the development of these design options (for further details see Annex A: List of Stakeholders).

1.5. We sought feedback on the design options and used it to inform the evaluation against the agreed Design Principles (Ref 5). This forms the basis for selection of the most appropriate design options for further development, and rejection of the remainder.

1.6. We thank the stakeholders for their involvement and feedback during this engagement.

1.7. Where are we in the Airspace Change Process? We have completed Stage 1: Define, where we recognised the need for an airspace change and the Design Principles underpinning it. We are now in Stage 2: Develop and Assess, and this document is part of Step 2A Options Development, Design Option and Design Principle Evaluation, see Figure 1.

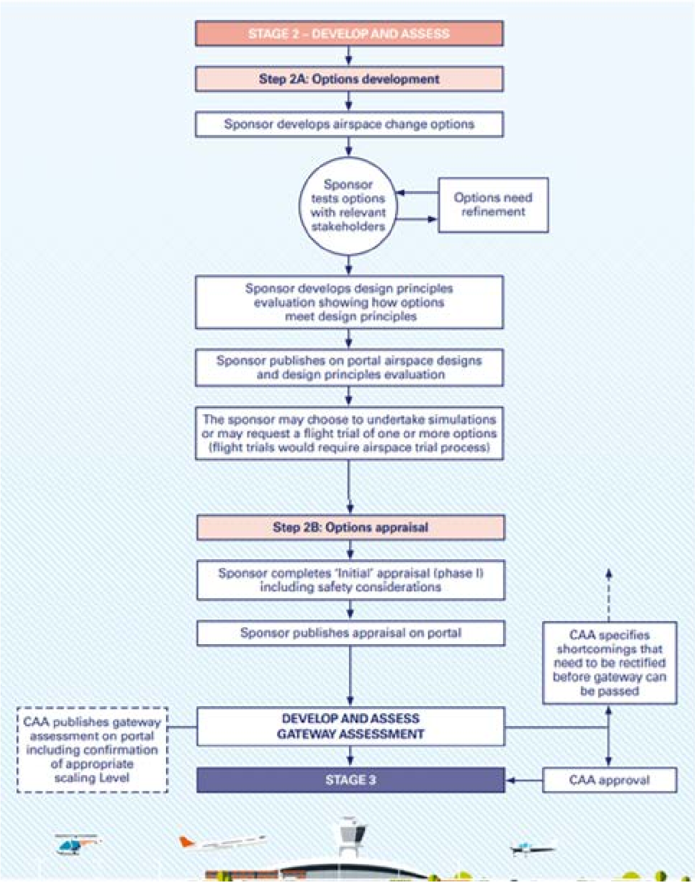

Figure 1: CAP1616 (Ed. 4: Page 45) Airspace Change Process Stage 2

2. Scope

2.1. The changes described within this documentation are in accordance with the AMS (Ref 1) which was initiated by the CAA and the UK Government (this superseded the CAA's Future Airspace Strategy, FAS). The AMS aims to make large-scale improvements within UK airspace.

2.2. This ACP is part of the programme, referred to as the Future Airspace Strategy Implementation (FASI), to redesign airspace in the UK, including upper airspace structures.

2.3. This ACP seeks to make changes to the enroute network, at and above 7,000ft, serving the Manchester TMA as well as the network in the surrounding airspace, in particular Manchester (EGCC), Liverpool (EGGP), Leeds Bradford (EGNM) and East Midlands (EGNX) airports. Figure 2 shows the lateral perimeter of the Manchester TMA (blue shape) and the lateral limits of this change (red shape). This change is constrained laterally by existing airspace structures. Vertically, the changes will extend from a lowest Level, FL70 (~7,000ft, below this level the changes will be made by an airport), up to where the ATS routes will interface with Free Route Airspace (FRA), FL245/255 (~24,500ft/25,500ft) and the remainder of the extant upper ATS route network. This ACP seeks to modernise the enroute network through the systemisation of traffic arriving and departing the Manchester TMA and surrounding airspace where this would provide an operational benefit.

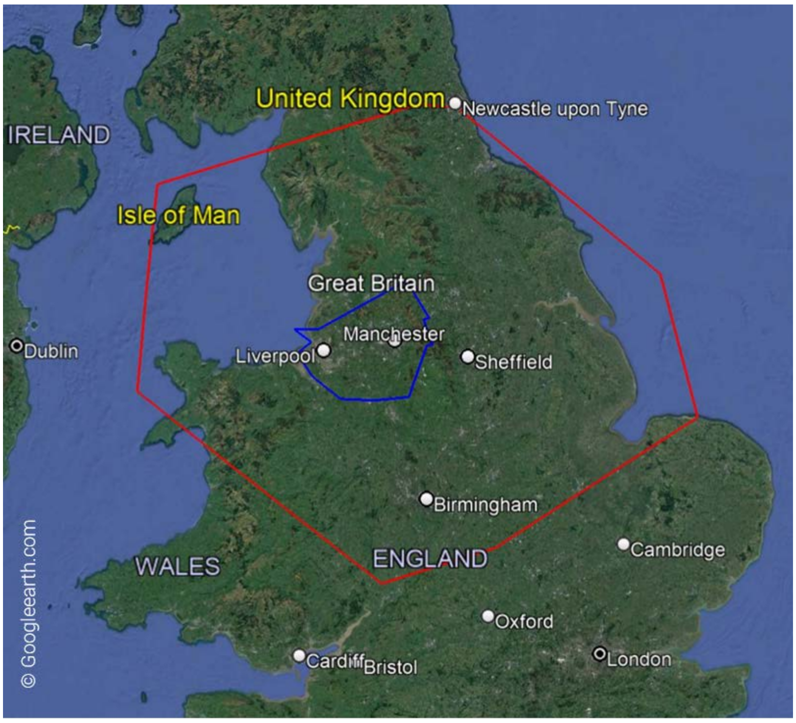

Figure 2: Lateral extent of the MTMA ACP changes (red shape) and the extant Manchester TMA (blue shape).

2.4. Whilst the majority of the change will be within the red boundary, indicating the scope of the change, amendments to the surrounding airspace and structure will be considered if a demonstrable benefit, within the scope of this ACP, can be identified.

2.5. The route network affected by this change may extend into the airspace managed by London Area Control (LAC) and hence there may be changes between the interface with NERL ScAC and NERL LAC.

2.6. The lateral limits of this ACP do not extend to the boundaries of the UK FIR/UIR and therefore there are no interdependencies with neighbouring Air Navigation Service Providers (ANSPs).

2.7. Why must this change happen now?

2.7.1. The enroute network has evolved over many years and has been defined by the use of ground-based navigation beacons. Improvements in navigation technology (e.g., satellite-based navigation) have removed these constraints and hence it is possible to undertake a complete redesign of the route network within the fixed constraints. This change aims to deliver safety, environmental and capacity benefits. Undertaking such a fundamental redesign of the airspace is considered a 'once in a generation' opportunity and will secure efficiencies and benefits for many years to come.

2.8. Combining ACPs

2.8.1. Two enroute ACPs were originally submitted by NERL to make changes to the enroute route network serving the MTMA. These were split in accordance with the on-going FASI ACPs to address the route network serving:

- Manchester and East Midlands airports (NERL ACP: ACP-2019-077) and

- Liverpool airport (NERL ACP: ACP-2019-076)

2.8.2. Subsequently, Leeds Bradford raised an ACP (ACP-2021-066) in September 2021 to address their lower route connectivity as part of the FASI programme. NERL is cognisant of this ACP and will consider their submission alongside the other FASI airport-led ACPs; Manchester (ACP-2019-23), Liverpool (ACP-2015-09) and East Midlands (ACP-2019-44).

2.8.3. As the design options for each ACP were being developed, NERL identified that the design options being discussed for the two NERL ACPs were fully intwined and dependent upon each other. This meant that each ACP would only tell half the story and it would be simpler to present and understand if these changes were combined into a single submission incorporating all the MTMA enroute network changes. NERL initiated combining these ACPs in June 2022. This involved:

- Confirming the Statements of Need for both ACPs aligned
- Confirming the Design Principles for both ACPs aligned
- Confirming the Airspace Change Organising Group (ACOG), the CAA, Manchester, East Midlands and Liverpool airports agreed with the proposal to amalgamate the 2 MTMA enroute ACPs
- Confirming our stakeholders had no objections to the proposed amalgamation of these ACPs

2.8.4. NERL formally combined the enroute ACPs in January 2023. Owing to the similarities between the Manchester and East Midlands enroute ACP and the Liverpool enroute ACP, it was agreed between NERL and the CAA that this work would continue using the original Manchester and East Midlands enroute ACP portal page and Statement of Need, (NERL ACP: ACP-2019-77), however, the portal page would be renamed Future Airspace Strategy Implementation: Manchester Terminal Manoeuvring Area.

2.8.5. The changes being proposed in this ACP will predominantly affect the arrival and departure routes of four airports: Manchester, Liverpool, Leeds Bradford, and East Midlands. NERL is in regular engagement with these airports to ensure that the designs proposed are compatible with the airports' known aspirations or extant procedures to ensure connectivity is maintained or new connectivity can be provided.

2.9. What was the Statement of Need for this proposal?

2.9.1. The Statement of Need (SoN), (Ref 4), is the first step a Sponsor must take, to initiate an airspace change proposal with the CAA. The original SoN did not consider all four MTMA FASI airports.

2.9.2. From a process point of view, the SoN has been superseded by this documentation. The intent of this airspace change proposal is the same, but now applies to the four airports: Manchester, Liverpool, Leeds Bradford, and East Midlands.

2.9.3. The designs in this document strive to address the issues raised in the SoN which is summarised below. The full document is published on the CAA's Airspace Change Portal.

This airspace change proposal will make changes to the Manchester Terminal Manoeuvring Area (MTMA) airspace, STARs and ATS route network. The proposed changes will interface with SIDs and arrival transitions serving Manchester and East Midlands airports. Manchester and East Midlands airports are currently in the process of proposing changes to their SIDs/arrival transitions. The changes proposed to the MTMA by this ACP will be coordinated with, and will complement, the airport's proposals.

Current Situation

The extant conventional SIDs/ STARs at Manchester and East Midlands airports are not PBN and will soon be made obsolete by the planned decommissioning of several conventional navigation beacons.

Issue to be addressed

Consideration of interacting traffic flows between Manchester, East Midlands and neighbouring airports (i.e., Liverpool, Warton, Birmingham, Leeds Bradford, Doncaster Sheffield etc). Introduction of improved holding/delay absorption arrangements and ATS routes will reduce conflicts by systemising the traffic, also reducing fuel burn & CO2 emissions for flights using these routes. New ATS routes and STARs may be required to provide network connectivity for changes as proposed by Manchester and East Midlands airports.

This proposal forms part of the plan for delivering the Airspace Modernisation Strategy.

Cause

Legacy ATS structure requires modernisation in accordance with the Airspace Modernisation Strategy.

2.9.4. Note, this Statement of Need was written pre-COVID-19 pandemic. Whilst the situation has changed, this airspace change is designed to address long-term growth and capitalise on available modern navigation capabilities to facilitate efficiencies and environmental benefits. NERL believes that, despite the COVID-19 impact on the air traffic network, and the subsequent air traffic recovery, the changes proposed remain fully justified and beneficial for the long-term benefit of the UK economy and the aviation industry.

2.10. Design Principles

2.10.1. The Design Principles and priorities were set following engagement with representative stakeholder groups and feedback received as part of CAP1616 Stage 1. The Design Principles and their relative priorities are shown in Table 1 below. Stakeholder feedback as well as input from Subject Matter Experts (SMEs) was incorporated into the Design Principle Evaluation. This will be used to determine which options will be discarded and which will be progressed. The analysis is contained in Annex D: Design Principle Evaluation.

No	Design Principle and Priority	Category	Notes
1	The airspace will maintain or enhance current levels of Safety (High)	Safety	

2	The proposed airspace will maintain or enhance operational resilience of the ATC network **(High)**	Operational	
3	The proposed airspace design will yield the greatest capacity benefits from systemisation **(High)**	Operational	*The proposed airspace design should provide increased capacity and reduce delay. This could include the delivery of a suitable delay absorption mechanism or reducing departure intervals. Systemisation will minimise the need for ATC tactical intervention; for example, through better traffic; management.*
4	The MTMA airspace design will provide a compatible and optimised interface between the lower level terminal airspace; the upper Free Route Airspace (FRA) and the ATS network **(High)**	Technical	*The intent of this Design Principle is for the provision of a design that supports the systemisation of traffic flows: from low-level terminal traffic to high-level Free Route flows. The future design should effectively manage arrivals and departures within the TIMA without impacting capacity.*
5	The proposed MTMA airspace will facilitate optimised network economic performance **(Medium)**	Economic	*Economic benefits could include environmental improvements such as reduced track miles/ emissions or revenue from increased capacity/ route charges.*
6	The proposed MTMA airspace will facilitate the reduction of CO_2 emissions per flight **(Medium)**	Environmental	
7	Minimise environmental impacts to stakeholders on the ground (note: network changes are >7,000ft, the position of the interface with the airport's lower-level routes will be determined by the airport, hence impacts below 7,000ft will be addressed in the separate airport sponsored ACP) **(Low)**	Environmental	
8	The MTMA airspace should be compatible with the requirements of the MoD and take into consideration the requirements of the defence industry stakeholders **(Medium)**	Operational	*Consider where impacts might be greatest by considering Military-use areas against placement of airspace structures.*
9	The impacts on GA, non-commercial and other civilian airspace users due to MTMA should be minimised **(Medium)**	Operational	*Consider where impacts might be greatest by considering known VFR significant areas against placement of airspace structures. This includes a wide variety of airspace users such as emergency, recreational, training and sport aviation.*
10	The classification and volume of controlled airspace required for the MTMA should be the minimum necessary to deliver an efficient airspace design, taking into account the needs of UK airspace users **(Medium)**	Technical	*This may include releasing CAS as appropriate*
11	The route network linking Airport procedures with the enroute phase of flight will be spaced to yield maximum safety, capacity and	Technical	*Where appropriate, the use of RNP should be considered if the fleet mix can support it.*

	efficiency benefits by using an optimal standard of PBN. **(High)**		
12	The MTMA airspace design will provide a compatible and optimised interface with London Airspace Modernisation Programme (LAMP) design **(High)**	Technical	*Closely spaced routes across the interface.*
13	Must accord with the CAA's published Airspace Modernisation Strategy (CAP1711) and any current or future plans associated with it. **(High)**	Policy	*The CAA have stated that this DP is required by all change sponsors.* *CAP1711 describes what airspace modernisation must deliver including:* *- the need to increase aviation capacity.* *- growth to be sustainable.* *- the need to maximise the utilisation of existing runway capacity.*
14	The airspace should introduce improved Continuous Climb Operations (CCO) and Continuous Descent Operations (CDO) for all aircraft **(Medium)**	Environmental	*This Design Principle includes enabling continuous operations below 7,000ft, where possible.*

Table 1: Design Principles

2.10.2. The Design Principle development document is published on the CAA airspace change portal here.

2.10.3. As the options presented in this document will be high-level concepts (see section 3.11) rather than defined solutions within defined volumes of airspace, the airspace classification (part of Design Principle 10) will be considered in the Design Principle Evaluation but not included in the options at this stage. NERL will seek to use the lowest appropriate airspace classification and minimum volume of CAS possible to deliver the finalised design. This level of detail will be provided at Stage 3.

2.11. The Airspace Modernisation Strategy (AMS) Alignment

2.11.1. The Department for Transport (DfT) and CAA's co-sponsored Airspace Modernisation Strategy (AMS, CAP1711) is detailed in Ref 1.

2.11.2. The CAA have consulted on Issue 2 of the AMS, but this has not been published at the time of writing. NERL will ensure that the holistic solution presented at Stage 3 will accord with the latest iteration of the AMS.

2.11.3. It was originally intended that the Masterplan[1] would be developed to facilitate coordination of the FASI ACPs and assist where there may be dependencies or conflicting requirements between ACPs. Iteration 1 of the Masterplan, approved and published by the CAA in February 2021, covered the FASI-South Airports. In May 2021 the DfT/CAA informed NERL of the requirement to update the Masterplan to cover both the FASI-South and FASI-North Airports. Iteration 2 of the Masterplan (Ref 6) was submitted by the Airspace Change Organising Group (ACOG) to the DfT/CAA at the end of 2021 and was accepted by the CAA/DfT January 2022.

[1] The Masterplan is a high-level coordinated implementation plan of a series of individual airspace design changes that need to be developed in coordination to achieve the range of benefits that modernisation can deliver.

2.11.4. Until Iteration 3 of the Masterplan, relating to the MTMA change including the updated programme plan, has been assessed and accepted by the CAA and DfT as co-sponsors of airspace modernisation, the full indicative timeline for this ACP cannot be confirmed.

2.11.5. This Design Principle Evaluation will be a qualitative evaluation by experienced SMEs and will consider the degree of alignment with the AMS, based on balancing capacity provision, noise impacts and flight efficiency.

2.11.6. The MTMA documents fully align with the guidance set out in the Masterplan and the objectives in the AMS. A matrix detailing how the MTMA ACP aligns with each objective of the AMS is given in Annex C: Airspace Modernisation Strategy Alignment. Note: this matrix relates to the alignment of the MTMA ACP with the AMS, not the alignment of individual design options.

2.12. Potential Interactions and Dependencies with other FASI ACPs

2.12.1. The FASI programme involves NERL and numerous UK airports which are sponsoring separate ACPs.

2.12.2. Manchester, Liverpool, Leeds Bradford and East Midlands airports are undertaking their own ACPs (ACP-2019-23, ACP-2015-09, ACP-2021-066 and ACP-2019-44, respectively) to propose changes to their arrival and departure procedures below 7,000ft. The changes being proposed in this ACP will predominantly impact these airports and they have been engaged with throughout the CAP1616 process thus far, (see Annex A: List of Stakeholders). There is potential for conflicts across these interdependent ACPs which may lead to compromises and or trade-offs. These will be considered further at Stage 3 of the CAP1616 process.

2.12.3. BAE Warton, City Airport & Manchester Heliport (Barton), Birmingham, Blackpool, Doncaster Sheffield (now ceased operations)[2], Hawarden and Leeds East airports are within airspace potentially affected by this airspace change and have been included as stakeholders. However, these airports are not implementing any new or changed procedures connecting them to the ATS route network; this ACP will ensure connectivity will be maintained.

2.12.4. This ACP contains changes that abut the changes being made to the NERL Scottish TMA (ScTMA) ACP (NERL ACP: ACP-2019-74). The changes proposed in this ACP consider the ScTMA proposed changes and will ensure that they remain compatible.

2.12.5. Additionally, this ACP contains changes that abut the changes being made to the NERL-led London Airspace Management Programme 2 (LAMP) Deployment 1.1 (NERL ACP: ACP-2017-70), Deployment 1.2 (NERL ACP: ACP-2021-050), Deployment 2 (NERL ACP: ACP-2020-043), Deployment 3 (NERL ACP: ACP-2020-044), and Deployment 4 (NERL ACP: ACP-2020-045) which seek to optimise the ATS route network in the southwest of England and Wales, and in the southeast region of England. The changes proposed in this ACP consider the LAMP proposed changes and will ensure that they remain compatible.

[2] The future of Doncaster Sheffield airspace is, at the time of writing, uncertain, see section 2.14

2.13. Potential Interactions and Dependencies with non-FASI ACPs

2.13.1. Interface with Free Route Airspace

2.13.2. Free Route Airspace (FRA) is specified airspace within which users may freely plan a route between a defined entry point and a defined exit point, with the possibility to route via intermediate (published or unpublished) way points, without reference to the ATS route network, subject to airspace availability. Within this airspace, flights remain subject to air traffic control.

2.13.3. The introduction of FRA was mandated for European Union (EU) members in European Law (Implementing Rule EU716 /2014, superseded by EU2021/116). EU716/2014 was retained (and amended) in UK domestic law under the EU (Withdrawal) Act 2018 and sets the requirements for FRA implementation which NATS will adhere to until such a time it is superseded in UK law. The introduction of FRA is also included within the AMS.

2.13.4. In accordance with this guidance, NATS is in the process of introducing FRA within the UK's upper airspace.

2.13.5. To deliver this change, NATS has split this introduction into 4 proposed deployments[3], listed below and shown in Figure 3, each covering a separate geographic region of the UK upper airspace:[4]

- FRA D1 (NERL ACP: ACP-2018-11, blue region, the introduction of FRA within the upper airspace over the northern portion of UK airspace, implemented, December 2021)
- FRA D2 (NERL ACP: ACP-2019-12, green region, the introduction of FRA within the upper airspace over the south-western portion of UK airspace, implementation due 2023)
- FRA D3 (NERL ACP: ACP-2021-071, yellow region, the introduction of FRA within the upper airspace over the central portion of UK airspace, implementation planned 2024)
- FRA D4 (NERL ACP: ACP-2021-072, orange region, the introduction of FRA within the upper airspace over the south-eastern portion of UK airspace, implementation planned 2026)

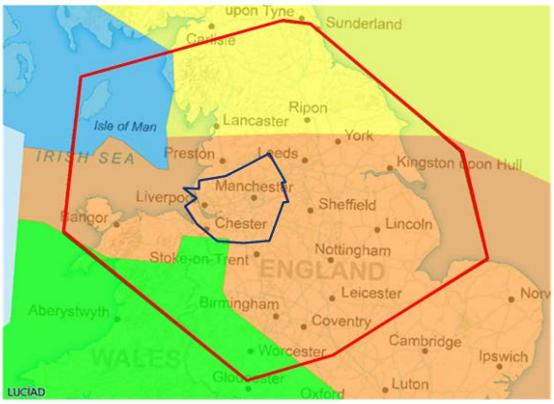

Figure 3: Location of existing (blue section) and planned (green, yellow, and orange sections) UK FRA airspace. The lateral limits of this ACP (red shape) and existing MTMA (blue shape) are also shown.

[3] At the time of writing there are 4 proposed FRA deployments for the UK FIRs. Subject to requirements these indicative divisions could be combined, or split further, prior to implementation.

[4] It should be noted that the timescales, whilst agreed with the CAA and published on the relevant portal pages, can be updated and changed if needed with agreement from the CAA.

2.13.6. The FRA D1 airspace structure extends from FL255 up to FL660. The later FRA deployments are expected to extend from c.FL245 to FL660.

2.13.7. Aircraft arriving and departing FRA do so via published FRA entry and exit points which are defined within the UK AIP.

2.13.8. It is not certain whether the FRA deployments will be complete prior to the implementation of the MTMA changes. However, should FRA be delayed, this ACP will connect to the existing, or modernised, upper airspace structures in line with the concepts described within this submission.

2.13.9. The lateral limits of this ACP overlap all 4 FRA deployment areas, therefore any revision to the ATS routes in this airspace may result in the requirement to amend/introduce new FRA exit and/or entry points as required.

2.14. Removal of Doncaster Sheffield Airport Airspace

2.14.1. On the 13th July 2022 Doncaster Sheffield Airport (EGCN) announced the commencement of a strategic review to discuss the future of the airport. This review concluded on the 26th September 2022 and determined that no viable options existed for the continuation of operations at EGCN. The airport planned to cease operations on the 18th November 2022. In anticipation of this suspension, the CAA sponsored an ACP (ACP-2022-082) to transfer the management of/ remove the airspace for which EGCN is the nominated unit providing service.

2.14.2. The provision of air traffic services at EGCN ceased on the 2nd December 2022. A NOTAM (Notice to Air Missions) was published stating that the airspace has been deactivated and reverts to Class G. At the time of writing (January 2023) this NOTAM was still in force, and it is not certain that another ANSP will offer to reopen some or all of the airspace. The last date to submit considerations to manage the airspace is the 17th February 2023, with changes becoming effective on the 18th May 2023, AIRAC (Aeronautical Information Regulation and Control) 05/2023.

2.14.3. The status of this airspace may be subject to further change in the coming months.

2.14.4. With this uncertainty in the baseline, and to uphold the MTMA Design Principle Evaluation, the assessment of options is performed against 2 contrasting baseline variants[5]: 'Baseline Variation 1) Extant Doncaster Sheffield airspace' and 'Baseline Variation 2) De-notification of Doncaster Sheffield airspace', see section 6.4.3.

2.14.5. Both sets of evaluations are presented herein and included in consideration of how well the design options have responded to the Design Principles.

2.15. Interaction with the Isle of Man/Antrim Changes

2.15.1. A previous ACP (NERL ACP: ACP-2015-11) introduced a systemised airspace structure in the Isle of Man/Antrim region. This change is on the periphery of the lateral scope of this ACP and will be

[5] Neither baseline variant impacts the list of options shortlisted following the Design Principle Evaluation.

considered as a constraint on the design. As such, this airspace change will ensure no adverse impact to the current systemisation in this area.

2.16. ACP Categorisation Level

2.16.1. Under CAP1616 the CAA categorises ACPs by assigning them a 'Level', which in turn influences the process that is required to be followed. The Levels are primarily based on the altitude and area in which the changes occur and are defined in CAP1616 (Ed. 4) Table 2 (page 26).

2.16.2. Prior to the COVID-19 pandemic this ACP was being progressed in parallel with ACPs sponsored by Manchester, Liverpool, and East Midlands airports. The impact of COVID-19 on air traffic levels resulted in the airports and NERL suspending progress on their ACPs. Following the upturn in traffic and the availability of DfT funding to continue the FASI changes, the airports (including a subsequent submission by Leeds Bradford) and NERL were in a position to continue with the CAP1616 process to improve the MTMA airspace.

2.16.3. During the assessment meeting NERL explained the changes which will be included and progressed under this ACP are only to the enroute airspace and would only change flight paths at and above 7,000ft. However, NERL are aware that these changes could have an impact on aircraft tracks below 7,000ft and understands that by the definitions in CAP1616 this change is expected to be categorised as a Level 1 ACP.

2.16.4. The changes included within this ACP are to the enroute airspace and would only change flight paths at and above 7,000ft[6]. As agreed, Manchester, Liverpool, Leeds Bradford, and East Midlands airports are pursuing their own ACPs to change the low level (below 7,000ft). As such, NERL would consider it disproportionate to consider noise impacts within this ACP and therefore proposes the process is scaled as follows:

2.16.5. NERL intends to:

- Continue to work closely with airport stakeholders on options development and, as changes are being progressed by an airport, provide support to their consultations (where requested and appropriate).
- Continue to engage with airport stakeholders to determine suitable hold locations and SID connectivity points.
- Consult with relevant identified stakeholders on the proposals for change to the enroute network at and above 7,000ft.
- Produce enroute network CO_2 emissions analysis (during Stage 3).

2.16.6. NERL does not intend to:

- Consult on routes below 7,000ft. If no changes below 7,000ft are proposed by airports, the MTMA ACP designs will interface with the extant routes.
- Proactively consult local communities.
- Produce noise analyses (unless related to ATS route changes below 7,000ft above ground level (agl) and not within the scope of one of the FASI associated airport ACPs).

[6] See DfT Air Navigation Guidance 2017

2.16.7. A note on biodiversity impacts:

- Airspace changes are unlikely to have an impact on biodiversity because they do not normally involve changes to ground based infrastructure (habitat disturbance).
- Biodiversity was not part of a Design Principle in Stage 1. During engagement, stakeholders did not identify biodiversity concerns in any specific region.
- No such ground-based infrastructure changes are associated with this proposal, therefore this proposal is not predicted to impact biodiversity.

3. Design Options Summary

3.1. The Statement of Need for this proposal identifies the following areas contained within the enroute (at and above 7,000ft) environment which this proposal seeks to address:

- Introduction of improved holding arrangements and airport connectivity
- Introduction of systemised routes

3.2. Appropriate connectivity between the holding structures and routes will also be provided as will connectivity from the SID end points to the route network as required.

3.3. The options proposed to modernise the airspace have been developed using a user-centred design process. This process uses first-hand knowledge provided through SMEs, in this case NERL air traffic controllers and airspace design experts, to develop options which are theoretically feasible within the constraints and demands of the airspace.

3.4. Furthermore, the options have been developed in coordination with the FASI MTMA airport stakeholders, (Manchester, Liverpool, Leeds Bradford and East Midlands) to ensure the options proposed are compatible with the airports' own ACP aspirations.

3.5. The options have been shared with stakeholders contacted during Stage 1 so that they could inform the design.

3.6. Whilst the comprehensive list of options is substantial, it does not attempt to list every possible solution which could be proposed if starting with no constraints. Only those options thought to offer benefits to the operation are presented herein, see section 3.11.

3.7. LAMP Deployment 1.1 (NERL ACP: ACP-2017-70) and the ScTMA (NERL ACP: ACP-2019-74) FASI enroute proposals addressed similar issues and we considered their approaches in the creation and progression of this MTMA ACP.

3.8. Airspace Constraints

3.8.1. The lateral limits of this airspace change are contained within the London FIR and includes several existing airspace structures which restrict the options that can be considered. The main airspace considerations are shown in Figure 4 and listed in Table 3. Note, this list intends to demonstrate the complexity of the airspace and the design considerations, and is not considered exhaustive. Further detail is provided within the design options presented in section 6.

3.8.2. All changes which are proposed have considered these fixed airspace constraints. Where an option has been proposed which may require additional CAS or encroaches upon the fixed airspace structures, the relevant stakeholder organisation has been engaged to determine if the solution is feasible. Only feasible options will be considered and included within this documentation.

3.8.3. Within the lateral limits of this airspace change there are areas designated as National Parks and Areas of Outstanding Natural Beauty (AONB). CAP1616 states that, where practicable, it is desirable that airspace routes below 7,000ft should seek to avoid flying over AONBs and National Parks and ACP sponsors should consider these areas with regard to impacts on tranquillity. During Stage 1 of the CAP1616 process the following National Park and AONBs, proximate to the Manchester TMA, have been engaged with:

- Cannock Chase
- Clwydian Range and Dee Valley
- Forest of Bowland
- Peak District

3.8.4. The changes included in this ACP are to the enroute network and would only change flight paths at and above 7,000ft, and therefore AONBs and National Parks do not need to be considered. However, NERL are aware that changes could have a consequential impact on aircraft tracks below 7,000ft (for example through the release of CAS); should it transpire that an option will impact an AONB/National Park with regard to impacts on tranquillity, then the relevant stakeholders will be informed and engaged with, see section 2.16.5 and 2.16.6.

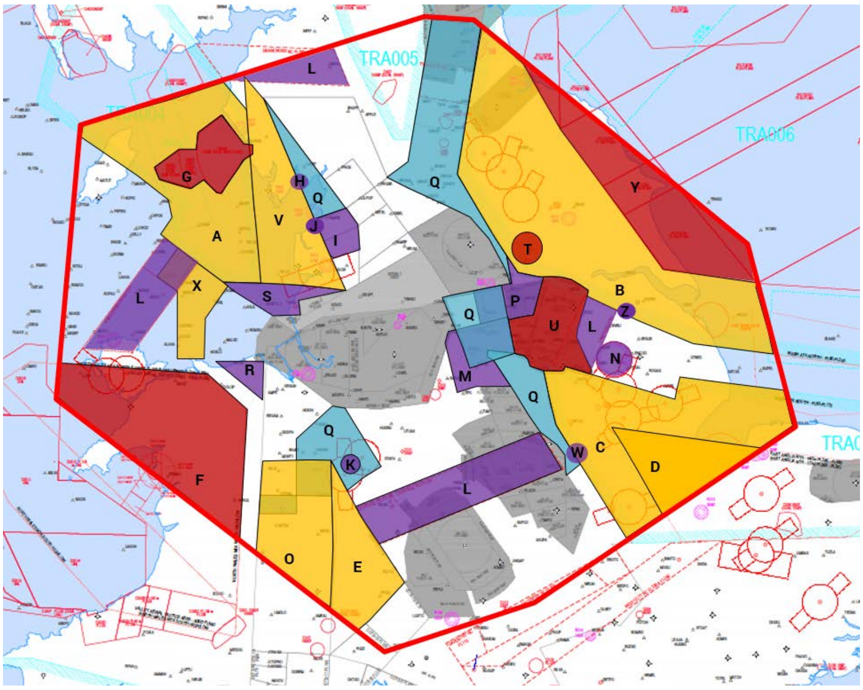

Figure 4: Existing airspace structures which constrain the options development (list is not exhaustive). Changes to structures in red are likely to be exceptionally challenging to make e.g., Military Danger areas. Changes to structures in orange are likely to be challenging to make e.g., Temporary Reserved Areas between FL195 and FL245. Structures in purple have unusual activity that needs to be considered through the design process e.g., gliding areas. Structures in light blue have areas where CAS bases limit operations. Structures are labelled A-Z and listed in Table 3.

A	TRA004
B	TRA006
C	TRA003
D	East Anglian MTA
E	Cotswold FUA time dependent
F	North Wales MTA
G	Eskmeals D406
H	Cark Paradrop site – up to FL150
I	Chipping Box – up to FL140
J	Cockerham Paradrop site – up to FL150
K	Tilstock Paradrop site - up to FL110
L	Radar Corridor
M	Camphill Gliding FL85 to FL100, max FL190
N	R313 – Red Arrows up to 9500ft
O	N862/N864 Complex
P	L975 Glider Crossing DB to FL120, max FL190
Q	Areas where CAS bases limit operations. Potential to investigate lowering bases.
R	AMPIT Triangle (5LNC) FL145-FL185 (as req)
S	Warton Fillet FL85-FL195 (as req)
T	Leeds East airport
U	EGCN[7] zone
V	N864 Triangle
W	Langer Paradrop
X	Base of CAS to be reviewed, to facilitate continuous descent operations
Y	D323 complex
Z	Hibaldstow Paradrop

Table 2: Existing airspace structures, labelled A-Z and shown in Figure 4, which constrain the options development (list is not exhaustive).

[7] The future of Doncaster Sheffield airspace is, at the time of writing, uncertain, see section 2.14.

3.8.5. Transition Altitude

3.8.5.1. Aircraft can use different vertical references when flying. "Altitude" specifically means the distance of an aircraft above mean sea level using a local or regional pressure setting; "height" specifically means the distance above the surface/terrain; a "Flight Level" (FL) is the vertical distance of an aircraft above the isobaric surface of 1013.25 hPa (hectopascals), and is the standard reference for aircraft at higher levels, in hundreds of feet, i.e., with standard pressure set, an aircraft at 9,000ft is at FL90.

3.8.5.2. Controllers need to use common vertical references for the aircraft under their control, and those adjacent, to maintain separation, hence the use of altitudes and flight levels. The Transition Altitude (TA) is the altitude at or below which the vertical position of an aircraft is controlled by reference to altitudes. Above the TA, aircraft fly with reference to Flight Levels. ENR 1.7 of the UK AIP defines the TA within the UK as 3,000ft except in, or beneath, that airspace specified within Table 3.

Airspace Block	Transition Altitude
Aberdeen CTR/CTA	6,000ft
Belfast CTR/TMA	6,000ft
Birmingham CTR/CTA	**6,000ft**
Bristol CTR/CTA	6,000ft
Cardiff CTR/CTA	6,000ft
Channel Islands CTR/CTA	5,000ft
Clacton CTA	6,000ft
Daventry CTA	**6,000ft**
Doncaster Sheffield CTR/CTA[8]	**5,000ft**
East Midlands CTR/CTA	**6,000ft**
Edinburgh CTR/CTA	6,000ft
Glasgow CTR/CTA	6,000ft
Leeds Bradford CTR/CTA	**5,000ft †**
Liverpool CTR/CTA	**5,000ft**
London TMA	6,000ft
Manchester TMA	**5,000ft**
Newcastle CTR/CTA	**6,000ft**
Norwich CTR/CTA	5,000ft †
Scottish TMA	6,000ft
Solent CTA	6,000ft †
Sumburgh CTR/CTA	6,000ft †
Teesside International CTR/CTA	**6,000ft**
Worthing CTA 1, 2, 3 and 5	6,000ft

Table 3: Exceptions to the standard UK TA - Airspace structures in bold are contained partially or wholly within the lateral limits of the MTMA ACP. (Note: † Outside the notified hours of operation the Transition Altitude is 3,000ft).

3.8.5.3. For the lateral limits of the MTMA ACP, the TA within and below controlled airspace is either 3,000ft, 5,000ft or 6,000ft (UK AIP ENR 1.7), see Figure 5. Within the scope of this airspace change NATS will introduce consolidation of the TA from 5,000ft to 6,000ft.

[8] The future of Doncaster Sheffield airspace is, at the time of writing, uncertain, see section 2.14.

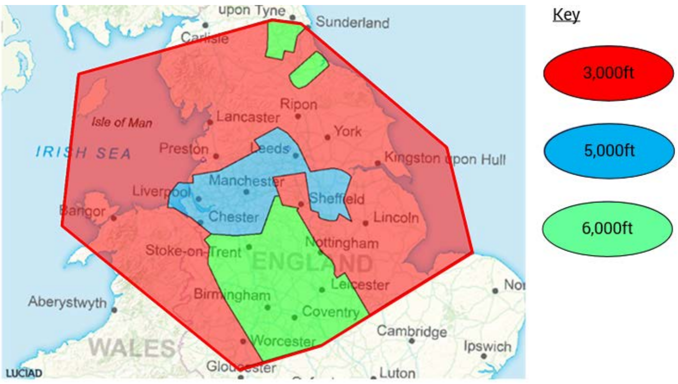

Figure 5: TA within the lateral limits of the MTMA ACP (red shape)

3.8.5.4. Previous NATS ACP submissions consolidating the TA within controlled airspace have ascertained that doing so would not alter the "patterns of flights (IFR, VFR or SVFR) using the impacted airspace, or aircraft operating within Class 'G' airspace under the airspace" and as such specific consultation with environmental stakeholders would not be required. This change of TA, from 5,000ft to 6,000ft, supports CAA policy to consolidate the TA within UK controlled airspace (CAS), and, in line with previous TA consolidation submissions, will not create any additional impact on the lateral patterns of flights proposed within the airport ACPs. However, the consolidation would facilitate the consideration of additional options, in particular for the airports, such as higher SID endpoints at 6,000ft.

3.8.5.5. NATS considers that the MTMA ACP provides an ideal opportunity to implement this change as it complements the changes described within this ACP submission as well as those being proposed in the corresponding airport ACPs. Therefore, NATS has introduced consolidation of the TA within the lateral limits of the MTMA ACP change as a constraint on the design and it will be included in all options described herein.

3.8.5.6. NATS has reviewed the stakeholder list for the MTMA ACP and has concluded that the current stakeholder list for the MTMA change and that required for consolidation of the TA is analogous and therefore all pertinent stakeholders are included. NATS therefore considers there is no need to extend this audience. All the MTMA ACP stakeholders, (see Annex A: List of Stakeholders) have been notified of the intention to include a consolidated TA as a constraint on the MTMA ACP design and no objections have been received. The associated ACPs for the MTMA airports, Manchester, Liverpool, Leeds Bradford and East Midlands, will be based on a consolidated 6,000ft TA.

3.8.5.7. Consolidation of the TA will have the following benefits:

- progresses CAA policy to consolidate the TA within UK CAS
- consolidates the TA within the Manchester TMA and surrounding airspace
- reduces the possibility of (vertical) infringement into CAS in this region due to a common TA
- simplifies the airspace picture:
    - reduces operational confusion
    - reduces pilot and controller workload
- enables higher SID endpoints to be considered within the airport ACPs enabling the associated benefits, such as:
    - improved continuous climb operations
    - reduction in fuel burn
    - reduction in greenhouse gas emissions

- o reduced noise

3.8.5.8. Consolidation of the TA will not:

- constrain in any way the designs options being considered
- alter the patterns of flights (IFR, VFR or SVFR) using this airspace.

3.8.5.9. Consolidation of the TA, from 5,000ft to 6,000ft, will lead to the TA levels within the lateral limits of the MTMA ACP as shown in Figure 6.

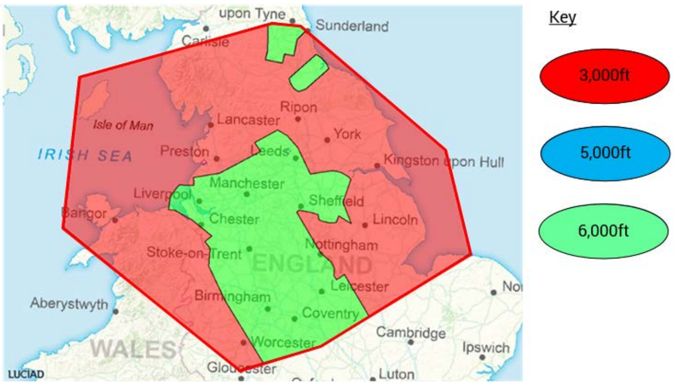

Figure 6: Consolidated TA, from 5,000ft to 6,000ft, within the lateral limits of the MTMA ACP (red shape)

3.9. Airspace Sharing

3.9.1. The military relies on the use of certain airspace structures to secure our nation's borders and requires dedicated training areas to be reserved and segregated for hazardous activities, that are not compatible with other airspace users, such as training fast jet pilots and testing munitions.

3.9.2. Advanced Flexible Use of Airspace (AFUA) is a concept promoted by Eurocontrol, and aligned with the CAA's Airspace Modernisation Strategy (Ref 1), in which airspace is no longer designated as purely 'civil' or 'military' airspace, but considered as one continuum and allocated according to user.

3.9.3. This flexibility in airspace management enables airspace users to fly without being constrained by fixed airspace structures or fixed route networks, and allows operations that require segregation to take place safely and flexibly and with minimum impact on other airspace users.

3.9.4. The progressive development of AFUA in UK airspace seeks to create an environment that can accommodate the predicted increase in network traffic and demand for segregated operations in the future.

3.9.5. As such, the MTMA ACP will align with AFUA principles ensuring that, where possible, any necessary airspace segregation is temporary in nature and optimisation of network performance is the primary consideration.

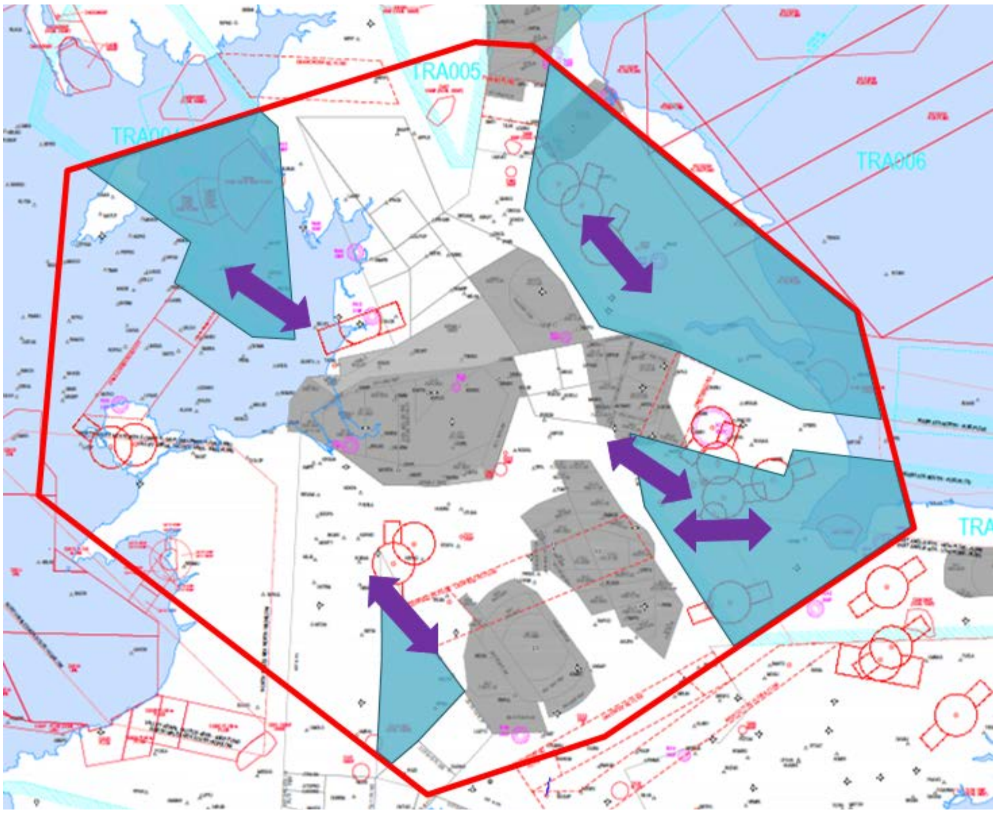

Figure 7: Within the lateral limits of the MTMA ACP (red shape); potential opportunities to share military airspace are shown as blue polygons and possible traffic flows are shown as purple arrows.

3.9.6. Within the lateral limits of this airspace change, there are certain areas which are not suitable for flexible airspace management and serve as constraints on the design. However, there are airspace volumes (specifically the Cotswold AFUA and the military Temporary Reserved Areas - TRAs, shown as blue polygons, see Figure 7) where opportunities may exist to share the airspace, (e.g., through the use of conditional routes). NERL considers these volumes (location, size, times of usage etc.) to be open for discussion around the sharing of airspace. Possible traffic flows through these volumes are represented in Figure 7 as purple arrows.

3.9.7. In this airspace, this is considered a 'radical' alteration to the current-day operation, and will be considered, as part of the developing options, to provide additional connectivity consistent with the design described herein.

3.9.8. NATS will continue to engage regularly with the Military through DAATM (Defence Airspace and Air Traffic Management) in the development of the holistic design options prior to consultation in Stage 3 to ensure the consulted designs are compatible with Military requirements.

3.10. Route Structure and Traffic Flows

3.10.1. Figure 8 shows the existing airway structure (left figure) and density of flights (right figure), and demonstrates that traffic arriving and departing within the MTMA ACP area do so predominantly around Manchester, Liverpool, East Midlands, and Birmingham airports. Traffic primarily follows the route structure, and published inbound and outbound procedures, with some controller vectoring, and c.50% of the traffic concentrated in the south.

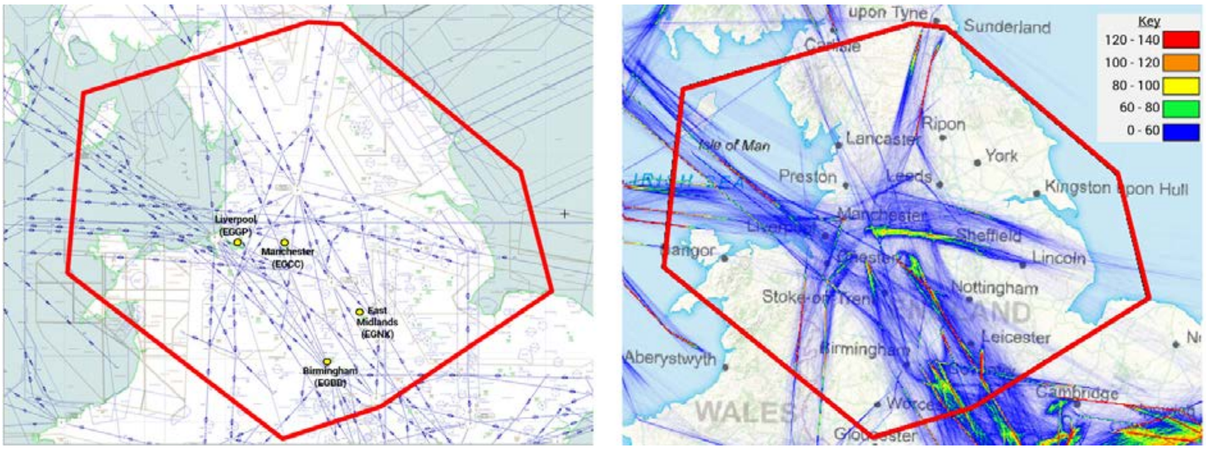

Figure 8: Within the MTMA ACP area (red shape); Left Figure - Lower ATS route Structure (FL70-FL250), Right Figure – Flight Density (FL70-250, Aug 1-7, 2022)

3.11. Method - High-level Concepts and Geographical Elements

3.11.1. In this document we have divided the design options into those addressing the:

- Route network
- MTMA airport connectivity (at and above 7,000ft), including departures connectivity, arrivals connectivity, and arrival structures

3.11.2. Design options will consider existing constraints (Figure 4), current traffic flows (Figure 8) and enroute connectivity. As such, they will be limited to modernising the existing route network and providing MTMA airport connectivity unless SME input indicates there is an opportunity to provide benefit by the addition of new connectivity.

3.11.3. Due to the lateral scope of the MTMA ACP, including the various existing airspace constraints (see section 3.8), and the route demand (see section 3.10), for simplification the route network design options will be subdivided into 5 geographical elements (Northern Spine, Eastern Arm, Southern Spine, Western Arm and Central – see Figure 9) with a list of design options presented for the main traffic flows to/from the MTMA within each element. In addition, where appropriate, connectivity will be provided between adjacent geographical elements using the design option described.

3.11.4. The depicted geographical elements are indicative of where the majority of the changes could be implemented and are not definitive airspace boundaries.

3.11.5. Design options may extend outside of the geographical elements to provide connectivity, as required, with the surrounding airspace.

Figure 9: Lateral regions of the 5 geographical elements - Northern Spine, Eastern Arm, Southern Spine, Western Arm and Central

3.11.6. MTMA airport connectivity will be subdivided into design options:

- Providing connectivity to airport departures
- Providing connectivity to airport arrivals
- Providing airport arrival structures, e.g., radial holds or linear delay absorption structures

3.11.7. Owing to the number of possible route positions within the airspace, it is not proportional to list all possible design permutations. Therefore, the design options will be presented as high-level concepts at this stage before being developed into holistic design options at Stage 3.

3.11.8. NERL has undertaken visualisation simulations to check the overall operability of the constituent parts of the design using indicative tracks which align with the design options.

3.11.9. These simulations have been used for stakeholder engagement to demonstrate how the design options could operate together, although it was clearly stated that they do not necessarily represent the final location of tracks.

3.11.10. At Stage 2, the design options, presented as high-level concepts, will be qualitatively appraised and evaluated. Without defined routes, working in unison with the other constituent parts of the holistic design, it is not proportional to quantify the benefits for each option.

3.11.11. In some instances, within existing CAS, it may be more appropriate to provide connectivity via a flight plannable direct route (DCT) as opposed to an ATS route. In these instances, a new flight plannable DCT will be incorporated in Appendix 4 of the Route Availability Document (RAD). RAD changes are outside the scope of the CAP1616 process and will be included as information only. However, if NERL considers increased use of DCTs it may be more appropriate that this will be included as a specific question in the Stage 3 consultation.

3.11.12. During the later Stage 3 work, the progressed high-level concepts for the route network and for MTMA airport connectivity will be evaluated for design option compatibility.

3.11.13. Following this evaluation, NERL reserves the right to revive a design option eliminated at Stage 2 if the progressed option is found to be incompatible with the options progressed for the other elements. This is consistent with the Airspace Masterplan (Ref 6).

3.11.14. During Stage 3, compatible options will be combined and developed into a holistic design solution (or solutions) which will be consulted on and quantitatively appraised.

3.11.15. The following tables, Table 4 to Table 11, summarise the design options considered for the route network (separated into the 5 geographical elements - Northern Spine, Eastern Arm, Southern Spine, Western Arm and Central) and for MTMA airport connectivity (separated into departure connectivity, arrival connectivity, and arrival structures).

Route Network: Northern Spine		
Option No.	Option Name	Description
0	Baseline	The "Do-Nothing" option. Keep everything as it is currently
1	Systemised	Introduction of systemised routes providing connectivity for Manchester TMA traffic routing to/from the ScTMA or NATEB (Newcastle). Additionally, connectivity may be required to, from, and between adjacent geographic elements.
2	Part-systemised	Introduction of a mix of systemised routes and non-systemised routes providing connectivity for Manchester TMA traffic routing to/from the ScTMA or NATEB (Newcastle). Additionally, connectivity may be required to, from, and between adjacent geographic elements.
3	Most direct route	Introduction of direct routes providing connectivity for Manchester TMA traffic routing to/from the ScTMA or NATEB (Newcastle). Additionally, connectivity may be required to, from, and between adjacent geographic elements.
4	Bi-directional route	Introduction of bi-directional routes providing connectivity for Manchester TMA traffic routing to/from the ScTMA or NATEB (Newcastle). Additionally, connectivity may be required to, from, and between adjacent geographic elements.

Table 4: Summary of route network design options for the Northern Spine

Route Network: Eastern Arm		
Option No.	Option Name	Description
0	Baseline	The "Do-Nothing" option. Keep everything as it is currently
1	Systemised	Introduction of a systemised airspace structure providing connectivity for Manchester TMA traffic routing to /from central Europe and Scandinavia. Additionally, connectivity may be required to, from and between adjacent geographical elements.
2	Part-systemised	Introduction of a mix of systemised airspace structures and non-systemised route structures providing connectivity for Manchester TMA traffic routing to /from central

		Europe and Scandinavia. Additionally, connectivity may be required to, from and between adjacent geographical elements.
3	Most direct route	Introduction of direct routes providing connectivity for Manchester TMA traffic routing to /from central Europe and Scandinavia. Additionally, connectivity may be required to, from and between adjacent geographical elements.
4	Bi-directional route	Introduction of bi-directional routes providing connectivity for Manchester TMA traffic routing to /from central Europe and Scandinavia. Additionally, connectivity may be required to, from and between adjacent geographical elements.

Table 5: Summary of route network design options for the Eastern Arm

Route Network: Southern Spine		
Option No.	Option Name	Description
0	Baseline	The “Do-Nothing” option. Keep everything as it is currently
1	Systemised	Introduction of a systemised airspace structure providing connectivity for Manchester TMA traffic which is routing to/from the southern ATS route network. Additionally, connectivity may be required to, from, and between adjacent geographic elements.
2	Part-systemised	Introduction of a mix of a systemised airspace structures and non-systemised route structures providing connectivity for Manchester TMA traffic which is routing to/from the southern ATS route network. Additionally, connectivity may be required to, from, and between adjacent geographic elements.
3	Most direct route	Introduction of direct routes providing connectivity for Manchester TMA traffic which is routing to/from the southern ATS route network. Additionally, connectivity may be required to, from, and between adjacent geographic elements.
4	Bi-directional route	Introduction of bi-directional routes providing connectivity for Manchester TMA traffic which is routing to/from the southern ATS route network. Additionally, connectivity may be required to, from, and between adjacent geographic elements.

Table 6: Summary of route network design options for the Southern Spine

Route Network: Western Arm		
Option No.	Option Name	Description
0	Baseline	The “Do-Nothing” option. Keep everything as it is currently
1	Systemised	Extension of the existing systemised airspace structures, providing connectivity for Manchester TMA traffic to route to/from Ireland, the Isle of Man and the southwest. Additionally, connectivity may be required to, from, and between adjacent geographic elements.
2	Part-systemised	Extension of the existing systemised airspace structures and additionally introduction of non-systemised route structures providing connectivity for Manchester TMA traffic to route to/from Ireland, the Isle of Man and the southwest. Additionally, connectivity may be required to, from, and between adjacent geographic elements.
3	Most direct route	Introduction of direct routes providing connectivity between the existing systemised airspace structures, and Manchester TMA traffic routing to/from Ireland, the Isle of

		Man and the southwest. Additionally, connectivity may be required to, from, and between adjacent geographic elements.
4	Bi-directional route	Introduction of bi-directional routes providing connectivity between the existing systemised airspace structures, and Manchester TMA traffic routing to/from Ireland, the Isle of Man and the southwest. Additionally, connectivity may be required to, from, and between adjacent geographic elements.

Table 7: Summary of route network design options for the Western Arm

Route Network: Central		
Option No.	Option Name	Description
0	Baseline	The "Do-Nothing" option. Keep everything as it is currently
1	Route connectivity	Provide route connectivity to/from the Central geographic element and the surrounding geographic elements.

Table 8: Summary of route network design options for the Central geographic element

MTMA Airport Connectivity: Departure Connectivity		
Option No.	Option Name	Description
0	Baseline	The "Do-Nothing" option. Keep everything as it is currently
1	Departure connectivity without new CAS	Provide departure connectivity from SID end points to the route network without requiring new CAS
2	Departure connectivity with new CAS	Provide departure connectivity from SID end points to the route network requiring new CAS

Table 9: Summary of design options for connectivity from the airport departure routes to the route network

MTMA Airport Connectivity: Arrival Connectivity		
Option No.	Option Name	Description
0	Baseline	The "Do-Nothing" option. Keep everything as it is currently
1	Arrival connectivity without new CAS	Provide arrival connectivity from the route network to airport arrival structures via STARs/arrival routes without requiring new CAS
2	Arrival connectivity with new CAS	Provide arrival connectivity from the route network to airport arrival structures via STARs/arrival routes requiring new CAS

Table 10: Summary of design options for connectivity from the route network to airport arrival routes

MTMA Airport Connectivity: Arrival Structures		
Option No.	Option Name	Description
0	Baseline	The "Do-Nothing" option. Keep everything as it is currently
1	Radial holds	Existing radial holds will be reviewed and kept, amended, or removed. Additional radial holding structures will be introduced where required.
2	New linear delay absorption structures	Existing radial holds will be reviewed and kept, amended, or removed. In addition, at least one new linear delay absorption structure (i.e., point merge, trombone etc) will be introduced, where required.
3	New radial holds and new linear delay absorption structures	Existing radial holds will be reviewed and kept, amended, or removed. In addition, at least one new radial hold and at least one new linear delay absorption structure will be introduced, where required.

Table 11: Summary of design options for airport arrival structures

4. Current Airspace

4.1. The Manchester TMA is currently served by 15 main traffic flows, as illustrated in Figure 10 and described in Table 12.

4.2. The ATS routes, historically predicated on historic Doppler VHF Omni Directional Range (DVOR) radials, are contained within Control Areas (CTAs), and are described in detail within the design options presented in section 6.

4.3. ATS routes and CTAs will be reviewed and modernised, as required, as part of this ACP.

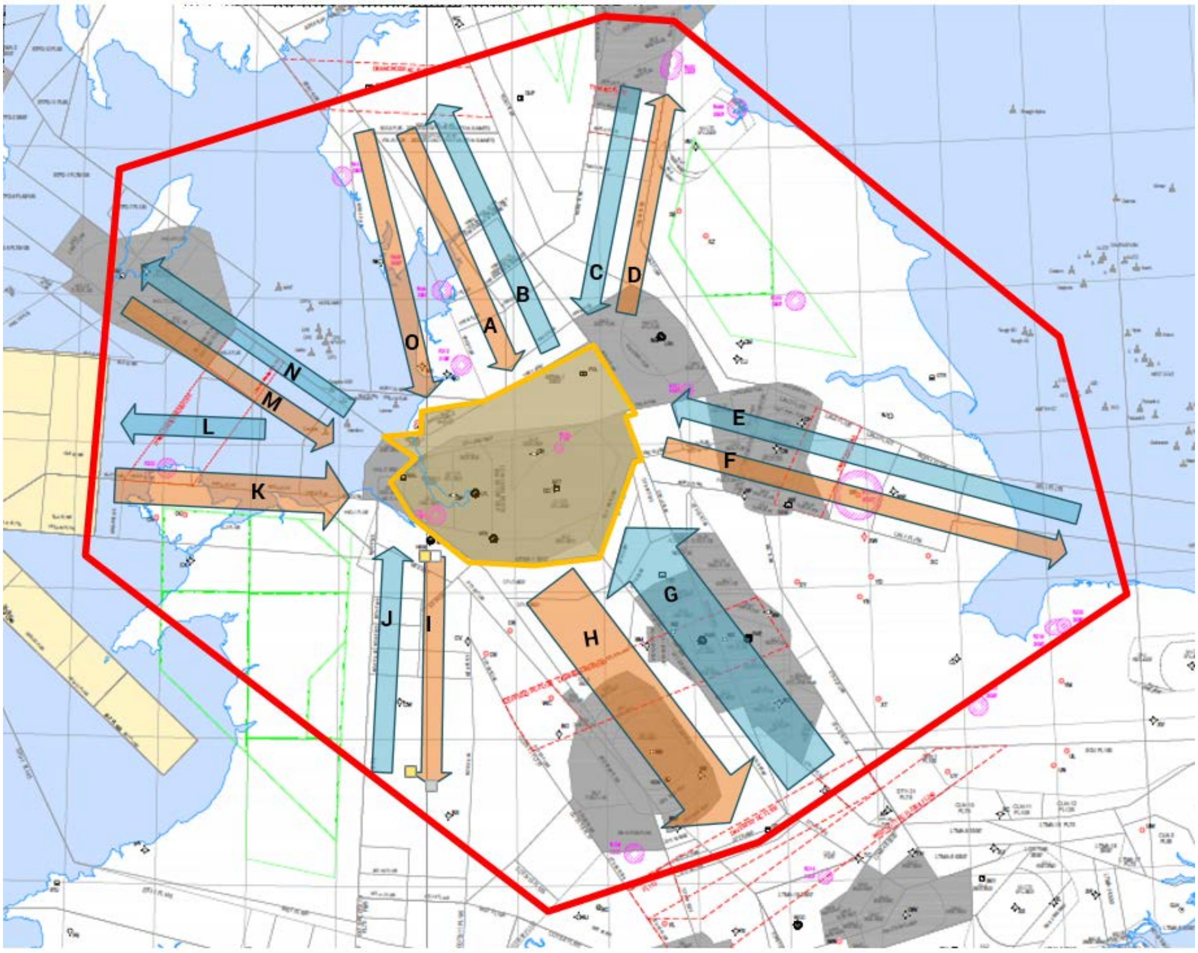

Figure 10: Adapted internal airspace map illustrating the 15 main traffic flows which converge on the Manchester TMA (shown as a yellow shape); orange arrows represent eastbound flows and blue arrows represent westbound flows.

Flow	Description of Traffic[9, 10]
A	From the ScTMA, Reykjavik FIR and North Atlantic tracks to the Manchester TMA, London TMA, and southbound overflights.
B	From the Manchester TMA, London TMA, and northbound overflights to the ScTMA, Reykjavik FIR and northern Atlantic tracks.
C	Traffic from Newcastle, Aberdeen, and Norway FIR to the Manchester TMA, southbound overflights and inbounds to Midlands group airports and London TMA.
D	Traffic to Newcastle, Aberdeen, and Norway FIR from the Manchester TMA, northbound overflights and outbounds from Midlands group airports and London TMA.
E	Flights from the Amsterdam and Maastricht FIRs to the Manchester TMA, Scottish TMA, Humberside, Doncaster Sheffield, Leeds Bradford, Teesside, Newcastle and Midlands group airports, and westbound overflights to Ireland and the Oceanic track system.
F	Flights to the Amsterdam and Maastricht FIRs from the Manchester TMA, Scottish TMA, Humberside, Doncaster Sheffield, Leeds Bradford, Teesside, Newcastle and Midlands group airports, and eastbound overflights to Ireland and the Oceanic track system.
G	Traffic from the London TMA, London Upper airspace (DTY), and Midlands group airports inbound to the Manchester TMA, Humberside, Doncaster Sheffield, Leeds Bradford, Teesside, Newcastle airports, ScTMA and northbound overflights. Westbound traffic from the Midlands group airports to the Isle of Man, Belfast TMA, Dublin, and Shannon.
H	Traffic to the London TMA, London Upper airspace (DTY), and Midlands group airports outbound from the Manchester TMA, Humberside, Doncaster Sheffield, Leeds Bradford, Teesside, Newcastle airports, ScTMA and southbound overflights. Eastbound traffic to the Midlands group airports from the Isle of Man, Belfast TMA, Dublin, and Shannon.
I	Traffic from the Manchester TMA, ScTMA, Belfast TMA, Leeds Bradford, Doncaster Sheffield, Humberside, Newcastle and Teesside airports and southbound overflights to the south.
J	Traffic to the Manchester TMA, ScTMA, Belfast TMA, Leeds Bradford, Doncaster Sheffield, Humberside, Newcastle and Teesside airports and northbound overflights from the south.
K	Traffic from Dublin, Shannon and North Atlantic to the Manchester TMA, Leeds Bradford, Doncaster Sheffield, Newcastle, Teesside, Midlands group airports, London TMA and eastbound overflights.
L	Traffic to Dublin, Shannon and North Atlantic from the Manchester TMA, Leeds Bradford, Doncaster Sheffield, Newcastle, Teesside, Midlands group airports, London TMA and westbound overflights.
M	Traffic from the North Atlantic, Belfast TMA and Ronaldsway to the Manchester TMA, Leeds Bradford, Doncaster Sheffield, Midlands group airports, London TMA and southbound overflights.
N	Traffic to the North Atlantic, Belfast TMA and Ronaldsway from the Manchester TMA, Leeds Bradford, Doncaster Sheffield, Midlands group airports, London TMA and northbound overflights.
O	Southbound overflights from ScTMA, Reykjavik FIR and North Atlantic.

Table 12: Description of the traffic flows between the Manchester TMA and the UK ATS route network. Note: the descriptions here illustrate the primary traffic flows and not comprehensive.

[9] Operations at Doncaster Sheffield airport ceased in December 2022 and the redistribution of traffic to/from other regional airports is currently unclear.

[10] The Midlands group airports are Birmingham, Coventry and East Midlands airports

4.4. Arrivals into Manchester, Liverpool, and East Midlands airports follow published STARs to transition from the ATS route network to the published holds, and arrivals into Leeds Bradford airport follow Standard Inbound Routes. These are listed in Table 13 and shown in Figure 11.

Airport	Hold	Standard Arrival Route (STAR)/ Standard Inbound Route	Associated ATS Routes
Manchester (EGCC)	DAYNE MIRSI ROSUN	ELVOS 1M, LESTA 1M MAKUX 1M, MALUD 1M, OKTEM 1M, PENIL 1M LAKEY 1M, SETEL 1M, TILNI 1M, LIBSO 1M, OTBED 1M	T420, N601, UP6 L15, Q38, L975, Q37, N864, L10, L28 L612, N57, (U)P18, UL975, Y70, L60
Liverpool (EGGP)	KEGUN TIPOD	ELVOS 1L, LESTA 1L, OKTEM 1L GASKO 1L, LAKEY 1L, LIBSO 1L, POL 1L, VEGUS 1L, BOFUM 1L, PENIL 1L	T420, N601, UP6, N864 P18, L612, UL975, N57, P18, Y70, Q37, L10, L28, Q38
Leeds Bradford (EGNM)	LBA	CALDA-POL-LBA POL-LBA GASKO-LBA GOLES-BATLI-LBA TNT-DENBY-LBA EMBOR-TNT-DENBY-LBA REXAM-BARTN-POL-LBA WAL-BARTN-POL-LBA	L612 N57 P18 Y70 N57/T420 N601 N864 L10/L975
East Midlands (EGNX)	ROKUP PIGOT	AMPIT 2E, DOLOP 1E, MAKUX 1E, MALUD 1E, WAL 2E, POL 1E BEGAM 1E, CROFT 1E, LIBSO 1E, VEGUS 1E, DTY 1E, HEMEL 1E	L15, (U)Y124, L15, Q38, (U)L975, Q37, L975, L10, Q39, P18, N57 UP16, (U)L612, UL975, Y70, M605, L610, M184, T420

Table 13: List of the Manchester, Liverpool, Leeds Bradford, and East Midlands holds and the arrival routes which supply them.

Figure 11: Geographic location of extant holds and arrival routes; Manchester (top left, yellow), Liverpool (top right, purple), Leeds Bradford (bottom left, pink) and East Midlands (bottom right, white)

4.5. Departures from Manchester, Liverpool, Leeds Bradford and East Midlands airports follow published SIDs to transition from the airport to join the ATS route network as listed in Table 14 and shown in Figure 12.

Airport	SID	Associated ATS Routes
Manchester (EGCC)	MONTY 1R/1S	For aircraft leaving CAS at MONTY
	MONTY 1Y/1Z	For aircraft leaving CAS at MONTY
	ASMIM 1S	P16, L975
	ASMIM 1Z	P16, L975
	KUXEM 1R	P17
	KUXEM 1Y	P17
	EKLAD 1R	Y53
	EKLAD 1Y	Y53
	LISTO 2S	L612, P18 (L151), L10, Y53 southbound and for aircraft leaving controlled airspace via TNT VOR
	LISTO 2Z	L612, P18 (L151), L10, Y53 southbound and for aircraft leaving controlled airspace via TNT VOR
	LISTO 2R	L612, P18 (L151), L10, Y53 southbound and for aircraft leaving controlled airspace via TNT VOR
	LISTO 2Y	L612, P18 (L151), L10, Y53 southbound and for aircraft leaving controlled airspace via TNT VOR
	POL 5R/1Z	N57, N601, P18, P17/UP17 northbound and for aircraft leaving controlled airspace
	POL 1Y/4S	N57, N601, P18, P17/UP17 northbound and for aircraft leaving controlled airspace
	SONEX 1R	L975
	SONEX 1Y	L975
	DESIG 1S	L603
	DESIG 1Z	L603
	SANBA 1R	N859
	SANBA 1Y	N859
Liverpool (EGGP)	POL 4T/5V	N57, N601, P18, (U)P17 northbound and for aircraft leaving controlled airspace
	REXAM 2T/2V	N864 southbound
	BARTN 1T/1W	L975, eastbound
	WAL 2T/2V	L10, (U)L70 (via L10/ PENIL) westbound
	NANTI 2T/2V	L8: (P18/ L151), Y53, M605, L612 southbound
Leeds Bradford (EGNM)	NELSA 3W	Northbound – N601, P18 (DCT GASKO) Southbound – L612 (DCT MCT DCT LISTO), N862 via P17 (DCT BARTN), L8 via P18 (DCT MCT DCT LISTO), M605 (DCT POL) Westbound – Y70 (DCT CROFT), L10 FL85 – (DCT CROFT DCT WAL)
	POL 2X	Northbound – N601, P18 Southbound – L612 (DCT MCT DCT LISTO), N862 via P17, L8 via P18 (DCT MCT DCT LISTO), M605 Westbound – Y70, L10 FL85 – (DCT WAL)
	DOPEK 2W/2X	L60 eastbound
	LAMIX 2W/2X	L603 eastbound
East Midlands (EGNX)	DTY 3N/4P	L10, M605 southbound. L608, P155, P166 eastbound
	TNT 2N/3P	N57, M868 and Q4
	POL 2P	P18, N601, N57
	BPK 2P	L10, L608, N601, P155

Table 14: List of Manchester, Liverpool, Leeds Bradford, and East Midlands Standard Instrument Departures (SIDs) and the connected ATS routes.

Figure 12: Extant SIDs (cyan) and the connected ATS routes (yellow) from Manchester (top left), Liverpool (top right), Leeds Bradford (bottom left) and East Midlands (bottom right)

4.6. Illustration of Number of Flights

4.6.1. In 2022, 774,623 flights transited the airspace impacted by this change. The 2022 data is the most credible and up-to-date data available.

4.6.2. These flights are split by the arrivals and departures for Manchester, Liverpool, Leeds Bradford, East Midlands, Doncaster Sheffield and 'Other' airports[11], and MTMA Overflights, as shown in Table 15. Operations at Doncaster Sheffield airport ceased in December 2022; it is currently unclear as to how these flights will be redistributed to other airports in the future. As such the arrival/departure flights associated with Doncaster Sheffield airport are highlighted in grey.

[11] 'Other' Airports includes: Birmingham, Coventry, Leeds East, Retford (Gamston), Blackpool, Humberside, Barrow/Walney Island, Warton, Hawarden, Ronaldsway, Teesside, RAF Valley/Anglesey, and Coningsby.

Airport	Arrivals	Departures	Total Movements
Manchester Airport	79,258	79,253	158,511
Liverpool Airport	15,850	16,010	31,860
Leeds Bradford Airport	15,106	14,907	30,013
East Midlands Airport	29,285	29,393	58,678
Doncaster Sheffield Airport	4,060	4,065	8,125
'Other' Airports	55,502	55,466	110,968
Total	199,061	199,094	398,155
MTMA Overflights	n/a	n/a	376,468
Grand Total			774,623

Table 15: Breakdown of 2022 traffic which is impacted by this airspace change. 'Other' Airports includes: Birmingham, Coventry, Leeds East, Retford (Gamston), Blackpool, Humberside, Barrow/Walney Island, Warton, Hawarden, Ronaldsway, Teesside, RAF Valley/Anglesey, and Coningsby. Operations at Doncaster Sheffield airport, highlighted in grey, ceased in December 2022.

4.6.3. The 2022 movement data is based on Central Flow Management Unit (CFMU) figures i.e., flight planned data. The CFMU figures were interrogated to determine how many aircraft arrived or departed the aforementioned airports. For MTMA overflights, the data was filtered based on those flights traversing air traffic control sectors within the scope of the MTMA airspace change and not arriving or departing at any of the aforementioned airports. Note: the discrepancy between arrival and departure data is likely explained by aircraft arriving at an airport not on the flight plan, or aircraft not filing a flight plan for part of the trip, or due to a variation in the number of aircraft parked at the airport at the start or end of the year.

4.6.4. It should be noted that the data the FASI airports use within their submissions may differ from these values as they are likely to have more accurate airport data, i.e., actual movement data and/or different growth models.

4.6.5. Figure 13 shows the airlines[12] and the proportions of flights which accounted for more than 1% of the total traffic in 2022.

[12] Flybe (BEE), which previously ceased trading, recommenced trading in April 2022. However, they are no longer flying all the routes they previously flew.

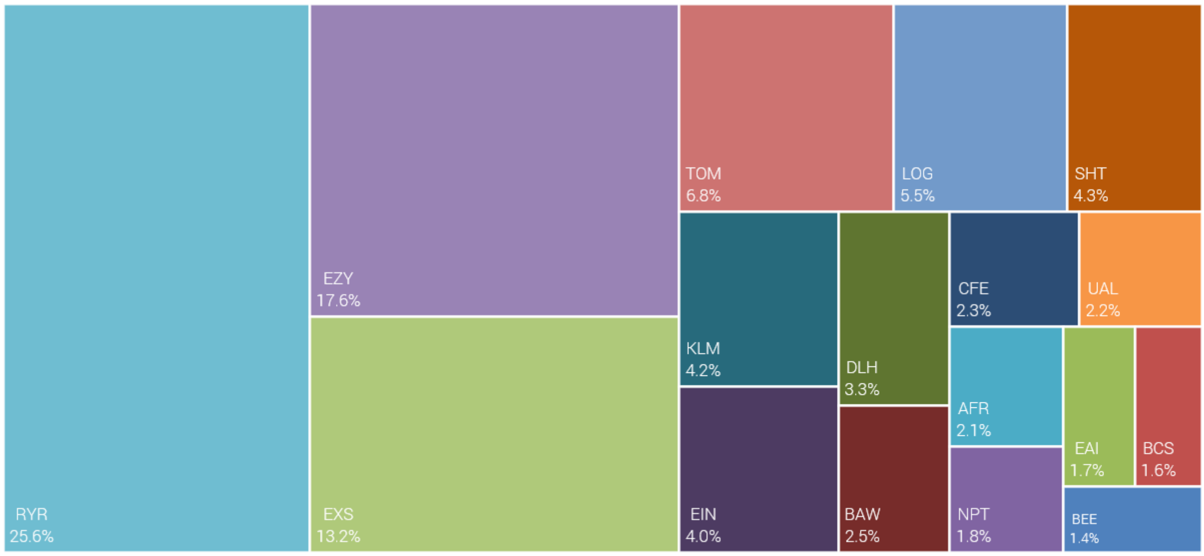

Figure 13: List of operators which accounted for >1% of flights and the proportion of these flights flown in the impacted airspace in 2022.

4.6.6. Based on the 2022 CFMU traffic data, NERL analytics team has forecast the total traffic up to 2028, (one year after the planned year of implementation) using the EUROCONTROL air traffic forecast (STATFOR October 2022). To forecast traffic from 2029 to 2037 (10 years post implementation) a long-term average annual UK growth rate of 1.9% is used. The growth values are shown in Table 16. Operations at Doncaster Sheffield airport ceased in December 2022; it is currently unclear as to how these flights will be redistributed to other airports in the future. As such the arrival/departure flights associated with Doncaster Sheffield airport are highlighted in grey.

Year	Manchester Airport		Liverpool Airport		Leeds Bradford Airport		East Midlands Airport		Doncaster Sheffield Airport		Other Airports		MTMA Overflights
	Arrivals	Departures	Arrivals	Departures	Arrivals	Departures	Arrivals	Departures	Arrivals	Departures	Arrivals	Departures	
2027	103,356	103,349	20,669	20,877	19,699	19,440	38,189	38,331	5,295	5,300	72,373	72,331	490,932
2028	105,284	105,276	21,054	21,266	20,066	19,803	38,901	39,046	5,394	5,399	73,721	73,680	500,088
2029	107,247	107,239	21,447	21,663	20,440	20,172	39,626	39,774	5,495	5,500	75,097	75,052	509,414
2030	109,247	109,239	21,847	22,067	20,821	20,548	40,365	40,516	5,597	5,603	76,499	76,453	518,914
2031	111,284	111,276	22,254	22,479	21,209	20,931	41,118	41,272	5,701	5,707	77,927	77,877	528,591
2032	113,359	113,351	22,669	22,898	21,605	21,321	41,885	42,042	5,807	5,813	79,380	79,332	538,449
2033	115,473	115,465	23,092	23,325	22,008	21,719	42,666	42,826	5,915	5,921	80,859	80,811	548,491
2034	117,627	117,618	23,523	23,760	22,418	22,124	43,462	43,625	6,025	6,031	82,368	82,318	558,720
2035	119,821	119,812	23,962	24,203	22,836	22,537	44,273	44,439	6,137	6,143	83,905	83,855	569,140
2036	122,056	122,046	24,409	24,654	23,262	22,957	45,099	45,268	6,251	6,258	85,471	85,418	579,754
2037	124,332	124,322	24,864	25,114	23,696	23,385	45,940	46,112	6,368	6,375	87,064	87,011	590,566

Table 16: Forecast growth of traffic impacted by this change; 2027 (implementation year) to 2037 (10 years post implementation). Operations at Doncaster Sheffield airport, highlighted in grey, ceased in December 2022. It is currently unclear as to how these flights will be redistributed to other airports in the future.

4.7. Baseline

4.7.1. The holistic baseline is described in section 4 Current Airspace. In addition, a baseline description detailing the existing use of airspace for the 5 geographical elements (Northern Spine, Eastern Arm, Southern Spine, Western Arm and Central) and for the departure connectivity, arrival connectivity and arrival structures is provided in section 6.4 High-Level Concepts: Route Network and section 6.5 High-Level Concepts: MTMA Airport Connectivity.

5. Engagement Activities

5.1. In-line with CAP1616 requirements NATS has undertaken an extensive engagement programme during the development of the following design options.

5.2. As the options have been developed in collaboration with our representative stakeholder groups, identified during the Stage 1 Design Principles development, and presented as high-level concepts, there was limited scope for stakeholder feedback to impact the options as presented in this submission. However, some general feedback has been received and is detailed in Table 17.

Stakeholder	Feedback	Impact
Jet2.com	Safety and workload in the cockpit are a key priority.	Enhancing the current level of Safety (including cockpit procedures and operations) is a key consideration throughout the design process.
	Currently aircraft are kept at higher levels/speeds for longer which means high fuel burn for the aircraft.	Designs are expected to provide improved environmental and economic benefits including Continuous Climb and Descent Operations in line with DP5, DP6, DP13 and DP14.
	Positive feedback that the changes will facilitate operations and hopefully remove some of the existing issues.	Noted, thank-you
British Airways	Predictability is key for airlines.	Systemised airspace concepts seek to provide increased predictability through reduced tactical intervention.
	Reducing pilot workload below 4000ft is favourable.	The changes within this submission would only change flight paths at and above 7,000ft and therefore are likely to have minimal impact to workload below 4,000ft. However, consolidation of the TA is expected to provide a reduction in workload.
	Question - noise issues with the SID concepts?	SID design and the corresponding noise analysis will be included within the airport ACP, the changes described within this submission are for flight paths at and above 7,000ft.
	General concerns that Point Merge systems can increase unpredictability and pilot workload with the use of direct routings to the merge point.	Enhancing the current level of Safety (including cockpit procedures and operations) is a key consideration throughout the design process. This feedback will be considered in any option which includes a Point Merge.

	Potential for pilot error changing from FL to ALT on Point Merge procedures; pilots may forget to change QNH if not prompted by a controller.	Enhancing the current level of Safety (including cockpit procedures and operations) is a key consideration throughout the design process. This feedback will be considered in any option which includes a Point Merge.
BAE Warton	Anticipated increase in flying activity in the 2027 timeframe; continued access to the airspace is imperative.	NERL understands the significance of the activities and will continue to engage with BAE Warton, as design options are developed, to minimise any impact.
	Concerns with the complexity of procedures for shared airspace use.	The design will consider the suitability of the airspace (e.g., size, time periods, nature of activities, impact on airspace users) for shared usage. Certain areas will not be suitable for flexible airspace management and will serve as constraints on the MTMA design.
East Midlands airport	Question – does the EGCN closure affect the designs?	NERL advises that they hope to utilise this airspace, however the volume/classification of CAS would be minimised in line with DP10. We will ensure any developments with the EGCN airspace will be considered in any designs considered.
Leeds Bradford airport	Predictability and cost are the most important "headlines" for our airlines. Airlines want to avoid levelling off during the descent stage and achieve as much continuous descent as possible.	Designs seek to provide improved environmental and economic benefits including Continuous Descent Operations in line with DP5, DP6, DP13 and DP14.
Manchester airport	General concerns that Point Merge systems may take up too much airspace.	This feedback will be considered in any option which includes a point merge. Suitable delay absorption mechanisms will be developed to increase capacity, reduce delay, and provide a compatible and optimised interface with the lower airspace in line with DP3 and DP4, and the volume/classification of CAS would be minimised in line with DP10.
DAATM (Defence Airspace and Air Traffic Management)	Support for design options that can be used flexibly and realise benefits without impeding military training.	Designs will seek to ensure segregated operations take place safely and, where possible, flexibly, minimising the impact on other airspace users, and considering the optimisation of network performance.
DAATM (Defence Airspace and Air Traffic Management)	Consider test and development activity from Warton aerodrome as critically important to the national infrastructure; do not wish any re-design of airspace to impact negatively on such activity.	NERL understands the significance of the activities and advises that they have engaged with BAE Warton and will continue to do so, as design options are developed, to minimise any impact.
BGA (British Gliding Association)	Post engagement request for traffic data.	Traffic densities and movement analytics provided on 15th December 2022 to inform BGA's feedback.
LAA (Light Aircraft Association)	Potential for current CAS to provide more space.	Designs will seek to ensure that CAS is kept to the minimum required in line with DP10, and wherever possible simplified (such as consolidation of the TA), to deliver a safe modernised airspace.
British Skydiving	Concerns over limited, and reducing, access to parachuting sites in UK airspace	NERL understands the significance of continued access to these sites and advises that they will continue to engage with British Skydiving as design options are developed, to minimise any impact.

easyJet	Support for continuous climb/descent operations, increased scheduling predictability and track mileage predictability	Designs are expected to provide improved environmental and economic benefits including Continuous Climb and Descent Operations in line with DP5, DP6, DP13 and DP14.
easyJet	Favour Point Merge for larger traffic volumes/airfields; recommendation for airfield feedback/input.	NERL is in regular engagement with the airports to ensure that the designs proposed are compatible and optimised with the airports' known aspirations. Suitable delay absorption mechanisms will be developed to increase capacity, reduce delay, and provide a compatible and optimised interface with the lower airspace in line with DP3 and DP4, and the volume/classification of CAS would be minimised in line with DP10.
easyJet	Comment that the proposals do not consider alternative holding/merge points.	At this stage, the design options are presented as high-level concepts only. Arrival structure design (e.g., location, type, level/s, direction) are not finalised and NERL welcomes further design discussions. The finalised arrival structure design will be dependent on the finalised ATS route design, and the airport departure and arrival procedures. NERL is in regular engagement with the airports to ensure that the designs proposed are compatible and optimised with the airports' known aspirations. More detail will be provided as the options are developed into a holistic design for consultation in Stage 3 of the CAP1616 process.
easyJet	Support for giving back airspace that is not utilised commercially.	CAS will be kept to the minimum required, in line with DP10, and wherever possible simplified (such as consolidation of the TA) to deliver a safe modernised airspace.
Ryanair	Comment that a higher TA would enable continuous climb operations	Consolidation of the TA, from 5,000ft to 6,000ft within the lateral limits of the MTMA ACP change is a constraint on the design and is included in all design options. The associated ACPs for the MTMA airports, Manchester, Liverpool, Leeds Bradford and East Midlands, will be based on a consolidated 6,000ft TA.
Ryanair	A joint approach between NERL and MAG would be of benefit	NERL is in regular engagement with the airports to ensure that the designs proposed are compatible and optimised with the airports' known aspirations.
Ryanair	Favour utilising military/restricted airspace during quiet times of the day	The design will consider the suitability of the airspace (e.g., size, time periods, nature of activities, impact on airspace users) for shared usage. Certain areas will not be suitable for flexible airspace management and will serve as constraints on the MTMA design.

Table 17: General feedback and impact on considered designs

5.3. 1 response was received from a non-targeted stakeholder; the Irish Aviation Authority (IAA) provided general feedback, during a regular NERL/IAA ACP update meeting, that there were no concerns for Dublin or Shannon with the airspace change.

5.4. Stakeholder feedback relevant to the design is included with the description of options in section 6.4 High-Level Concepts: Route Network and section 6.5 High-Level Concepts: MTMA Airport Connectivity.

5.5. Following the Stage 2 submission, any additional stakeholder feedback received will be included for consideration as the concepts are developed into defined solutions for the Stage 3 consultation.

6. High-Level Concepts

6.1. Introduction and Release of Controlled Airspace

6.1.1. Some options may require a change to the volume or classification of CAS. Where possible, CAS that is no longer required will be released. This could serve to offset, in part, any new CAS that may be required.

6.1.2. When considering any release or additional airspace requirements, NERL will consider the value/ useability of the airspace to the impacted users. An example of 'low value' airspace could be a narrow enclave between two existing structures. This airspace would not be able to be flown and therefore has low value to airspace users. An example of 'high value' airspace could be a downgrade of Class A airspace to Class C airspace (or lower), which would allow airspace users, subject to the required ATC clearance, to transit areas they were previously unable to, or to gain increased access to airspace which is routinely used.

6.1.3. The lowest flight path level proposed by any option herein, is FL70. However, where the base of CAS could be raised, it is possible that a base below 6,000ft could be raised to say FL75, thereby releasing CAS (converting it to uncontrolled Class G airspace).

6.1.4. NERL considers this to be analogous to the Safety & Airspace Regulation Group's (SARG) policy; Reduction In Notified Hours Or Disestablishment Of Airspace Restrictions, which is a Level 0 ACP process. The release of CAS will only be considered where there is existing Class G airspace available for General Aviation (GA) traffic to currently use below CAS. Therefore, any release of CAS will result in an increase in airspace volume of existing Class G airspace. NERL considers that the release of airspace, under this condition, will have a negligible impact on the number of aircraft using the airspace. Therefore, the release of CAS will only deliver positive impact to our stakeholders by providing a greater volume of airspace for GA traffic to fly within. This could also lead to a potential reduction in the noise impact for stakeholders on the ground as aircraft will be able to elect to fly at a higher altitude.

6.1.5. NERL considers the release of CAS will not compromise the arguments for scalability within this ACP as this would only deliver positive benefits. NERL does not consider it proportional to attempt an analysis of potential GA use/impact of using the released CAS as it is not possible to predict the GA utilisation of this airspace.

6.2. Interface with Airport Procedures

6.2.1. Manchester, Liverpool, Leeds Bradford, and East Midlands airports are progressing ACPs to amend their arrival and departure procedures.

6.2.2. NERL, Manchester, Liverpool, Leeds Bradford, and East Midlands airports are progressing their ACPs in close collaboration with each other so that individual requirements can be considered and incorporated into the others' design.

6.2.3. The airports will be responsible for all changes below 7,000ft agl unless the change is associated with an airspace change outside the scope of an airport ACP. NERL will provide connectivity to the airports' proposed procedures, but any resultant impact below 7,000ft agl will remain the responsibility of the airport to consult upon.

6.2.4. In order to provide connectivity to other airports within or in close proximity to this airspace change NERL will ensure connectivity to existing procedures is maintained. These airports are included as stakeholders and are aware of the changes proposed. It may be the case that minimal changes are required to maintain connectivity (e.g., truncating existing SIDs or realigning STARs) however, any changes made within this ACP would only change flight paths at and above 7,000ft.

6.3. What do we mean by 'systemisation'?

6.3.1. Systemisation is an operational concept which utilises improved aircraft navigation capabilities to develop routes which are deconflicted, by design and procedure, to keep aircraft safely separated from one another. Thus, systemisation reduces the need for air traffic controllers to intervene for the purposes of tactical separation management, whilst benefiting safety and capacity.

6.3.2. A systemised route network is characterised by the following:

- Climbing and descending aircraft follow a structured route system based on their departure point and/or destination.
- Route design is predicted on the use of Performance based Navigation (PBN) which enables very accurate track conformance to routes. This allows the distance between routes to be safely minimised based on CAP1385 (Ref 7) requirements.
- Systemising ATS routes should reduce the amount of tactical intervention required by reducing the number of route conflictions in the airspace.
- Systemising ATS routes should increase capacity by reducing controller workload and by optimising the distance between routes.
- Although systemisation reduces the amount of controller intervention required, there will still be instances where controllers will need to use tactical intervention (e.g., radar headings or shortcuts between waypoints) for expedition and to resolve conflictions.
- It is recognised that the introduction of systemised airspace may introduce additional planned track miles for some routes.

6.4. High-Level Concepts: Route Network

6.4.1. Sections 6.4.2 to 6.4.6 describe the comprehensive list of options to modernise the UK ATS route network within the scope of this airspace change. The airspace has been split into 5 geographical elements (Northern Spine, Eastern Arm, Southern Spine, Western Arm and Central), as described in section 3.10 and depicted in Figure 9, with the high-level concepts presented as numbered options for each.

6.4.2. Northern Spine

The Northern Spine, see Figure 14, seeks to introduce new routes providing connectivity for Manchester TMA traffic routing to/from the ScTMA or NATEB (Newcastle). Additionally, connectivity may be required to, from, and between adjacent geographic elements.

6.4.2.1. Option 0: Baseline

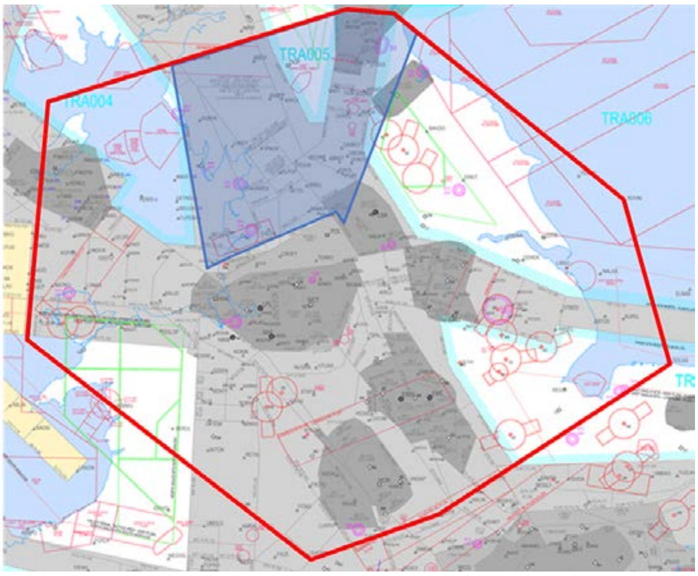

Figure 14: Adapted internal airspace map showing the lateral limits of the Northern Spine (blue polygon) and surrounding airspace.

A 'Do-Nothing' option representing the current day operation must be included and is used as the baseline against which all other options are compared.

The Northern Spine abuts the changes being implemented in the ScTMA ACP (ACP-2019-74). These changes seek to introduce a systemised airspace structure which reflects the existing flows and extends from the ScTMA to the southern edge of Yorkshire CTAs 4, 7, 15 and 16.

The Northern Spine accommodates traffic to/from the ScTMA, Reykjavik FIR and North Atlantic tracks to/from the Manchester TMA, London TMA, and northbound/southbound overflights. Additionally, traffic to/from Newcastle, Aberdeen, and Norway FIR to/from the Manchester TMA, northbound/southbound overflights and inbounds/outbounds to/from Midlands group[13] airports and the London TMA. These traffic flows are depicted by arrows A, B, C, D and O in Figure 10.

The existing airspace within the confines of this change above FL195 is Class C airspace (UK AIP ENR 1.4, 2.3.1). Below FL195 and above FL70, the airspace is constructed of the following airspace structures, (CTRs extend to the surface (SFC), CTA base of CAS is above the surface):

- Yorkshire CTA 1 (Class A, 4,500ft – FL195)
- Yorkshire CTA 2 (Class A, FL55 – 195)
- Yorkshire CTA 3 (Class A, FL75 – 195)
- Borders CTA 1[14] (Class A, FL135 – 195)
- Borders CTA 3[14] (Class A, FL125 – 195)
- Borders CTA 8[14] (Class A, FL125 – 195)

[13] The Midlands group airports are Birmingham, Coventry, and East Midlands airports

- Yorkshire CTA 4 (Class A, FL125 – 195)
- Yorkshire CTA 5 (Class A, FL65 – 195)
- Yorkshire CTA 6 (Class A, FL95 – 195)
- Yorkshire CTA 7 (Class A, FL145 – 195)
- Yorkshire CTA 8[14] (Class A, FL95 – 195)
- Yorkshire CTA 9 (Class A, FL85 – 195)
- Yorkshire CTA 10[14] (Class A, FL125 – 195)
- Yorkshire CTA 15 (Class A, FL75 – 125)
- Yorkshire CTA 16 (Class A, FL95 – 125)
- Yorkshire CTA 17 (Class D, FL105 – 125)
- Borders CTA 9[14] (Class D, FL105 – 125)
- Borders CTA 11 (Class D, FL75 – 125)
- Borders CTA 10[14] (Class D, FL55 – 125)
- Newcastle CTA 1[14] (Class D, 1,500ft – FL105)
- Newcastle CTA 3[14] (Class D, 3,000ft – FL105)
- Newcastle CTA 4[14] (Class D, 3,000ft – FL105)
- Newcastle CTA 7 (Class D, 6,000ft – FL75)
- Holyhead CTA 18[14] (Class C, FL85 – 195)
- Leeds Bradford CTA 3[14] (Class D, 3,000ft – FL85)

These CTAs contain the lower airspace routes N864, L612, N57 and N601 connecting the Manchester TMA with ScTMA airspace, routes P18, P16 and P17 providing connectivity towards Newcastle, Y250 providing connectivity between the Northern Spine and the Eastern Arm, and L70 and Z196 providing connectivity between the Northern Spine and the Western Arm. The lower airspace route structure within the Northern Spine is shown in Figure 15 below. These routes were historically constructed using the Dean Cross (DCS), Wallasey (WAL), Pole Hill (POL) and Honiley (HON) DVORs. As such these routes do not provide the most direct connectivity within the airspace.

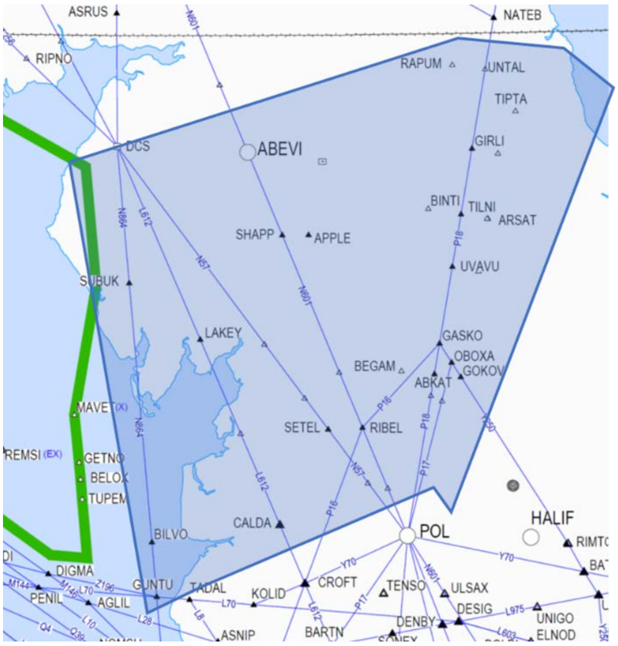

Figure 15: Adapted internal airspace map showing the lower airspace routes contained within the lateral limits of the Northern Spine (blue polygon).

Within the Northern Spine, the following airspace structures exist above FL70 which will be considered in any airspace design:

- TILNI Radar Corridor (FL190)
- Dean Cross Radar Corridor (FL190)
- Cark Paradrop (up to FL150)
- Cockerham Paradrop (base of CAS up to FL150)

[14] This CTA is only partially contained within the Northern Spine

- Chipping Box (up to FL140 on request)
- TRA005 (FL195 – 245)
- TRA004 (FL195 – 245)
- TRA006 (FL195 – 245)
- D406A Eskmeals (SFC – 50,000ft)
- D407 Warcop (SFC – 10,000ft)
- Advisory Radio Area (ARA) Warton (FL95 – 190)

The existing route structure within the Northern Spine positions northbound traffic (Manchester TMA departures) on the east side and southbound traffic (Manchester TMA arrivals) on the west side. This serves to keep arrival and departure traffic separated and aligns with the existing network to the south. Overflying traffic also adopts this general orientation scheme.

SME feedback has identified that the classification of airspace within the Northern Spine is potentially overly restrictive. Subsequently, subject to receiving the required ATC clearance, there may be opportunities to improve access to the airspace for all airspace users, by lowering the airspace classification. Additionally, there are opportunities to enable improved descent profiles for arrivals by lowering the base of CAS in some areas, as well as releasing CAS in other areas by raising the base.

Stakeholder feedback relevant to the Northern Spine is shown in Table 18.

Stakeholder	Feedback	Impact
Blackpool airport	Importance of the early transfer of aircraft from area control to achieve the required procedural separations.	This will be considered as the design options are developed; however, this relates to the method of operation in addition to airspace design.
Blackpool airport	Concerns around current CAS infringements and terrain; a simplification of the airspace and raising the level of CAS (in particular to the east of Blackpool) was viewed as a positive change.	CAS will be kept to the minimum required, in line with DP10, and wherever possible simplified (such as consolidation of the TA) to deliver a safe modernised airspace.
Blackpool airport	Amending the airspace around the DIGMA, ERDUV area may impact inbound/outbound traffic from DCS and Walney.	We will continue to engage with Blackpool as design options are developed to minimise any impact.
Blackpool airport	Concerns around the use of airspace in the Warton Fillet which could result in the late transfer of Blackpool arrivals, arrival delays and difficulty achieving the required level for Blackpool departures (slow climbers).	We will continue to engage with Blackpool as design options are developed to minimise any impact; however, this relates to the method of operation in addition to airspace design.
DAATM (Defence Airspace and Air Traffic Management)	Concerns around the use of airspace in the Warton Fillet which could impact operations out of RAF Woodvale and increase airspace infringements.	This will be considered in the development of the design options.
DAATM (Defence Airspace and Air Traffic Management)	Potential to reduce the impact of increased CAS in the Warton Fillet, by lowering the base and extending the north/west edge of MTMA-2 to cover the southern portion of the Warton Fillet.	This will be considered in the development of the design options.

British Skydiving	Operations at Cockerham are unlikely to be impacted.	We will continue to engage with British Skydiving as design options are developed; any impact on GA, non-commercial and other airspace users will be minimised in line with DP9.
BAE Warton	Warton's test and development activity primarily takes place 0900-1900 hours; additional CAS may be considered outside these hours.	This will be considered as the design options are developed in line with flexible use of airspace operations.
BAE Warton	Designs should not compromise the departure/arrival of those aircraft wishing to join/leave the ATS structure; specifically consider those aircraft operating from/to Blackpool and Walney Island.	This will be considered as the design options are developed.
BAE Warton	Should airspace be switched on/off (due to clawback) consideration should be given for traffic routing WAL/DCS which is currently transferred from NERL to Warton.	This will be considered as the design options are developed.
BAE Warton	Warton provides an Approach service for Walney so this should be taken into consideration.	This will be considered as the design options are developed.
BAE Warton	Any impact to TRA004 requires careful consideration and input from the Military	We will continue to engage with the Military as design options are developed to minimise any impact, in line with DP8.
BAE Warton	Desire to retain current clawback arrangements; any additional clawback would need to integrate into those arrangements or be easily managed.	This will be considered as the design options are developed.
BAE Warton	D406 and D405 currently constrain operations; new CAS, which could push traffic north and create further restrictions, is unfavourable.	This will be considered as the design options are developed.
BAE Warton	Consider Warton TACAN hold (FL150)	This will be considered as the design options are developed.

Table 18: Stakeholder feedback received pertinent to the Northern Spine

For the full detailed analysis, see Annex D: Design Principle Evaluation.

Option 0: Baseline, the 'Do-Nothing' option, is **REJECTED** since it would bring no benefit and did not meet the progression requirements set for the Design Principle Evaluation.

6.4.2.2. Option 1: Systemised

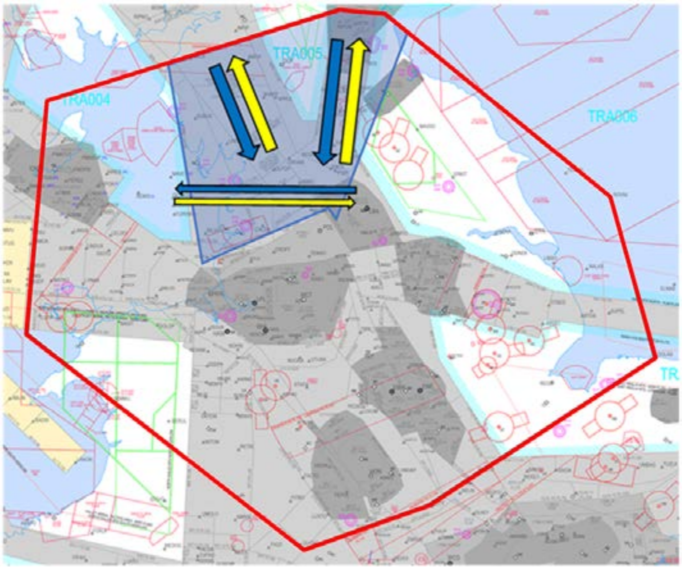

Figure 16: Adapted internal airspace map showing the Northern Spine Option 1: Systemised. (For illustration only, does not indicate any specific route design)

Option 1 will replace the existing ATS route structure with systemised routes providing connectivity between the Manchester TMA and the ScTMA, or Newcastle, see Figure 16. Systemised routes will also provide connectivity between the Northern Spine and the adjacent geographic elements.

Systemised routes provide separation by route design (and procedure) for arrival, departure, and overflight flows. By reducing route conflictions, and therefore the requirement for controller tactical separation management, operational safety may be improved compared to the current airspace.

The reduction in controller tactical intervention enables improved vertical profiles for arriving and departing aircraft, (Continuous Descent Operations – CDO, Continuous Climb Operations – CCO), potentially reducing fuel burn and associated greenhouse gas emissions.

The reduction in controller tactical intervention may reduce controller and pilot workload and, alongside more optimally spaced routes, could provide an increase in capacity and resilience.

The introduction of Option 1 within the Northern Spine may require additional CAS to ensure appropriate separation can be provided between the routes, in line with CAP1385 requirements (Ref 7), as well as achieving improved connectivity between the elements. This may impact GA/non-commercial/other civilian airspace users and Military operations. However, systemisation would reduce the complexity of the airspace (through deconflicted routes), allowing for a potential reduction in the airspace classification. Currently the CTAs within this airspace are primarily Class A and, as such, any reduction in airspace classification is considered, subject to receiving the required ATC clearance, to offer a marked improvement for airspace access.

The bases of CAS within the Northern Spine will be reviewed; SMEs have identified that there are opportunities to enable improved CDOs by lowering the base of CAS in some areas, as well as releasing CAS in other areas by raising the base.

A fully systemised airspace design does not have the flexibility required to maximise the efficiency of the interface with the surrounding airspace. The route structure will need to provide alignment with the existing traffic flows, (e.g., northbound flows on the eastern side of the airspace) affecting the efficacy of the design. Additional entry/exit points may also be required (e.g., for connectivity to FRA) as well as modifications to routes within the neighbouring airspace to ensure connectivity to the wider network.

Conclusion

Systemisation provides separated traffic flows, increasing capacity, resilience and predictability and reducing unplanned track miles to the benefit of environmental and economic performance. A potential reduction in CTA classification and changes to the base of CAS could improve accessibility to the airspace in this option.

Benefits

- Improved safety through the separation of traffic flows
- Reduction in CO_2 and fuel burn for departures and arrivals
- Reduction in controller and pilot workload
- Increased airspace resilience
- Increased airspace capacity
- Improved CCO/CDO

Issues

- Additional CAS required may impact Military and GA/non-commercial/other civilian airspace users' operations (potentially mitigated by the release or reduction in airspace classification of CAS)
- A fully systemised airspace may not provide an optimised interface with neighbouring airspace structures.

The Design Principle Evaluation, see Annex D: Design Principle Evaluation, concluded that:

- 11 design principles were "MET"
- 3 design principles were "PARTIAL" (1 High, 2 Med)
- 0 design principles were "NOT" met

Option 1: Systemised is considered a promising candidate and has been PROGRESSED to the next stage.

6.4.2.3. Option 2: Part-systemised

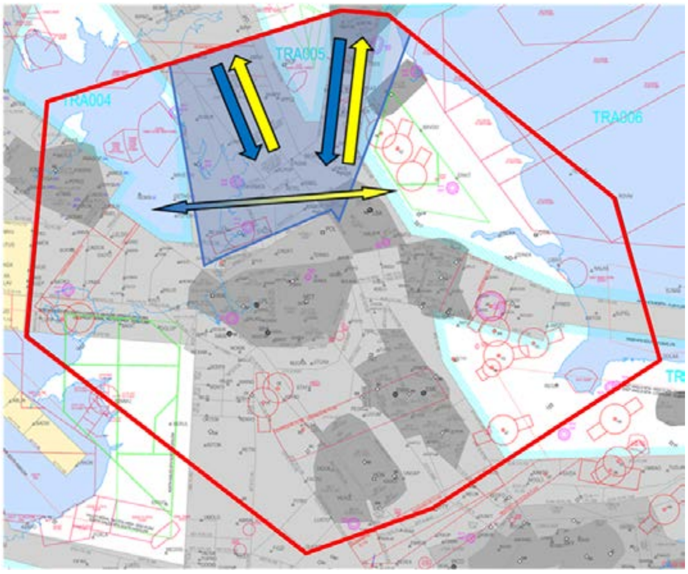

Figure 17: Adapted internal airspace map showing the Northern Spine Option 2: Part-systemised. (For illustration only, does not indicate any specific route design)

Option 2 will replace the existing ATS route structure with a mix of systemised and non-systemised routes providing connectivity between the Manchester TMA, and the ScTMA, or Newcastle, see Figure 17. A mix of systemised and non-systemised routes will also provide connectivity between the Northern Spine and adjacent geographic elements.

This option introduces systemised route structures which provide separation by route design (and procedure) for arrival, departure, and overflight flows. By reducing route conflictions, and therefore the requirement for controller tactical separation management, operational safety may be improved compared to the current airspace.

The reduction in controller tactical intervention enables improved vertical profiles for arriving and departing aircraft, potentially reducing fuel burn and associated greenhouse gas emissions. In airspace where the non-systemised solution is better, this option reduces the burden of extending the miles to support the systemised solution, thereby improving environmental performance compared to today and compared to the fully systemised solution.

The reduction in controller tactical intervention may reduce controller and pilot workload and, alongside more optimally spaced routes, could provide an increase in capacity and resilience.

The introduction of Option 2 within the Northern Spine may require additional CAS to ensure appropriate separation can be provided between the routes, in line with CAP1385 requirements (Ref 7), as well as achieving improved connectivity between the elements. This may impact GA/non-commercial/other civilian airspace users and Military operations. However, systemisation would reduce the complexity of the airspace (through deconflicted routes), allowing for a potential reduction in the airspace classification. Currently the CTAs within this airspace are primarily Class A and, as such, any reduction in airspace classification is considered, subject to receiving the required ATC clearance, to offer a marked improvement for airspace access. The inclusion of non-systemised routes within this option could reduce this requirement for additional CAS.

The bases of CAS within the Northern Spine will be reviewed; SMEs have identified that there are opportunities to enable improved CDOs by lowering the base of CAS in some areas, as well as releasing CAS in other areas by raising the base.

The inclusion of non-systemised routes enables optimal connectivity to the existing surrounding airspace. A part-systemised route structure can provide better alignment with the existing traffic flows, (e.g., northbound flows on the eastern side of the airspace) enabling an optimised interface with neighbouring airspace and providing connectivity to the wider network. In addition, non-systemised routes can be utilised in instances where there are limited anticipated conflictions. These could include connectivity options with low utilisation or routes where the traffic flow is predominantly in one direction. In these instances, a fully systemised route structure would not be advantageous as it could introduce additional planned track miles without the workload benefit associated with reducing route conflictions.

Conclusion

Part-systemisation provides the benefits of full systemisation with respect to increased capacity, resilience, and predictability, reduced unplanned track miles and improved environmental and economic performance. Additionally, it could provide the flexibility to interface more optimally with other airspace environments and further reduce planned track miles, in airspace where the non-systemised solution is better. A potential reduction in CTA classification and changes to the base of CAS could improve accessibility to the airspace in this option.

Benefits

- Improved safety through the separation of traffic flows
- Reduction in CO_2 and fuel burn for departures and arrivals
- Reduction in controller and pilot workload
- Increased airspace resilience
- Increased airspace capacity
- Increased CCO/ CDO
- Optimised interface with adjacent airspace
- Reduces unnecessary additional planned track miles

Issues

- Additional CAS required may impact Military and GA/non-commercial/other civilian airspace users' operations (potentially mitigated by the release or reduction in airspace classification of CAS)

The Design Principle Evaluation, see Annex D: Design Principle Evaluation, concluded that:

- 12 design principles were "MET"
- 2 design principles were "PARTIAL" (2 Med)
- 0 design principles were "NOT" met

Option 2: Part-systemised is considered a promising candidate and has been PROGRESSED to the next stage.

6.4.2.4. Option 3: Most direct

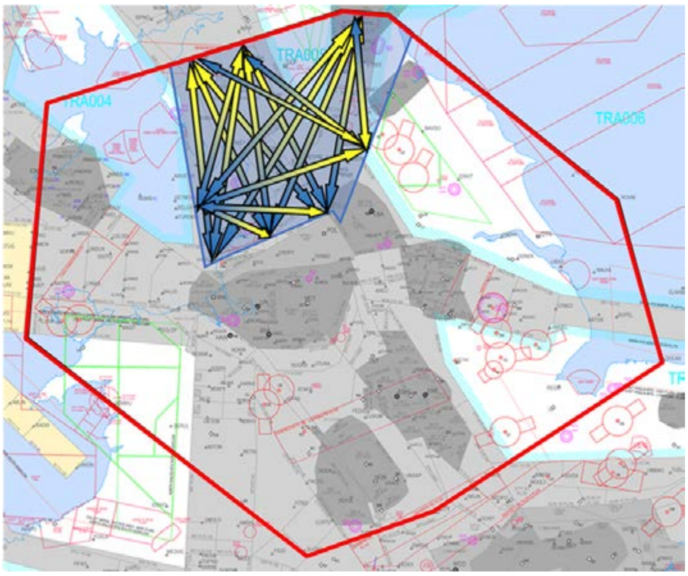

Figure 18: Adapted internal airspace map showing the Northern Spine Option 3: Most direct. (For illustration only, does not indicate any specific route design)

Option 3 will replace the existing ATS route structure with direct routes between all entry/exit points for this airspace volume, providing optimal connectivity between the Northern Spine and the surrounding airspace, see Figure 18. Direct routes will also provide connectivity between the Northern Spine and the adjacent geographic elements

The use of direct routes could potentially distribute (scatter) route confliction points throughout the Northern Spine, making it more difficult for controllers to anticipate and resolve interactions, particularly in high complexity/density traffic scenarios, thus diminishing safety compared to Option 0: Baseline.

The use of direct routes within this airspace will provide the shortest flight-plannable tracks. However vertical constraints (either procedural or tactical intervention by controllers) may be required to keep aircraft safely separated at the numerous confliction points created by direct routes, thereby disrupting continuous climb/descent profiles. Additionally, for tactical separation management, controllers may need to deviate (vector) aircraft from their flight planned routings, increasing unplanned track miles. The level of tactical intervention required to support direct routes may increase controller and pilot workload and thus reduce the resilience and capacity of the airspace.

Adherence to the SUA buffer policy (Ref 8) will ensure that no SUAs will be impacted in this option.

Increased CAS is required to enable the benefits for direct routes, which may impact Military and GA/non-commercial/other civilian airspace users' activities. In addition, due to potentially increased controller workload associated with tactical separation management for this option, it may be more difficult for controllers to undertake ad hoc requests from airspace users (e.g., a CAS crossing clearance).

The potential to reduce the classification of CTAs/review the base of CAS in this option is considered less likely due to the complexity of interactions resulting from the use of direct routes.

Conclusion
Direct routes could improve both environmental and economic performance by enabling the most direct flight plannable routings and providing an optimised interface with neighbouring airspace. However, the increased complexity in operation could lead to a dispersal of, and a reduction in predictability of, route conflictions. This may increase controller workload, leading to a reduction in the safety, capacity, and resilience of the airspace. Additional CAS may also be required to accommodate the direct routes and, with the increased complexity of route conflictions, the potential to increase airspace accessibility by reducing the airspace classification or changing the base of CAS, is limited in this option.

Benefits
- Improved track miles for flight planning
- Reduction in planned CO_2 and fuel burn
- Optimised interface with adjacent airspace

Issues
- Reduction in safety
- Increased controller and pilot workload
- Decreased airspace resilience
- Decreased airspace capacity
- Reduction in CCO/CDO
- Additional CAS required may impact Military and GA/non-commercial/other civilian airspace users' operations

The Design Principle Evaluation, see Annex D: Design Principle Evaluation, concluded that:
- 6 design principles were "MET"
- 3 design principles were "PARTIAL" (2 Med, 1 High)
- 5 design principles were "NOT" met (2 Med, 3 High)

Option 3: Most direct, is REJECTED since it did not meet the progression requirements set for the Design Principle Evaluation.

6.4.2.5. Option 4: Bi-directional

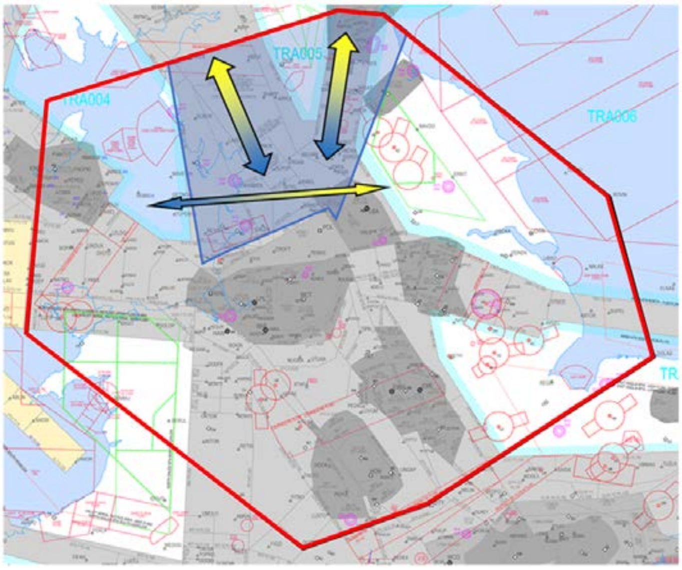

Figure 19: Adapted internal airspace map showing the Northern Spine Option 4: Bi-directional. (For illustration only, does not indicate any specific route design)

Option 4 will replace the existing ATS route structure with bi-directional routes to providing connectivity between the Manchester TMA, and the ScTMA or Newcastle airspace, see Figure 19. Bi-directional routes will also provide connectivity between the Northern Spine and the adjacent geographic elements.

The use of bi-directional routes would reduce route conflictions in the current airspace created by the convergence of routes on a single navigation aid (originally designed this way due to the historic dependence on ground-based navigation aids). However, the interface with neighbouring airspace will create a convergence of route conflictions; in Option 0 : Baseline, northbound and southbound traffic flows are procedurally separated by uni-directional routes, however with bi-directional routes, northbound and southbound traffic may require tactical separation management which could elevate the safety risk in comparison to today's operation.

Additionally, this incompatibility would require the development of a complex interface to correctly orientate traffic with the surrounding airspace.

The use of bi-directional routes provides more direct flight plannable routings between the Manchester TMA and surrounding airspace, reducing the track miles of aircraft and potentially reducing fuel burn and associated greenhouse gas emissions. However vertical constraints (either procedural or tactical intervention by controllers) may be required to keep aircraft safely separated at the confliction points created by direct routes, thereby disrupting continuous climb/descent profiles.

Whilst these more direct bi-directional routes offer a flight plannable benefit in terms of total planned track miles, this benefit could be diminished by the increased tactical intervention to resolve opposite direction conflictions. The increased complexity at the interface and the introduction of opposite direction conflictions may increase controller and pilot workload and thus reduce the resilience and capacity of the airspace.

Increased CAS is required to enable the benefits for bi-directional routes, which may impact Military and GA/non-commercial/other civilian airspace users' activities. In addition, due to potentially increased controller workload associated with tactical separation management for this option, it may be more difficult for controllers to undertake ad hoc requests from airspace users (e.g., a CAS crossing clearance).

The potential to reduce the classification of CTAs/review the base of CAS in this option is considered less likely due to the complexity of interactions resulting from the use of bi-directional routes.

Conclusion

Whilst the introduction of bi-directional routes offers a benefit in terms of planned fuel burn and CO_2 it does so at the expense of CCO/CDO operations and does not provide compatibility with the route network in the neighbouring airspace. The resultant route conflictions may increase controller workload, leading to a reduction in the safety, capacity, and resilience of the airspace. Additional CAS may also be required to accommodate the bi-directional routes and, with the increased complexity of route conflictions, the potential to increase airspace accessibility by reducing the airspace classification or changing the base of CAS, is limited in this option.

Benefits

- Improved track miles for flight planning
- Reduction in planned CO_2 and fuel burn

Issues

- Reduction in safety
- Increased controller and pilot workload
- Decreased airspace resilience
- Decreased airspace capacity
- Reduction in CCO/CDO
- Additional CAS required may impact Military and GA/non-commercial/other civilian airspace users' operations
- Not compatible with adjacent airspace

The Design Principle Evaluation, see Annex D: Design Principle Evaluation, concluded that:

- 5 design principles were "MET"
- 3 design principles were "PARTIAL" (1 High, 2 Med)
- 6 design principles were "NOT" met (4 High, 2 Med)

Option 4: Bi-directional, is REJECTED since it did not meet the progression requirements set for the Design Principle Evaluation.

6.4.3. Eastern Arm

The Eastern Arm, see Figure 20, seeks to introduce new routes providing connectivity for traffic routing to/from central Europe and Scandinavia. Additionally, connectivity may be required to, from and between adjacent geographical elements.

6.4.3.1. Option 0: Baseline

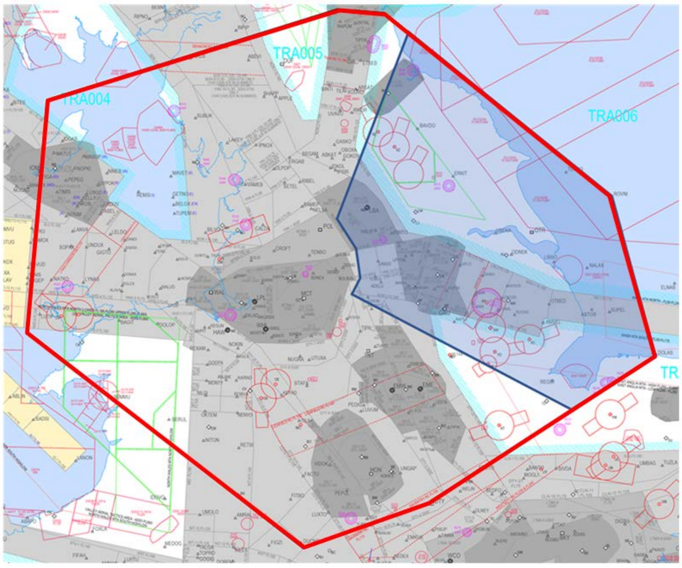

Figure 20: Adapted internal airspace map showing the lateral limits of the Eastern Arm (blue polygon) and surrounding airspace.

A 'Do-Nothing' option representing the current day operation must be included and is used as the baseline against which all other options are compared.

The Eastern Arm accommodates traffic to/from the Amsterdam and Maastricht FIRs to/from the Manchester TMA, Scottish TMA, Humberside, Doncaster Sheffield[15], Leeds Bradford, Teesside, Newcastle and Midlands group[16] airports. Additionally, traffic includes eastbound/westbound overflights to/from Ireland and the Oceanic track system. These traffic flows are depicted by arrows E and F in Figure 10.

The existing airspace within the confines of this change above FL195 is Class C airspace (UK AIP ENR 1.4, 2.3.1). Below FL195 and above FL70, the airspace is constructed of the following airspace structures, (CTRs extend to the surface (SFC), CTA base of CAS is above the surface):

- Yorkshire CTA 9[17] (Class A, FL85 – 195)
- Yorkshire CTA 10[17] (Class A, FL125 – 195)
- Yorkshire CTA 11 (Class A, FL65 – 195)
- Yorkshire CTA 12 (Class A, FL55 – 195)
- Daventry CTA 1[17] (Class A, 4,500ft – FL195)
- Daventry CTA 10[17] (Class A, FL65 – 195)
- Daventry CTA 11[17] (Class A, FL85 – 195)
- Daventry CTA 12[17] (Class A, FL105 – 195)

[15] Operations at Doncaster Sheffield airport, ceased in December 2022. It is currently unclear as to how these flights will be redistributed to other airports in the future.

[16] Midlands group airports are Birmingham, Coventry, and East Midlands airports

[17] This CTA is only partially contained within the Eastern Arm

- Yorkshire CTA 13[17] (Class A, 3,500ft – FL195)
- Yorkshire CTA 14 (Class A, FL85 – 195)
- Leeds Bradford CTA 1 (Class D, 2,500ft – FL85)
- Leeds Bradford CTA 2 (Class D, 2,500ft – FL85)
- Leeds Bradford CTA 3[17] (Class D, 3,000ft – FL85)
- Leeds Bradford CTR (Class D, SFC – FL85)
- North Sea CTA 1[17] (Class A, FL175 – 195)
- Northern CTA 2[17] (Class C, FL195 – 245)
- Wash CTA 1 (Class C, FL195 – 245)
- Midlands CTA[17] (Class C, FL195 – 245)
- Lincolnshire CTA 1 (Class A, FL155 – 195)
- Lincolnshire CTA 2 (Class A, FL125 – 195)
- Lincolnshire CTA 3 (Class A, FL105 – 195)
- Lincolnshire CTA 4 (Class A, FL85 – 195)
- Doncaster Sheffield CTAs/CTRs[15] (Class D/E, between SFC – FL105)

These CTAs contain the lower airspace routes Y70, L60, L603 and L975 connecting the Manchester TMA with European airspace and Y250, M868, and N601 providing connectivity between the Eastern Arm and the Northern Spine, the Southern Spine and Central. The lower airspace route structure within the Eastern Arm is shown in Figure 21 below.

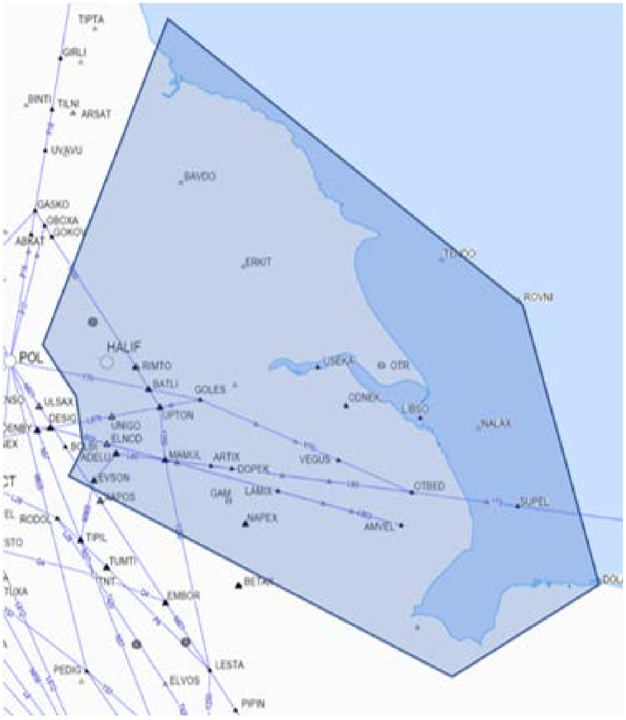

Figure 21: Adapted internal airspace map showing the lower airspace routes contained within the lateral limits of the Eastern Arm (blue polygon)

As described in section 2.14, Removal of Doncaster Sheffield Airport Airspace, operations at EGCN ceased in December 2022. The CAA sponsored ACP (ACP-2022-082) will transfer the management of/ remove the airspace for which EGCN is the nominated unit providing service.

Owing to the uncertainty surrounding the status of this airspace, the Design Principle Evaluation (DPE) will provide an assessment of options within the Eastern Arm considering both the continued provision of ATS in Doncaster Sheffield airspace and, alternatively, the reversion of Doncaster Sheffield airspace back to Class G; these assessments are presented herein as 'Baseline Variation 1) Extant Doncaster Sheffield airspace' and 'Baseline Variation 2) De-notification of Doncaster Sheffield airspace' respectively. Neither baseline variant impacts the list of options shortlisted following the Design Principle Evaluation.

Within the Eastern Arm, the following airspace structures exist above FL70 which will be considered in any airspace design:

- D207 Holbeach[18] (SFC - 23,000ft)
- D307 Donna Nook[18] (SFC - 20,000 ft, occasional 23,000ft)
- D323 complex Southern Military Danger Area (MDA) (lowest base FL50 up to a maximum FL660)
- R313 Scampton (SFC - 9,500ft)
- Wash Aerial Tactics Area (ATA)[18] (North FL50 – 245, South FL50 - 175)
- Gamston Radar Corridor (FL190)
- East Anglia MTA Low (FL245 – 285)
- Hibaldstow Paradrop (SFC - FL160)
- Yorkshire TRA(G) North Lower Area (FL195 – FL240)
- Yorkshire TRA(G) South Lower Area (FL195 – FL240)
- Camphill Box (SFC - FL190 on request)
- Glider Crossing Area (SFC - FL190 on request)
- Air to Air Refuelling Area 08 (AARA)(FL70 - 170)
- TRA006 (FL195 – 245)

Within the Eastern Arm, ATC vector westbound (inbound) aircraft to the north of the airspace and eastbound (outbound) traffic, towards European airspace, to the south. This serves to keep arrival and departure traffic separated and provides predictability for traffic as the provision of an Air Traffic Service (ATS) is passed between controllers[19].

SME feedback has identified that the classification of airspace within the Eastern Arm is potentially overly restrictive. Subsequently, there may be opportunities to improve access to the airspace for all airspace users by lowering the airspace classification. In addition, SMEs identified that aircraft arriving into Leeds Bradford through the Eastern Arm are restricted from achieving an optimal descent profile due to the published base of the CTAs, see Figure 22. Operationally, controllers regularly coordinate with Doncaster Sheffield to allow the continued (optimal) descent of Leeds Bradford arrivals through their airspace. This benefit, however, is limited by the base of airspace for the preceding CTAs. As a result, aircraft arrive high in Leeds Bradford airspace, increasing the complexity of arrival management and therefore controller workload.

[18] D207, D307 and the Wash Aerial Tactics Area are within the lateral limits of the change. However, the vertical limits of these areas make any impact on these structures unlikely.

[19] The UK FIR is split into different sectors with different controllers responsible for providing an Air Traffic Control Service within each sector.

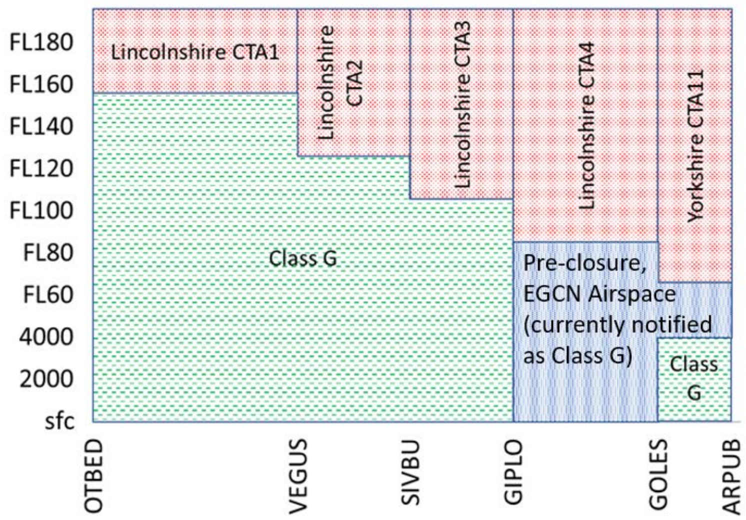

Figure 22: Vertical profile of the bases of pertinent CTAs within the Eastern Arm.

Stakeholder feedback relevant to the Eastern Arm is shown in Table 19.

Stakeholder	Feedback	Impact
DAATM (Defence Airspace and Air Traffic Management)	Increased CAS to the East of EGNX is unfavourable; this is a key operating area for the military. Potential to mitigate the impact with time deconfliction.	The use of time-banded CAS (available during quiet hours i.e., at night) in this area will be considered within the design options.
DAATM (Defence Airspace and Air Traffic Management)	Increased CAS in the Leeds area may impact the transfer of aircraft between Swanwick Mil and RAF Leeming ATC or EGNV.	We will continue to engage with the Military as design options are developed to minimise any impact, in line with DP8.
DAATM (Defence Airspace and Air Traffic Management)	Consideration should be given to plans for RAF Aerobatic Team (RAFAT) and Protector segregated airspace at RAF Syerston and Waddington.	NERL is cognisant of ACP-2019-18 enabling RPAS and RAF Aerobatic Team Operations out of RAF Waddington; this ACP will ensure that the designs proposed are compatible with the requirements of the Military, in line with DP8, and the proposed changes in their ACP.
BAE Warton	Additional CAS in the TR006 area is not anticipated to cause a detrimental impact	This will be considered in the developed design options.

Table 19: Stakeholder feedback received pertinent to the Eastern Arm

For the full detailed analysis, see Annex D: Design Principle Evaluation.

Option 0: Baseline, the ‘Do-Nothing’ option, is **REJECTED** since it would bring no benefit and did not meet the progression requirements set for the Design Principle Evaluation.

6.4.3.2. Option 1: Systemised

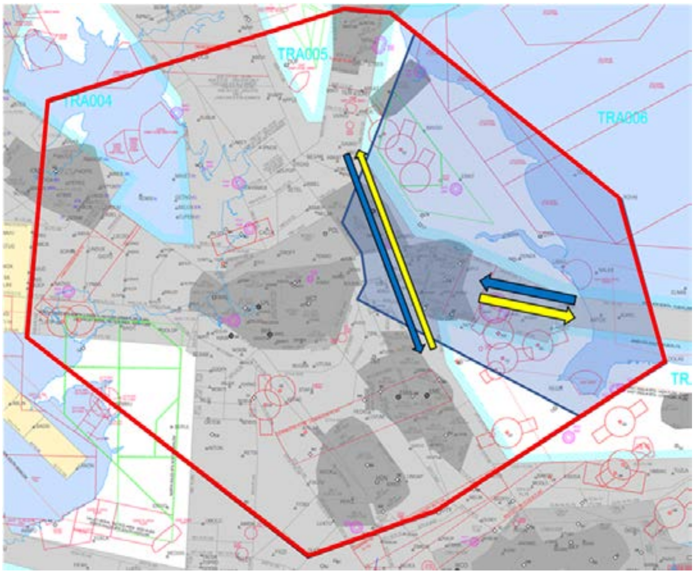

Figure 23: Adapted internal airspace map showing the Eastern Arm Option 1: Systemised. (For illustration only, does not indicate any specific route design)

Option 1 will replace the existing ATS route structure with systemised routes providing connectivity between the Manchester TMA and central Europe or Scandinavia, see Figure 23. Systemised routes will also provide connectivity between the Eastern Arm and the adjacent geographic elements.

Systemised routes provide separation by route design (and procedure) for arrival, departure, and overflight flows. By reducing route conflictions, and therefore the requirement for controller tactical separation management, operational safety may be improved compared to the current airspace.

The reduction in controller tactical intervention enables improved vertical profiles for arriving and departing aircraft, potentially reducing fuel burn and associated greenhouse gas emissions.

The reduction in controller tactical intervention may reduce controller and pilot workload and, alongside more optimally spaced routes, could provide an increase in capacity and resilience.

The introduction of Option 1 within the Eastern Arm may require additional CAS to ensure appropriate separation can be provided between the routes, in line with CAP1385 requirements (Ref 7), as well as achieving improved connectivity between the elements. This may impact GA/non-commercial/other civilian airspace users and Military operations. However, systemisation would reduce the complexity of the airspace (through deconflicted routes), allowing for a potential reduction in the airspace classification. Currently the CTAs within this airspace are a mix of Class A and Class D and, as such, any reduction in airspace classification is considered, subject to receiving the required ATC clearance, to offer a marked improvement for airspace access.

The bases of CAS within the Eastern Arm will be reviewed; SMEs have identified that there are opportunities to enable improved CDOs for aircraft arriving into Leeds Bradford by lowering the base of the Lincolnshire CTAs. As yet, no benefits are identified for aircraft inbound to the Manchester TMA by lowering the base of CAS, however, as the concept is developed into a holistic solution, additional opportunities may be realised. The proximity of Hibaldstow parachute operations will need to be considered in any additional CAS requirements.

The release of excess CAS in other areas may be achieved by raising the base of airspace; this possibility is increased following the closure of Doncaster Sheffield airspace (due to the reduction in aircraft entering/exiting EGCN).

A fully systemised airspace design does not have the flexibility required to maximise the efficiency of the interface with the surrounding airspace. The route structure will need to provide alignment with the existing traffic flows, (e.g., westbound flows on the northern side of the airspace) affecting the efficacy of the design. Additional entry/exit points may also be required (e.g., for connectivity to FRA) as well as modifications to routes within the neighbouring airspace to ensure connectivity to the wider network.

Conclusion

Systemisation provides separated traffic flows, increasing capacity, resilience and predictability and reducing unplanned track miles to the benefit of environmental and economic performance. A potential reduction in CTA classification and changes to the base of CAS could improve accessibility to the airspace in this option. Airspace may be released following the closure of Doncaster Sheffield airport.

Benefits

- Improved safety through the separation of traffic flows
- Reduction in CO_2 and fuel burn for departures and arrivals
- Reduction in controller and pilot workload
- Increased airspace resilience
- Increased airspace capacity
- Improved CCO/CDO

Issues

- Additional CAS required may impact Military and GA/non-commercial/other civilian airspace users' operations (potentially mitigated by the release or reduction in airspace classification of CAS)
- A fully systemised airspace may not provide an optimised interface with neighbouring airspace structures.
- Hibaldstow parachute operations may limit vertical release of CAS

The Design Principle Evaluation, see Annex D: Design Principle Evaluation, concluded that:

Baseline Variation	
1) Extant Doncaster Sheffield airspace • 11 design principles were "MET" • 3 design principles were "PARTIAL" (1 High, 2 Med) • 0 design principles were "NOT" met	2) De-notification of Doncaster Sheffield airspace • 11 design principles were "MET" • 3 design principles were "PARTIAL" (1 High, 2 Med) • 0 design principles were "NOT" met

Option 1: Systemised is considered a promising candidate and has been PROGRESSED to the next stage.

6.4.3.3. Option 2: Part-systemised

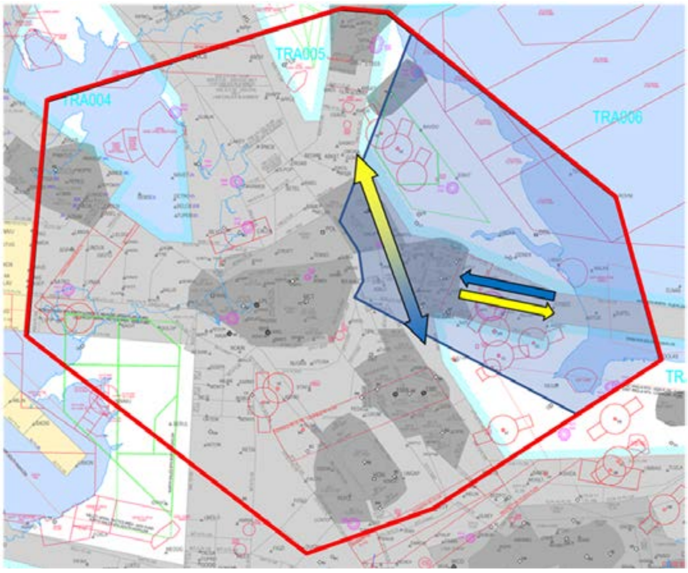

Figure 24: Adapted internal airspace map showing the Eastern Arm Option 2: Part-systemised. (For illustration only, does not indicate any specific route design)

Option 2 will replace the existing ATS route structure with a mix of systemised and non-systemised routes providing connectivity between the Manchester TMA, and central Europe or Scandinavia, see Figure 24. A mix of systemised and non-systemised routes will also provide connectivity between the Eastern Arm and adjacent geographic elements.

This option introduces systemised route structures which provide separation by route design (and procedure) for arrival, departure, and overflight flows. By reducing route conflictions, and therefore the requirement for controller tactical separation management, operational safety may be improved compared to the current airspace.

The reduction in controller tactical intervention enables improved vertical profiles for arriving and departing aircraft, potentially reducing fuel burn and associated greenhouse gas emissions. In airspace where the non-systemised solution is better, this option reduces the burden of extending the miles to support the systemised solution, thereby improving environmental performance compared to today and compared to the fully systemised solution.

The reduction in controller tactical intervention may reduce controller and pilot workload and, alongside more optimally spaced routes, could provide an increase in capacity and resilience.

The introduction of Option 2 within the Eastern Arm may require additional CAS to ensure appropriate separation can be provided between the routes, in line with CAP1385 requirements (Ref 7), as well as achieving improved connectivity between the elements. This may impact Military and GA/non-commercial/other civilian airspace users' operations. However, systemisation would reduce the complexity of the airspace (through deconflicted routes), allowing for a potential reduction in the airspace classification. Currently the CTAs within this airspace are a mix of Class A and Class D and, as such, any reduction in airspace classification is considered, subject to receiving the required ATC clearance, to offer a marked improvement for airspace access. The inclusion of non-systemised routes within this option could reduce this requirement for additional CAS.

The bases of CAS within the Eastern Arm will be reviewed; SMEs have identified that there are opportunities to enable improved CDOs for aircraft arriving into Leeds Bradford by lowering the base of the Lincolnshire CTAs. As yet, no benefits are identified for aircraft inbound to the Manchester TMA by lowering the base of CAS, however, as the concept is developed into a holistic solution, additional opportunities may be realised. The proximity of Hibaldstow parachute operations will need to be considered in any additional CAS requirements.

The release of excess CAS in other areas may be achieved by raising the base of airspace; this possibility is increased following the closure of Doncaster Sheffield airspace (due to the reduction in aircraft entering/exiting EGCN).

The inclusion of non-systemised routes enables optimal connectivity to the existing surrounding airspace. A part-systemised route structure can provide better alignment with the existing traffic flows, (e.g., westbound flows on the northern side of the airspace) enabling an optimised interface with neighbouring airspace and providing connectivity to the wider network. In addition, non-systemised routes can be utilised in instances where there are limited anticipated conflictions. These could include connectivity options with low utilisation or routes where the traffic flow is predominantly in one direction. In these instances, a fully systemised route structure would not be advantageous as it could introduce additional planned track miles without the workload benefit associated with reducing route conflictions.

Conclusion

Part-systemisation provides the benefits of full systemisation with respect to increased capacity, resilience, and predictability, reduced unplanned track miles and improved environmental and economic performance. Additionally, it could provide the flexibility to interface more optimally with other airspace environments and further reduce planned track miles, in airspace where the non-systemised solution is better. A potential reduction in CTA classification and changes to the base of CAS could improve accessibility to the airspace in this option.

Benefits

- Improved safety through the separation of traffic flows
- Reduction in CO_2 and fuel burn for departures and arrivals
- Reduction in controller and pilot workload
- Increased airspace resilience
- Increased airspace capacity
- Increased CCO/CDO
- Optimised interface with adjacent airspace
- Reduces unnecessary additional planned track miles

Issues

- Additional CAS required may impact Military and GA/non-commercial/other civilian airspace users' operations (potentially mitigated by the release or reduction in airspace classification of CAS)
- Hibaldstow parachute operations may limit vertical release of CAS

The Design Principle Evaluation, see Annex D: Design Principle Evaluation, concluded that:

Baseline Variation	
1) Extant Doncaster Sheffield airspace • 12 design principles were “MET” • 2 design principles were “PARTIAL” (2 Med) • 0 design principles were “NOT” met	2) De-notification of Doncaster Sheffield airspace • 12 design principles were “MET” • 2 design principles were “PARTIAL” (2 Med) • 0 design principles were “NOT” met

Option 2: Part-systemised is considered a promising candidate and has been PROGRESSED to the next stage.

6.4.3.4. Option 3: Most direct

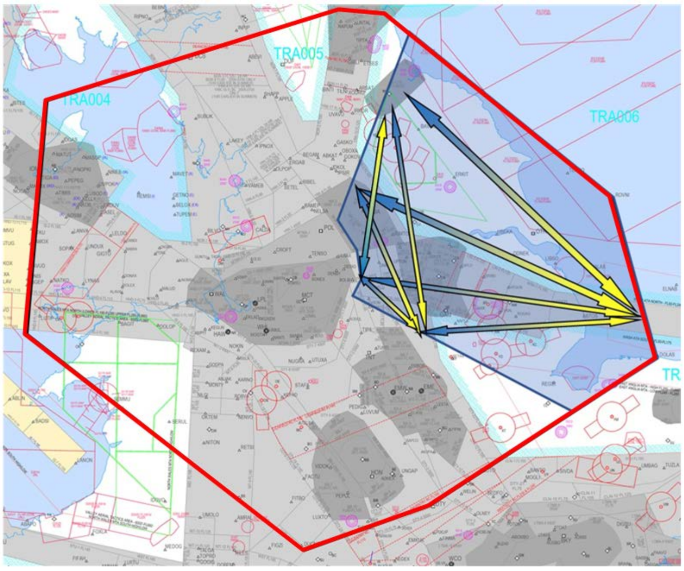

Figure 25: Adapted internal airspace map showing the Eastern Arm Option 3: Most direct. (For illustration only, does not indicate any specific route design)

Option 3 will replace the existing ATS route structure with direct routes between all entry/exit points for this airspace volume, providing optimal connectivity between the Eastern Arm and the surrounding airspace, see Figure 25. Direct routes will also provide connectivity between the Eastern Arm and the adjacent geographic elements

The use of direct routes could potentially distribute (scatter) route confliction points throughout the Eastern Arm, making it more difficult for controllers to anticipate and resolve interactions, particularly in high complexity/density traffic scenarios, thus diminishing safety compared to Option 0: Baseline.

The use of direct routes within this airspace will provide the shortest flight-plannable tracks. However, vertical constraints (either procedural or tactical intervention by controllers) may be required to keep aircraft safely separated at the numerous confliction points created by direct routes, thereby disrupting continuous climb/descent profiles. Additionally, for tactical separation management, controllers will need to deviate (vector) aircraft from their flight planned routings, increasing unplanned track miles. The level of tactical intervention required to support direct routes may increase controller and pilot workload and thus reduce the resilience and capacity of the airspace.

Adherence to the SUA buffer policy (Ref 8) will ensure that no SUAs will be impacted in this option.

Increased CAS is required to enable the benefits for direct routes, which may impact Military and GA/non-commercial/other civilian airspace users' activities. In addition, due to potentially increased controller workload associated with tactical separation management for this option it may be more difficult for controller to undertake ad hoc requests from airspace users (e.g., a CAS crossing clearance). However, the presence (and retention) of a radar corridor in this airspace facilitates Military crossing traffic and thereby limits the adverse impact on the Military.

The proximity of Hibaldstow parachute operations will need to be considered in any additional CAS requirements.

The potential to reduce the classification of CTAs/review the base of CAS in this option is considered less likely due to the complexity of interactions resulting from the use of direct routes.

Conclusion

Direct routes could improve both environmental and economic performance by enabling the most direct flight plannable routings and providing an optimised interface with neighbouring airspace. However, the increased complexity in operation could lead to a dispersal of, and a reduction in predictability of, route conflictions. This may increase controller workload, leading to a reduction in the safety, capacity, and resilience of the airspace. Additional CAS may also be required to accommodate the direct routes and, with the increased complexity of route conflictions, the potential to increase airspace accessibility by reducing the airspace classification or changing the base of CAS, is limited in this option.

Benefits

- Improved track miles for flight planning
- Reduction in planned CO_2 and fuel burn
- Optimised interface with adjacent airspace

Issues

- Reduction in safety
- Increased controller and pilot workload
- Decreased airspace resilience
- Decreased airspace capacity
- Reduction in CCO/CDO
- Additional CAS required may impact Military and GA/non-commercial/other civilian airspace users' operations
- Hibaldstow parachute operations may limit vertical release of CAS

The Design Principle Evaluation, see Annex D: Design Principle Evaluation, concluded that:

Baseline Variation	
1) Extant Doncaster Sheffield airspace • 6 design principles were "MET" • 4 design principles were "PARTIAL" (1 High, 3 Med) • 4 design principles were "NOT" met (3 High, 1 Med)	2) De-notification of Doncaster Sheffield airspace • 6 design principles were "MET" • 4 design principles were "PARTIAL" (1 High, 3 Med) • 4 design principles were "NOT" met (3 High, 1 Med)

Option 3: Most direct, is REJECTED since it did not meet the progression requirements set for the Design Principle Evaluation.

6.4.3.5. Option 4: Bi-directional

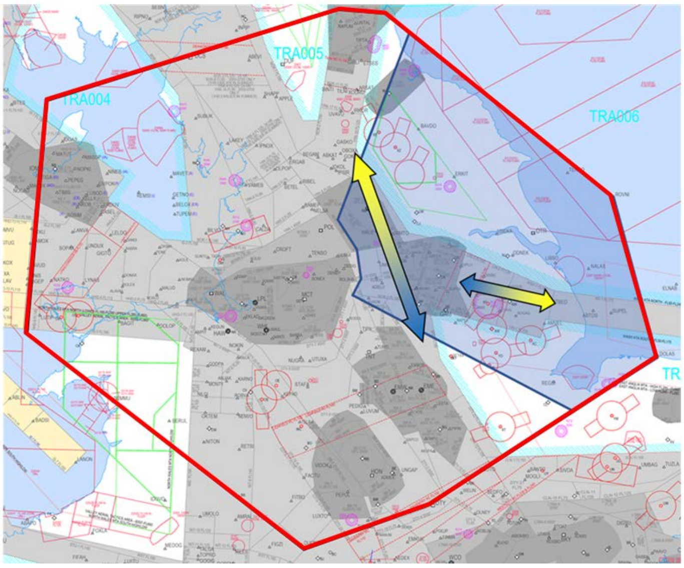

Figure 26: Adapted internal airspace map showing the Eastern Arm Option 4: Bi-directional. (For illustration only, does not indicate any specific route design)

Option 4 will replace the existing ATS route structure with bi-directional routes providing connectivity between the Manchester TMA, and central Europe or Scandinavia, see Figure 26. Bi-directional routes will also provide connectivity between the Eastern Arm and the adjacent geographic elements.

The use of bi-directional routes would reduce route conflictions in the current airspace created by the convergence of routes on a single navigation aid (originally designed this way due to the historic dependence on ground-based navigation aids). However, the interface with neighbouring airspace will create a convergence of route conflictions; in Option 0 : Baseline, eastbound and westbound traffic flows are procedurally separated by uni-directional routes, however with bi-directional routes, eastbound and westbound traffic may require tactical separation management which could elevate the safety risk in comparison to today's operation.

Additionally, this interface incompatibility would require the development of a complex interface to correctly orientate traffic with the surrounding airspace.

The use of bi-directional routes provides more direct flight plannable routings between the Manchester TMA and surrounding airspace, reducing the track miles of aircraft and potentially reducing fuel burn and associated greenhouse gas emissions. However vertical constraints (either procedural or tactical intervention by controllers) may be required to keep aircraft safely separated at the confliction points created by direct routes, thereby disrupting continuous climb/descent profiles.

Whilst these more direct bi-directional routes offer a flight plannable benefit in terms of total planned track miles, this benefit could be diminished by the increased tactical intervention to resolve opposite direction conflictions. The increased complexity at the interface and the introduction of opposite direction conflictions may increase controller and pilot workload and thus reduce the resilience and capacity of the airspace.

Increased CAS is required to enable the benefits for bi-directional routes, which may impact Military and GA/non-commercial/other civilian airspace users' activities. In addition, due to potentially increased controller workload associated with tactical separation management for this option, it may be more difficult for controllers to undertake ad hoc requests from airspace users (e.g., a CAS crossing clearance). However, the presence (and retention) of a radar corridor in this airspace facilitates Military crossing traffic and thereby limits the adverse impact on the Military.

The proximity of Hibaldstow parachute operations will need to be considered in any additional CAS requirements.

The potential to reduce the classification of CTAs/review the base of CAS in this option is considered less likely due to the complexity of interactions resulting from the use of bi-directional routes.

Conclusion

Whilst the introduction of bi-directional routes offers a benefit in terms of planned fuel burn and CO_2 it does so at the expense of CCO/CDO operations and does not provide compatibility with the route network in the neighbouring airspace. The resultant route conflictions may increase controller workload, leading to a reduction in the safety, capacity, and resilience of the airspace. Additional CAS may also be required to accommodate the bi-directional routes and, with the increased complexity of route conflictions, the potential to increase airspace accessibility by reducing the airspace classification or changing the base of CAS, is limited in this option.

Benefits

- Improved track miles for flight planning
- Reduction in planned CO_2 and fuel burn

Issues

- Reduction in safety
- Increased controller and pilot workload
- Decreased airspace resilience
- Decreased airspace capacity
- Reduction in CCO/CDO
- Additional CAS required may impact Military and GA/non-commercial/other civilian airspace users' operations
- Not compatible with adjacent airspace
- Hibaldstow parachute operations may limit vertical release of CAS

The Design Principle Evaluation, see Annex D: Design Principle Evaluation, concluded that:

Baseline Variation	
1) Extant Doncaster Sheffield airspace • 5 design principles were "MET" • 4 design principles were "PARTIAL" (1 High, 3 Med) • 5 design principles were "NOT" met (4 High, 1 Med)	2) De-notification of Doncaster Sheffield airspace • 5 design principles were "MET" • 4 design principles were "PARTIAL" (1 High, 3 Med) • 5 design principles were "NOT" met (4 High, 1 Med)

Option 4: Bi-directional, is REJECTED since it did not meet the progression requirements set for the Design Principle Evaluation.

6.4.4. Southern Spine

The Southern Spine, see Figure 27, seeks to introduce new routes providing connectivity for Manchester TMA traffic which is routing to/from the southern ATS route network. Additionally, connectivity may be required to, from, and between adjacent geographic elements.

6.4.4.1. Option 0: Baseline

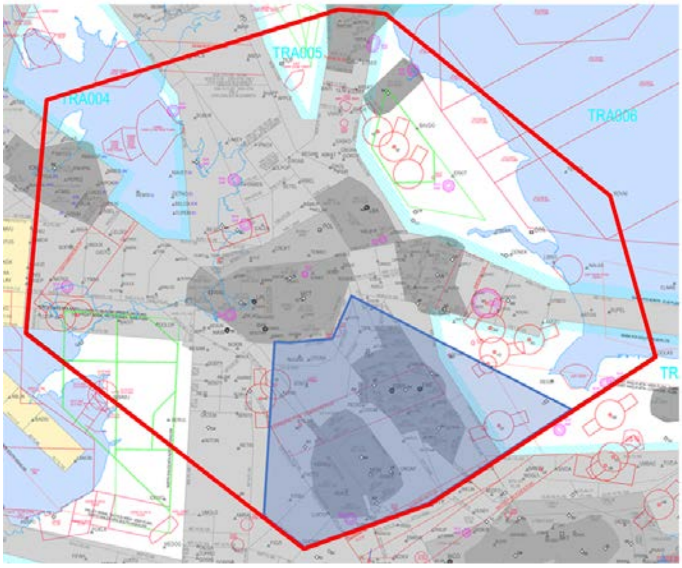

Figure 27: Adapted internal airspace map showing the lateral limits of the Southern Spine (blue polygon) and surrounding airspace.

A 'Do-Nothing' option representing the current day operation must be included and is used as the baseline against which all other options are compared.

The Southern spine abuts the changes being implemented by the LAMP ACPs, see section 2.12. These changes seek to introduce a systemised airspace structure which reflects the existing flows and extends from the LTMA to the southern edge of the DTY CTAs.

The Southern Spine accommodates traffic to/from the London TMA, London Upper airspace (DTY), and Midlands group[20] airports outbound/inbound to the Manchester TMA, Humberside, Doncaster Sheffield[21], Leeds Bradford, Teesside, Newcastle airports, ScTMA and southbound/northbound overflights. Additionally, eastbound/westbound traffic to/from the Midlands group[20] airports from/to the Isle of Man, Belfast TMA, Dublin, and Shannon. These traffic flows are depicted by arrows G and H in Figure 10.

The existing airspace within the confines of this change above FL195 is Class C airspace (UK AIP ENR 1.4, 2.3.1). Below FL195 and above FL70, the airspace is constructed of the following airspace structures, (CTRs extend to the surface (SFC), CTA base of CAS is above the surface):

[20] The Midlands group airports are Birmingham, Coventry, and East Midlands airports.

[21] Operations at Doncaster Sheffield airport ceased in December 2022

- Daventry CTA 1[22] (Class A, 4,500ft – FL195)
- Daventry CTA 2 (Class A, 5,500ft – FL195)
- Daventry CTA 3 (Class A, 5,500ft – FL195)
- Daventry CTA 7[22] (Class A, 4,500ft – FL195)
- Daventry CTA 8 (Class A, 5,500ft – FL195)
- Daventry CTA 9 (Class A, 4,500ft – FL195)
- Daventry CTA 10[22] (Class A, FL65 – 195)
- Daventry CTA 11[22] (Class A, FL85 – 195)
- Daventry CTA 12[22] (Class A, FL105 – 195)
- Daventry CTA 13[22] (Class A, FL75 – 195)
- Daventry CTA 17 (Class A, FL65 – 195)
- Daventry CTA 18 (Class A, 5,500ft – FL195)
- Daventry CTA 19[22] (Class A, FL145 – 195)
- Daventry CTA 20[22] (Class A, FL85 – 195)
- Daventry CTA 21[22] (Class C, FL75 – 155)
- Daventry CTA 22 (Class C, FL145 – 195)
- Daventry CTA 23 (Class C, FL105 – 145)
- Daventry CTA 24[22] (Class C, FL105 – 145)
- Cotswold CTA 17[22] (Class C, FL175 – 195)
- Cotswold CTA 18 (Class C, FL75 – 195)
- Clacton CTA 1[22] (Class A, FL155 – 195)
- East Midlands CTA 1 (Class D, 2,500ft – FL105)
- East Midlands CTA 2 (Class D, 1,500ft – FL105)
- East Midlands CTA 3 (Class D, 2,500ft – FL105)
- East Midlands CTA 7 (Class D, 4,000ft – FL105)
- East Midlands CTA 14 (Class D, FL65 – 105)
- East Midlands CTA 15 (Class D, 4,500ft – FL105)
- East Midlands CTA 16 (Class D, FL75 – 105)
- East Midlands CTA 17 (Class D, 5,500ft – FL105)
- East Midlands CTA 18 (Class D, FL65 – 105)
- East Midlands CTA 19 (Class D, 5,500ft – 105)
- East Midlands CTA 20 (Class D, FL75 – 105)
- East Midlands CTA 21 (Class D, 5,500ft – FL85)
- East Midlands CTA 22 (Class D, FL75 – 85)
- East Midlands CTR 1 (Class D, SFC – FL105)
- Midlands CTA[22] (Class C, FL195 – 245)
- Southern CTA[22] (Class C, FL195 – 245)
- Birmingham CTA 5 (Class D, 2,500ft – FL145)
- Birmingham CTA 6 (Class D, 3,500ft – FL145
- Birmingham CTA 7 (Class D, FL65 – 145)
- Birmingham CTA 9 (Class D, FL65 – 85)
- Birmingham CTA 10 (Class D, FL65 – 105)

These CTAs contain the lower airspace routes L10, L151, L612, L8, M605, N57, N601and N859 connecting the Manchester TMA with the LTMA, routes L15, L28, L608, L613, M16, M868, N92, P155, P18, P6, Q36, Q38, Q4, T420, Y125, Y250, Y321, Y322 and Y53 providing connectivity between the Southern Spine and surrounding airspace, and N93 for Birmingham outbounds to the southwest. The lower airspace route structure within the Southern Spine is shown in Figure 28 below. These routes were historically constructed using the Honiley (HON), Wallasey (WAL), Pole Hill (POL), Daventry (DTY) and Trent (TNT) DVORs. As such these routes do not provide the most direct connectivity within the airspace.

Within the Southern Spine, the following airspace structures exist above FL70 which will be considered in any airspace design:

- Lichfield Radar Corridor (FL140 – 150)
- Daventry Radar Corridor (FL100 – 110)
- Camphill Box (airway base - FL190 on request)
- Langar Parachute site (SFC - FL150)
- Peterborough/Sibson Parachute site (SFC – FL150)
- East Anglian Military Training Area Low (FL245 – 285)
- Non SSR Gliding Area (NSGA) Areas 3 and 4 (FL100 – 195)
- Area of Intense Aerial Activity (AIAA) Lincolnshire (SFC – FL130)
- Temporary Reserved Area (TRA) 003 (FL195 – 245)

[22] This CTA is only partially contained within the Southern Spine

The existing route structure within the Southern spine positions northbound traffic (LTMA departures) on the east side and southbound traffic (Manchester TMA departures) on the west side. This serves to keep arrival and departure traffic separated and aligns with the existing network to the south. Overflying traffic also adopts this general orientation scheme.

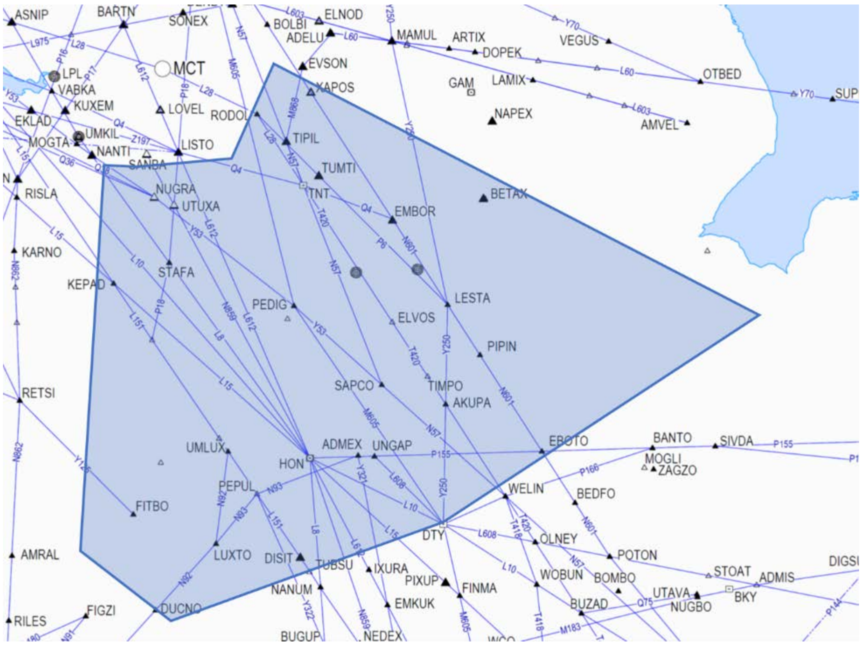

Figure 28: Adapted internal airspace map showing the lower airspace routes contained within the lateral limits of the Southern Spine (blue polygon)

SME feedback has identified that the classification of airspace within the Southern Spine is potentially overly restrictive. Subsequently, there may be opportunities to improve access to the airspace for all airspace users by lowering the airspace classification. Additionally, there are opportunities to enable improved CDOs by lowering the base of CAS in some areas, as well as releasing CAS in other areas by raising the base.

Stakeholder feedback relevant to the Southern Spine is shown in Table 20.

Stakeholder	Feedback	Impact
DAATM (Defence Airspace and Air Traffic Management)	Increased CAS to the East of EGNX is unfavourable; this is a key operating area for the military. Potential to mitigate the impact with time deconfliction.	The use of time-banded CAS (available during quiet hours i.e., at night) in this area will be considered within the design options.
DAATM (Defence Airspace and Air Traffic Management)	Lowering the base of DTY CTA 20 is unfavourable; increased CAS in this area may affect fixed-wing IFR departures, and operations at RAF Shawbury and RAF Valley.	We will continue to engage with the Military as design options are developed to minimise any impact, in line with DP8.
DAATM (Defence Airspace and Air Traffic Management)	General concerns about access to the Lichfield and Daventry Radar Corridors.	Military access to the radar corridor will be a consideration as the design options are developed.

DAATM (Defence Airspace and Air Traffic Management)	Raising the base of CAS in the DTY CTA area is favoured.	This will be considered in the developed design options.
DAATM (Defence Airspace and Air Traffic Management)	The flexible use of airspace around the Cotswold FUA area could mitigate the impact of additional CAS on military activities; specifically, expansion of CAS to the south of Birmingham is a concern.	Designs will seek to ensure segregated operations take place safely and, where possible, flexibly, minimising the impact on other airspace users, and considering the optimisation of network performance, in line with DP8, DP9 and DP10.
British Skydiving	Operations at Langar are unlikely to be impacted.	We will continue to engage with British Skydiving as design options are developed; any impact on GA, non-commercial and other airspace users will be minimised in line with DP9.

Table 20: Stakeholder feedback received pertinent to the Southern Spine

For the full detailed analysis, see Annex D: Design Principle Evaluation.

Option 0: Baseline, the ‘Do-Nothing’ option, is **REJECTED** since it would bring no benefit and did not meet the progression requirements set for the Design Principle Evaluation.

6.4.4.2. Option 1: Systemised

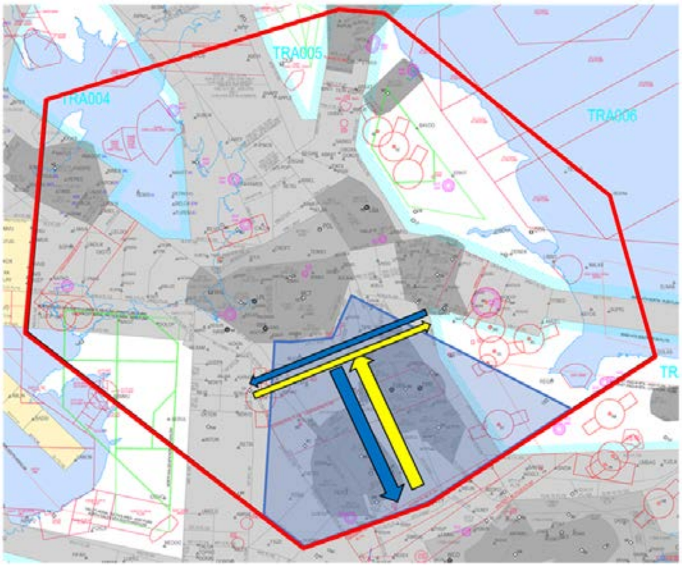

Figure 29: Adapted internal airspace map showing the Southern Spine Option 1: Systemised. (For illustration only, does not indicate any specific route design)

Option 1 will replace the existing ATS route structure with systemised routes providing connectivity between the Manchester TMA, LTMA and Southern Europe as well as traffic overflying the LTMA from southern airspace, see Figure 29. Systemised routes will also provide connectivity between the Southern Spine and the adjacent geographic elements.

Systemised routes provide separation by route design (and procedure) for arrival departure, and overflight flows. By reducing route conflictions, and therefore the requirement for controller tactical separation management, operational safety may be improved compared to the current airspace.

The reduction in controller tactical intervention enables improved vertical profiles for arriving and departing aircraft, potentially reducing fuel burn and associated greenhouse gas emissions.

The reduction in controller tactical intervention may reduce controller and pilot workload and, alongside more optimally spaced routes, could provide an increase in capacity and resilience.

The introduction of Option 1 within the Southern Spine may require additional CAS to ensure appropriate separation can be provided between the routes, in line with CAP1385 requirements (Ref 7), as well as achieving improved connectivity between the elements. This may impact GA/non-commercial/other civilian airspace users and Military operations. However, systemisation would reduce the complexity of the airspace (through deconflicted routes), allowing for a potential reduction in the airspace classification. Currently the CTAs within this airspace are a mix of Class A and Class D and, as such, any reduction in airspace classification is considered, subject to receiving the required ATC clearance, to offer a marked improvement for airspace access.

The bases of CAS within the Southern Spine will be reviewed. As yet, no benefits are identified for aircraft inbound to the Manchester TMA by lowering the base of CAS, however, as the concept is developed into a holistic solution, additional opportunities may be realised. The release of excess CAS in other areas may be achieved by raising the base of airspace.

A fully systemised airspace design does not have the flexibility required to maximise the efficiency of the interface with the surrounding airspace. The route structure will need to provide alignment with the existing traffic flows, (e.g., northbound flows on the eastern side of the airspace) affecting the efficacy of the design. Additional entry/exit points may also be required (e.g., for connectivity to FRA) as well as modifications to routes within the neighbouring airspace to ensure connectivity to the wider network.

Conclusion

Systemisation provides separated traffic flows, increasing capacity, resilience and predictability and reducing unplanned track miles to the benefit of environmental and economic performance. A potential reduction in CTA classification and changes to the base of CAS could improve accessibility to the airspace in this option.

Benefits

- Improved safety through the separation of traffic flows
- Reduction in CO_2 and fuel burn for departures and arrivals
- Reduction in controller and pilot workload
- Increased airspace resilience
- Increased airspace capacity
- Improved CCO/CDO

Issues

- Additional CAS required may impact Military and GA/non-commercial/other civilian airspace users' operations (potentially mitigated by the release or reduction in airspace classification of CAS)
- A fully systemised airspace may not provide an optimised interface with neighbouring airspace structures.

The Design Principle Evaluation, see Annex D: Design Principle Evaluation, concluded that:

- 10 design principles were "MET"
- 4 design principles were "PARTIAL" (2 High, 2 Med)
- 0 design principles were "NOT" met

Option 1: Systemised is considered a promising candidate and has been PROGRESSED to the next stage.

6.4.4.3. Option 2: Part-systemised

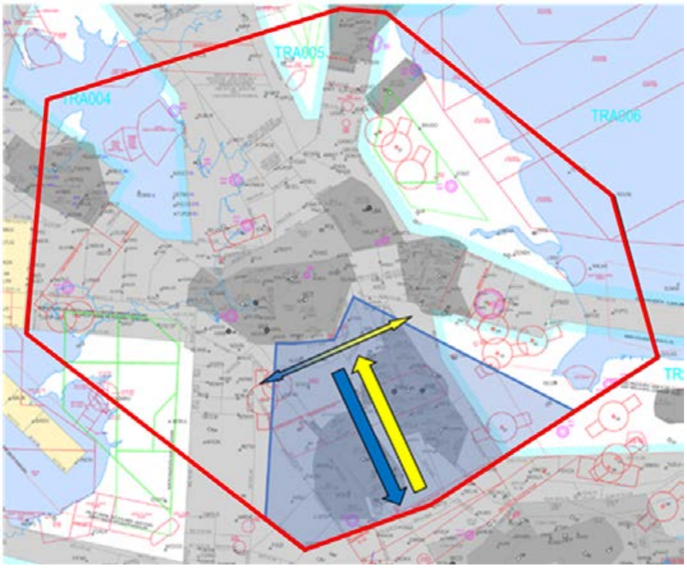

Figure 30: Adapted internal airspace map showing the Southern Spine Option 2: Part-systemised. (For illustration only, does not indicate any specific route design)

Option 2 will replace the existing ATS route structure with a mix of systemised and non-systemised routes providing connectivity between the Manchester TMA, LTMA and Southern Europe as well as traffic overflying the LTMA from southern airspace, see Figure 30. A mix of systemised and non-systemised routes will also provide connectivity between the Southern Spine and adjacent geographic elements.

This concept introduces systemised route structures which provide separation by route design (and procedure) for arrival, departure, and overflight flows. By reducing route conflictions, and therefore the requirement for controller tactical separation management, operational safety may be improved compared to the current airspace.

The reduction in controller tactical intervention enables improved vertical profiles for arriving and departing aircraft, potentially reducing fuel burn and associated greenhouse gas emissions. In airspace where the non-systemised solution is better, this concept reduces the burden of extending the miles to support the systemised solution, thereby improving environmental performance compared to today and compared to the fully systemised solution.

The reduction in controller tactical intervention may reduce controller and pilot workload and, alongside more optimally spaced routes, could provide an increase in capacity and resilience.

The introduction of Option 2 in the Southern Spine may require additional CAS to ensure appropriate separation can be provided between the routes in line with CAP1385 requirements (Ref 7) as well as achieving improved connectivity between the elements. This may impact GA/non-commercial/other civilian airspace users and Military operations. However, systemisation would reduce the complexity of the airspace (through deconflicted routes), allowing for a potential reduction in the airspace classification. Currently the CTAs within this airspace are a mix of Class A and Class D and, as such, any reduction in airspace classification is considered, subject to receiving the required ATC clearance, to offer a marked improvement for airspace access. The inclusion of non-systemised routes within this concept could reduce this requirement for additional CAS.

The bases of CAS within the Southern Spine will be reviewed. As yet, no benefits are identified for aircraft inbound to the Manchester TMA by lowering the base of CAS, however, as the concept is developed into a holistic solution, additional opportunities may be realised. The release of excess CAS in other areas may be achieved by raising the base of airspace.

The inclusion of non-systemised routes enables optimal connectivity to the existing surrounding airspace. A part-systemised route structure can provide better alignment with the existing traffic flows, (e.g., northbound flows on the eastern side of the airspace) enabling an optimised interface with neighbouring airspace and providing connectivity to the wider network. In addition, non-systemised routes can be utilised in instances where there are limited anticipated conflictions. These could include connectivity options with low utilisation or routes where the traffic flow is predominantly in one direction. In these instances, a fully systemised route structure would not be advantageous as it could introduce additional planned track miles without the workload benefit associated with reducing route conflictions.

Conclusion

Part-systemisation provides the benefits of full systemisation with respect to increased capacity, resilience, and predictability, reduced unplanned track miles and improved environmental and economic performance. Additionally, it could provide the flexibility to interface more optimally with other airspace environments and further reduce planned track miles, in airspace where the non-systemised solution is better. A potential reduction in CTA classification and changes to the base of CAS could improve accessibility to the airspace in this option.

Benefits

- Improved safety through the separation of traffic flows
- Reduction in CO_2 and fuel burn for departures and arrivals
- Reduction in controller and pilot workload
- Increased airspace resilience
- Increased airspace capacity
- Increased CCO/CDO
- Optimised interface with adjacent airspace
- Reduces unnecessary additional planned track miles

Issues

- Additional CAS required may impact Military and GA/non-commercial/other civilian airspace users' operations (potentially mitigated by the release or reduction in airspace classification of CAS)

The Design Principle Evaluation, see Annex D: Design Principle Evaluation, concluded that:

- 12 design principles were "MET"
- 2 design principles were "PARTIAL" (2 Med)
- 0 design principles were "NOT" met

Option 2: Part-systemised is considered a promising candidate and has been PROGRESSED to the next stage.

6.4.4.4. Option 3: Most direct

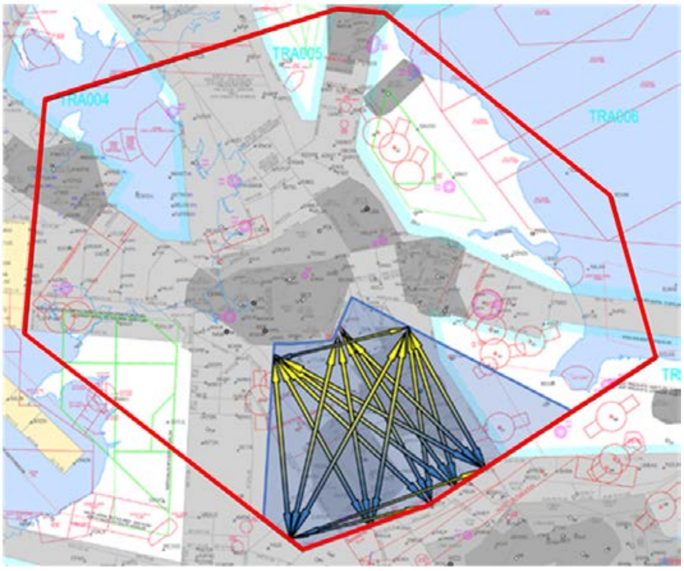

Figure 31: Adapted internal airspace map showing the Southern Spine Option 3: Most direct. (For illustration only, does not indicate any specific route design)

Option 3 will replace the existing ATS route structure with direct routes between all entry/exit points for this airspace volume, providing optimal connectivity between the Southern Spine and the surrounding airspace, see Figure 31. Direct routes will also provide connectivity between the Southern Spine and the adjacent geographic elements.

The use of direct routes could potentially distribute (scatter) route confliction points throughout the Southern Spine, making it more difficult for controllers to anticipate and resolve interactions, particularly in high complexity/density traffic scenarios, thus diminishing safety compared to Option 0: Baseline.

The use of direct routes within this airspace will provide the shortest flight-plannable tracks. However vertical constraints (either procedural or tactical intervention by controllers) may be required to keep aircraft safely separated at the numerous confliction points created by direct routes, thereby disrupting continuous climb/descent profiles. Additionally, for tactical separation management, controllers may need to deviate (vector) aircraft from their flight planned routings, increasing unplanned track miles. The level of tactical intervention required to support direct routes may increase controller and pilot workload and thus reduce the resilience and capacity of the airspace.

Adherence to the SUA buffer policy (Ref 8) will ensure that no SUAs will be impacted in this option.

Increased CAS is required to enable the benefits for direct routes, which may impact Military and GA/non-commercial/other civilian airspace users' activities. In addition, due to potentially increased controller workload associated with tactical separation management for this option it may be more difficult for controllers to undertake ad hoc requests from airspace users (e.g., a CAS crossing clearance). However, the presence (and retention) of a radar corridor in this airspace facilitates Military crossing traffic and thereby limits the adverse impact on the Military.

The potential to reduce the classification of CTAs/review the base of CAS in this option is considered less likely due to the complexity of interactions resulting from the use of direct routes.

Conclusion

Direct routes could improve both environmental and economic performance by enabling the most direct flight plannable routings and providing an optimised interface with neighbouring airspace. However, the increased complexity in operation could lead to a dispersal of, and a reduction in predictability of, route conflictions. This may increase controller workload, leading to a reduction in the safety, capacity, and resilience of the airspace. Additional CAS may also be required to accommodate the direct routes and, with the increased complexity of route conflictions, the potential to increase airspace accessibility by reducing the airspace classification or changing the base of CAS, is limited in this option.

Benefits

- Improved track miles for flight planning
- Reduction in planned CO_2 and fuel burn
- Optimised interface with adjacent airspace

Issues

- Reduction in safety
- Increased controller and pilot workload
- Decreased airspace resilience
- Decreased airspace capacity
- Reduction in CCO/CDO
- Additional CAS required may impact Military and GA/non-commercial/other civilian airspace users' operations

The Design Principle Evaluation, see Annex D: Design Principle Evaluation, concluded that:

- 6 design principles were "MET"
- 4 design principles were "PARTIAL" (3 Med, 1 High)
- 4 design principles were "NOT" met (3 High, 1 Med)

Option 3: Most direct, is **REJECTED** since it did not meet the progression requirements set for the Design Principle Evaluation.

6.4.4.5. Option 4: Bi-directional

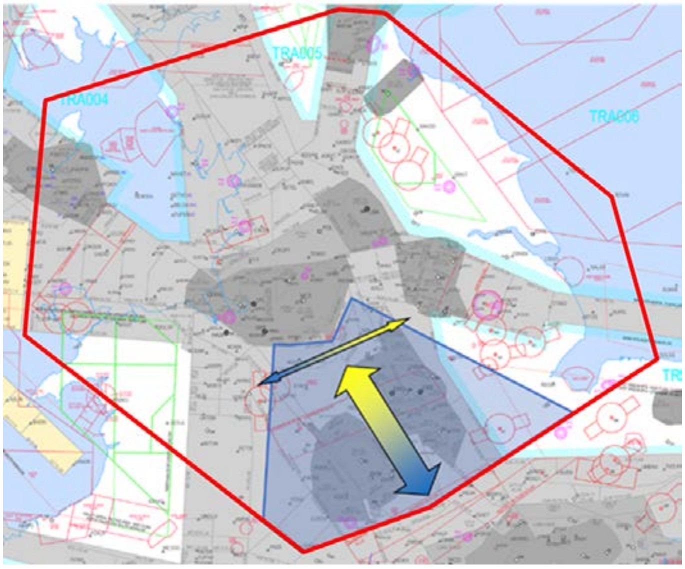

Figure 32: Adapted internal airspace map showing the Southern Spine Option 4: Bi-directional. (For illustration only, does not indicate any specific route design)

Option 4 will replace the existing ATS route structure with bi-directional routes providing connectivity between the Manchester TMA, LTMA and Southern Europe as well as traffic overflying the LTMA from southern airspace, see Figure 32. Bi-directional routes will also provide connectivity between the Southern Spine and the adjacent geographic elements.

The use of bi-directional routes would reduce route conflictions in the current airspace created by the convergence of routes on a single navigation aid (originally designed this way due to the historic dependence on ground-based navigation aids). However, the interface with neighbouring airspace will create a convergence of route conflictions; in Option 0 : Baseline, northbound and southbound traffic flows are procedurally separated by uni-directional routes, however with bi-directional routes, northbound and southbound traffic may require tactical separation management which could elevate the safety risk in comparison to today's operation.

Additionally, this incompatibility would require the development of a complex interface to correctly orientate traffic with the surrounding airspace.

The use of bi-directional routes provides more direct flight plannable routings between the Manchester TMA and surrounding airspace, reducing the track miles of aircraft and potentially reducing fuel burn and associated greenhouse gas emissions. However vertical constraints (either procedural or tactical intervention by controllers) may be required to keep aircraft safely separated at the confliction points created by direct routes, thereby disrupting continuous climb/descent profiles.

Whilst these more direct bi-directional routes offer a flight plannable benefit in terms of total planned track miles, this benefit could be diminished by the increased tactical intervention to resolve opposite direction conflictions. The increased complexity at the interface and the introduction of opposite direction conflictions may increase controller and pilot workload and thus reduce the resilience and capacity of the airspace.

Increased CAS is required to enable the benefits for bi-directional routes, which may impact Military and GA/non-commercial/other civilian airspace users' activities. In addition, due to potentially increased controller workload associated with tactical separation management for this option it may be more difficult for controllers to undertake ad hoc requests from airspace users (e.g., a CAS crossing clearance). However, the presence (and retention) of a radar corridor in this airspace facilitates Military crossing traffic and thereby limits the adverse impact on the Military.

The potential to reduce the classification of CTAs/review the base of CAS in this option is considered less likely due to the complexity of interactions resulting from the use of bi-directional routes.

Conclusion

Whilst the introduction of bi-directional routes offers a benefit in terms of planned fuel burn and CO_2 it does so at the expense of CCO/CDO operations and does not provide compatibility with the route network in the neighbouring airspace. The resultant route conflictions may increase controller workload, leading to a reduction in the safety, capacity, and resilience of the airspace. Additional CAS may also be required to accommodate the bi-directional routes and, with the increased complexity of route conflictions, the potential to increase airspace accessibility by reducing the airspace classification or changing the base of CAS, is limited in this option.

Benefits

- Improved track miles for flight planning
- Reduction in planned CO_2 and fuel burn

Issues

- Reduction in safety
- Increased controller and pilot workload
- Decreased airspace resilience
- Decreased airspace capacity
- Reduction in CCO/CDO
- Additional CAS required may impact Military and GA/non-commercial/other civilian airspace users' operations
- Not compatible with adjacent airspace

The Design Principle Evaluation, see Annex D: Design Principle Evaluation, concluded that:

- 4 design principles were "MET"
- 4 design principles were "PARTIAL" (1 High, 3 Med)
- 6 design principles were "NOT" met (5 High, 1 Med)

Option 4: Bi-directional, is REJECTED since it did not meet the progression requirements set for the Design Principle Evaluation.

6.4.5. Western Arm

The Western Arm, see Figure 33, seeks to introduce new routes providing connectivity for Manchester TMA traffic routing to/from Ireland, the Isle of Man and the southwest. Additionally, connectivity may be required to, from, and between adjacent geographic elements.

6.4.5.1. Option 0: Baseline

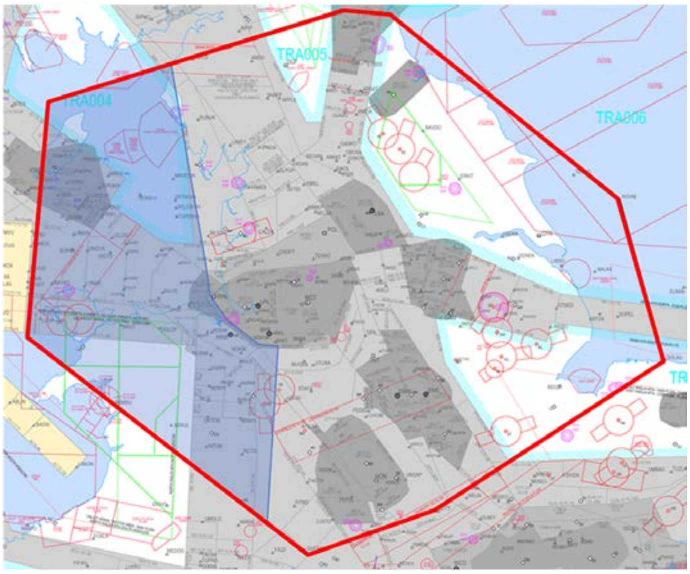

Figure 33: Adapted internal airspace map showing the lateral limits of the Western Arm (blue polygon) and surrounding airspace.

A 'Do-Nothing' option representing the current day operation must be included and is used as the baseline against which all other options are compared.

The Western Arm abuts the changes implemented in FRA D1 (NERL ACP: ACP-2018-11, the introduction of FRA within the upper airspace over the northern portion of UK airspace, implemented, December 2021) and the Isle of Man Antrim Systemisation (NERL ACP: ACP-2015-11, the introduction of a systemised airspace structure in the Isle of Man/Antrim region, implemented, November 2017).

Additionally, the Western Arm is required to interface with the changes being implemented in: FRA D2 (NERL ACP: ACP-2019-12, the introduction of FRA within the upper airspace over the south-western portion of UK airspace, implementation due 2023), FRA D4 (NERL ACP: ACP-2021-072, the introduction of FRA within the upper airspace over the south-eastern portion of UK airspace, planned 2026) and the LAMP ACPs, see section 2.12, which seek to optimise the ATS route network in the southwest of England and Wales, and in the southeast region of England.

The Western Arm accommodates traffic to/from Dublin, Shannon, the North Atlantic, Belfast TMA and Ronaldsway from/to the Manchester TMA, Leeds Bradford, Doncaster Sheffield, Newcastle, Teesside, Midlands group[23] airports, London TMA and northbound/southbound/eastbound/westbound overflights. Additionally, traffic to/from the Manchester TMA, ScTMA, Belfast TMA, Leeds, Doncaster,

[23] The Midlands group airports are Birmingham, Coventry and East Midlands

Humberside, Newcastle and Teesside and northbound/southbound overflights from/to the south. These traffic flows are depicted by arrows I, J, K, L, M and N in Figure 10.

The existing airspace within the confines of this change above FL195 is Class C airspace (UK AIP ENR 1.4, 2.3.1). Below FL195 and above FL70, the airspace is constructed of the following airspace structures, (CTRs extend to the surface (SFC), CTA base of CAS is above the surface):

- Niton CTA 9 (Class A, FL145 – 195)
- Niton CTA 8 (Class A, FL125 – 195)
- Niton CTA 7 (Class A, FL105 – 195)
- Niton CTA 6 (Class A, FL95 – 195)
- Niton CTA 5 (Class A, FL85 – 195)
- Niton CTA 4 (Class A, FL65 – 195)
- Niton CTA 3 (Class A, 4,500ft – FL195)
- Niton CTA 2 (Class A, FL55 – 195)
- Niton CTA 1 (Class A, 3,000ft – FL195)
- Daventry CTA 19[24] (Class A, FL145 – 195)
- Daventry CTA 20[24] (Class A, FL85 – 195)
- Daventry CTA 7[24] (Class A, 4,500ft – FL195)
- Borders CTA 1[24] (Class A, FL135 – 195)
- Midlands CTA[24] (Class C, FL195 – 245)
- Cotswold CTA 17[24] (Class C, FL175 – 195)
- Irish Sea CTA 1[24] (Class C, FL195 – 255)
- Irish Sea CTA 2 (Class C, FL195 – 245)
- Irish Sea CTA 3 (Class C, FL195 – 245)
- Holyhead CTA 1 (Class C, FL145 – 195)
- Holyhead CTA 2 (Class C, FL45 – 195)
- Holyhead CTA 3 (Class C, FL75 – 195)
- Holyhead CTA 4 (Class C, FL115 – 195)
- Holyhead CTA 5[24] (Class C, FL145 – 195)
- Holyhead CTA 6 (Class C, FL45 – 195)
- Holyhead CTA 7[24] (Class C, FL45 – 195)
- Holyhead CTA 8 (Class C, FL135 – 195)
- Holyhead CTA 9 (Class C, FL145 – 195)
- Holyhead CTA 17[24] (Class C, 3,500ft – FL195)
- Holyhead CTA 18[24] (Class C, FL85 – 195)
- Northern CTA 1[24] (Class C, FL195 – 245)
- Isle of Man CTA 1 (Class D, 1,500ft – FL105)
- Isle of Man CTA 3 (Class D, 2,500ft – FL105)
- Isle of Man CTA 4 (Class D, 3,500ft – FL105)
- Strangford CTA 1[24] (Class D, FL75 – 195)
- Strangford CTA 6[24] (Class D, FL45 – 195)
- Strangford CTA 7[24] (Class D, FL135 – 195)
- Isle of Man CTR[24] (Class D, SFC – FL105)

These CTAs contain the lower airspace routes M148, M147, M146, Z196, L10, Q39, Q38, L15, Q36, M145, L70, L28, M144, Q37, L975, Z195, Z197, Y124, N864, Y125, P17, N862, N42, and L151 connecting the Manchester TMA with Ireland, the southwest, the Northern Spine, the Southern Spine and Central. The lower airspace route structure within the Western Arm is shown in Figure 34.

Within the Western Arm, the following airspace structures exist above FL70 which will be considered in any airspace design:

- D406 Eskmeals (5,000ft – FL660)
- D405 Kirkcudbright (SFC - 15,000ft, occasional 50, 000ft)
- Temporary Reserved Area (TRA) 004 (FL195 – 245)
- Air To Air Refuelling Area (AARA) 13 (FL150 - 240)
- Advisory Radio Area (ARA) Warton (FL95 – 190)
- Non SSR Gliding Area (NSGA) Areas 2 and 4 (FL100 – 195)
- North Wales Military Training Area (NWMTA Low) (FL195 – 285)
- Area of Intense Aerial Activity (AIAA) Shawbury (SFC – FL70)
- Aerial Tactics Area (ATA) Valley (6,000ft – FL660)
- Temporary Reserved Area Gliding (TRA (G)) (above FL195)
- Welsh Lower Areas A-F (FL195 – 240)

[24] This CTA is only partially contained in the Western Arm

- Tilstock Parachute site (SFC - FL150)
- Llanbedr Parachute site (SFC - FL150)
- AMPIT 5 LNC (FL145 – 185)
- LYNAS Radar Corridor (SFC – FL170)

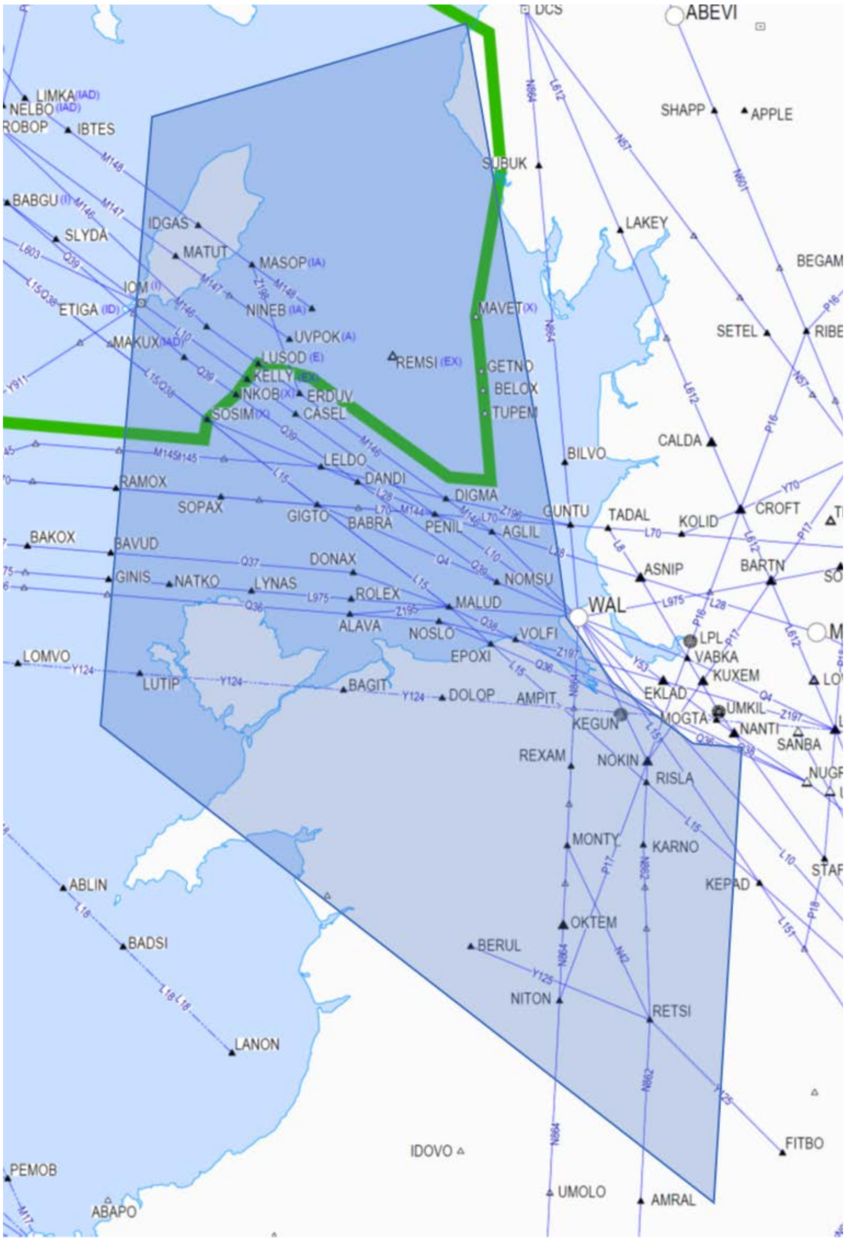

Figure 34: Adapted internal airspace map showing the lower airspace routes contained within the lateral limits of the Western Arm (blue polygon).

The existing route structure within the Western Arm provides for westerly and north-westerly traffic, by positioning westbound (outbound) traffic to the north and eastbound (inbound) traffic to the south of each flow. Traffic to/from the south is positioned such that northbound traffic (MTMA arrivals) are on the west side and southbound traffic (MTMA departures) are on the east. Overflying traffic also adopt this general orientation scheme. This serves to keep arrival and departure traffic separated and provides predictability for traffic as the provision of an Air Traffic Service (ATS) is passed between controllers[25]. An interface to FRA airspace is provided through designated FRA Entry and Exit points.

SME feedback has identified that the classification of airspace within the Western Arm is predominantly Class C; as such, it is considered that there is limited opportunity to improve access to the airspace for all airspace users by lowering the airspace classification. However, there are opportunities to enable improved CDOs by lowering the base of CAS in some areas, as well as releasing CAS in other areas by raising the base.

Stakeholder feedback relevant to the Western Arm is shown in Table 21.

Stakeholder	Feedback	Impact
Blackpool airport	Amending the airspace around the DIGMA, ERDUV area may impact inbound/outbound traffic from DCS and Walney.	We will continue to engage with Blackpool as design options are developed to minimise any impact.
Blackpool airport	Concerns around the use of airspace in the Warton Fillet which could result in the late transfer of Blackpool arrivals, arrival delays and difficulty achieving the required level for Blackpool departures (slow climbers).	We will continue to engage with Blackpool as design options are developed to minimise any impact; however, this relates to the method of operation in addition to airspace design.
DAATM (Defence Airspace and Air Traffic Management)	Lowering the base of airspace in the OKTEM/NITON area is not anticipated to cause a detrimental impact.	This will be considered in the developed design options.
DAATM (Defence Airspace and Air Traffic Management)	Additional CAS around EGNR is not anticipated to cause a detrimental impact.	This will be considered in the developed design options.
DAATM (Defence Airspace and Air Traffic Management)	The flexible use of airspace in/around the TRA004 area would help mitigate the impact on military activities within TRA004, to the north of RAF Valley, and to the west and north of Eskmeals (D406).	Designs will seek to ensure segregated operations take place safely and, where possible, flexibly, minimising the impact on other airspace users, and considering the optimisation of network performance, in line with DP8, DP9 and DP10.
DAATM (Defence Airspace and Air Traffic Management)	Consider the impact on AARA13.	This will be considered in the development of the design options.
DAATM (Defence Airspace and Air Traffic Management)	Concerns around the use of airspace in the Warton Fillet which could impact operations out of RAF Woodvale and increase airspace infringements.	This will be considered in the development of the design options.

[25] The UK FIR is split into different sectors with different controllers responsible for providing an Air Traffic Control Service within each sector

DAATM (Defence Airspace and Air Traffic Management)	Potential to reduce the impact of increased CAS in the Warton Fillet, by lowering the base and extending the north/west edge of MTMA-2 to cover the southern portion of the Warton Fillet.	This will be considered in the development of the design options.
DAATM (Defence Airspace and Air Traffic Management)	General concerns about retaining access to LYNAS Radar Corridor	Military access to the radar corridor will be a consideration as the design options are developed
LAA (Light Aircraft Association)	Additional CAS in the Irish Sea area is not anticipated to cause a detrimental impact.	This will be considered in the developed design options.
British Skydiving	Concerns regarding access to parachuting activity at Tilstock.	We will continue to engage with British Skydiving as design options are developed; any impact on GA, non-commercial and other airspace users will be minimised in line with DP9.
BAE Warton	Additional CAS in the Shawbury area is not anticipated to cause a detrimental impact	This will be considered in the developed design options.

Table 21: Stakeholder feedback received pertinent to the Western Arm

For the full detailed analysis, see Annex D: Design Principle Evaluation.

Option 0: Baseline, the 'Do-Nothing' option, is **REJECTED** since it would bring no benefit and did not meet the progression requirements set for the Design Principle Evaluation.

6.4.5.2. Option 1: Systemised

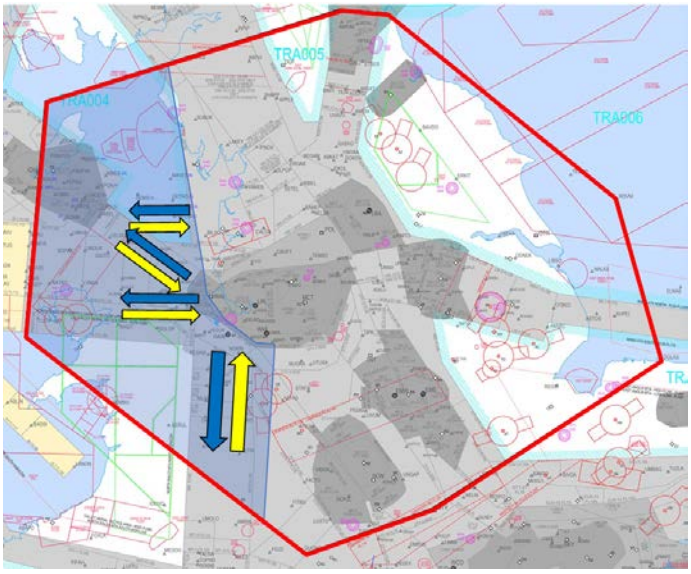

Figure 35: Adapted internal airspace map showing the Western Arm Option 1: Systemised. (For illustration only, does not indicate any specific route design)

Option 1 will extend the existing systemised airspace structures providing connectivity for Manchester TMA traffic to route to/from Ireland and the southwest, see Figure 35. Systemised routes will also provide connectivity between the Western Arm and the adjacent geographic elements.

Systemised routes provide separation by route design (and procedure) for arrival, departure, and overflight flows. By reducing route conflictions, and therefore the requirement for controller tactical separation management, operational safety may be improved compared to the current airspace.

The reduction in controller tactical intervention enables improved vertical profiles for arriving and departing aircraft, potentially reducing fuel burn and associated greenhouse gas emissions.

The reduction in controller tactical intervention may reduce controller and pilot workload and, alongside more optimally spaced routes, could provide an increase in capacity and resilience.

The introduction of Option 1 within the Western Arm may require additional CAS to ensure appropriate separation can be provided between the routes, in line with CAP1385 requirements (Ref 7), as well as achieving improved connectivity between the elements. This may impact GA/non-commercial/other civilian airspace users and Military operations. However, systemisation would reduce the complexity of the airspace (through deconflicted routes), allowing for a potential reduction in the airspace classification. The potential to reduce airspace classification in the Western Arm is considered limited however, as the majority of the CTAs within this airspace are Class C.

The bases of CAS within the Western Arm will be reviewed; SMEs have identified that there are opportunities to enable improved CDOs by lowering the base of CAS in some areas, as well as releasing CAS in other areas by raising the base. The proximity of TRA004 and associated Military operations will need to be considered in any additional CAS requirements, although this airspace is considered to have low usage currently.

A fully systemised airspace design does not have the flexibility required to maximise the efficiency of the interface with the surrounding airspace. However, the existing systemised route structure extends significantly into the Western Arm providing connectivity with FRA in this airspace and it is considered that limited additional connectivity is required for compatibility with the future deployments of LAMP and FRA.

Conclusion

Systemisation provides separated traffic flows, increasing capacity, resilience and predictability and reducing unplanned track miles to the benefit of environmental and economic performance. Limited additional connectivity is required for compatibility with the LAMP and Free Route Airspace environments. Additional CAS may be required; however, it is anticipated that the impact on Military, GA, non-commercial and other civilian airspace users will be minimal. The potential to increase accessibility of the airspace may be achieved through the release of CAS.

Benefits

- Improved safety through the separation of traffic flows
- Reduction in CO_2 and fuel burn for departures and arrivals
- Reduction in controller and pilot workload
- Increased airspace resilience
- Increased airspace capacity
- Improved CCO/CDO
- Potential for release of CAS
- Limited additional connectivity required for LAMP and FRA compatibility

Issues

- Additional CAS required (although considered to have low impact on Military and GA/non-commercial/other civilian airspace users' operations)
- Limited opportunity for a reduction in airspace classification of CAS

The Design Principle Evaluation, see Annex D: Design Principle Evaluation, concluded that:

- 12 design principles were "MET"
- 2 design principles were "PARTIAL" (2 Med)
- 0 design principles were "NOT" met

Option 1: Systemised is considered a promising candidate and has been **PROGRESSED** to the next stage.

6.4.5.3. Option 2: Part-systemised

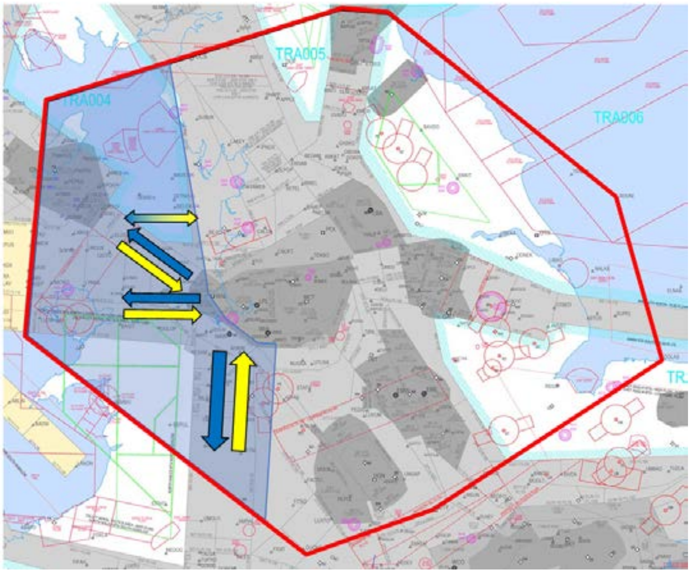

Figure 36: Adapted internal airspace map showing the Western Arm Option 2: Part-systemised. (For illustration only, does not indicate any specific route design)

Option 2 will extend the existing systemised airspace structures and additionally introduce non-systemised route structures, providing connectivity for Manchester TMA traffic to route to/from Ireland and the southwest, see Figure 36. A mix of systemised and non-systemised routes will also provide connectivity between the Western Arm and adjacent geographic elements.

This option introduces systemised route structures which provide separation by route design (and procedure) for arrival, departure, and overflight flows. By reducing route conflictions, and therefore the requirement for controller tactical separation management, operational safety may be improved compared to the current airspace.

The reduction in controller tactical intervention enables improved vertical profiles for arriving and departing aircraft, potentially reducing fuel burn and associated greenhouse gas emissions. In airspace where the non-systemised solution is better, this option reduces the burden of extending the miles to support the systemised solution, thereby improving environmental performance compared to today and compared to the fully systemised solution.

The reduction in controller tactical intervention may reduce controller and pilot workload and, alongside more optimally spaced routes, could provide an increase in capacity and resilience.

The introduction of Option 2 within the Western Arm may require additional CAS to ensure appropriate separation can be provided between the routes, in line with CAP1385 requirements (Ref 7), as well as achieving improved connectivity between the elements. This may impact GA/non-commercial/other civilian airspace users and Military operations. However, systemisation would reduce the complexity of the airspace (through deconflicted routes), allowing for a potential reduction in the airspace classification. A reduction of airspace classification in the Western Arm is considered limited however, as the majority of the CTAs within this airspace are Class C. The inclusion of non-systemised routes within this option could reduce this requirement for additional CAS.

The bases of CAS within the Western Arm will be reviewed; SMEs have identified that there are opportunities to enable improved CDOs by lowering the base of CAS in some areas, as well as releasing CAS in other areas by raising the base. The proximity of TRA004 and associated Military operations will need to be considered in any additional CAS requirements, although this airspace is considered to have low usage currently.

The inclusion of non-systemised routes enables optimal connectivity to the existing surrounding airspace. A part-systemised route structure can provide better alignment with the existing traffic flows, (e.g., westbound flows on the northern side of the airspace) enabling an optimised interface with neighbouring airspace and connectivity to the wider network. In addition, non-systemised routes can be utilised in instances where there are limited anticipated conflictions. These could include connectivity options with low utilisation or routes where the traffic flow is predominantly in one direction. In these instances, a fully systemised route structure would not be advantageous as it could introduce additional planned track miles without the workload benefit associated with reducing route conflictions. The existing systemised route structure extends significantly into the Western Arm providing connectivity with FRA in this airspace with limited additional connectivity required for compatibility with the future deployments of LAMP and FRA.

Conclusion

Part-systemisation provides the benefits of full systemisation, increasing capacity and predictability, reducing unplanned track miles and improving environmental and economic performance. Additionally, it could provide the flexibility to interface more optimally with other airspace environments and further reduce planned track miles, in airspace where the non-systemisation solution is better. Limited additional connectivity is required for compatibility with the LAMP and Free Route Airspace environments. Additional CAS may be required; however, it is anticipated that the impact on airspace users will be minimal. Accessibility of the airspace may be increased through the release of CAS.

Benefits

- Improved safety through the separation of traffic flows
- Reduction in CO_2 and fuel burn for departures and arrivals
- Reduction in controller and pilot workload
- Increased airspace resilience
- Increased airspace capacity
- Increased CCO/CDO
- Optimised interface with adjacent airspace
- Reduces unnecessary additional planned track miles
- Potential for release of CAS
- Limited additional connectivity required for LAMP and FRA compatibility

Issues

- Additional CAS required (although considered to have low impact on Military and GA/non-commercial/other civilian airspace users’ operations)
- Limited opportunity for a reduction in airspace classification of CAS

The Design Principle Evaluation, see Annex D: Design Principle Evaluation, concluded that:

- 12 design principles were “MET”
- 2 design principles were “PARTIAL” (2 Med)
- 0 design principles were “NOT” met

Option 2: Part-systemised is considered a promising candidate and has been PROGRESSED to the next stage.

6.4.5.4. Option 3: Most direct

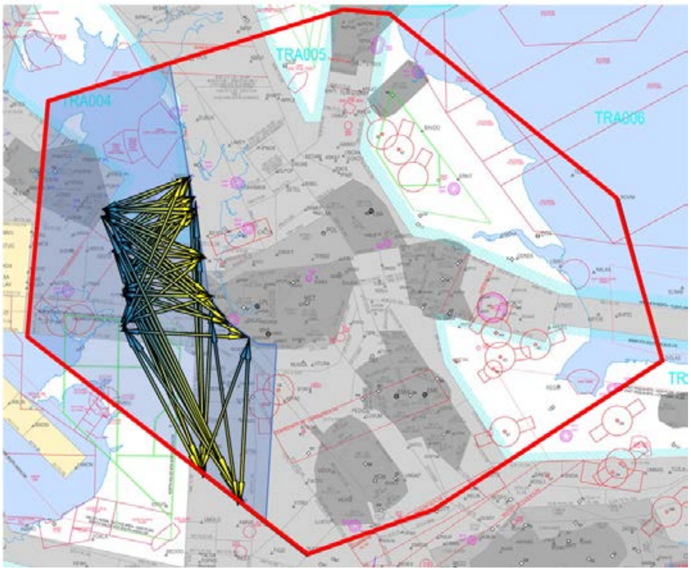

Figure 37: Adapted internal airspace map showing the Western Arm Option 3: Most direct. (For illustration only, does not indicate any specific route design)

Option 3 will introduce direct routes providing connectivity between the existing systemised airspace structures and Manchester TMA traffic routing to/from Ireland and the southwest, see Figure 37. Direct routes will also provide connectivity between the Western Arm and the adjacent geographic elements.

The use of direct routes could potentially distribute (scatter) route confliction points throughout the Western Arm, making it more difficult for controllers to anticipate and resolve interactions, particularly in high complexity/density traffic scenarios, thus diminishing safety compared to Option 0: Baseline.

The use of direct routes within this airspace will provide the shortest flight-plannable tracks. However vertical constraints (either procedural or tactical intervention by controllers) may be required to keep aircraft safely separated at the numerous confliction points created by direct routes, thereby disrupting continuous climb/descent profiles. Additionally, for tactical separation management, controllers may need to deviate (vector) aircraft from their flight planned routings, increasing unplanned track miles. The level of tactical intervention required to support direct routes may increase controller and pilot workload and thus reduce the resilience and capacity of the airspace.

Adherence to the SUA buffer policy (Ref 8) will ensure that no SUAs will be impacted in this option.

Increased CAS is required to enable the benefits for direct routes, which may impact Military and GA/non-commercial/other civilian airspace users' activities. In addition, due to potentially increased controller workload associated with tactical separation management for this option, it may be more difficult for controllers to undertake ad hoc requests from airspace users (e.g., a CAS crossing clearance).

The potential to reduce the classification of CTAs/review the base of CAS in this option is considered less likely due to the complexity of interactions resulting from the use of direct routes. Moreover, the use of direct routes in this airspace may increase the complexity of aircraft interactions to such an extent that an increase in the classification of CTAs is required (as the majority of the airspace is currently Class C).

Conclusion
Direct routes could improve both environmental and economic performance by enabling the most direct flight plannable routings and providing an optimised interface with neighbouring airspace. However, the increased complexity in operation could lead to a dispersal of, and a reduction in predictability of, route conflictions. This may increase controller workload, leading to a reduction in the safety, capacity, and resilience of the airspace. Additional CAS may also be required to accommodate the direct routes and, with the increased complexity of route conflictions, not only is the potential to increase airspace accessibility limited, but this option could require an increase in airspace classification in this region.
Benefits
- Improved track miles for flight planning
- Reduction in planned CO_2 and fuel burn
- Optimised interface with adjacent airspace

Issues
- Reduction in safety
- Increased controller and pilot workload
- Decreased airspace resilience
- Decreased airspace capacity
- Reduction in CCO/CDO
- Additional CAS required may impact Military and GA/non-commercial/other civilian airspace users' operations
- Potential to increase airspace classification of CAS

The Design Principle Evaluation, see Annex D: Design Principle Evaluation, concluded that:
- 6 design principles were "MET"
- 2 design principles were "PARTIAL" (1 Med, 1 High)
- 6 design principles were "NOT" met (3 Med, 3 High)

Option 3: Most direct, is REJECTED since it did not meet the progression requirements set for the Design Principle Evaluation.

6.4.5.5. Option 4: Bi-directional

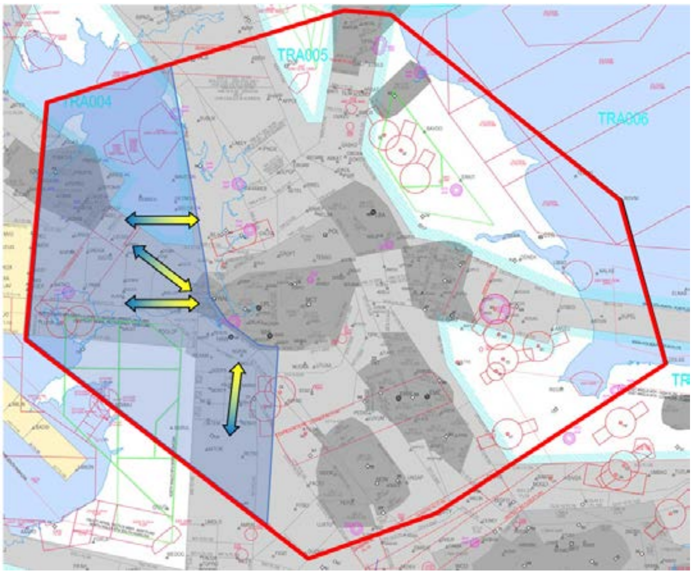

Figure 38: Adapted internal airspace map showing the Western Arm Option 4: Bi-directional. (For illustration only, does not indicate any specific route design)

Option 4 will introduce bi-directional routes to providing connectivity between the existing systemised airspace structures and Manchester TMA traffic routing to/from Ireland and the southwest, see Figure 38. Bi-directional routes will also provide connectivity between the Western Arm and the adjacent geographic elements.

The use of bi-directional routes would reduce route conflictions in the current airspace created by the convergence of routes on a single navigation aid (originally designed this way due to the historic dependence on ground-based navigation aids). However, the interface with neighbouring airspace will create a convergence of route conflictions; in Option 0 : Baseline, eastbound/westbound and northbound/southbound traffic flows are procedurally separated by uni-directional routes, however with bi-directional routes, opposite direction traffic may require tactical separation management which could elevate the safety risk in comparison to today's operation.

Additionally, this incompatibility would require the development of a complex interface to correctly orientate traffic with the surrounding airspace.

The use of bi-directional routes provides more direct flight plannable routings between the Manchester TMA and surrounding airspace, reducing the track miles of aircraft and potentially reducing fuel burn and associated greenhouse gas emissions. However vertical constraints (either procedural or tactical intervention by controllers) may be required to keep aircraft safely separated at the confliction points created by direct routes, thereby disrupting continuous climb/descent profiles.

Whilst these more direct bi-directional routes offer a flight plannable benefit in terms of total planned track miles, this benefit could be diminished by the increased tactical intervention to resolve opposite direction conflictions. The increased complexity at the interface and the introduction of opposite direction conflictions may increase controller and pilot workload and thus reduce the resilience and capacity of the airspace.

Increased CAS is required to enable the benefits for bi-directional routes, which may impact Military and GA/non-commercial/other civilian airspace users' activities. In addition, due to potentially increased controller workload associated with tactical separation management for this option, it may be more difficult for controllers to undertake ad hoc requests from airspace users (e.g., a CAS crossing clearance).

The potential to reduce the classification of CTAs/review the base of CAS in this option is considered less likely due to the complexity of interactions resulting from the use of bi-directional routes. Moreover, the use of bi-directional routes in this airspace may increase the complexity of aircraft interactions to such an extent that an increase in the classification of CTAs is required (as the majority of the airspace is currently Class C).

Conclusion

Whilst the introduction of bi-directional routes offers a benefit in terms of planned fuel burn and CO_2 it does so at the expense of CCO/CDO operations and does not provide compatibility with the route network in the neighbouring airspace. The resultant route conflictions may increase controller workload, leading to a reduction in the safety, capacity, and resilience of the airspace. Additional CAS may also be required to accommodate the bi-directional routes and, with the increased complexity of route conflictions, not only is the potential to increase airspace accessibility limited, but this option could require an increase in airspace classification in this region.

Benefits

- Improved track miles for flight planning
- Reduction in planned CO_2 and fuel burn

Issues

- Reduction in safety
- Increased controller and pilot workload
- Decreased airspace resilience
- Decreased airspace capacity
- Reduction in CCO/CDO
- Additional CAS required may impact Military and GA/non-commercial/other civilian airspace users' operations
- Not compatible with adjacent airspace
- Potential to increase airspace classification of CAS

The Design Principle Evaluation, see Annex D: Design Principle Evaluation, concluded that:

- 4 design principles were "MET"
- 3 design principles were "PARTIAL" (1 High, 2 Med)
- 7 design principles were "NOT" met (5 High, 2 Med)

Option 4: Bi-directional, is **REJECTED** since it did not meet the progression requirements set for the Design Principle Evaluation.

6.4.6. Central

The Central geographic element, see Figure 39, seeks to introduce new routes to provide route connectivity to/from this region and the surrounding geographic elements. Note: departure connectivity will be addressed in section 6.5.5 and arrival connectivity will be addressed in section 6.5.6.; hence, this section addresses overflight provision only.

6.4.6.1. Option 0: Baseline

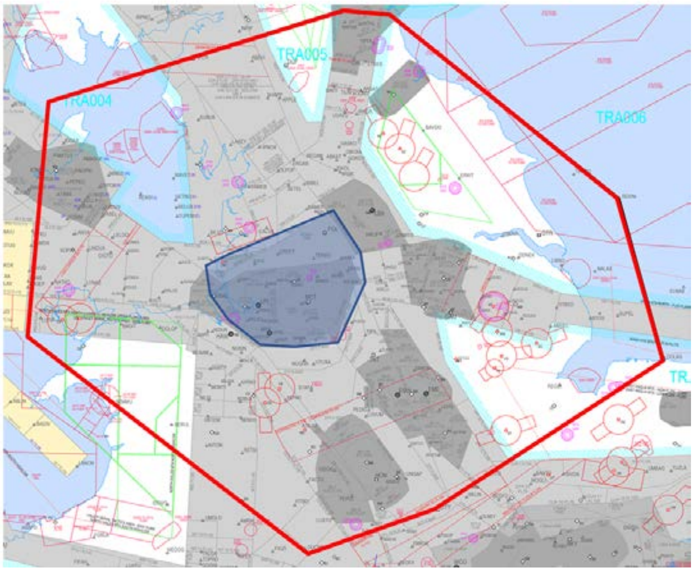

Figure 39: Adapted internal airspace map showing the lateral limits of the Central geographic element (blue polygon) and surrounding airspace.

A 'Do-Nothing' option representing the current day operation must be included and is used as the baseline against which all other options are compared.

The Central geographic element encompasses Manchester TMA airspace and is used by aircraft arriving and departing the Manchester TMA airports in addition to aircraft overflying the Manchester TMA. The base of CAS starts below 7,000ft and this airspace provides an ATS route network for airport SIDs to connect to (STARs typically commence further out from the airports). Note: departure connectivity will be addressed in section 6.5.5 and arrival connectivity will be addressed in section 6.5.6.; hence, this section addresses overflight provision only.

The extant ATS route structure within the Central geographic element is historically predicated on DVOR radials and as such the connectivity in this region is not direct.

The existing airspace within the confines of this change above FL195 is Class C airspace (UK AIP ENR 1.4, 2.3.1). Below FL195 and above FL70, the airspace is constructed of the following airspace structures, (CTRs extend to the surface (SFC), CTA base of CAS is above the surface):

- Yorkshire CTA 1[26] (Class A, 4,500ft – FL195)
- Yorkshire CTA 5[26] (Class A, FL65 – 195)
- Holyhead CTA 17[26] (Class C, 3,500ft – FL195)
- Holyhead CTA 18[26] (Class C, FL85 – 195)

[26] This CTA is only partially contained within the Central geographic element

- Yorkshire CTA 13[26] (Class A, 3,500ft – FL195)
- Daventry CTA 10[26] (Class A, FL65 – 195)
- Daventry CTA 1[26] (Class A, 4,500ft – FL195)
- Holyhead CTA 22 (Class C, FL145 – 195)
- MTMA 2 (Class A, FL55 – 145)
- MTMA 1 (Class C, 3,500ft – FL245)

These CTAs contain the lower airspace routes Y70, P17, P18, M605, N57, N601, L612, P16, L70, L975, L8, Q4, Y53, L10, L15, N862, N864, M146, Q39, Q36, Q38, Z197 and L28 providing connectivity between the Central geographical element and adjacent airspace. The lower airspace route structure within the Central geographical element is shown in Figure 40 below.

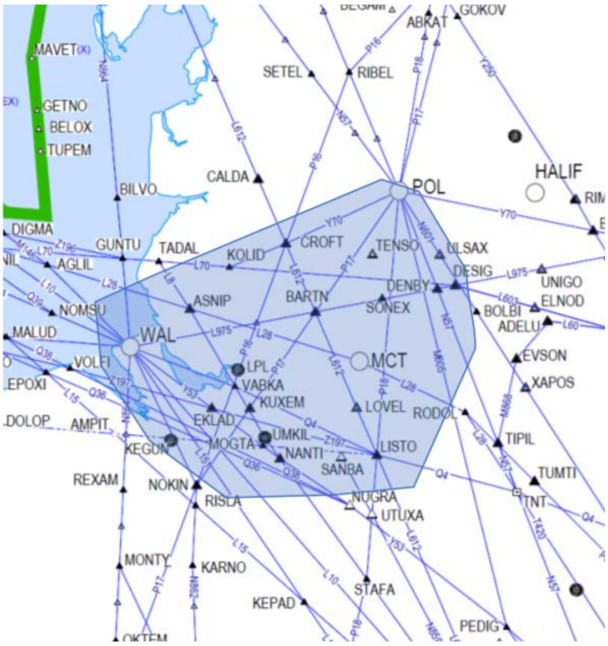

Figure 40: Adapted internal airspace map showing the lower airspace routes contained within the lateral limits of the Central geographical element (blue polygon)

SME feedback has identified that there may be opportunities to improve access to the airspace for all airspace users by releasing CAS in some areas of the Manchester TMA by raising the base.

Stakeholder feedback relevant to the Central geographical element is shown in Table 22.

Stakeholder	Feedback	Impact
DAATM (Defence Airspace and Air Traffic Management)	Request for details of the proposed final outline of the Manchester TMA; extension of controlled airspace (even within current CAS boundaries) would potentially cause concern.	At this stage, the design options are being considered as high-level concepts. We will continue to engage with DAATM as the options are developed into a holistic design for consultation in Stage 3 of the CAP1616 process.
LAA (Light Aircraft Association)	Currently there are regular infringements of the low-level corridor through the Manchester zone; a high(er) level VFR corridor is favourable.	This ACP proposes changes to the enroute network which would only change flight paths at and above 7,000ft; changes below 7,000ft are included within the relevant airport ACP.

Table 22: Stakeholder feedback received pertinent to the Central geographical element

For the full detailed analysis, see Annex D: Design Principle Evaluation.

Option 0: Baseline, the ‘Do-Nothing’ option, is REJECTED since it would bring no benefit and did not meet the progression requirements set for the Design Principle Evaluation. Additionally, all the surrounding geographical elements, (Northern Spine, Eastern Arm, Southern Spine, and Western Arm) have rejected the Baseline ‘Do-Nothing’ option, and therefore the Baseline ‘Do-Nothing’ option for the Central geographic element would no longer provide the required connectivity.

6.4.6.2. Option 1: Route Connectivity

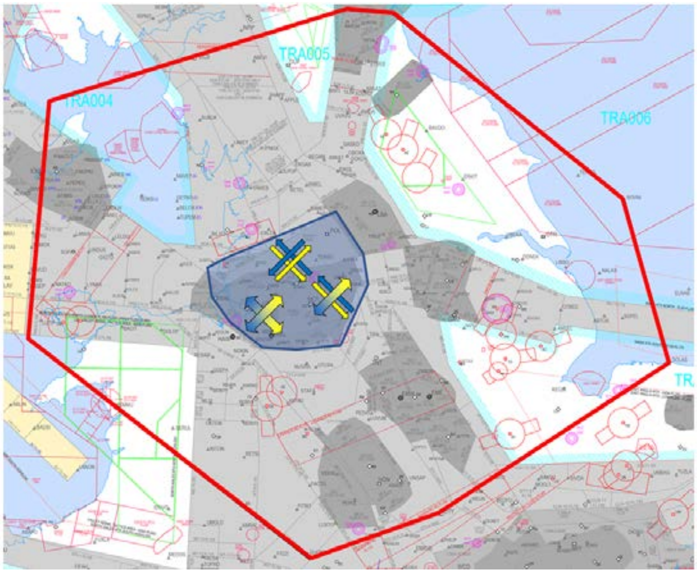

Figure 41: Adapted internal airspace map showing the Central geographic element Option 1: Route connectivity. (For illustration only, does not indicate any specific route design)

Option 1 will replace the existing route structure with new routes providing connectivity for overflights between the Central geographic element and the Northern Spine, Eastern Arm, Southern Spine, and Western Arm, see Figure 41.

This option seeks to remain consistent with existing flight plan options, utilising the required combination of systemised, direct, and bi-directional routes to provide an optimised interface with the surrounding geographical elements. In very early options development, it was clear that this relatively small central region could not function using a single concept (systemised, bi-directional, or direct), so we discounted them and developed the most flexible hybrid concept and engaged on it with our stakeholders.

Through the use of modern navigation standards, a re-design of the Central geographic element could remove the convergence of ATS routes at a single point, resulting in more efficient routes and therefore improved economic and environmental performance compared to today.

Additionally, by reducing route conflictions, and therefore the requirement for controller tactical separation management, operational safety may be improved compared to the current airspace. The reduction in controller tactical intervention may reduce controller and pilot workload and, alongside more optimally spaced routes, could provide an increase in capacity and resilience.

This option will be contained within existing CAS so would have minimal impact on Military and GA/non-commercial/other civilian airspace users' operations. Additionally, there is the potential to raise the base of northern Manchester TMA airspace providing increased accessibility in this region.

Conclusion
Route connectivity allows re-design of the Central geographic element, optimising the connectivity with surrounding airspace and potentially reducing route conflictions, increasing safety, capacity, resilience

and improving environmental and economic performance. The potential to raise the base of Manchester TMA airspace could provide increased accessibility for Military and GA/non-commercial/other civilian airspace users in this region.

Benefits

- Improved safety through the separation of traffic flows
- Reduction in CO_2 and fuel burn
- Reduction in controller and pilot workload
- Increased airspace resilience
- Increased airspace capacity
- Optimised interface with adjacent airspace
- Potential for release of CAS

Issues

- None identified

The Design Principle Evaluation, see Annex D: Design Principle Evaluation, concluded that:

- 13 design principles were "MET"
- 1 design principle was "PARTIAL" (1 Med)
- 0 design principles were "NOT" met

Option 1: Route connectivity is considered a promising candidate and has been PROGRESSED to the next stage.

6.5. High-Level Concepts: MTMA Airport Connectivity

6.5.1. Sections 6.5.5 to 6.5.7 describe the comprehensive list of options providing connectivity between the airport procedures and the ATS route network at and above 7,000ft. These options are dependent on the finalised ATS route network design and the low-level ACP changes being made by the airports.

6.5.2. High-level concepts, presented as options, for MTMA airport connectivity are subdivided into design options:

- Providing connectivity to airport departures
- Providing connectivity to airport arrivals
- Providing airport arrival structures

6.5.3. NERL are continually engaging with the airports so that both parties understand the other parties' requirements as their respective design options develop.

6.5.4. In the Stage 3 submission, NERL and the airports will provide options for consultation which provide seamless connectivity between the proposed airport designs and NERL designs. However, at Stage 2 it is not proportional to provide more than a high-level "connectivity will be provided by…" statement.

6.5.5. Departure Connectivity

Departure connectivity seeks to provide connectivity between MTMA Airport SIDs and the UK ATS route network.

6.5.5.1. Option 0: Baseline

Figure 42: Extant SIDs (cyan) and the connected ATS routes (yellow) from Manchester (top left), Liverpool (top right), Leeds Bradford (bottom left) and East Midlands (bottom right)

A 'Do-Nothing' option representing the current day operation must be included and is used as the baseline against which all other options are compared.

The four main airports included within the MTMA ACP; Manchester, Liverpool, Leeds Bradford and East Midlands all operate using SIDs (see Figure 42). A SID is a published procedure which aircraft follow when departing an airport.

At the end of a SID aircraft either join the existing route network (SID finishes at a published waypoint on the route), join a link route to connect to the route network, continue their flight planned route via a flight plannable DCT or leave CAS.

The other airports contained within the scope of this airspace change have departure procedures published within the relevant aerodrome section of the UK AIP (AD2.22).

As previously discussed, the four airports listed above are pursuing their own ACPs as part of the FASI programme of work. These ACPs will be aligned with this submission, and seek to update their low-level procedures. These changes are being undertaken in close collaboration with each other and NERL to ensure the airspace remains fully compatible and an optimal design is reached.

In this option, any new/revised SIDs will need to interface as appropriate to the existing airspace design. Connectivity to the four airports will be maintained.

Additionally, connectivity will be maintained for those airports within the scope of this change which are not pursuing their own ACPs as part of the FASI programme.

Stakeholder feedback relevant to departure connectivity is shown in Table 23.

Stakeholder	Feedback	Impact
BAE Warton	Liverpool/Leeds Bradford airports: Any SID/STAR design which overlaps with Warton's departure/arrival routes is not favoured. Potentially mitigated by clawback arrangements (to Class G), but concerns with how stakeholders would manage the process.	This will be considered in the development of the design options.
Ryanair	East Midlands airport: Departure options will need to align with proposals being considered locally.	These changes are being undertaken in close collaboration with the airports to ensure the airspace remains fully compatible and an optimal design is reached.
Ryanair	East Midlands airport: Additional CAS to the northeast is favoured, providing more environmentally friendly profiles for arrival traffic	This will be considered in the developed design options.
Ryanair	Support for continuous climb operations. Longer departure routes (more track miles) are not favoured.	This will be considered in the development of the design options.
Ryanair	Manchester airport: Support for continuous climb operations; current turn-and-burn procedure results in unpredictable delivery	This will be considered in the developed design options.
Ryanair	PBN (RNAV/RNP) SIDs which contain altitude constraints within the coding is beneficial; reduces crew workload, enhances situation awareness, and improves safety.	This will be considered in the development of the design options.

Table 23: Stakeholder feedback received pertinent to departure connectivity

For the full detailed analysis, see Annex D: Design Principle Evaluation.

Option 0: Baseline, the 'Do-Nothing' option, is **REJECTED** since it would bring no benefit and did not meet the progression requirements set for the Design Principle Evaluation

6.5.5.2. Option 1: Departure connectivity without new CAS

The concept of departure connectivity in Option 1 is to provide connectivity from the finalised airport SID end points to the ATS route network within the confines of existing CAS.

These SIDs are being developed by the airports in coordination with each other and NERL. Where possible, the SIDs will finish at a waypoint included in the modernised ATS route network.

Where this is not possible, NERL will provide connectivity via appropriate link routes between SID end points and the ATS network to maximise the benefits achieved through this ACP.

This departure connectivity is anticipated to:

- Provide a departure route that remains separated from arrivals reducing controller and pilot workload.
- Integrate efficiently with the proposed route network within the confines of CAS.

Option 1 provides connectivity from the airports SID end points to the ATS route network. However, until the SID endpoints are finalised, the requirements for link routes are unknown. Link routes can be designed to remain separated from arrival aircraft enabling improved CCO, CDO, fuel and CO_2 emission benefits whilst reducing controller and pilot workload, although the realisation of benefits may be limited by the extant base of CAS in this concept.

Conclusion

Option 1 could improve the efficiency of the SID/route network interface potentially enabling more direct routes and reducing route conflictions, increasing capacity and resilience, and enabling more continuous climb/descent profiles to the benefit of environmental and economic performance. It is noted that the realisation of benefits may be limited by the extant base of CAS in this concept.

Benefits

- Increase in safety
- Reduction in controller and pilot workload
- Increase in capacity and resilience
- Improved connectivity enabling CCO benefit
- Improved CDO by further separating arriving and departing aircraft.
- Improved connectivity reducing fuel burn and CO_2 emissions

Issues

- Maintaining the departure routes within existing CAS reduces the options available to limit route conflictions
- Maintaining the departure routes within existing CAS precludes the most direct routes, limiting the benefits to capacity, in addition to economic and environmental performance
- SID endpoints are not yet known

Design Principle Evaluation, see Annex D: Design Principle Evaluation, concluded that:

- 13 design principles were “MET”
- 1 design principle was “PARTIAL” (1 Low)
- 0 design principles were “NOT” met

Option 1: Departure connectivity without new CAS is considered a promising candidate and has been PROGRESSED to the next stage.

6.5.5.3. Option 2: Departure connectivity with new CAS

The concept of departure connectivity in Option 2 is to provide connectivity from the finalised airport SID end points to the ATS route network without the constraint of existing CAS.

These SIDs are being developed by the airports in coordination with each other and NERL. Where possible, the SIDs will finish at a waypoint included in the modernised ATS route network.

Where this is not possible, NERL will provide connectivity via appropriate link routes between SID end points and the ATS network to maximise the benefits achieved through this ACP.

This connectivity would provide the same benefits as Option 1, but the interface between the SID and the route network is not limited to the confines of existing CAS; removing this restriction will allow the interface between the SID/ATS route or SID/link route, to route outside of existing CAS.

An indicative example of this, (others may be identified prior to Stage 3 of the CAP1616 process), is shown in Figure 43. In this example, a Leeds Bradford NELSA departure from runway 32 routing north via N601 currently has to fly additional track miles to remain within CAS, routing first to NELSA before joining N601. Option 2 would enable Leeds Bradford to design a truncated SID that turns to RIBEL earlier, creating a more efficient route and reducing planned track miles.

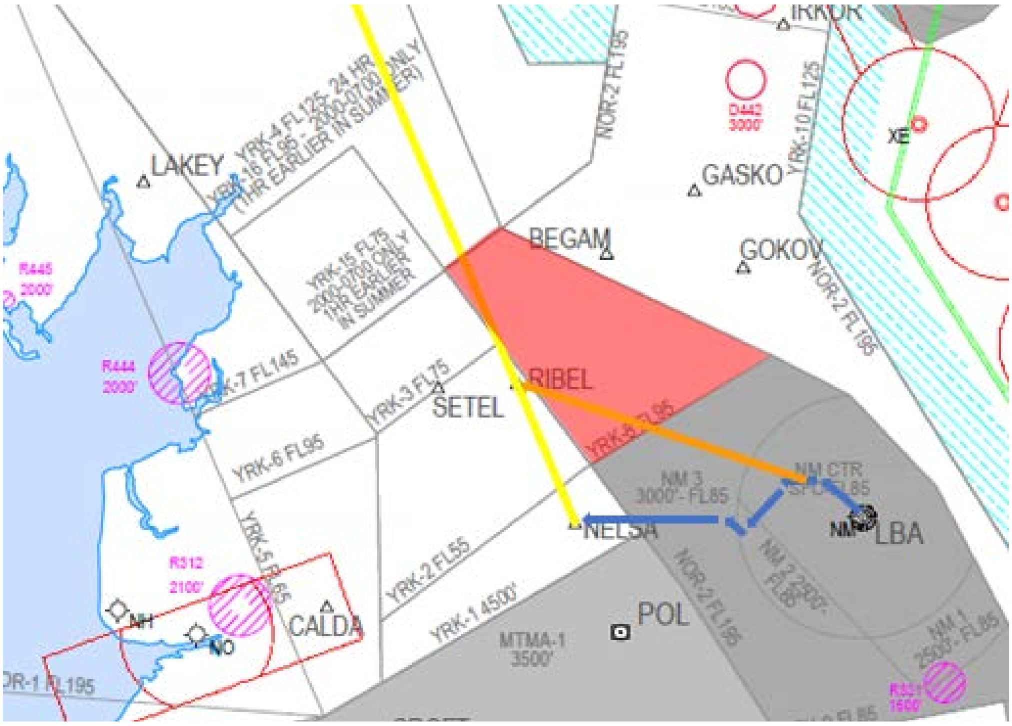

Figure 43: Adapted internal airspace map showing an example of an early turn providing track miles savings by routing a departure route/link route outside of CAS. (Blue arrows = NELSA SID, Yellow line = N601, Orange arrow = potential direct link route, Red area = new CAS requirement)

Additional CAS enabling departures to take more direct routings would reduce the track miles, improving environmental and economic performance. In addition, the SID/network interface could be optimised to reduce route conflictions, thereby reducing controller and pilot workload, and increasing capacity and resilience.

The additional CAS required to implement Option 2 could be incorporated into any additional airspace required to implement the corresponding route network change.

The quantity of additional CAS required for this option could be limited by re-joining the ATS route earlier. However, this would limit the environmental and economic benefits of this option.

The use of stepped bases for CAS will also ensure that any additional CAS is kept to a minimum.

The requirement for additional CAS may impact the Military and GA/non-commercial/other civilian airspace users. However, improvements to the SID/route network interface could potentially allow for the release of CAS in other areas, and clawback procedures/ flexible use of airspace will be considered to minimise any impact on Military activities.

Conclusion

Option 2 could improve the efficiency of the SID/route network interface without being constrained by the extant bases or lateral limits of existing CAS, potentially enabling more direct routes and reducing route conflictions, increasing capacity and resilience and enabling more continuous climb/descent profiles to the benefit of environmental and economic performance. The use of additional CAS may impact the Military and GA/non-commercial/other civilian airspace users, however the impact is considered minor only. Additionally, there may be the potential to release some CAS increasing accessibility for airspace users.

Benefits

- Improved safety through the separation of traffic flows
- Reduction in CO_2 and fuel burn
- Reduction in controller and pilot workload
- Increased airspace resilience
- Increased airspace capacity
- Optimised interface with adjacent airspace
- Improved CCO/CDO by further separating arriving and departing aircraft

Issues

- Requires additional CAS
- Minor impact on Military and GA/non-commercial/other civilian airspace users' operations
- SID endpoints are not yet known

Design Principle Evaluation, see Annex D: Design Principle Evaluation, concluded that:

- 11 design principles were "MET"
- 3 design principles were "PARTIAL" (2 Med, 1 Low)
- 0 design principles were "NOT" met

Option 2: Departure connectivity with new CAS is considered a promising candidate and has been PROGRESSED to the next stage.

6.5.6. Arrival Connectivity

Arrival connectivity seeks to provide connectivity between the UK ATS route network and airport arrival structures.

6.5.6.1. Concept 0: Baseline

Figure 44: Geographic location of extant holds and arrival routes; Manchester (top left, yellow), Liverpool (top right, purple), Leeds Bradford (bottom left, pink) and East Midlands (bottom right, white)

'A 'Do-Nothing' option representing the current day operation must be included and is used as the baseline against which all other options are compared.

Arrivals into Manchester, Liverpool, and East Midlands follow published STARs to transition from the ATS route network to the published holds (see Figure 44). A STAR is a standard ATS route identified in an approach procedure by which aircraft should proceed from the enroute phase to an initial approach fix. It is a published Instrument Flight Plan (IFP) procedure with a corresponding chart.

Arrivals into Leeds Bradford follow Standard Inbound Routes (see Figure 44). This differs from a STAR by not being a published IFP procedure with a corresponding chart. A Standard Inbound Route is published in the relevant airport section of the UK AIP (AD2.22).

The other airports contained within the scope of this airspace change have arrival procedures published within the relevant airport section of the UK AIP (AD2.22).

As previously discussed, the four airports listed above are pursuing their own ACPs as part of the FASI programme of work. These ACPs will be aligned with this submission, and seek to update their low-level procedures. These changes are being undertaken in close collaboration with each other and NERL to ensure the airspace remains fully compatible and an optimal design is reached.

In this option, any new/revised airport approach procedures and arrival structures will need to interface appropriately with the extant arrival routes. Connectivity to the four airports will be maintained.

Additionally, connectivity will be maintained for those airports within the scope of this change which are not pursuing their own ACPs as part of the FASI programme.

Stakeholder feedback relevant to arrival connectivity is shown in Table 24.

Stakeholder	Feedback	Impact
BAE Warton	Liverpool/Leeds Bradford airports: Any SID/STAR design which overlaps with Warton's departure/arrival routes is not favoured. Potentially mitigated by clawback arrangements (to Class G), but concerns with how stakeholders would manage the process.	This will be considered in the development of the design options.
Ryanair	East Midlands airport: Welcome changes delivering efficiencies, continuous descent operations, and shortened arrivals from the east/northeast	This will be considered in the developed design options.
Ryanair	Support for continuous descent operations. Longer arrival routes (more track miles) are not favoured.	This will be considered in the developed design options
Ryanair	Leeds Bradford airport: More direct routings towards 10NM final Runway 32 when arriving from the south	This will be considered in the development of the design options.
Ryanair	Liverpool airport: The use of additional CAS facilitating lower altitude arrivals for Runway 09 is favoured.	This will be considered in the developed design options
Ryanair	Liverpool airport: For Runway 27, an earlier northerly turn for NANTI arrivals and earlier southerly turn for ASMIM arrivals would be welcome; current procedures are fuel/environmentally inefficient.	This will be considered in the development of the design options.
Ryanair	Manchester airport: More direct routings towards 10NM final Runway 23R when arriving from the northeast, east and southeast.	This will be considered in the development of the design options.
Ryanair	PBN (RNAV/RNP) STARs which contain altitude constraints within the coding is beneficial; reduces crew workload, enhances situation awareness and improves safety.	This will be considered in the development of the design options.

Table 24: Stakeholder feedback received pertinent to arrival connectivity

For the full detailed analysis, see Annex D: Design Principle Evaluation.

Option 0: Baseline, the 'Do-Nothing' option, is **REJECTED** since it would bring no benefit and did not meet the progression requirements set for the Design Principle Evaluation.

6.5.6.2. Option 1: Arrival connectivity without new CAS

The concept of arrival connectivity in Option 1 is to provide connectivity from the UK ATS route network to the finalised airport arrival structure within the confines of existing CAS.

The airports are, in coordination with each other and NERL, redesigning their low-level procedures. Until there is a better understanding of how the airports plan to route their approach procedures, it is not proportionate to determine the preferred arrival structure location and, subsequently, to design a STAR/Standard Inbound Route, as the end point is not yet known.

Preferred arrival structure locations will be confirmed following the Stage 2 submissions as concepts are developed into defined solutions for the Stage 3 consultation.

STARs/Standard Inbound Routes will be introduced which connect the modernised ATS route network to the required airport arrival structure.

The arrival connectivity is anticipated to:

- Provide an arrival route that remains separated from departures reducing controller and pilot workload.
- Integrate efficiently with the proposed route network within the confines of CAS.

Option 1 provides connectivity between the ATS route network and the airport arrival structure via STARs/Standard Inbound Routes. However, until the arrival route endpoints are finalised the potential routing is unknown. Arrival routes will be designed to remain separated from departure aircraft enabling improved CCO, CDO, fuel and CO_2 emission benefits whilst reducing controller and pilot workload.

Conclusion

Option 1 could improve the efficiency of STAR/Standard Inbound Route profiles, increasing capacity, resilience, and predictability, reducing planned track miles, and enabling more continuous climb/descent profiles to the benefit of environmental and economic performance. It is noted that the realisation of benefits may be limited by the extant base of CAS in this concept

Benefits

- Increase in safety
- Reduction in controller and pilot workload
- Increase in capacity and resilience
- Improved connectivity enabling CDO benefit
- Improved CCO by further separating arriving and departing aircraft.
- Improved connectivity reducing fuel burn and CO_2 emissions

Issues

- Maintaining the arrival routes within existing CAS reduces the options available to limit route conflictions
- Maintaining the arrival routes within existing CAS precludes the most direct routes, limiting the benefits to capacity, in addition to economic and environmental performance
- Planned airport arrival procedures are not yet known

Design Principle Evaluation, see Annex D: Design Principle Evaluation, concluded that:

- 12 design principles were “MET”

- 2 design principles were “PARTIAL” (1 Med, 1 Low)
- 0 design principles were “NOT” met

Option 1: Arrival connectivity without new CAS is considered a promising candidate and has been PROGRESSED to the next stage.

6.5.6.3. Option 2: Arrival connectivity with new CAS

The concept of arrival connectivity in Option 2 is to provide connectivity from the UK ATS route network to the finalised airport arrival structure without the constraint of existing CAS.

STARs/Standard Inbound Routes will be introduced which connect the modernised ATS route network to the required airport arrival structure.

The provision of this connectivity provides the same benefits as Option 1, but would not be limited to the confines of existing CAS; removing this restriction will allow the routing of STARs and Standard Inbound Routes, outside of existing CAS.

An indicative example of this, (others may be identified prior to Stage 3 of the CAP1616 process), is shown in Figure 45. In this example, Leeds Bradford traffic currently arrives from the south via TNT, following the inbound arrival route: TNT – DENBY – LBA. This traffic would be provisioned with a new STAR which would redistribute the traffic away from the eastern edge of the Manchester TMA, relieving this high-density traffic area.

Figure 45: Adapted internal airspace map showing an example of an early turn that could relocate Leeds Bradford arrival aircraft into less congested airspace using a STAR following a route requiring new CAS outside the extant CAS boundary, to the east. (Brown arrows = EGNM Standard Inbound Route from the south, Blue arrow = northbound traffic flow, Yellow arrow = potential new STAR to LBA or equivalent arrival structure, Red area = new CAS requirement).

Currently, where arrival/departure route conflictions exist, arrivals are deconflicted by controllers either through vectoring or by issuing vertical constraints (e.g., an early descent, or interrupted descent profile) in order to safely separate against departure flights.

In Option 2, the use of additional CAS allows the route design to redistribute arrival traffic away from the busier regions of the Manchester TMA, simplifying and/or removing route conflictions in this airspace which currently limit CCO/CDO Operations. By reducing these route conflictions, arrivals and departures can follow a more optimal vertical profile, reducing fuel burn and CO_2 emissions, as well as reducing controller workload and improving capacity and resilience. Additional CAS would enable arrivals to take more direct routings, further improving environmental and economic performance.

This option provides connectivity between the ATS route network and airport arrival structures without the constraint of existing CAS. By providing additional airspace for the STARs/Standard Inbound Routes, aircraft can be redistributed within the Manchester TMA and surrounding airspace to provide fuel, capacity and resilience benefits by reducing route conflictions and controller and pilot workload. This option will require additional CAS and, as such, could have a minor negative impact on the operations of the Military and GA/non-commercial/other civilian airspace users.

Conclusion

Option 2 could improve the efficiency of arrival routes without being constrained by the extant bases or lateral limits of existing CAS, potentially enabling more direct routes, and reducing route conflictions, increasing capacity and resilience, and enabling more continuous climb/descent profiles to the benefit of environmental and economic performance. The use of additional CAS may impact the Military and GA/non-commercial/other civilian airspace users, however the impact is considered minor only.

Benefits

- Improved safety through the separation of traffic flows
- Reduction in CO_2 and fuel burn
- Reduction in controller and pilot workload
- Increased airspace resilience
- Increased airspace capacity
- Optimised interface with adjacent airspace
- Improved CCO/CDO by further separating arriving and departing aircraft

Issues

- Requires additional CAS
- Minor impact on Military and GA/non-commercial/other civilian airspace users operations
- Arrival route endpoints are not yet known

Design Principle Evaluation, see Annex D: Design Principle Evaluation, concluded that:

- 10 design principles were “MET”
- 4 design principles were “PARTIAL” (3 Med, 1 Low)
- 0 design principles were “NOT” met

Option 2: Arrival connectivity with new CAS is considered a promising candidate and has been PROGRESSED to the next stage.

6.5.7. Arrival Structures

The concept options for airport arrival structures seek to provide delay absorption structures for aircraft arriving at the MTMA airports: Manchester, Liverpool, Leeds Bradford, and East Midlands.

The options presented reflect the *type* of delay absorption structure, not the position; although where initial airport engagement has provided some information on the suitability of certain locations this is captured in each option.

6.5.7.1. Option 0: Baseline

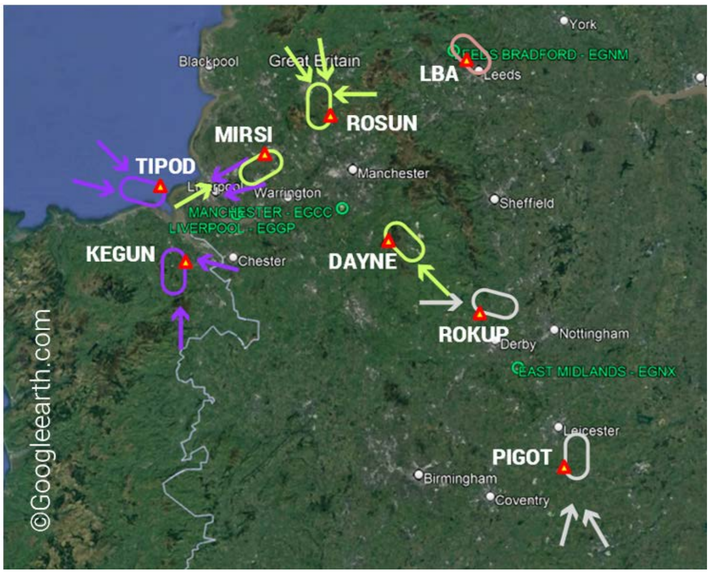

Figure 46: Geographic location of extant airport holds and associated traffic flows; Manchester (yellow), Liverpool (purple), Leeds Bradford (pink) and East Midlands (white).

A 'Do-Nothing' option representing the current day operation must be included and is used as the baseline against which all other options are compared.

Delay absorption structures, primarily holds, are included at the end of airport arrival procedures/routes to safely absorb the delay of aircraft which are unable to land or continue their flight. This could be as a result of delay (e.g., caused by airport capacity constraints), or unplanned events (e.g., aircraft emergency, runway closure, abnormal weather etc).

In the event of *predictable* delay, ATC endeavour to absorb this pre-departure and/or within the enroute phase of flight. Where it is not possible to do so, and in the case of an unplanned event, delay absorption structures are utilised closer to the airport.

The MTMA airports, Manchester, Liverpool, Leeds Bradford, and East Midlands, use the following radial holds, as shown in Figure 46:

- DAYNE (Manchester, FL70-140)
- MIRSI (Manchester, FL60 - 140)
- ROSUN (Manchester, FL70 -140)
- KEGUN (Liverpool, FL70 - 100)

- TIPOD (Liverpool, FL70 - 100)
- LBA (Leeds Bradford, FL80 – 120)
- ROKUP (East Midlands, FL80 - 140)
- PIGOT (East Midlands, FL80 - 140)

Radar data from 1-7 August 2022, a busy summer week, demonstrates that the DAYNE and MIRSI holds are both regularly utilised, ROSUN is less regularly used and KEGUN, TIPOD, LBA, ROKUP and PIGOT have only limited use, see Figure 47.

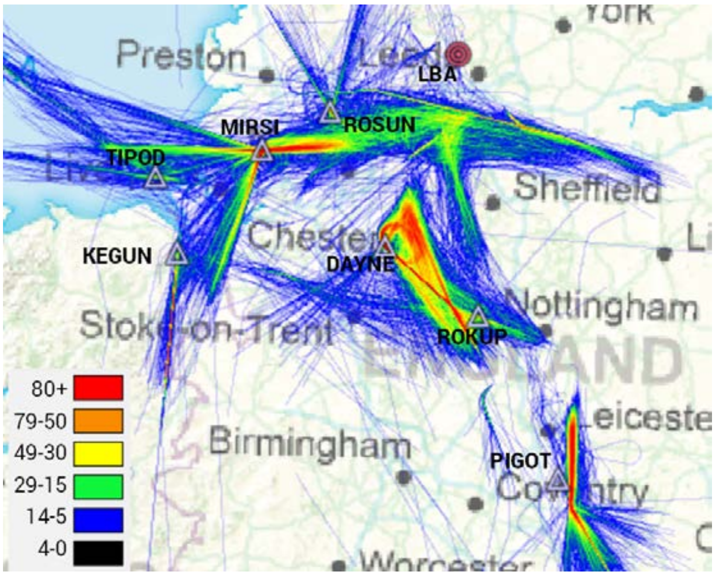

Figure 47: Flight density plot for Manchester, Liverpool, Leeds Bradford and East Midlands arrivals (5,500ft to FL145, Aug 1-7, 2022)

Manchester, Liverpool, Leeds Bradford and East Midlands airports are pursuing their own ACPs (ACP-2019-23, ACP-2015-09, ACP-2021-066 and ACP-2019-44, respectively), aligned with this submission, to update their low-level procedures. These changes are being undertaken in close collaboration, with each other and with NERL, to ensure that the airspace remains fully compatible.

Based on current traffic levels, there is limited requirement for holding in this airspace; therefore, it is considered that, in terms of capacity, the extant radial holds will likely support future growth in arrival demand.

The extant radial holds are compatible with the current lower airspace environment. However, until the airspace changes from the airport ACPs are defined, NERL is unable to determine if the existing holds are in the preferred hold locations.

Stakeholder feedback relevant to arrival structures is shown in Table 25.

Stakeholder	Feedback	Impact
Manchester airport	Currently traffic is delayed in the hold when EGGP are on a left-hand circuit.	The interaction between Manchester and Liverpool traffic flows will be considered in the options development.

Liverpool airport	Liverpool ACP design is considering not having a hold apart from contingency. Significant changes to the original design are not favoured.	NERL will consider the number and location of holds as part of the development of the holistic design considering stakeholder feedback and design requirements. Consideration will need to be given for how the release procedures will work if the number of holds (currently 2) is reduced from today.
Leeds Bradford airport	Currently the LBA hold is not used on a regular basis, e.g., only for weather etc.	Traffic demand and capacity of the holds will be considered in the options development.
East Midlands airport	Question – has a switch merge been considered	Switch merge is a variation on a Point Merge system which is considered in the linear delay absorption options.
Ryanair	PBN (RNAV/RNP) transition routings linking STARs to instrument approach procedures are beneficial; improve predictability, and crew situation awareness	This will be considered in the development of the design options.

Table 25: Stakeholder feedback received pertinent to arrival structures

For the full detailed analysis, see Annex D: Design Principle Evaluation.

Option 0: Baseline, the ‘Do-Nothing’ option, is **REJECTED** since it would bring no benefit and did not meet the progression requirements set for the Design Principle Evaluation.

6.5.7.2. Option 1: Radial holds

For Option 1, existing holds will be reviewed (with the intention of either keeping, amending, or removing them), and new radial holding structures will be introduced as required.

Radial holds are 'racetrack' type structures, with a pre-defined number of holding levels (separated by 1,000 ft, single aircraft occupancy) and a specified dimension, located over a holding fix. The holding fix can be on the ATS route or away from it and is reached by a STAR or flight plannable direct route (DCT).

MTMA airspace will benefit from the use of radial holds to absorb delay for arriving aircraft as needed. However, the location and number of radial holds is not yet known, and will be dependent on the design of the route network and the airport planned arrival and departure procedures.

Manchester, Liverpool, Leeds Bradford and East Midlands airports were provided with a set of indicative radial hold locations, see Figure 48 to Figure 51, and asked to provide feedback, see Table 26, on their suitability. Note: hold locations are illustrative and for visual effect only.

Manchester airport optimised existing radial holds and new radial holds (illustrative)

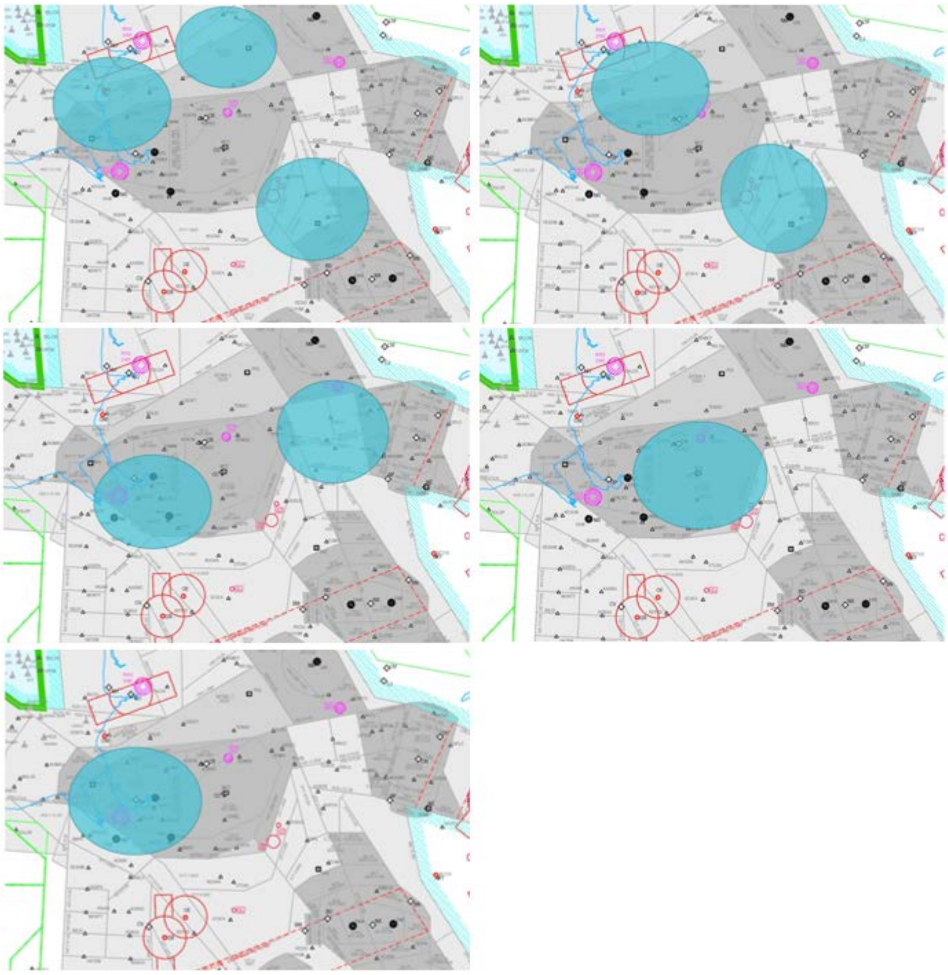

Figure 48: Adapted internal airspace map showing potential locations of optimised existing radial holds and new radial holds which could serve Manchester airport; in order top left to bottom right: optimised holds, north and south holds, east and west holds, overhead EGCC airport, overhead EGGP airport. Blue shape = illustrates a possible placement area for a radial hold.

Liverpool airport optimised existing radial holds and new radial holds (illustrative)

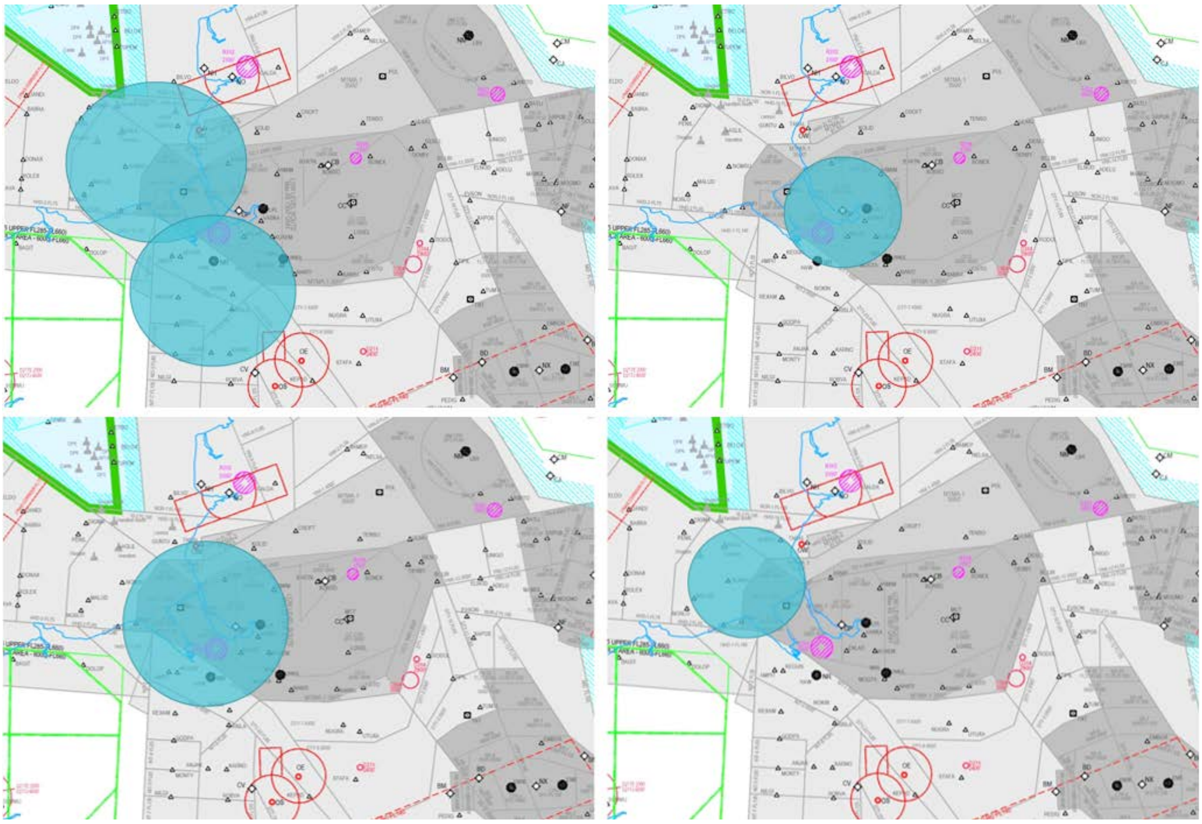

Figure 49: Adapted internal airspace map showing potential locations of optimised existing radial holds and new radial holds which could serve Liverpool airport; top left: optimised holds, top right: overhead the airport, bottom left: near the airport, bottom right: single contingency hold. Blue shape = illustrates a possible placement area for a radial hold.

Leeds Bradford airport optimised existing radial holds and new radial holds (illustrative)

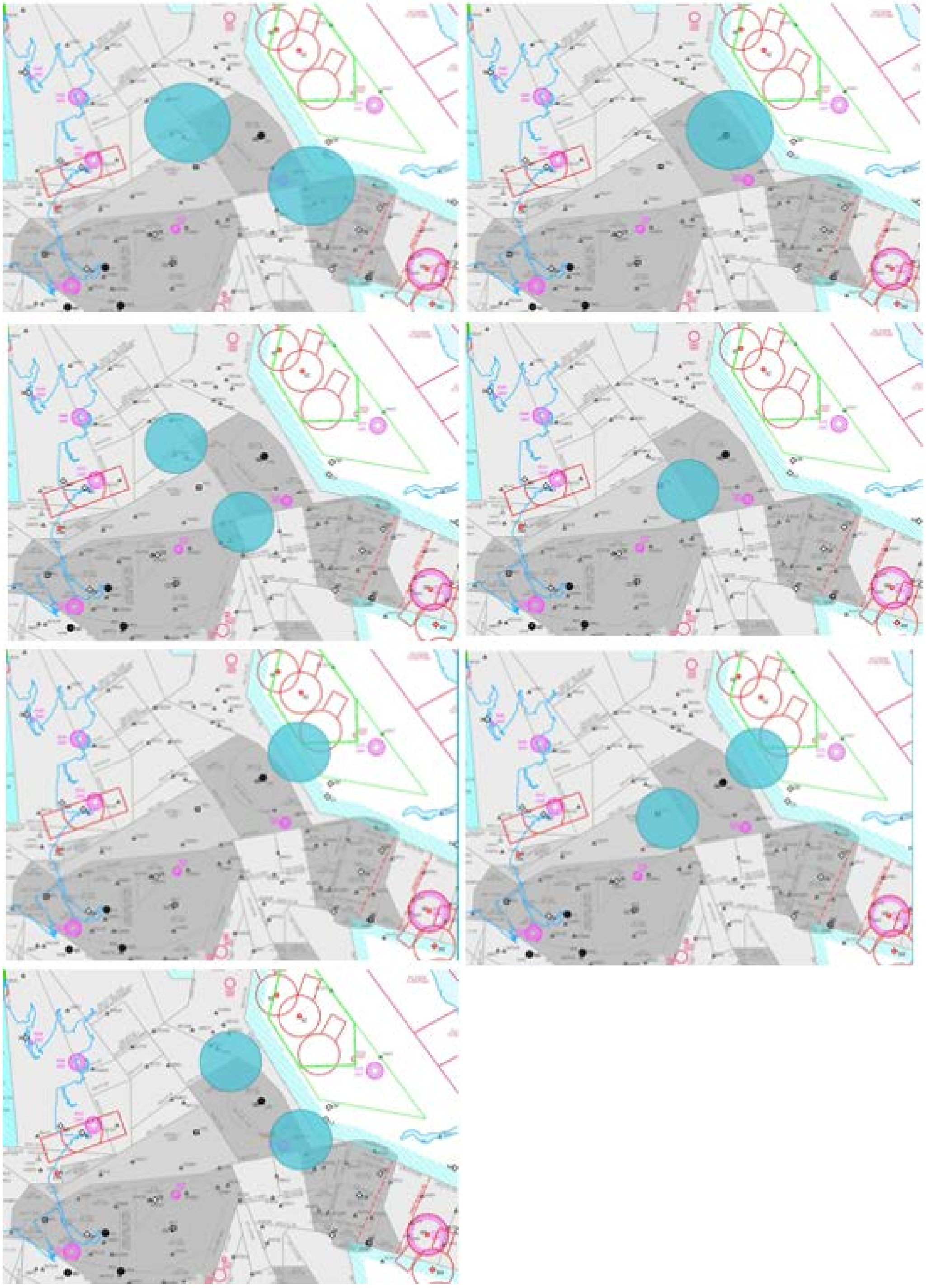

Figure 50: Adapted internal airspace map showing potential locations of optimised existing radial holds and new radial holds which could serve Leeds Bradford airport; in order top left to bottom right: northwest and southeast holds, published hold overhead the airport, northwest and southwest holds, west hold equidistant from both runways, east hold equidistant from both runways, east and west holds, holds at the end of each extended runway centreline. Blue shape = illustrates a possible placement area for a radial hold.

East Midlands airport optimised existing radial holds and new radial holds (illustrative)

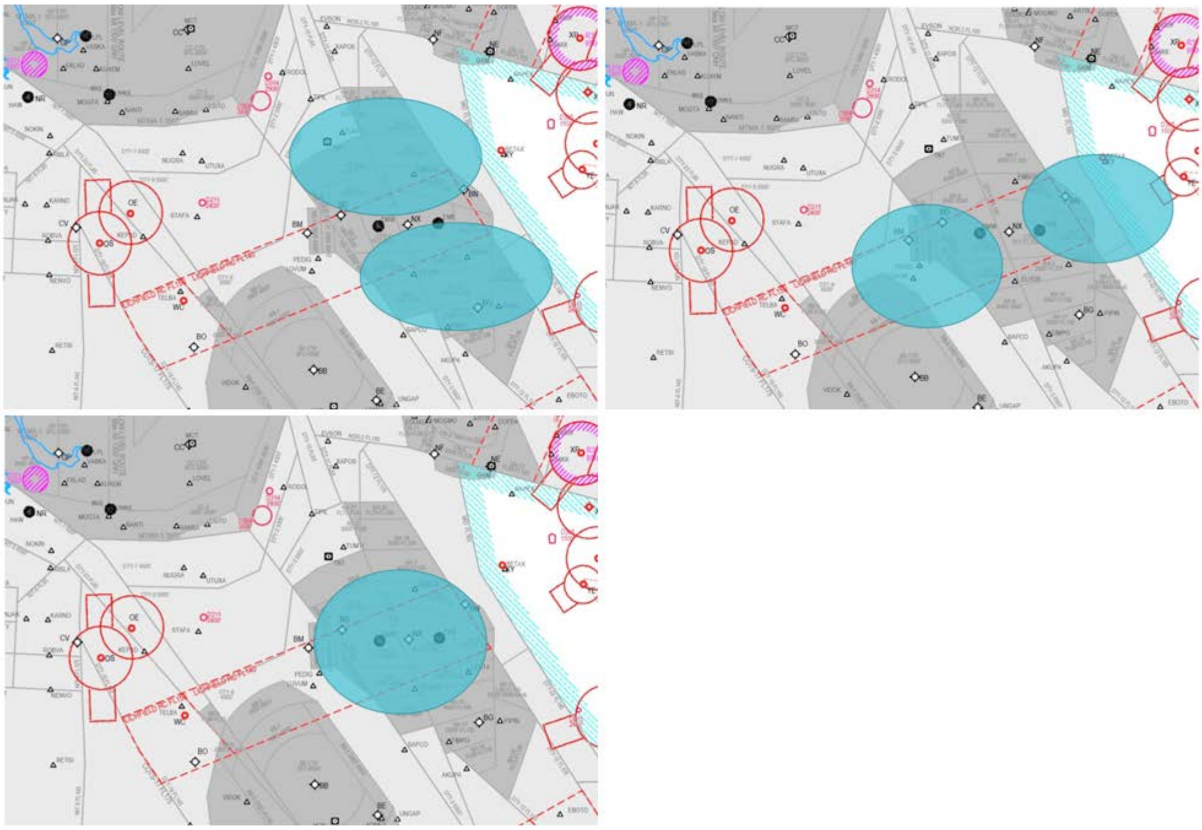

Figure 51: Adapted internal airspace map showing potential locations of optimised existing radial holds and new radial holds which could serve East Midlands airport; top left: north and south holds, top right: east and west holds, bottom left: overhead the airport. Blue shape = illustrates a possible placement area for a radial hold.

Stakeholder	Feedback	Impact
Leeds Bradford airport	Consider a hold on the western edge of the airspace and to the east of POL.	This will be considered in the developed design options.
easyJet	Comment that the proposals do not consider alternative holding/merge points.	At this stage, the design options are presented as high-level concepts only. Arrival structure design (e.g., location, type, level/s, direction) are not finalised and NERL welcomes further design discussions. The finalised arrival structure design will be dependent on the finalised ATS route design, and the airport departure and arrival procedures. NERL is in regular engagement with the airports to ensure that the designs proposed are compatible and optimised with the airports' known aspirations. More detail will be provided as the options are developed into a holistic design for consultation in Stage 3 of the CAP1616 process.

Table 26: Stakeholder feedback on potential optimised existing radial holds and new radial hold locations

Manchester, Liverpool, Leeds Bradford and East Midlands airports, in coordination with each other and NERL, are redesigning their low-level procedures. Until a better understanding exists of the airport departure and arrival procedures, it is not possible to determine the preferred hold location, ensuring alignment with both the enroute and the airport airspace changes. As such, preferred radial hold locations will be confirmed following the Stage 2 submissions as the concepts are developed into defined solutions for the Stage 3 consultation.

In Option 1, the potential to introduce new radial holds and/or optimise current holds could require increased CAS airspace to ensure they can be safely positioned for low level and enroute operations. This may impact Military and GA/non-commercial/other civilian airspace users operations, however NERL will seek to use the lowest classification applicable to the airspace.

Existing holds can be kept to maintain safety, or amended to enhance safety. An existing hold will not be removed unless it can be demonstrated safety is either maintained or improved. New radial holds could be designed (position and orientation) to reduce route conflictions resulting from aircraft routing to sub-optimal holding locations, thereby enhancing safety.

Existing radial holds could be realigned/relocated to create additional space for routes, and potentially reduce route confliction points, thereby increasing capacity and reducing controller workload. Additional delay absorption could be provided by new holds, designed in more optimal locations, providing additional capacity for airports arrivals.

In instances where there are arrival delays, revised/new radial holds would be more optimally located, potentially reducing track miles, and enabling improved economic and environmental performance compared to today.

Additionally, more optimal positioning/orientation of radial holds could deconflict arrival/departure traffic enabling more continuous profiles.

Conclusion

Optimised and new radial holds, could create additional space for routes, reduce route confliction points, enable more continuous profiles, and reduce track miles potentially improving capacity, environmental and economic performance, and reducing controller workload.

Benefits

- Improved safety
- Reduction in CO_2 and fuel burn for arrivals
- Reduction in controller workload
- Increased airspace resilience
- Increased airspace capacity
- Improved CCO/CDO through optimised radial hold locations
- Controller familiarity with radial holds

Issues

- Additional CAS required may impact Military and GA/non-commercial/other civilian airspace users operations
- Hold locations are not yet determined
- Sequencing is not as straightforward as a point merge/ trombone structure.

The Design Principle Evaluation, see Annex D: Design Principle Evaluation, concluded that:

- 10 design principles were “MET”
- 4 design principles were “PARTIAL” (3 Med, 1 Low)
- 0 design principles were “NOT” met

Option 1: Radial holds is considered a promising candidate and has been PROGRESSED to the next stage.

6.5.7.3. Option 2: New linear delay absorption structures

For Option 2, existing holds will be reviewed (with the intention of either keeping, amending, or removing them), and at least one new linear delay absorption structure will be introduced as required.

Linear delay absorption structures e.g., Point Merge and Trombone, see Figure 52, utilise PBN procedures in terminal areas, enabling controllers to sequence and merge arrivals without vectoring to simplify and enhance arrival operations, enable continuous descent operations, and maintain runway throughput.

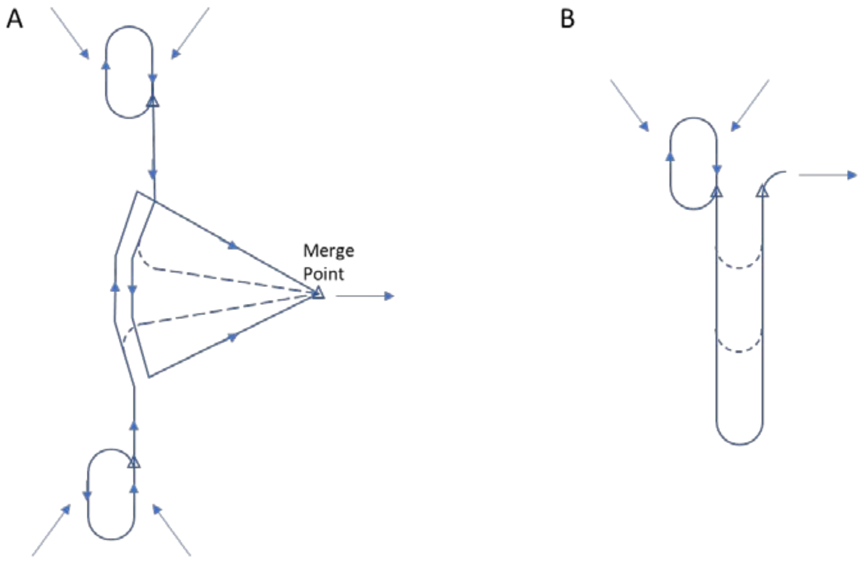

Figure 52: Examples of linear delay absorption structures. A- Point Merge structure, B- Trombone structure. Solid line represents planned route, dashed line represents indicative early turns to achieve spacing.

With these structures, arrivals on approach to the airport follow a defined PBN procedure. Trombone procedures replace typical vectoring patterns with a set of waypoints defined in the upwind, downwind, and final approach segments which, through controller (tactical) route changes, support path stretching/shortening for separation and spacing management as required. For Point Merge, this is similarly achieved along the sequencing legs, by controllers clearing aircraft to turn, once traffic permits, to the Merge Point. From the exit point, aircraft join the final approach via a fixed path, a transition, requiring minimal controller intervention. Without a transition, connecting the merge point to the end of the runway, the benefit of sequencing aircraft in this manner is limited.

Linear delay absorption structures provide a finite amount of delay absorption relative to their size, for instance larger structures take longer to fly the full procedure and therefore more delay without the need for resorting to other methods. A feature of these structures is the need to include radial holds at the entry points in order to provide safe contingency or extra delay absorption when the overall capacity of the structure is exceeded. The use of arrival management tools (AMAN or XMAN) to slow aircraft before they reach the structures can also ensure the capacity is not exceeded.

As such, with the current requirement to include a radial hold as part of the procedure, see the Policy for Point Merge and Trombone Transition Procedures (Ref 9), these structures can utilise excessively large airspace volumes, and design consideration is required to ensure they remain clear of departing aircraft or other airspace users.

Manchester, Liverpool, Leeds Bradford and East Midlands airports were provided with a set of indicative locations for optimised existing radial holds in conjunction with linear delay absorption structures, see Figure 53 to Figure 55, and asked to provide feedback, see Table 27 on their suitability. Note: locations are illustrative and for visual effect only.

Manchester airport optimised existing radial holds in conjunction with new linear delay absorption structures (illustrative)

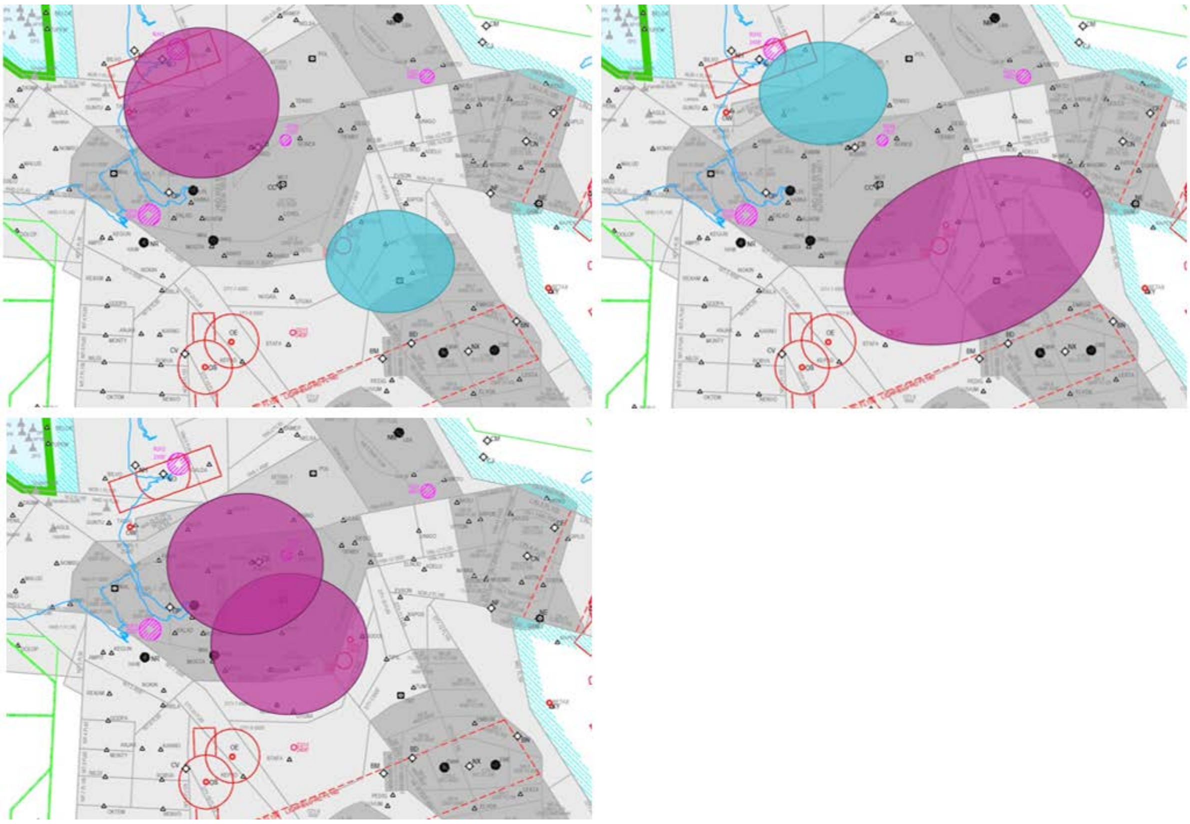

Figure 53: Adapted internal airspace map showing potential locations of optimised existing radial holds in conjunction with new linear delay absorption structures which could serve Manchester airport; top left: northerly Point Merge with 2 contingency holds and a single radial hold to the south, top right: southerly Point Merge with 2 contingency holds and a single radial hold to the north, bottom left: two Point Merges each with a contingency hold providing a switch merge system. Blue shape = illustrates a possible placement area for a radial hold. Purple shape = illustrates a possible placement area for a linear delay absorption structure, including contingency holds.

Liverpool airport optimised existing radial holds in conjunction with new linear delay absorption structures (illustrative)

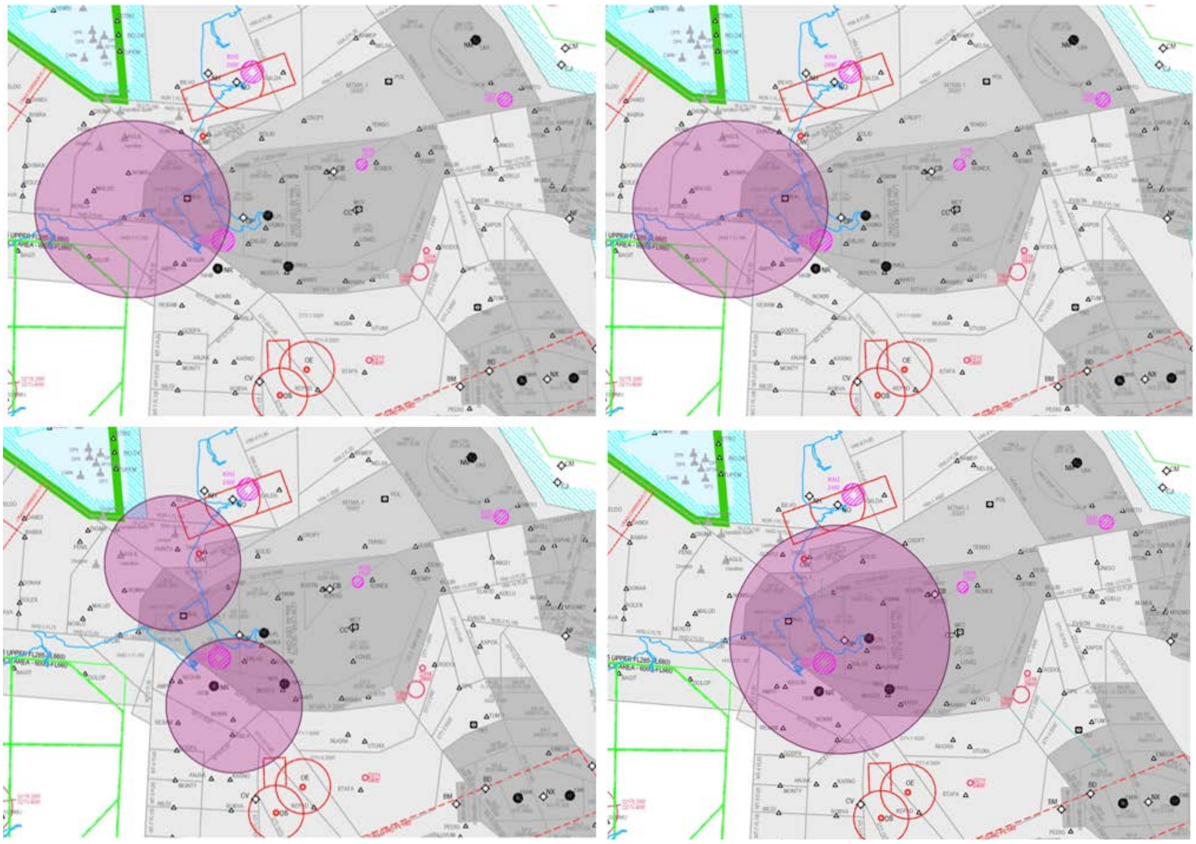

Figure 54: Adapted internal airspace map showing potential locations of optimised existing radial holds in conjunction with new linear delay absorption structures which could serve Liverpool airport; top left: Point Merge with 1 contingency hold, top right: Point Merge with 2 contingency holds, bottom left: two Point Merges each with a contingency hold, bottom right: Trombone with 2 contingency holds. Purple shape = illustrates a possible placement area for a linear delay absorption structure, including contingency holds.

Leeds Bradford airport optimised existing radial holds in conjunction with new linear delay absorption structures (illustrative)

No designs identified, as Leeds Bradford currently does not have any published holds at or above 7,000ft and therefore a new hold will need to be introduced.

East Midlands airport optimised existing radial holds in conjunction with new linear delay absorption structures (illustrative)

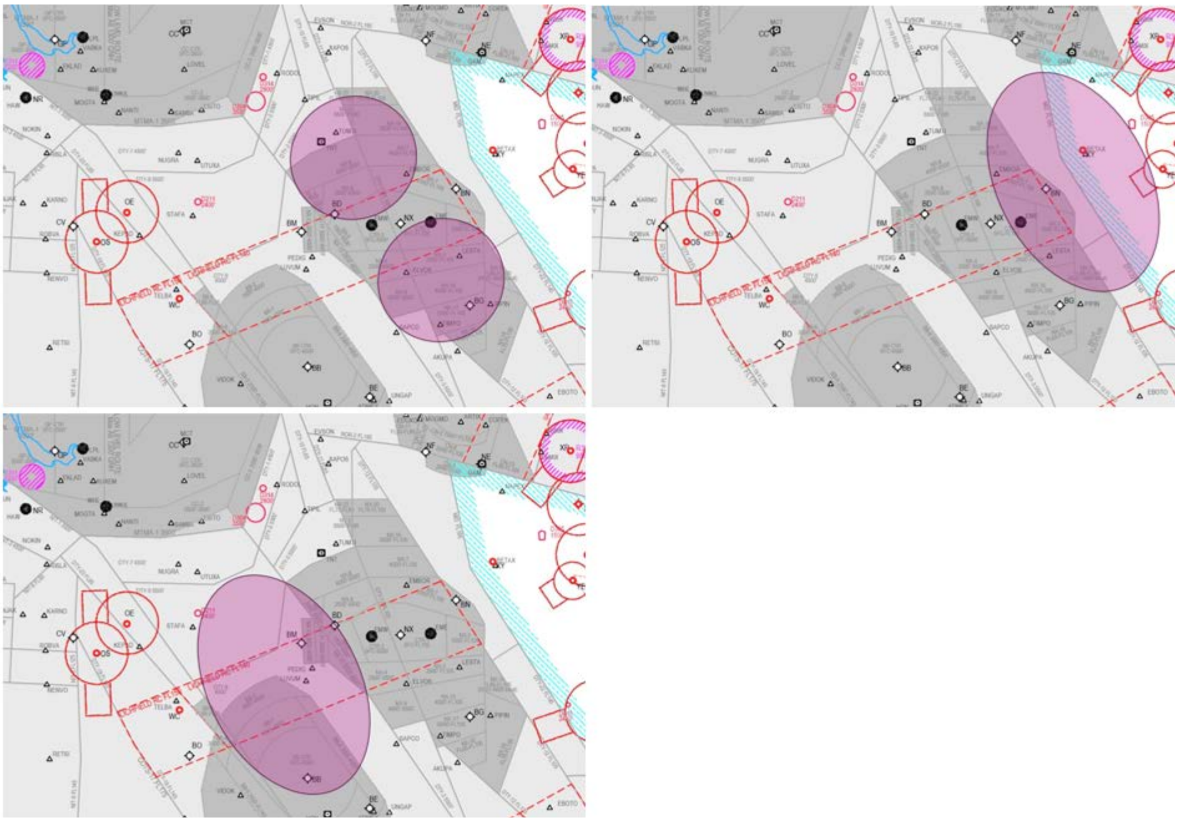

Figure 55: Adapted internal airspace map showing potential locations of optimised existing radial holds in conjunction with new linear delay absorption structures which could serve East Midlands airport; top left: northerly and southerly Point Merges each with a contingency hold, top right: easterly Point Merge with 2 contingency holds, bottom left: westerly Point Merge with 2 contingency holds. Purple shape = illustrates a possible placement area for a linear delay absorption structure, including contingency holds.

Stakeholder	Feedback	Impact
Jet2.com	Point Merge could be utilised during night hours to maximise arrival efficiency into East Midlands during high traffic demand at night.	This feedback has been used to help inform SME evaluation of DP8, DP9, and DP10.
Manchester airport	General concerns that Point Merge systems may take up too much airspace.	This feedback has been used to help inform SME evaluation of DP8, DP9, and DP10.

Jet2.com BA	Point Merge system to the South of Manchester airport may not be feasible due to congestion/conflicting traffic in the area	This feedback has been used to help inform SME evaluation of DP1, DP2, and DP3.
BA	General concerns that Point Merge systems can increase unpredictability and pilot workload with the use of direct routings to the merge point.	This feedback has been used to help inform SME evaluation of DP1, DP2, and DP3.
BAE Warton	Potential impact on how aircraft are presented to Warton (and Blackpool) as they route around the Point Merge; should this option be considered further, we would like to understand the likely impact.	This feedback has been used to help inform SME evaluation of DP5, DP6, DP8, DP9 and DP10.
easyJet	Comment that the proposals do not consider alternative holding/merge points.	At this stage, the design options are presented as high-level concepts only. Arrival structure design (e.g., location, type, level/s, direction) are not finalised and NERL welcomes further design discussions. The finalised arrival structure design will be dependent on the finalised ATS route design, and the airport departure and arrival procedures. NERL is in regular engagement with the airports to ensure that the designs proposed are compatible and optimised with the airports' known aspirations. More detail will be provided as the options are developed into a holistic design for consultation in Stage 3 of the CAP1616 process.
easyJet	Favour Point Merge for larger traffic volumes/airfields; recommendation for airfield feedback/input.	NERL is in regular engagement with the airports to ensure that the designs proposed are compatible and optimised with the airports' known aspirations. More detail will be provided as the options are developed into a holistic design for consultation in Stage 3 of the CAP1616 process.
Ryanair	For East Midlands airport, lateral holding facilities are not considered to be a workable solution.	This feedback has been used to help inform SME evaluation of DP5, and DP6.

Table 27: Stakeholder feedback on the locations of optimised existing radial holds in conjunction with new linear delay absorption structures

Linear delay absorption structures reduce the requirement for tactical vectoring, and improve the predictability of sequenced arrival flows, reducing controller and cockpit workload and improving situation awareness, thereby improving safety.

However, the transition procedures require traditional radial holds at the end of the STAR, see the Policy for Point Merge and Trombone Transition Procedures (Ref 9), to accommodate situations where 'delay is not determined'. Thus, the volume of airspace required for both the Point Merge/Trombone and the accompanying radial hold, would significantly limit the airspace available for the redesign and optimisation of routes, specifically, reducing the possibility of implementing systemised route structures in MTMA airspace.

This is most evident regarding the systemisation of arrivals and departures for Manchester, Liverpool, and East Midlands airports. Considering the current radial hold locations (DAYNE/ ROSUN/ MIRSI/ TIPOD/ KEGUN/ ROKUP/ PIGOT), and their proximity to the airports, it is viewed that multiple systemised/part-systemised routes could not be deployed at the same time as linear delay absorption structures in this airspace. As such, the benefits afforded by systemisation of the route network (i.e., improved safety, capacity, resilience, controller/pilot workload, and economic and environmental performance) would not be available with this option.

SMEs have identified that, given the complexity of the airspace surrounding the airports, any linear delay absorption structure would need to be located some distance away from the airports, potentially increasing track miles flown for arrivals, and would likely require increased CAS. As such, the location of these structures could significantly impact the Military, and GA/non-commercial/other civilian airspace users. It is noted that potentially the time-banded use of these structures could provide some level of mitigation (but not completely) for the negative impact on the wider aviation community.

In addition, the optimisation of departure profiles could potentially be limited by the requirement to remain deconflicted against the large volume of airspace needed for a linear delay absorption structure in this airspace.

Conclusion

Linear delay absorption structures reduce the requirement for tactical vectoring and improve the predictability of sequenced arrival flows, reducing controller and cockpit workload and improving situation awareness, and safety. However, this option would occupy a large volume of airspace, reducing the possibility of implementing systemised route structures in MTMA airspace, and limiting the optimisation of departure profiles. Additionally, the complexity of this airspace may require linear delay absorption structures to be located further out from the airports, increasing the track miles flown for arrivals. This option would require increased CAS, impacting Military, GA, non-commercial and other civilian airspace users.

Benefits

- Improved safety
- Reduction in controller workload
- Improved predictability

Issues

- Requires associated contingency radial holds which utilise a large area
- Not compatible with the implementation of systemised route structures in this airspace; the benefits afforded by systemisation of the route network (i.e., improved safety, capacity, resilience, controller/pilot workload, and economic and environmental performance) would not be available with this option
- Additional CAS required may impact Military and GA/non-commercial/other civilian airspace users' operations
- Increased track miles for arrivals
- Limits optimisation of departure profiles
- Hold locations are not yet determined

The Design Principle Evaluation, see Annex D: Design Principle Evaluation, concluded that:

- 4 design principles were "MET"

- 4 design principles were “PARTIAL” (3 High, 1 Low)
- 6 design principles were “NOT” met (6 Med)

Option 2: New linear delay absorption structures, is REJECTED since it did not meet the progression requirements set for the Design Principle Evaluation.

6.5.7.4. Option 3: New radial holds and new linear delay absorption structures

For Option 3, existing holds will be reviewed (with the intention of either keeping, amending, or removing them), and at least one new radial hold and one new linear delay absorption structure will be introduced as required.

Manchester, Liverpool, Leeds Bradford and East Midlands airports were provided with a set of indicative radial hold locations, see Figure 56 and Figure 57, and asked to provide feedback, see Table 28, on their suitability. Note: locations are illustrative and for visual effect only.

Manchester airport optimised existing radial holds in conjunction with new radial holds and new linear delay absorption structures (illustrative)

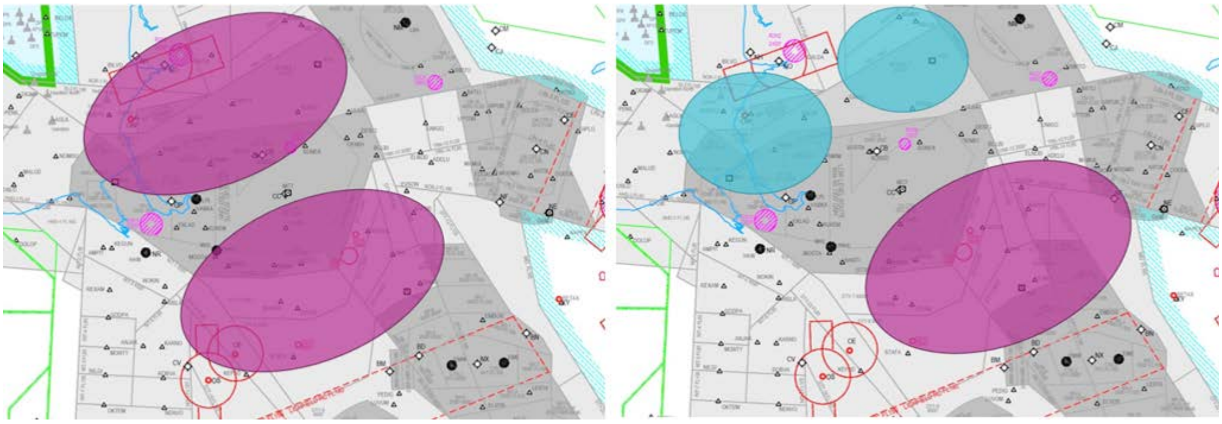

Figure 56: Adapted internal airspace map showing potential locations of optimised existing radial holds in conjunction with new radial holds and new linear delay absorption structures which could serve Manchester airport; left: northerly and southerly Point Merges each with 2 contingency holds, right: southerly Point Merge with two contingency holds and two radial holds to the north. Blue shape = illustrates a possible placement area for a radial hold. Purple shape = illustrates a possible placement area for a linear delay absorption structure, including contingency holds.

Liverpool airport optimised existing radial holds in conjunction with new radial holds and new linear delay absorption structures (illustrative)

Following engagement through collaborative options development sessions with Liverpool airport, no workable concepts have been identified under this option.

Leeds Bradford airport optimised existing radial holds in conjunction with new radial holds and new linear delay absorption structures (illustrative)

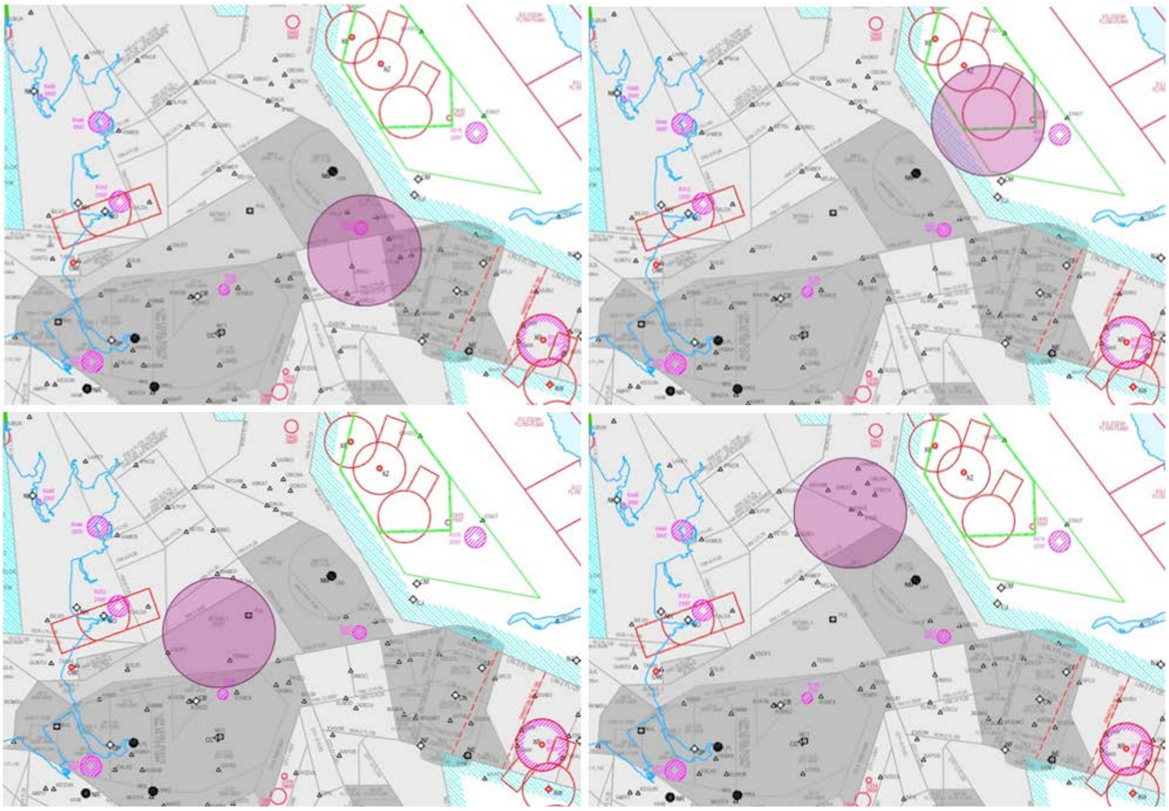

Figure 57: Adapted internal airspace map showing potential locations of optimised existing radial holds in conjunction with new radial holds and new linear delay absorption structures which could serve Leeds Bradford airport; top left: southerly Point Merge with either 1 or 2 contingency holds, top right: easterly Point Merge with either 1 or 2 contingency holds, bottom left: westerly Point Merge with either 1 or 2 contingency holds, bottom right: northerly Point Merge with either 1 or 2 contingency holds. Purple shape = illustrates a possible placement area for a linear delay absorption structure, including contingency holds.

East Midlands airport optimised existing radial holds in conjunction with new radial holds and new linear delay absorption structures (illustrative)

Following engagement through collaborative options development sessions with East Midlands airport, no workable concepts have been identified under this option

Stakeholder	Feedback	Impact
Manchester airport	General concerns that Point Merge systems may take up too much airspace.	This feedback has been used to help inform SME evaluation of DP8, DP9, and DP10.
Jet2.com BA	Point Merge system to the South of Manchester airport may not be feasible due to congestion/conflicting traffic in the area	This feedback has been used to help inform SME evaluation of DP1, DP2, and DP3.

BA	General concerns that Point Merge systems can increase unpredictability and pilot workload with the use of direct routings to the merge point.	This feedback has been used to help inform SME evaluation of DP1, DP2, and DP3.
BAE Warton	Potential impact on how aircraft are presented to Warton (and Blackpool) as they route around the Point Merge; should this option be considered further, we would like to understand the likely impact.	This feedback has been used to help inform SME evaluation of DP5, DP6, DP8, DP9 and DP10.
easyJet	Comment that the proposals do not consider alternative holding/merge points.	At this stage, the design options are presented as high-level concepts only. Arrival structure design (e.g., location, type, level/s, direction) are not finalised and NERL welcomes further design discussions. The finalised arrival structure design will be dependent on the finalised ATS route design, and the airport departure and arrival procedures. NERL is in regular engagement with the airports to ensure that the designs proposed are compatible and optimised with the airports' known aspirations. More detail will be provided as the options are developed into a holistic design for consultation in Stage 3 of the CAP1616 process.
easyJet	Favour Point Merge for larger traffic volumes/airfields; recommendation for airfield feedback/input.	NERL is in regular engagement with the airports to ensure that the designs proposed are compatible and optimised with the airports' known aspirations. More detail will be provided as the options are developed into a holistic design for consultation in Stage 3 of the CAP1616 process.
Ryanair	For East Midlands airport, lateral holding facilities are not considered to be a workable solution.	This feedback has been used to help inform SME evaluation of DP5, and DP6.

Table 28: Stakeholder feedback on the locations of optimised existing radial holds in conjunction with new radial holds and new linear delay absorption structures

The introduction of both new radial holds and new linear delay absorption structures in Option 3 will likely require substantial additional CAS.

The location of these structures could severely impact the surrounding airports, as well as significantly reducing the accessibility of airspace for the Military, and GA/non-commercial/other civilian airspace users.

The resulting complexity of the airspace and potential conflictions with adjacent traffic flows (including departures) limits the aforementioned benefits of introducing new radial holds (as discussed in Option 1) and amplifies the disbenefits of linear delay absorption structures (as discussed in Option 2) in this airspace.

Conclusion

The introduction of *both* new radial holds and new linear delay absorption structures, requires a large volume of airspace and therefore substantial additional CAS. The location of these structures could significantly impact surrounding airports, the Military, and GA/non-commercial/other civilian airspace users. In addition, this option may increase route conflictions and therefore the complexity of the airspace, increasing controller workload and reducing safety, capacity, and resilience.

Benefits

- Improved predictability

Issues

- Increased controller workload
- Reduced safety, capacity, and resilience
- Requires associated contingency radial holds which utilise a large area
- Not compatible with the implementation of systemised route structures in this airspace; the benefits afforded by systemisation of the route network (i.e., improved safety, capacity, resilience, controller/pilot workload, and economic and environmental performance) would not be available with this option
- Additional CAS required may impact Military and GA/non-commercial/other civilian airspace users' operations
- Increased track miles for arrivals
- Limits optimisation of departure profiles
- Hold locations are not yet determined

The Design Principle Evaluation, see Annex D: Design Principle Evaluation, concluded that:

- 2 design principles were "MET"
- 4 design principles were "PARTIAL" (3 High, 1 Low)
- 8 design principles were "NOT" met (2 High, 6 Med)

Option 3: New radial holds and new linear delay absorption structures, is REJECTED since it did not meet the progression requirements set for the Design Principle Evaluation.

7. Step 2A Conclusion and Next Steps

7.1. Design options presenting opportunities to modernise the airspace within scope of the MTMA ACP have been divided into those addressing the:

- Route network (split into 5 geographical elements)
- MTMA airport connectivity (at and above 7,000ft), including departures connectivity, arrivals connectivity, and arrival structures

7.2. We have engaged with our stakeholder audience, resulting in comprehensive discussions on the possibilities for the MTMA ACP airspace change.

7.3. This engagement has led to a comprehensive list of viable design options, presented as high-level concepts, which address the SoN (Ref 4) and align with the Design Principles (Ref 5) from Stage 1 of the CAP1616 Airspace Change Process.

7.4. The comprehensive list of design options has been illustrated within this document and developed through continued stakeholder feedback and engagement.

7.5. We have identified all viable options, noting that the Masterplan is a high-level coordinated implementation plan of a series of individual airspace design changes, that need to be developed in coordination to achieve the range of benefits that modernisation can deliver.

7.6. We also state that, at this stage, we have no reason to believe the indicative design options would not comply with the required technical criteria, once fully refined.

7.7. The design options have been evaluated against the Design Principles from Stage 1 of the CAP1616 Airspace Change Process, resulting in the following shortlist of options, see Table 29, which will be carried forward to Stage 2, Step 2B.

7.8. The overall timeline for this ACP is consistent with Iteration 2 of the Masterplan (Ref 6) for the regional cluster within which this ACP sits.

		Design Option	Description
Route Network	Northern Spine	Option 1: Systemised	Introduces systemised routes providing connectivity for Manchester TMA traffic routing to/from the ScTMA or NATEB (Newcastle). Additionally, connectivity may be required to, from, and between adjacent geographic elements.
		Option 2: Part-systemised	Introduces a mix of systemised routes and non-systemised routes providing connectivity for Manchester TMA traffic routing to/from the ScTMA or NATEB (Newcastle). Additionally, connectivity may be required to, from, and between adjacent geographic elements.
	Eastern Arm	Option 1: Systemised	Introduces a systemised airspace structure providing connectivity for Manchester TMA traffic routing to /from central Europe and Scandinavia. Additionally, connectivity may be required to, from and between adjacent geographical elements
		Option 2: Part-systemised	Introduces a mix of systemised airspace structures and non-systemised route structures providing connectivity for Manchester TMA traffic routing to /from central Europe and Scandinavia. Additionally, connectivity may be required to, from and between adjacent geographical elements.
	Southern Spine	Option 1: Systemised	Introduces a systemised airspace structure providing connectivity for Manchester TMA traffic which is routing to/from the southern ATS route network. Additionally, connectivity may be required to, from, and between adjacent geographic elements.
		Option 2: Part-systemised	Introduces a mix of a systemised airspace structures and non-systemised route structures providing connectivity for Manchester TMA traffic which is routing to/from the southern ATS route network. Additionally, connectivity may be required to, from, and between adjacent geographic elements.
	Western Arm	Option 1: Systemised	Extends the existing systemised airspace structures, providing connectivity for Manchester TMA traffic to route to/from Ireland and the southwest. Additionally, connectivity may be required to, from, and between adjacent geographic elements.
		Option 2: Part-systemised	Extends the existing systemised airspace structures and additionally introduce non-systemised route structures providing connectivity for Manchester TMA traffic to route to/from Ireland and the southwest. Additionally, connectivity may be required to, from, and between adjacent geographic elements.
	Central	Option 1: Route connectivity	Provides route connectivity to/from the Central geographic element and the surrounding geographic elements.
Airport Connectivity	Departure Connectivity	Option 1: Departure connectivity without new CAS	Provides departure connectivity from SID end points to the route network without requiring new CAS
		Option 2: Departure connectivity with new CAS	Provides departure connectivity from SID end points to the route network requiring new CAS

	Arrival Connectivity	Option 1: Arrival connectivity without new CAS	Provides arrival connectivity from the route network to airport arrival structures via STARs/arrival routes without requiring new CAS
		Option 2: Arrival connectivity with new CAS	Provides arrival connectivity from the route network to airport arrival structures via STARs/arrival routes requiring new CAS
	Arrival Structures	Option 1: Radial holds	Existing radial holds will be reviewed and kept, amended, or removed. Additional radial holding structures will be introduced where required.

Table 29: Shortlisted Design Options

8. Annex A: List of Stakeholders

Organisation	Notes
BAE Warton (Management and Operations)	
Birmingham Airport (Management and Operations)	
Blackpool Airport (Management and Operations)	
City Airport & Manchester Heliport (Barton) (Management and Operations)	
Doncaster Sheffield Airport (Management and Operations)	
East Midlands Airport (Management and Operations)	
Hawarden Airport (Management and Operations)	
Leeds Bradford Airport (Management and Operations)	
Leeds East (Management and Operations)	
Liverpool Airport (Management and Operations)	
Manchester Airport (Management and Operations)	
MoD DAATM (Defence Airspace and Air Traffic Management)	NERL Contact
Irish Aviation Authority	Non-targeted stakeholder
Cannock Chase	AONB
Clwydian Range and Dee Valley	AONB
Forest of Bowland	AONB
Peak District	National Park
Atlantic Airlines	Airline operators, as identified in Stage 1
British Airways Shuttle	Airline operators, as identified in Stage 1
easyJet	Airline operators, as identified in Stage 1
European Air Transport	Airline operators, as identified in Stage 1
Flybe	Airline operators, as identified in Stage 1
Jet2.com	Airline operators, as identified in Stage 1
Lufthansa	Airline operators, as identified in Stage 1
Ryanair	Airline operators, as identified in Stage 1
Thomas Cook Airlines	Airline operators, as identified in Stage 1 – ceased operations 2019
Thomson Airways	Airline operators, as identified in Stage 1
Wizz Air	Airline operators, as identified in Stage 1
Aircraft Owners and Pilot Association (AOPA)	Relevant organisation from the NATMAC distribution list
Airport Operators Group (AOG)	Relevant organisation from the NATMAC distribution list
Airlines UK	Relevant organisation from the NATMAC distribution list
Airport Operators Association (AOA)	Relevant organisation from the NATMAC distribution list
Airspace Change Organising Group (ACOG)	Relevant organisation from the NATMAC distribution list
Airspace4All	Relevant organisation from the NATMAC distribution list
Association of Remotely Piloted Aircraft Systems UK (ARPAS-UK)	Relevant organisation from the NATMAC distribution list
Aviation Environment Federation (AEF)	Relevant organisation from the NATMAC distribution list
British Airline Pilots Association (BALPA)	Relevant organisation from the NATMAC distribution list
British Airways (BA)	Relevant organisation from the NATMAC distribution list
British Balloon and Airship Club	Relevant organisation from the NATMAC distribution list
British Business and General Aviation Association (BBGA)	Relevant organisation from the NATMAC distribution list
British Gliding Association (BGA)	Relevant organisation from the NATMAC distribution list
British Hang Gliding and Paragliding Association (BHPA)	Relevant organisation from the NATMAC distribution list
British Helicopter Association (BHA)	Relevant organisation from the NATMAC distribution list

British Microlight Aircraft Association (BMAA) / General Aviation Safety Council (GASCo)	Relevant organisation from the NATMAC distribution list
British Model Flying Association (BMFA)	Relevant organisation from the NATMAC distribution list
British Skydiving	Relevant organisation from the NATMAC distribution list
Drone Major	Relevant organisation from the NATMAC distribution list
General Aviation Alliance (GAA)	Relevant organisation from the NATMAC distribution list
Guild of Air Traffic Control Officers (GATCO)	Relevant organisation from the NATMAC distribution list
Heavy Airlines	Relevant organisation from the NATMAC distribution list
Helicopter Club of Great Britain (HCGB)	Relevant organisation from the NATMAC distribution list
Honourable Company of Air Pilots (HCAP)	Relevant organisation from the NATMAC distribution list
Iprosurv	Relevant organisation from the NATMAC distribution list
Isle of Man CAA	Relevant organisation from the NATMAC distribution list
Light Aircraft Association (LAA)	Relevant organisation from the NATMAC distribution list
Low Fare Airlines	Relevant organisation from the NATMAC distribution list
PPL/ IR (Europe)	Relevant organisation from the NATMAC distribution list
UK Airprox Board (UKAB)	Relevant organisation from the NATMAC distribution list
UK Flight Safety Committee (UKFSC)	Relevant organisation from the NATMAC distribution list

9. Annex B: Glossary

AARA	Air to Air Refuelling Areas	Areas designated for the process of transferring aviation fuel from one aircraft to another
ACOG	Airspace Change Organising Group	ACOG's role is to coordinate the delivery of key aspects of the UK Government's Airspace Modernisation Strategy
ACP	Airspace Change Proposal	An Airspace Change Proposal is a request from a 'change sponsor', usually an airport or a provider of air navigation services (including air traffic control), to change the notified airspace design
agl	Above Ground Level	Vertical distance with reference to the ground.
AIP	Aeronautical Information Publication	A publication issued by or with the authority of a state and containing aeronautical information of a lasting character essential to air navigation.
AMP	Airspace Masterplan	The Masterplan identifies where airspace changes are needed to support the delivery of the Airspace Modernisation Strategy.
AMS	Airspace Modernisation Strategy	The strategy sets out the ends, ways and means of modernising airspace
ANSP	Air Navigation Service Provider	An Air Navigation Service Provider is an organisation that provides the service of managing the aircraft in flight or on the manoeuvring area of an airport and which is the legitimate holder of that responsibility.
AONB	Area of Outstanding Natural Beauty	An Area of Outstanding Natural Beauty is a designated exceptional landscape whose distinctive character and natural beauty are precious enough to be safeguarded in the national interest.
ATC	Air Traffic Control	Air traffic control is a service provided by ground-based air traffic controllers who direct aircraft on the ground and through a given section of controlled airspace and can provide advisory services to aircraft in non-controlled airspace.
ATCO	Air Traffic Control Officer	Air traffic Control Officers are personnel responsible for the safe, orderly, and expeditious flow of air traffic in the global air traffic control system
ATS	Air Traffic Services	An air traffic service (ATS) is a service which regulates and assists aircraft in real-time to ensure their safe operations.
BGA	British Gliding Association	The governing body for the sport of gliding in the UK.
CAA	Civil Aviation Authority	The Civil Aviation Authority oversees and regulates all aspects of civil aviation in the United Kingdom.
CAP1385	CAA Performance-based Navigation (PBN): Enhanced Route Spacing Guidance	Guidelines for the spacing requirements of UK ATS routes

CAP1616	CAA Airspace Change Process	The CAA's guidance on the regulatory process for changing the notified airspace design and planned and permanent redistribution of air traffic.
CAP1711	CAA Airspace Modernisation Strategy	See AMS.
CAS	Controlled Airspace	Generic term for the airspace in which an air traffic control service is provided as standard; note that there are different sub classifications of airspace that define the particular air traffic services available in defined classes of controlled airspace.
CCO	Continuous Climb Operations	Continuous Climb Operations is an aircraft operating technique facilitated by the airspace and procedures design and assisted by appropriate ATC procedures, allowing the execution of a flight profile optimised to the performance of aircraft, leading to significant economy of fuel and environmental benefits in terms of noise and emissions reduction.
CDO	Continuous Descent Operations	Continuous Descent Operations is an aircraft operating technique in which an arriving aircraft descends from an optimal position with minimum thrust and avoids level flight to the extent permitted by the safe operation of the aircraft and compliance with published procedures and ATC instructions.
CDR	Conditional Route	A Conditional Route is defined as non-permanent ATS route or portion thereof which can be planned and used under specified conditions.
CFMU	Central Flow Management Unit	Centralised air traffic flow management capability within Eurocontrol, providing, amongst other services, flight plan processing for Europe.
CO_2	Carbon Dioxide	A greenhouse gas produced by burning aviation fuel.
CTA	Control Area	A control area is a Controlled Airspace extending upwards from a specified limit above the earth.
DAATM	Defence Airspace Air Traffic Management	The DAATM is the MoD focal point for all Defence Airspace policy, including airspace related to the UK Low Flying.
DCT	Direct	(Direct) Waypoint to waypoint routing, which does not use an airway. DCT's are published in the RAD appendix 4
DfT	Department for Transport	The Department for Transport is the United Kingdom government department responsible for the English transport network and a limited number of transport matters in Scotland, Wales and Northern Ireland that have not been devolved.
DP	Design Principle	The Design Principles encompass the safety, environmental and operational criteria and strategic policy objectives that the change sponsor aims for in developing the airspace change proposal.

DVOR	Doppler VHF Omnidirectional Range	A Doppler VHF Omnidirectional Range is a ground-based Navigation Aid that allows the airborne receiving equipment to derive the magnetic bearing from the station to the aircraft.
EGCC	Manchester Airport	ICAO code for Manchester Airport
EGCN	Doncaster Sheffield Airport	ICAO code for Doncaster Sheffield Airport. Doncaster Sheffield airport ceased operations December 2022.
EGGP	Liverpool Airport	ICAO code for Liverpool Airport
EGNM	Leeds Bradford Airport	ICAO code for Leeds Bradford Airport
FAS	Future Airspace Strategy	A forerunner of the AMS
FASI	Future Airspace Strategy Implementation North	An airspace programme modernising airspace in the north of the UK
FIR	Flight Information Region	Flight Information Region (Airspace below FL255)
FL	Flight Level	A flight level (FL) is an aircraft's altitude at standard air pressure (1013 hPa), expressed in hundreds of feet.
FRA	Free Route Airspace	Free route airspace (FRA) is a specified airspace within which users may freely plan a route between a defined entry point and a defined exit point.
ft	feet	The standard measure for vertical distances used in air traffic control
GA	General Aviation	All civil aviation operations other than scheduled air services and non-scheduled air transport operations for remuneration or hire. The most common type of GA activity is recreational flying by private light aircraft and gliders, but it can range from paragliders and parachutists to microlights and private corporate jet flights.
hPa	Hectopascal	The Hectopascal is the international unit for measuring atmospheric or barometric pressure.
IFP	Instrument Flight Rules	Instrument Flight Rules are rules which allow properly equipped aircraft to be flown under instrument meteorological conditions.
LAA	Light Aircraft Association	A NATMAC member representing Light Aircraft users
LAC	London Area Control	The unit which manages the enroute traffic in the London Flight Information Region. This includes enroute airspace over England and Wales up to the Scottish border.
MoD	Ministry of Defence	Department responsible for implementing the defence policy set by His Majesty's Government, and the headquarters of the British Armed Forces
MTMA	Manchester TMA	TMA surrounding the Manchester group airports

NATMAC	National Air Traffic Management Advisory Committee	A group of organisations representing various users of the UK Airspace
NATS	UK ANSP	The UK's licenced air traffic service provider for the enroute airspace that connects our airports with each other, and with the airspace of neighbouring states. In addition, the air navigation service provider at various UK airports.
NERL	NATS En Route plc	See NATS
PBN	Performance Based Navigation	Performance Based Navigation is a generic term for modern standards for aircraft navigation capabilities including satellite navigation (as opposed to 'conventional' navigation standards).
RAD	Route Availability Document	The Route Availability Document is a flight-planning document.
RAF	Royal Air Force	United Kingdom's air and space force.
RAFAT	RAF Aerobatic Team	Aerobatics display team of the Royal Air Force based at RAF Waddington.
RC	Radar Corridor	Radar Corridors are routes that allow aircraft to cross controlled airspace with minimum disturbance to controllers and other aircraft.
SARG	Safety & Airspace Regulation Group	Drive UK civil aviation safety standards including overseeing aircraft, airlines, and air traffic controllers. Responsible for the planning and regulation of UK airspace.
ScAC	Scottish Area Control	The unit which manages the enroute traffic within the Scottish Flight Information Region.
ScTMA	Scottish Terminal Manoeuvring Area	TMA surrounding the Scottish group airports
SFC	Surface	Ground level or sea level
SID	Standard Instrument Departure	A Standard Instrument Departure is a published route with climb for aircraft to follow straight after take-off
SME	Subject Matter Expert	A subject-matter expert is a person who is an authority in a particular area or topic.
SoN	Statement of Need	The Statement of Need sets out what issue or opportunity an airspace change seeks to address.
STAR	Standard Arrival Route	A Standard Terminal Arrival Route is a published route for arriving traffic. In today's system these bring aircraft from the route network to the holds (some distance from the airport at high levels), from where they follow ATC instructions (see Vector) rather than a published route. Under PBN it is possible to connect the STAR to the runway via a Transition.

TA	Transition Altitude	The Transition Altitude is the altitude at or below which the vertical position of an aircraft is controlled by reference to altitudes.
TMA	Terminal Manoeuvring Area	A Terminal Manoeuvring Area is a Control Area normally established at the confluence of ATS Routes in the vicinity of one or more major aerodromes.
UIR	Upper Information Region	Upper Information Region (Airspace above FL245)

10. Annex C: Airspace Modernisation Strategy Alignment

AMS ref	Description	RAG	Notes
DfT + CAA Objectives Pg. 23	Create sufficient airspace capacity to deliver safe and efficient growth of commercial aviation	G	This ACP aims to deliver safe and efficient growth in capacity
DfT + CAA Objectives Pg. 23	Progressively reduce the noise of individual flights, through quieter operating procedures and, in situations where planning decisions have enabled growth which may adversely affect noise, require that noise impacts are considered through the airspace design process and clearly communicated	G	This ACP proposes changes to the enroute network which would only change flight paths at and above 7,000ft. As such, in accordance with the DfT altitude-based priorities, noise impacts are not prioritised.
DfT + CAA Objectives Pg. 23	Use the minimum volume of controlled airspace consistent with safe and efficient air traffic operations	G	The volume of airspace required will be balanced; where new CAS is required this would be minimised and where possible, CAS that is no longer required will be released.
DfT + CAA Objectives Pg. 23	In aiming for a shared and integrated airspace, facilitate safe and ready access to airspace for all legitimate classes of airspace users, including commercial traffic, General Aviation and the military, and new entrants such as drones and spacecraft	G	The airspace will be classified to support access to users as appropriate.
DfT + CAA Objectives Pg. 23	Not conflict with national security requirements (temporary or permanent) specified by the Secretary of State for Defence.	G	There is no conflict with national security requirements.
Stakeholders Affected Pg. 26	Passengers- Fewer flight delays and service disruptions at short notice will save time and improve the passenger experience. A more efficient airspace will increase capacity while continuing to improve current high safety standards, leading to better value, including consistent quality of service, and more choice.	G	This ACP aims to introduce more efficient airspace which will increase capacity while continuing to improve current high safety standards.
Stakeholders Affected Pg. 26	Aircraft Operators- the airspace structure is a key determinant of costs, punctuality and environmental performance. More direct and efficient flightpaths will mean lower costs for operators because they will save on fuel and be able to enhance the utilisation of their aircraft. Timely access to appropriate airspace is essential for the maintenance of military capability. Airspace modernisation must enable this while minimising impact on other users. Airspace modernisation is also expected to improve access to airspace for General Aviation, by enabling greater integration (rather than segregation) of different airspace user groups. The same is true for new airspace users such as drones and spacecraft.	G	This ACP aims to meet these objectives. Airline operators, the Military, GA, non-commercial and other airspace users have been continuously engaged with and positive feedback received.
Stakeholders Affected Pg. 26	Airports- the sharing of accurate flight information about traffic using our airspace is expected to improve runway throughput and resilience. Additional airspace capacity will provide airports with the scope to develop their operations in line with their business plans (subject to planning considerations). Enhanced technology combined with updated airspace design enables safe, expeditious and efficient management of increased traffic.	G	This ACP aims to meet these objectives. Improved capacity of the network airspace is a key objective. These designs have been developed in collaboration with the airports which will assist airports to develop their operations in line with their business plans.
Stakeholders Affected Pg. 26	UK Economy- efficiency and enhanced global connections and emerging aviation technologies can help drive growth.	G	This ACP aims to meet these objectives. Improved capacity, efficiency and reduced environmental

			impacts are all targets which will help the wider UK economy.
Stakeholders Affected Pg. 26	**Communities**- airspace modernisation offers environmental improvements because aircraft can climb sooner, descend more quietly and navigate more accurately around populated centres. In some areas, the increase in traffic can lead to an increase in noise, or the concentration of traffic can concentrate noise over a smaller area, which can reduce the areas in which noise is heard and offer the opportunity for respite routes. This means that not every community will benefit, so it is important that noise is managed as well as possible, in adherence to government policy. Airports should also consider whether they can develop airspace change proposals to reduce noise, i.e. to reduce the total adverse health effects of noise. Where aircraft are able to follow more fuel-efficient routes, wider society will also benefit because fewer CO_2 emissions will reduce greenhouse-gas (GHG) impacts.	G	This ACP aims to meet these objectives. Reduced environmental impacts are key targets. Improved airspace allowing CCO/CDOs aim to reduce CO_2 emissions and GHG impacts. The changes proposed are all above FL70 (not withstanding possible release of CAS) hence no significant noise impacts are anticipated.
Ends modernised airspace must deliver Pg. 51	**Safety**- maintaining a high standard of safety has priority over all other ends to be achieved by airspace modernisation	G	This ACP will maintain the high standard of safety.
Ends modernised airspace must deliver Pg. 51	**Efficiency**- consistent with the safe operation of aircraft, airspace modernisation should secure the most efficient use of airspace and the expeditious flow of traffic	G	This ACP aims to use the airspace efficiently to enable the expeditious flow of traffic.
Ends modernised airspace must deliver Pg. 51	**Integration**- airspace modernisation should satisfy the requirements of operators and owners of all classes of aircraft across the commercial, General Aviation and military sectors	G	This ACP aims to use the airspace efficiently to enable the expeditious flow of traffic, including all classes of aircraft across the commercial, General Aviation and military sectors.
Ends modernised airspace must deliver Pg. 51	**Environmental performance**- the interests of all stakeholders affected by the use of airspace should be taken into account when it is modernised, in line with guidance provided by the Government on environmental objectives, the Air Navigation Guidance 2017, which sets out how carbon emissions, air quality and noise should be considered	G	This ACP aims to be consistent with the objectives in ANG2017. The proposed airspace structures will aim to strike an appropriate balance in accordance with the environmental objectives as set out in the ANG 2017.
Ends modernised airspace must deliver Pg. 52	**Defence and security**- airspace modernisation should facilitate the integrated operation of air traffic services provided by or on behalf of the armed forces and take account of the interests of national security	G	This ACP aims to meet these objectives. Liaison with the MoD will ensure effective integration of the operation of air traffic services provided by or on behalf of the armed forces and take account of the interests of national security.
Ends modernised airspace must deliver Pg. 52	**International alignment**- airspace modernisation should take account of any international recommended practices or obligations related to the UK's air navigation functions, such as those from ICAO and the EU.	G	This ACP has considered all international recommended practices and obligations.
Ends modernised airspace must deliver Pg. 52	Airspace **must** enable growth	G	This ACP aims to enable future growth.

11. Annex D: Design Principle Evaluation

11.1. MTMA Design Options Assessment Matrix

ANNEX D - MTMA Options assessment matrix

DP	Priority	Quick Ref	Description	Suggested areas to consider (but not limited to)	Assessment means	Red	Amber	Green
1	High	**Safety**	The airspace will maintain or enhance current levels of Safety.	Safety risk	SME - subjective	Unacceptable level of safety risk	Diminished - Issue(s) identified could result in an elevated level of safety risk when compared to today's operation	Enhanced - improvement over today's level of safety. Maintained - safety risk could be maintained within acceptable levels of today's operation
2	High	**Operational**	The proposed airspace will maintain or enhance operational resilience of the ATC network.	Delay Absorption	SME - Subjective	Significant reduction in delay absorption	Minor reduction in delay absorption	Maintain or improve delay absorption
				Disruption Recovery	SME - Subjective	Major reduction in disruption recovery	Minor reduction in disruption recovery	Maintain or improve disruption recovery
3	High	**Operational**	The proposed airspace design will yield the greatest capacity benefits from systemisation. *(Note: The proposed airspace design should provide increased capacity and reduce delay. This could include the delivery of a suitable delay absorption mechanism or reducing departure intervals. Systemisation will minimise the need for ATC tactical intervention; for example, through better traffic management).*	Capacity	SME - Subjective	Design option unable to support the forecast traffic loading	Design option supports the forecast traffic loading but provides no capacity benefit	Design option supports the forecast traffic loading and increases capacity
				Controller Workload	SME - Subjective	Design option increases ATCO workload	No change or minor increase to ATCO workload	Design option decreases ATCO workload
4	High	**Technical**	The MTMA airspace design will provide a compatible and optimised interface between the lower level terminal airspace; the upper Free Route Airspace (FRA) and the ATS network. *(Note: The intent of this Design Principle is for the provision of a design that supports the systemisation of traffic flows: from low-level terminal traffic to high-level Free Route flows. The future design should effectively manage arrivals and departures within the TMA without impacting capacity).*	FRA compatibility	SME - Subjective	Option incompatible with FRA	Significant changes with FRA required for compatibility	Minimal or no changes required for compatibility with FRA
				ATS route network compatibility	SME - Subjective	Option incompatible with ATS route network	Significant changes with ATS route network required for compatibility	Minimal or no changes required for compatibility with ATS route network
				Lower level airspace compatibility	SME - Subjective	Option incompatible with lower level airspace	Significant changes with lower level airspace required for compatibility	Minimal or no changes required for compatibility with lower level airspace
5	Medium	**Economic**	The proposed MTMA airspace will facilitate optimised network economic performance. *(Note: Economic benefits could include environmental improvements such as reduced track mileage/ emissions or revenue from increased capacity/ route charges).*	Economic performance	SME - Subjective	Economic performance reduced	Economic performance as per today	Economic performance increased
6	Medium	**Environmental**	The proposed MTMA airspace will facilitate the reduction of CO2 emissions per flight.	CO2 emissions	SME - Subjective	CO_2 emissions increased	CO_2 emissions as per today	CO_2 emissions reduced
7	Low	**Environmental**	Minimise environmental impacts to stakeholders on the ground. *(Note: network changes are >7,000ft, the position of the interface with the airport's lower level routes will be determined by the airport, hence impacts below 7,000ft will be addressed in the separate airport-sponsored ACP).*	Noise impact	SME - Subjective	Increase in noise impacts below 7000ft	Change, but no net detrimental impacts on noise below 7000ft	No change in noise impacts below 7000ft
8	Medium	**Operational**	The MTMA airspace should be compatible with the requirements of the MoD and take into consideration the requirements of the defence industry stakeholders. *(Note: Consider where impacts might be greatest by considering Military-use areas against placement of airspace structures).*	Military use of airspace	SME - Subjective	Major impact or safety critical impact	Minor impact and not safety critical	No impact or positive impact
9	Medium	**Operational**	The impacts on GA, non-commercial and other civilian airspace users due to MTMA should be minimised. *(Note: Consider where impacts might be greatest by considering known VFR significant areas against placement of airspace structures. This includes a wide variety of airspace users such as emergency, recreational, training and sport aviation)*.	Other (non-commercial, non Military) use of airspace	SME - Subjective	Major impact or safety critical impact	Minor impact and not safety critical	No impact or positive impact
10	Medium	**Technical**	The classification and volume of controlled airspace required for the MTMA should be the minimum necessary to deliver an efficient airspace design, taking into account the needs of UK airspace users. *(Note: This may include releasing CAS as appropriate).*	CAS volume	SME - Subjective	Major reduction in accessibility of airspace for airspace users	No change or minor reduction in accessibility of airspace for airspace users	Improved accessibility of airspace for airspace users
11	High	**Technical**	The route network linking Airport procedures with the enroute phase of flight will be spaced to yield maximum safety, capacity and efficiency benefits by using an optimal standard of PBN. *(Note: Where appropriate, the use of RNP should be considered if the fleet mix can support it)*.	PBN standard	SME - Subjective	Reduced PBN standard compared to today's operation	PBN standard as per today's operation	Increased PBN standard compared to today's operation
12	High	**Technical**	The MTMA airspace design will provide a compatible and optimised interface with London Airspace Modernisation Programme (LAMP) design. *(Note: Closely spaced routes across the interface)*	LAMP interface	SME - Subjective	Option incompatible with LAMP design	Significant changes required for LAMP design compatibility	Minimal or no changes required for compatibility with LAMP design
13	High	**Policy**	Must accord with the CAA's published Airspace Modernisation Strategy (CAP1711) and any current or future plans associated with it. *(Note: The CAA have stated that this DP is required by all change sponsors. CAP1711 describes what airspace modernisation must deliver including: - the need to increase aviation capacity; - growth to be sustainable; - the need to maximise the utilisation of existing runway capacity).*	No/Limited: compatibility with fewer than 1/3 of AMS aims Partial: compatibility with 1/3 - 2/3 of AMS aims Aligned: compatibility with greater than 2/3 of AMS aims	SME - Subjective	No or limited alignment with the AMS	Partial alignment with the AMS	Aligned with the AMS
14	Medium	**Environmental**	The airspace should introduce improved Continuous Climb Operations (CCO) and Continuous Descent Operations (CDO) for all aircraft. *(Note: This Design Principle includes enabling continuous operations below 7,000ft, where possible).*	Aircraft profiles	SME - Subjective Airline Operator Feedback	Negative impact on CCO and CDO compared with today	CCO and CDO as per today	Positive impact on CCO and CDO

11.2. Northern Spine DPE

Northern Spine

Northern Spine Conclusion and Shortlist

The design principle evaluation of each design option presented on the previous pages and are summarised in the table below.

Design Principle / Option Name:	Option 0: Baseline (Do Nothing)	Option 1: Systemised	Option 2: Part-systemised	Option 3: Most direct	Option 4: Bi-directional
Accept / Reject	REJECT	Accept & Progress	Accept & Progress	REJECT	REJECT
Design Principle 1: Safety High The airspace will maintain or enhance current levels of Safety.	MET	MET	MET	PARTIAL	PARTIAL
Design Principle 2: Operational High The proposed airspace will maintain or enhance operational resilience of the ATC network.	MET	MET	MET	NOT	NOT
Design Principle 3: Operational High The proposed airspace design will yield the greatest capacity benefits from systemisation. (Note: The proposed airspace design should provide increased capacity and reduce delay. This could include the delivery of a suitable delay absorption mechanism or reducing departure intervals. Systemisation will minimise the need for ATC tactical intervention; for example, through better traffic; management).	NOT	MET	MET	NOT	NOT
Design Principle 4: Technical High The MTMA airspace design will provide a compatible and optimised interface between the lower level terminal airspace; the upper Free Route Airspace (FRA) and the ATS network. (Note: The intent of this Design Principle is for the provision of a design that supports the systemisation of traffic flows: from low-level terminal traffic to high-level Free Route flows. The future design should effectively manage arrivals and departures within the TMA without impacting capacity).	MET	PARTIAL	MET	MET	NOT
Design Principle 5: Economic Medium The proposed MTMA airspace will facilitate optimised network economic performance. (Note: Economic benefits could include environmental improvements such as reduced track mileage/ emissions or revenue from increased capacity/ route charges).	PARTIAL	MET	MET	MET	MET
Design Principle 6: Environmental Medium The proposed MTMA airspace will facilitate the reduction of CO2 emissions per flight.	PARTIAL	MET	MET	MET	MET
Design Principle 7: Environmental Low Minimise environmental impacts to stakeholders on the ground. (Note: network changes are >7,000ft, the position of the interface with the airport's lower level routes will be determined by the airport, hence impacts below 7,000ft will be addressed in the separate airport-sponsored ACP).	MET	MET	MET	MET	MET
Design Principle 8: Operational Medium The MTMA airspace should be compatible with the requirements of the MoD and take into consideration the requirements of the defence industry stakeholders. (Note: Consider where impacts might be greatest by considering Military-use areas against placement of airspace structures).	MET	PARTIAL	PARTIAL	NOT	NOT
Design Principle 9: Operational Medium The impacts on GA, non-commercial and other civilian airspace users due to MTMA should be minimised. (Note: Consider where impacts might be greatest by considering known VFR significant areas against placement of airspace structures. This includes a wide variety of airspace users such as emergency, recreational, training and sport aviation).	MET	PARTIAL	PARTIAL	PARTIAL	PARTIAL
Design Principle 10: Technical Medium The classification and volume of controlled airspace required for the MTMA should be the minimum necessary to deliver an efficient airspace design, taking into account the needs of UK airspace users. (Note: This may include releasing CAS as appropriate).	PARTIAL	MET	MET	PARTIAL	PARTIAL
Design Principle 11: Technical High The route network linking Airport procedures with the enroute phase of flight will be spaced to yield maximum safety, capacity and efficiency benefits by using an optimal standard of PBN. (Note: Where appropriate, the use of RNP should be considered if the fleet mix can support it).	PARTIAL	MET	MET	MET	MET
Design Principle 12: Technical High The MTMA airspace design will provide a compatible and optimised interface with London Airspace Modernisation Programme (LAMP) design. (Note: Closely spaced routes across the interface)	MET	MET	MET	MET	MET
Design Principle 13: Policy High Must accord with the CAA's published Airspace Modernisation Strategy (CAP1711) and any current or future plans associated with it. (Note: The CAA have stated that this DP is required by all change sponsors. CAP1711 describes what airspace modernisation must deliver including: - the need to increase aviation capacity; - growth to be sustainable; - the need to maximise the utilisation of existing runway capacity).	NOT	MET	MET	NOT	NOT
Design Principle 14: Environmental Medium The airspace should introduce improved Continuous Climb Operations (CCO) and Continuous Descent Operations (CDO) for all aircraft. (Note: This Design Principle includes enabling continuous operations below 7,000ft, where possible).	PARTIAL	MET	MET	NOT	NOT

Progression criteria: Options having any High Design Principles which are 'NOT' met (red) or 2 or more Medium Design Principles 'NOT' met or greater than 5 Design Principles 'PARTIAL' met have been rejected.

Next Steps

Option 1 Systemised and Option 2 Part-systemised will be formally appraised under the Stage 2, Step 2B Options Appraisal (Phase 1 Initial), including Safety Assessment.

NATS

Northern Spine

Option 0: Baseline (Do Nothing)	REJECT	Assessment matrix ref
This option represents the existing airspace design, i.e. The "Do-Nothing" option. Keep everything as it is currently		
Design Principle 1: Safety High The airspace will maintain or enhance current levels of Safety. No change to the current level of safety.	MET	Enhanced - improvement over today's level of safety. Maintained - safety risk could be maintained within acceptable levels of today's operation
Design Principle 2: Operational High The proposed airspace will maintain or enhance operational resilience of the ATC network. No change to the current level of delay absorption or disruption recovery	MET	Maintain or improve delay absorption
Design Principle 3: Operational High The proposed airspace design will yield the greatest capacity benefits from systemisation. (Note: The proposed airspace design should provide increased capacity and reduce delay. This could include the delivery of a suitable delay absorption mechanism or reducing departure intervals. Systemisation will minimise the need for ATC tactical intervention; for example, through better traffic; management). The current airspace is near to operating at full capacity and unable to absorb future traffic growth.	NOT	Design option unable to support the forecast traffic loading
Design Principle 4: Technical High The MTMA airspace design will provide a compatible and optimised interface between the lower level terminal airspace; the upper Free Route Airspace (FRA) and the ATS network. (Note: The intent of this Design Principle is for the provision of a design that supports the systemisation of traffic flows: from low-level terminal traffic to high-level Free Route flows. The future design should effectively manage arrivals and departures within the TMA without impacting capacity). The current airspace supports connectivity with lower level airspace, FRA and the ATS network. Changes to any of these environments will need to be designed to interface as appropriate to the existing airspace design.	MET	Minimal or no changes required for compatibility with FRA
Design Principle 5: Economic Medium The proposed MTMA airspace will facilitate optimised network economic performance. (Note: Economic benefits could include environmental improvements such as reduced track mileage/ emissions or revenue from increased capacity/ route charges). No change, no impact.	PARTIAL	Economic performance as per today
Design Principle 6: Environmental Medium The proposed MTMA airspace will facilitate the reduction of CO2 emissions per flight. No change, no impact.	PARTIAL	CO2 emissions as per today
Design Principle 7: Environmental Low Minimise environmental impacts to stakeholders on the ground. (Note: network changes are >7,000ft, the position of the interface with the airport's lower level routes will be determined by the airport, hence impacts below 7,000ft will be addressed in the separate airport-sponsored ACP). No change, no impact.	MET	No change in noise impacts below 7000ft
Design Principle 8: Operational Medium The MTMA airspace should be compatible with the requirements of the MoD and take into consideration the requirements of the defence industry stakeholders. (Note: Consider where impacts might be greatest by considering Military-use areas against placement of airspace structures). No change to impact the current operation; however it is noted that as traffic levels increase, ATC ability to provide crossing clearance for CAS may, in the future, become reduced.	MET	No impact or positive impact
Design Principle 9: Operational Medium The impacts on GA, non-commercial and other civilian airspace users due to MTMA should be minimised. (Note: Consider where impacts might be greatest by considering known VFR significant areas against placement of airspace structures. This includes a wide variety of airspace users such as emergency, recreational, training and sport aviation). No change to impact the current operation; however it is noted that as traffic levels increase, ATC ability to provide crossing clearance for CAS may, in the future, become reduced.	MET	No impact or positive impact
Design Principle 10: Technical Medium The classification and volume of controlled airspace required for the MTMA should be the minimum necessary to deliver an efficient airspace design, taking into account the needs of UK airspace users. (Note: This may include releasing CAS as appropriate). The CTA classifications and bases of CAS in this region are considered disproportionately restrictive.	PARTIAL	No change or minor reduction in accessibility of airspace for airspace users
Design Principle 11: Technical High The route network linking Airport procedures with the enroute phase of flight will be spaced to yield maximum safety, capacity and efficiency benefits by using an optimal standard of PBN. (Note: Where appropriate, the use of RNP should be considered if the fleet mix can support it). No change to current RNAV standards; the existing ATS routes are RNAV5 non-systemised routes.	PARTIAL	PBN standard as per today's operation
Design Principle 12: Technical High The MTMA airspace design will provide a compatible and optimised interface with London Airspace Modernisation Programme (LAMP) design. (Note: Closely spaced routes across the interface) LAMP interface is not applicable for the Northern element.	MET	Minimal or no changes required for compatibility with LAMP design
Design Principle 13: Policy High Must accord with the CAA's published Airspace Modernisation Strategy (CAP1711) and any current or future plans associated with it. (Note: The CAA have stated that this DP is required by all change sponsors. CAP1711 describes what airspace modernisation must deliver including: - the need to increase aviation capacity; - growth to be sustainable; - the need to maximise the utilisation of existing runway capacity). Demonstrates alignment with fewer than 1/3 of the aims as set out in the AMS.	NOT	No or limited alignment with the AMS
Design Principle 14: Environmental Medium The airspace should introduce improved Continuous Climb Operations (CCO) and Continuous Descent Operations (CDO) for all aircraft. (Note: This Design Principle includes enabling continuous operations below 7,000ft, where possible). No change, no impact.	PARTIAL	CCO and CDO as per today

Conclusion:	Option 0: Baseline (Do Nothing) represents no change to the existing airspace design. 2 DPs (priority HIGH) were 'NOT' met, hence this option was REJECTED and will not be progressed.

Northern Spine

Option 1: Systemised	Accept & Progress	Assessment matrix ref
Option 1 will look to introduce systemised routes providing connectivity for Manchester TMA traffic routing to/from the ScTMA or NATEB (Newcastle). Additionally, connectivity may be required to, from, and between adjacent geographic elements.		
Design Principle 1: Safety High The airspace will maintain or enhance current levels of Safety. Systemised routes provide separation by route design for arrival, departure and overflight flows. This reduces route conflictions and the requirement for tactical separation management and may improve operational safety.	MET	Enhanced - improvement over today's level of safety. Maintained - safety risk could be maintained within acceptable levels of today's operation
Design Principle 2: Operational High The proposed airspace will maintain or enhance operational resilience of the ATC network. Systemised routes, separated by design, provide more efficient use of the airspace, increased capacity and predictability of the traffic flows and reduced ATC and pilot workload, potentially improving delay absorption and disruption recovery.	MET	Maintain or improve delay absorption
Design Principle 3: Operational High The proposed airspace design will yield the greatest capacity benefits from systemisation. (Note: The proposed airspace design should provide increased capacity and reduce delay. This could include the delivery of a suitable delay absorption mechanism or reducing departure intervals. Systemisation will minimise the need for ATC tactical intervention; for example, through better traffic; management). Systemised routes, separated by design, provide more efficient use of the airspace, increased capacity and predictability of the traffic flows and reduced ATC and pilot workload, supporting future traffic growth.	MET	Design option supports the forecast traffic loading and increases capacity
Design Principle 4: Technical High The MTMA airspace design will provide a compatible and optimised interface between the lower level terminal airspace; the upper Free Route Airspace (FRA) and the ATS network. (Note: The intent of this Design Principle is for the provision of a design that supports the systemisation of traffic flows: from low-level terminal traffic to high-level Free Route flows. The future design should effectively manage arrivals and departures within the TMA without impacting capacity). The systemisation concept does not provide the flexibility required to maximise the efficiency of the interface with FRA, the ATS route network and the lower airspace environment. Note: systemised routes do not support bi-directional entry/exit points.	PARTIAL	Significant changes with FRA required for compatibility
Design Principle 5: Economic Medium The proposed MTMA airspace will facilitate optimised network economic performance. (Note: Economic benefits could include environmental improvements such as reduced track mileage/ emissions or revenue from increased capacity/ route charges). Systemisation enables reduced tactical intervention, and therefore supports a potential reduction in unplanned track miles and improved economic performance compared to today.	MET	Economic performance increased
Design Principle 6: Environmental Medium The proposed MTMA airspace will facilitate the reduction of CO2 emissions per flight. Systemisation enables reduced tactical intervention, and therefore supports a potential reduction in unplanned track miles and improved environmental performance compared to today.	MET	CO2 emissions reduced
Design Principle 7: Environmental Low Minimise environmental impacts to stakeholders on the ground. (Note: network changes are >7,000ft, the position of the interface with the airport's lower level routes will be determined by the airport, hence impacts below 7,000ft will be addressed in the separate airport-sponsored ACP). No change below 7000ft.	MET	No change in noise impacts below 7000ft
Design Principle 8: Operational Medium The MTMA airspace should be compatible with the requirements of the MoD and take into consideration the requirements of the defence industry stakeholders. (Note: Consider where impacts might be greatest by considering Military-use areas against placement of airspace structures). No expected impact on CAS crossing opportunities. This concept could require increased CAS and may impact the Military. Note: We will seek to use the lowest classification applicable to the airspace. No SUAs are likely to be impacted and adherence to the SUA buffer policy will be maintained.	PARTIAL	Minor impact and not safety critical
Design Principle 9: Operational Medium The impacts on GA, non-commercial and other civilian airspace users due to MTMA should be minimised. (Note: Consider where impacts might be greatest by considering known VFR significant areas against placement of airspace structures. This includes a wide variety of airspace users such as emergency, recreational, training and sport aviation). This concept could require increased CAS and might impact the GA, non commercial and other civilian airspace users, although generally they fly at lower levels underneath CAS. We will seek to use the lowest classification applicable to the airspace.	PARTIAL	Minor impact and not safety critical
Design Principle 10: Technical Medium The classification and volume of controlled airspace required for the MTMA should be the minimum necessary to deliver an efficient airspace design, taking into account the needs of UK airspace users. (Note: This may include releasing CAS as appropriate). This concept has the potential to reduce the classification of CTAs and review the base of CAS improving accessibility for airspace users.	MET	Improved accessibility of airspace for airspace users
Design Principle 11: Technical High The route network linking Airport procedures with the enroute phase of flight will be spaced to yield maximum safety, capacity and efficiency benefits by using an optimal standard of PBN. (Note: Where appropriate, the use of RNP should be considered if the fleet mix can support it). The highest appropriate level of PBN will be used.	MET	Increased PBN standard compared to today's operation
Design Principle 12: Technical High The MTMA airspace design will provide a compatible and optimised interface with London Airspace Modernisation Programme (LAMP) design. (Note: Closely spaced routes across the interface) LAMP interface is not applicable for the Northern element.	MET	Minimal or no changes required for compatibility with LAMP design
Design Principle 13: Policy High Must accord with the CAA's published Airspace Modernisation Strategy (CAP1711) and any current or future plans associated with it. (Note: The CAA have stated that this DP is required by all change sponsors. CAP1711 describes what airspace modernisation must deliver including: - the need to increase aviation capacity; - growth to be sustainable; - the need to maximise the utilisation of existing runway capacity). Demonstrates alignment with more than 2/3 of the aims as set out in the AMS.	MET	Aligned with the AMS
Design Principle 14: Environmental Medium The airspace should introduce improved Continuous Climb Operations (CCO) and Continuous Descent Operations (CDO) for all aircraft. (Note: This Design Principle includes enabling continuous operations below 7,000ft, where possible). Improved CCO and CDO from separated traffic flows.	MET	Positive impact on CCO and CDO

Conclusion:	**Option 1: Systemised provides separated traffic flows, increasing capacity, resilience and predictability and reducing unplanned track miles to the benefit of environmental and economic performance. A potential reduction in CTA classification and changes to the base of CAS could improve accessibility to the airspace in this option. This option is considered a promising candidate and has been PROGRESSED to the next stage.**

Northern Spine

Option 2: Part-systemised	Accept & Progress	Assessment matrix ref
Option 2 will look to introduce a mix of systemised routes and non-systemised routes providing connectivity for Manchester TMA traffic routing to/from the ScTMA or NATEB (Newcastle). Additionally, connectivity may be required to, from, and between adjacent geographic elements.		
Design Principle 1: **Safety** High The airspace will maintain or enhance current levels of Safety. This concept includes the use of systemised routes which provide separation by route design for arrival, departure and overflight flows. This reduces route conflictions and the requirement for tactical separation management and may improve operational safety.	MET	Enhanced - improvement over today's level of safety. Maintained - safety risk which could be maintained within acceptable levels to today's operation
Design Principle 2: **Operational** High The proposed airspace will maintain or enhance operational resilience of the ATC network. In addition to the benefits provided by systemisation (see Concept 1), within this concept part-systemisation could provide extra flexibility, (in airspace where the non-systemised solution is better), to further improve the resilience of the operation.	MET	Maintain or improve delay absorption
Design Principle 3: **Operational** High The proposed airspace design will yield the greatest capacity benefits from systemisation. (Note: The proposed airspace design should provide increased capacity and reduce delay. This could include the delivery of a suitable delay absorption mechanism or reducing departure intervals. Systemisation will minimise the need for ATC tactical intervention; for example, through better traffic management). In addition to the benefits provided by systemisation (see Concept 1), within this concept part-systemisation could provide extra capacity, (in airspace where the non-systemised solution is better), to further reduce delay and/ or ATC and pilot workload.	MET	Design option supports the forecast traffic loading and increases capacity
Design Principle 4: **Technical** High The MTMA airspace design will provide a compatible and optimised interface between the lower level terminal airspace; the upper Free Route Airspace (FRA) and the ATS network. (Note: The intent of this Design Principle is for the provision of a design that supports the systemisation of traffic flows: from low-level terminal traffic to high-level Free Route flows. The future design should effectively manage arrivals and departures within the TMA without impacting capacity). Part-systemisation removes the rigidity of full systemisation and can potentially provide a seamless transtion to/from the other airspace environments.	MET	Minimal or no changes required for compatibility with FRA
Design Principle 5: **Economic** Medium The proposed MTMA airspace will facilitate optimised network economic performance. (Note: Economic benefits could include environmental improvements such as reduced track mileage/ emissions or revenue from increased capacity/ route charges). In addition to the benefits provided by systemisation (see Concept 1), within this concept a non-systemised solution could (in airspace where the non-systemised solution is better) reduce the burden of extending the mileage to support the systemised solution, thereby improving economic performance compared to today.	MET	Economic performance increased
Design Principle 6: **Environmental** Medium The proposed MTMA airspace will facilitate the reduction of CO2 emissions per flight. In addition to the benefits provided by systemisation (see Concept 1), within this concept a non-systemised solution could (in airspace where the non-systemised solution is better) reduce the burden of extending the mileage to support the systemised solution, thereby improving environmental performance compared to today.	MET	CO2 emissions reduced
Design Principle 7: **Environmental** Low Minimise environmental impacts to stakeholders on the ground. (Note: network changes are >7,000ft, the position of the interface with the airport's lower level routes will be determined by the airport, hence impacts below 7,000ft will be addressed in the separate airport-sponsored ACP). No change below 7000ft.	MET	No change in noise impacts below 7000ft
Design Principle 8: **Operational** Medium The MTMA airspace should be compatible with the requirements of the MoD and take into consideration the requirements of the defence industry stakeholders. (Note: Consider where impacts might be greatest by considering Military-use areas against placement of airspace structures). No expected impact on CAS crossing opportunities. This concept could require increased CAS (although potentially lower additional CAS than full systemisation) and may impact the Military. Note: We will seek to use the lowest classification applicable to the airspace. No SUAs are likely to be impacted and adherence to the SUA buffer policy will be maintained.	PARTIAL	Minor impact and not safety critical
Design Principle 9: **Operational** Medium The impacts on GA, non-commercial and other civilian airspace users due to MTMA should be minimised. (Note: Consider where impacts might be greatest by considering known VFR significant areas against placement of airspace structures. This includes a wide variety of airspace users such as emergency, recreational, training and sport aviation). This concept could require increased CAS (potentially lower additional CAS than full systemisation) and may impact the GA, non commercial and other civilian airspace users, although generally they fly at lower levels underneath CAS. Note: We will seek to use the lowest classification applicable to the airspace.	PARTIAL	Minor impact and not safety critical
Design Principle 10: **Technical** Medium The classification and volume of controlled airspace required for the MTMA should be the minimum necessary to deliver an efficient airspace design, taking into account the needs of UK airspace users. (Note: This may include releasing CAS as appropriate). This concept has the potential to reduce the classification of CTAs and review the base of CAS improving accessibility for airspace users.	MET	Improved accessibility of airspace for airspace users
Design Principle 11: **Technical** High The route network linking Airport procedures with the enroute phase of flight will be spaced to yield maximum safety, capacity and efficiency benefits by using an optimal standard of PBN. (Note: Where appropriate, the use of RNP should be considered if the fleet mix can support it). The highest appropriate level of PBN will be used.	MET	Increased PBN standard compared to today's operation
Design Principle 12: **Technical** High The MTMA airspace design will provide a compatible and optimised interface with London Airspace Modernisation Programme (LAMP) design. (Note: Closely spaced routes across the interface) LAMP interface is not applicable for the Northern element.	MET	Minimal or no changes required for compatibility with LAMP design
Design Principle 13: **Policy** High Must accord with the CAA's published Airspace Modernisation Strategy (CAP1711) and any current or future plans associated with it. (Note: The CAA have stated that this DP is required by all change sponsors. CAP1711 describes what airspace modernisation must deliver including: - the need to increase aviation capacity; - growth to be sustainable; - the need to maximise the utilisation of existing runway capacity). Demonstrates alignment with more than 2/3 of the aims as set out in the AMS.	MET	Aligned with the AMS
Design Principle 14: **Environmental** Medium The airspace should introduce improved Continuous Climb Operations (CCO) and Continuous Descent Operations (CDO) for all aircraft. (Note: This Design Principle includes enabling continuous operations below 7,000ft, where possible). Improved CCO and CDO from separated traffic flows.	MET	Positive impact on CCO and CDO

Conclusion:	**Option 2: Part-systemisation provides the benefits of full systemisation with respect to increased capacity, resilience and predictability, reduced unplanned track miles and improved environmental and economic performance. Additionally it could provide the flexibility to interface more optimally with other airspace environments and further reduce planned track miles, in airspace where the non-systemised solution is better. A potential reduction in CTA classification and changes to the base of CAS could improve accessibility to the airspace in this option. This option is considered a promising candidate and has been PROGRESSED to the next stage.**

Northern Spine

Option 3: Most direct	REJECT	Assessment matrix ref
Option 3 will look to introduce direct routes providing connectivity for Manchester TMA traffic routing to/from the ScTMA or NATEB (Newcastle). Additionally, connectivity may be required to, from, and between adjacent geographic elements.		
Design Principle 1: Safety High The airspace will maintain or enhance current levels of Safety. The use of direct routes could potentially distribute route confliction points, making it more difficult for ATC to anticipate and resolve interactions, particularly in high complexity/density traffic scenarios	PARTIAL	Diminished - Issue(s) identified could result in an elevated level of safety risk when compared to today's operation
Design Principle 2: Operational High The proposed airspace will maintain or enhance operational resilience of the ATC network. This concept could potentially increase the cognitive workload associated with ATC identifying and resolving route conflictions, therefore reducing the capacity in the system for ATC to manage/recover from high workload and abnormal scenarios.	NOT	Significant reduction in delay absorption
Design Principle 3: Operational High The proposed airspace design will yield the greatest capacity benefits from systemisation. (Note: The proposed airspace design should provide increased capacity and reduce delay. This could include the delivery of a suitable delay absorption mechanism or reducing departure intervals. Systemisation will minimise the need for ATC tactical intervention; for example, through better traffic; management). The use of direct routes could potentially distribute route confliction points, making it more difficult for ATC to anticipate and resolve interactions, particularly in high complexity/density traffic scenarios	NOT	Design option increases ATCO workload
Design Principle 4: Technical High The MTMA airspace design will provide a compatible and optimised interface between the lower level terminal airspace; the upper Free Route Airspace (FRA) and the ATS network. (Note: The intent of this Design Principle is for the provision of a design that supports the systemisation of traffic flows: from low-level terminal traffic to high-level Free Route flows. The future design should effectively manage arrivals and departures within the TMA without impacting capacity). This concept could route direct to the interface points for FRA, the ATS route network and the lower airspace environment.	MET	Minimal or no changes required for compatibility with FRA
Design Principle 5: Economic Medium The proposed MTMA airspace will facilitate optimised network economic performance. (Note: Economic benefits could include environmental improvements such as reduced track mileage/ emissions or revenue from increased capacity/ route charges). Enables, conceptually, the most direct flight plannable routings. However, it is noted that for tactical separation management ATC will need to deviate (vector) aircraft from their flight planned routings increasing contoller and pilot workload.	MET	Economic performance increased
Design Principle 6: Environmental Medium The proposed MTMA airspace will facilitate the reduction of CO2 emissions per flight. Enables, conceptually, the most direct flight plannable routings. However, it is noted that for tactical separation management ATC will need to deviate (vector) aircraft from their flight planned routings.	MET	CO2 emissions reduced
Design Principle 7: Environmental Low Minimise environmental impacts to stakeholders on the ground. (Note: network changes are >7,000ft, the position of the interface with the airport's lower level routes will be determined by the airport, hence impacts below 7,000ft will be addressed in the separate airport-sponsored ACP). No change below 7000ft.	MET	No change in noise impacts below 7000ft
Design Principle 8: Operational Medium The MTMA airspace should be compatible with the requirements of the MoD and take into consideration the requirements of the defence industry stakeholders. (Note: Consider where impacts might be greatest by considering Military-use areas against placement of airspace structures). This concept could require increased CAS (potentially more additional CAS than full systemisation) to enable the direct routes. Note: We will seek to use the lowest classification applicable to the airspace. Adherence to the SUA buffer policy will ensure that no SUAs will be impacted. Due to potentially increased ATC workload associated with tactical separation management and a greater distribution of route confliction points for this concept, it may be more difficult to achieve CAS crossing opportunities.	NOT	Major impact or safety critical impact
Design Principle 9: Operational Medium The impacts on GA, non-commercial and other civilian airspace users due to MTMA should be minimised. (Note: Consider where impacts might be greatest by considering known VFR significant areas against placement of airspace structures. This includes a wide variety of airspace users such as emergency, recreational, training and sport aviation). This concept could require increased CAS (potentially more additional CAS than full systemisation) to enable the direct routes and may impact the GA, non commercial and other civilian airspace users, although generally they fly at lower levels underneath CAS. Note: We will seek to use the lowest classification applicable to the airspace.	PARTIAL	Minor impact and not safety critical
Design Principle 10: Technical Medium The classification and volume of controlled airspace required for the MTMA should be the minimum necessary to deliver an efficient airspace design, taking into account the needs of UK airspace users . (Note: This may include releasing CAS as appropriate). The potential to reduce the classification of CTAs/review the base of CAS in this option is less likely due to the complexity of interactions resulting from the use of direct routes	PARTIAL	No change or minor reduction in accessibility of airspace for airspace users
Design Principle 11: Technical High The route network linking Airport procedures with the enroute phase of flight will be spaced to yield maximum safety, capacity and efficiency benefits by using an optimal standard of PBN. (Note: Where appropriate, the use of RNP should be considered if the fleet mix can support it). The highest appropriate level of PBN will be used.	MET	Increased PBN standard compared to today's operation
Design Principle 12: Technical High The MTMA airspace design will provide a compatible and optimised interface with London Airspace Modernisation Programme (LAMP) design. (Note: Closely spaced routes across the interface) LAMP interface is not applicable for the Northern element.	MET	Minimal or no changes required for compatibility with LAMP design
Design Principle 13: Policy High Must accord with the CAA's published Airspace Modernisation Strategy (CAP1711) and any current or future plans associated with it. (Note: The CAA have stated that this DP is required by all change sponsors. CAP1711 describes what airspace modernisation must deliver including: - the need to increase aviation capacity; - growth to be sustainable; - the need to maximise the utilisation of existing runway capacity). Demonstrates alignment with fewer than 1/3 of the aims as set out in the AMS.	NOT	Not aligned with the AMS
Design Principle 14: Environmental Medium The airspace should introduce improved Continuous Climb Operations (CCO) and Continuous Descent Operations (CDO) for all aircraft. (Note: This Design Principle includes enabling continuous operations below 7,000ft, where possible). Vertical constraints (either procedural or tactical intervention by ATC) may be required to keep aircraft safely separated at the confliction points created by direct routes, disrupting continuous climb/descent profiles.	NOT	Negative impact on CCO and CDO compared with today

Conclusion:	**Option 3: Most direct has 5 DPs 'NOT' met (3 of which are priority HIGH), hence this option was REJECTED and will not be progressed.**

Option 4: Bi-directional	REJECT	Assessment matrix ref
Option 4 will look to introduce bi-directional routes providing connectivity for Manchester TMA traffic routing to/from the ScTMA or NATEB (Newcastle). Additionally, connectivity may be required to, from, and between adjacent geographic elements.		
Design Principle 1: Safety High The airspace will maintain or enhance current levels of Safety. In the current airspace, northbound and southbound flows are procedurally separated by uni-directional routes. With bi-directional routes, southbound traffic could potentially conflict with the northbound flow, requiring tactical separation management which may elevate the safety risk in comparison to today's operation.	PARTIAL	Diminished - Issue(s) identified could result in an elevated level of safety risk when compared to today's operation
Design Principle 2: Operational High The proposed airspace will maintain or enhance operational resilience of the ATC network. This concept could potentially increase the cognitive workload associated with ATC resolving northbound/southbound route conflictions, therefore reducing the capacity in the system for ATC to manage/recover from high workload and abnormal scenarios.	NOT	Significant reduction in delay absorption
Design Principle 3: Operational High The proposed airspace design will yield the greatest capacity benefits from systemisation. (Note: The proposed airspace design should provide increased capacity and reduce delay. This could include the delivery of a suitable delay absorption mechanism or reducing departure intervals. Systemisation will minimise the need for ATC tactical intervention; for example, through better traffic; management). This concept could potentially increase the cognitive workload associated with ATC resolving northbound/southbound route conflictions.	NOT	Design option increases ATCO workload
Design Principle 4: Technical High The MTMA airspace design will provide a compatible and optimised interface between the lower level terminal airspace; the upper Free Route Airspace (FRA) and the ATS network. (Note: The intent of this Design Principle is for the provision of a design that supports the systemisation of traffic flows: from low-level terminal traffic to high-level Free Route flows. The future design should effectively manage arrivals and departures within the TMA without impacting capacity). Bi-directional routes may create bottlenecks, increasing complexity at the interface and restricting the flow of traffic to/from other airspace environments.	NOT	Option incompatible with ATS route network
Design Principle 5: Economic Medium The proposed MTMA airspace will facilitate optimised network economic performance. (Note: Economic benefits could include environmental improvements such as reduced track mileage/ emissions or revenue from increased capacity/ route charges). Enables, conceptually, more direct flight plannable routings. However, it is noted that for tactical separation management ATC will need to deviate (vector) aircraft from their flight planned routings increasing contoller and pilot workload.	MET	Economic performance increased
Design Principle 6: Environmental Medium The proposed MTMA airspace will facilitate the reduction of CO2 emissions per flight. Enables, conceptually, more direct flight plannable routings. However, it is noted that for tactical separation management ATC will need to deviate (vector) aircraft from their flight planned routings.	MET	CO2 emissions reduced
Design Principle 7: Environmental Low Minimise environmental impacts to stakeholders on the ground. (Note: network changes are >7,000ft, the position of the interface with the airport's lower level routes will be determined by the airport, hence impacts below 7,000ft will be addressed in the separate airport-sponsored ACP). No change below 7000ft.	MET	No change in noise impacts below 7000ft
Design Principle 8: Operational Medium The MTMA airspace should be compatible with the requirements of the MoD and take into consideration the requirements of the defence industry stakeholders. (Note: Consider where impacts might be greatest by considering Military-use areas against placement of airspace structures). This concept could require increased CAS to enable bi-directional routes. Note: We will seek to use the lowest classification applicable to the airspace. No SUAs are likely to be impacted and adherence to the SUA buffer policy will be maintained. Due to potentially increased ATC workload associated with tactical separation management it may be more difficult to achieve CAS crossing opportunities.	NOT	Major impact or safety critical impact
Design Principle 9: Operational Medium The impacts on GA, non-commercial and other civilian airspace users due to MTMA should be minimised. (Note: Consider where impacts might be greatest by considering known VFR significant areas against placement of airspace structures. This includes a wide variety of airspace users such as emergency, recreational, training and sport aviation). This concept could require increased CAS to enable bi-directional routes and may impact the GA, non commercial and other civilian airspace users, although generally they fly at lower levels underneath CAS. Note: We will seek to use the lowest classification applicable to the airspace.	PARTIAL	Minor impact and not safety critical
Design Principle 10: Technical Medium The classification and volume of controlled airspace required for the MTMA should be the minimum necessary to deliver an efficient airspace design, taking into account the needs of UK airspace users . (Note: This may include releasing CAS as appropriate). The potential to reduce the classification of CTAs/review the base of CAS in this option is less likely due to the complexity of interactions resulting from the use of bi-directional routes	PARTIAL	No change or minor reduction in accessibility of airspace for airspace users
Design Principle 11: Technical High The route network linking Airport procedures with the enroute phase of flight will be spaced to yield maximum safety, capacity and efficiency benefits by using an optimal standard of PBN. (Note: Where appropriate, the use of RNP should be considered if the fleet mix can support it). The highest appropriate level of PBN will be used.	MET	Increased PBN standard compared to today's operation
Design Principle 12: Technical High The MTMA airspace design will provide a compatible and optimised interface with London Airspace Modernisation Programme (LAMP) design. (Note: Closely spaced routes across the interface) LAMP interface is not applicable for the Northern element.	MET	Minimal or no changes required for compatibility with LAMP design
Design principle 13: Policy High Must accord with the CAA's published Airspace Modernisation Strategy (CAP1711) and any current or future plans associated with it. (Note: The CAA have stated that this DP is required by all change sponsors. CAP1711 describes what airspace modernisation must deliver including: - the need to increase aviation capacity; - growth to be sustainable; - the need to maximise the utilisation of existing runway capacity). Demonstrates alignment with fewer than 1/3 of the aims as set out in the AMS.	NOT	Not aligned with the AMS
Design principle 14: Environmental Medium The airspace should introduce improved Continuous Climb Operations (CCO) and Continuous Descent Operations (CDO) for all aircraft. (Note: This Design Principle includes enabling continuous operations below 7,000ft, where possible). Vertical constraints (either procedural or tactical intervention by ATC) may be required to keep aircraft safely separated at the confliction points created by bi-directional routes, disrupting continuous climb/descent profiles.	NOT	Negative impact on CCO and CDO compared with today

Conclusion:	Option 4: Bi-directional has 6 DPs 'NOT' met (4 of which are priority HIGH), hence this option was REJECTED and will not be progressed.

11.3. Eastern Arm DPE – Baseline Variation 1) Extant Doncaster Sheffield airspace

Eastern Arm

Eastern Arm, Extant EGCN airspace, Conclusion and Shortlist

The design principle evaluation of each design option presented on the previous pages and are summarised in the table below.

Design Principle / Option Name:	Option 0: Baseline (Do Nothing)	Option 1: Systemised	Option 2: Part-systemised	Option 3: Most direct	Option 4: Bi-directional
Accept / Reject	REJECT	Accept & Progress	Accept & Progress	REJECT	REJECT
Design Principle 1: Safety (High) The airspace will maintain or enhance current levels of Safety.	MET	MET	MET	PARTIAL	PARTIAL
Design Principle 2: Operational (High) The proposed airspace will maintain or enhance operational resilience of the ATC network.	MET	MET	MET	NOT	NOT
Design Principle 3: Operational (High) The proposed airspace design will yield the greatest capacity benefits from systemisation. (Note: The proposed airspace design should provide increased capacity and reduce delay. This could include the delivery of a suitable delay absorption mechanism or reducing departure intervals. Systemisation will minimise the need for ATC tactical intervention; for example, through better traffic; management).	NOT	MET	MET	NOT	NOT
Design Principle 4: Technical (High) The MTMA airspace design will provide a compatible and optimised interface between the lower level terminal airspace; the upper Free Route Airspace (FRA) and the ATS network. (Note: The intent of this Design Principle is for the provision of a design that supports the systemisation of traffic flows: from low-level terminal traffic to high-level Free Route flows. The future design should effectively manage arrivals and departures within the TMA without impacting capacity).	MET	PARTIAL	MET	MET	NOT
Design Principle 5: Economic (Medium) The proposed MTMA airspace will facilitate optimised network economic performance. (Note: Economic benefits could include environmental improvements such as reduced track mileage/ emissions or revenue from increased capacity/ route charges).	PARTIAL	MET	MET	MET	MET
Design Principle 6: Environmental (Medium) The proposed MTMA airspace will facilitate the reduction of CO2 emissions per flight.	PARTIAL	MET	MET	MET	MET
Design Principle 7: Environmental (Low) Minimise environmental impacts to stakeholders on the ground.(Note: network changes are >7,000ft, the position of the interface with the airport's lower level routes will be determined by the airport, hence impacts below 7,000ft will be addressed in the separate airport-sponsored ACP).	MET	MET	MET	MET	MET
Design Principle 8: Operational (Medium) The MTMA airspace should be compatible with the requirements of the MoD and take into consideration the requirements of the defence industry stakeholders. (Note: Consider where impacts might be greatest by considering Military-use areas against placement of airspace structures).	MET	PARTIAL	PARTIAL	PARTIAL	PARTIAL
Design Principle 9: Operational (Medium) The impacts on GA, non-commercial and other civilian airspace users due to MTMA should be minimised. (Note: Consider where impacts might be greatest by considering known VFR significant areas against placement of airspace structures. This includes a wide variety of airspace users such as emergency, recreational, training and sport aviation).	MET	PARTIAL	PARTIAL	PARTIAL	PARTIAL
Design Principle 10: Technical (Medium) The classification and volume of controlled airspace required for the MTMA should be the minimum necessary to deliver an efficient airspace design, taking into account the needs of UK airspace users (Note: This may include releasing CAS as appropriate).	PARTIAL	MET	MET	PARTIAL	PARTIAL
Design Principle 11: Technical (High) The route network linking Airport procedures with the enroute phase of flight will be spaced to yield maximum safety, capacity and efficiency benefits by using an optimal standard of PBN. (Note: Where appropriate, the use of RNP should be considered if the fleet mix can support it).	PARTIAL	MET	MET	MET	MET
Design Principle 12: Technical (High) The MTMA airspace design will provide a compatible and optimised interface withLondon Airspace Modernisation Programme (LAMP) design. (Note: Closely spaced routes across the interface)	MET	MET	MET	MET	MET
Design Principle 13: Policy (High) Must accord with the CAA's published Airspace Modernisation Strategy (CAP1711) and any current or future plans associated with it. (Note: The CAA have stated that this DP is required by all change sponsors. CAP1711 describes what airspace modernisation must deliver including: - the need to increase aviation capacity; - growth to be sustainable; - the need to maximise the utilisation of existing runway capacity).	NOT	MET	MET	NOT	NOT
Design Principle 14: Environmental (Medium) The airspace should introduce improved Continuous Climb Operations (CCO) and Continuous Descent Operations (CDO) for all aircraft. (Note: This Design Principle includes enabling continuous operations below 7,000ft, where possible).	PARTIAL	MET	MET	NOT	NOT

Progression criteria: Options having any High Design Principles which are 'NOT' met (red) or 2 or more Medium Design Principles 'NOT' met or greater than 5 Design Principles 'PARTIAL' met have been rejected.

Next Steps

Option 1 Systemised and Option 2 Part-systemised will be formally appraised under the Stage 2, Step 2B Options Appraisal (Phase 1 Initial), including Safety Assessment.

Eastern Arm

Option 0: Baseline (Do Nothing)	REJECT	Assessment matrix ref
This option represents the existing airspace design, i.e. The "Do-Nothing" option. Keep everything as it is currently		
Design Principle 1: Safety High The airspace will maintain or enhance current levels of Safety. No change to the current level of safety.	MET	Enhanced - improvement over today's level of safety. Maintained - safety risk could be maintained within acceptable levels of today's operation
Design Principle 2: Operational High The proposed airspace will maintain or enhance operational resilience of the ATC network. No change to the current level of delay absorption or disruption recovery	MET	Maintain or improve delay absorption
Design Principle 3: Operational High The proposed airspace design will yield the greatest capacity benefits from systemisation. (Note: The proposed airspace design should provide increased capacity and reduce delay. This could include the delivery of a suitable delay absorption mechanism or reducing departure intervals. Systemisation will minimise the need for ATC tactical intervention; for example, through better traffic; management). The current airspace is near to operating at full capacity and unable to absorb future traffic growth.	NOT	Design option unable to support the forecast traffic loading
Design Principle 4: Technical High The MTMA airspace design will provide a compatible and optimised interface between the lower level terminal airspace; the upper Free Route Airspace (FRA) and the ATS network. (Note: The intent of this Design Principle is for the provision of a design that supports the systemisation of traffic flows: from low-level terminal traffic to high-level Free Route flows. The future design should effectively manage arrivals and departures within the TMA without impacting capacity). The current airspace supports connectivity with lower level airspace, FRA and the ATS network. Changes to any of these environments will need to be designed to interface as appropriate to the existing airspace design.	MET	Minimal or no changes required for compatibility with FRA
Design Principle 5: Economic Medium The proposed MTMA airspace will facilitate optimised network economic performance. (Note: Economic benefits could include environmental improvements such as reduced track mileage/ emissions or revenue from increased capacity/ route charges). No change, no impact.	PARTIAL	Economic performance as per today
Design Principle 6: Environmental Medium The proposed MTMA airspace will facilitate the reduction of CO_2 emissions per flight. No change, no impact.	PARTIAL	CO_2 emissions as per today
Design Principle 7: Environmental Low Minimise environmental impacts to stakeholders on the ground. (Note: network changes are >7,000ft, the position of the interface with the airport's lower level routes will be determined by the airport, hence impacts below 7,000ft will be addressed in the separate airport-sponsored ACP). No change, no impact.	MET	No change in noise impacts below 7000ft
Design Principle 8: Operational Medium The MTMA airspace should be compatible with the requirements of the MoD and take into consideration the requirements of the defence industry stakeholders. (Note: Consider where impacts might be greatest by considering Military-use areas against placement of airspace structures). No change to impact the current operation; however it is noted that as traffic levels increase, ATC ability to deconflict against the military corridor may, in the future, become reduced.	MET	No impact or positive impact
Design Principle 9: Operational Medium The impacts on GA, non-commercial and other civilian airspace users due to MTMA should be minimised. (Note: Consider where impacts might be greatest by considering known VFR significant areas against placement of airspace structures. This includes a wide variety of airspace users such as emergency, recreational, training and sport aviation). No change to impact the current operation; however it is noted that as traffic levels increase, ATC ability to provide crossing clearance for CAS may, in the future, become reduced.	MET	No impact or positive impact
Design Principle 10: Technical Medium The classification and volume of controlled airspace required for the MTMA should be the minimum necessary to deliver an efficient airspace design, taking into account the needs of UK airspace users . (Note: This may include releasing CAS as appropriate). The CTA classifications in this region are considered disproportionately restrictive.	PARTIAL	No change or minor reduction in accessibility of airspace for airspace users
Design Principle 11: Technical High The route network linking Airport procedures with the enroute phase of flight will be spaced to yield maximum safety, capacity and efficiency benefits by using an optimal standard of PBN. (Note: Where appropriate, the use of RNP should be considered if the fleet mix can support it). No change to current RNAV standards; the existing ATS routes are RNAV5 non-systemised routes.	PARTIAL	PBN standard as per today's operation
Design Principle 12: Technical High The MTMA airspace design will provide a compatible and optimised interface with London Airspace Modernisation Programme (LAMP) design. (Note: Closely spaced routes across the interface) LAMP interface is not applicable for the Eastern element.	MET	Minimal or no changes required for compatibility with LAMP design
Design Principle 13: Policy High Must accord with the CAA's published Airspace Modernisation Strategy (CAP1711) and any current or future plans associated with it. (Note: The CAA have stated that this DP is required by all change sponsors. CAP1711 describes what airspace modernisation must deliver including: - the need to increase aviation capacity; - growth to be sustainable; - the need to maximise the utilisation of existing runway capacity). Demonstrates alignment with fewer than 1/3 of the aims as set out in the AMS.	NOT	No or limited alignment with the AMS
Design Principle 14: Environmental Medium The airspace should introduce improved Continuous Climb Operations (CCO) and Continuous Descent Operations (CDO) for all aircraft. (Note: This Design Principle includes enabling continuous operations below 7,000ft, where possible). No change, no impact.	PARTIAL	CCO and CDO as per today

Conclusion:	**Option 0: Baseline (Do Nothing) represents no change to the existing airspace design. 2 DPs (priority HIGH) were 'NOT' met, hence this option was REJECTED and will not be progressed.**

Eastern Arm

Option 1: Systemised	Accept & Progress	Assessment matrix ref
Option 1 will look to introduce a systemised airspace structure providing connectivity for Manchester TMA traffic routing to /from central Europe and Scandinavia. Additionally, connectivity may be required to, from and between adjacent geographical elements		
Design Principle 1: Safety High The airspace will maintain or enhance current levels of Safety. Systemised routes provide separation by route design for arrival, departure and overflight flows. This reduces route conflictions and the requirement for tactical separation management and may improve operational safety.	MET	Enhanced - improvement over today's level of safety. Maintained - safety risk could be maintained within acceptable levels of today's operation
Design Principle 2: Operational High The proposed airspace will maintain or enhance operational resilience of the ATC network. Systemised routes, separated by design, provide more efficient use of the airspace, increased capacity and predictability of the traffic flows and reduced ATC and pilot workload, potentially improving delay absorption and disruption recovery.	MET	Maintain or improve delay absorption
Design Principle 3: Operational High The proposed airspace design will yield the greatest capacity benefits from systemisation. (Note: The proposed airspace design should provide increased capacity and reduce delay. This could include the delivery of a suitable delay absorption mechanism or reducing departure intervals. Systemisation will minimise the need for ATC tactical intervention; for example, through better traffic; management). Systemised routes, separated by design, provide more efficient use of the airspace, increased capacity and predictability of the traffic flows and reduced ATC and pilot workload, supporting future traffic growth.	MET	Design option supports the forecast traffic loading and increases capacity
Design Principle 4: Technical High The MTMA airspace design will provide a compatible and optimised interface between the lower level terminal airspace; the upper Free Route Airspace (FRA) and the ATS network. (Note: The intent of this Design Principle is for the provision of a design that supports the systemisation of traffic flows: from low-level terminal traffic to high-level Free Route flows. The future design should effectively manage arrivals and departures within the TMA without impacting capacity). The systemisation concept does not provide the flexibility required to maximise the efficiency of the interface with FRA, the ATS route network and the lower airspace environment. Note: systemised routes do not support bi-directional entry/exit points.	PARTIAL	Significant changes with FRA required for compatibility
Design Principle 5: Economic Medium The proposed MTMA airspace will facilitate optimised network economic performance. (Note: Economic benefits could include environmental improvements such as reduced track mileage/ emissions or revenue from increased capacity/ route charges). Systemisation enables reduced tactical intervention, and therefore supports a potential reduction in unplanned track miles and improved economic performance compared to today.	MET	Economic performance increased
Design Principle 6: Environmental Medium The proposed MTMA airspace will facilitate the reduction of CO_2 emissions per flight. Systemisation enables reduced tactical intervention, and therefore supports a potential reduction in unplanned track miles and improved environmental performance compared to today.	MET	CO_2 emissions reduced
Design Principle 7: Environmental Low Minimise environmental impacts to stakeholders on the ground. (Note: network changes are >7,000ft, the position of the interface with the airport's lower level routes will be determined by the airport, hence impacts below 7,000ft will be addressed in the separate airport-sponsored ACP). No change below 7000ft.	MET	No change in noise impacts below 7000ft
Design Principle 8: Operational Medium The MTMA airspace should be compatible with the requirements of the MoD and take into consideration the requirements of the defence industry stakeholders. (Note: Consider where impacts might be greatest by considering Military-use areas against placement of airspace structures). This concept could require increased CAS and may impact the Military. Note: We will seek to use the lowest classification applicable to the airspace. No SUAs are likely to be impacted and adherence to the SUA buffer policy will be maintained.	PARTIAL	Minor impact and not safety critical
Design Principle 9: Operational Medium The impacts on GA, non-commercial and other civilian airspace users due to MTMA should be minimised. (Note: Consider where impacts might be greatest by considering known VFR significant areas against placement of airspace structures. This includes a wide variety of airspace users such as emergency, recreational, training and sport aviation). This concept could require increased CAS and might impact the GA, non commercial and other civilian airspace users, although generally they fly at lower levels underneath CAS. We will seek to use the lowest classification applicable to the airspace.	PARTIAL	Minor impact and not safety critical
Design Principle 10: Technical Medium The classification and volume of controlled airspace required for the MTMA should be the minimum necessary to deliver an efficient airspace design, taking into account the needs of UK airspace users. (Note: This may include releasing CAS as appropriate). This concept has the potential to reduce the classification of CTAs/ release CAS improving accessibility for airspace users.	MET	Improved accessibility of airspace for airspace users
Design Principle 11: Technical High The route network linking Airport procedures with the enroute phase of flight will be spaced to yield maximum safety, capacity and efficiency benefits by using an optimal standard of PBN. (Note: Where appropriate, the use of RNP should be considered if the fleet mix can support it). The highest appropriate level of PBN will be used.	MET	Increased PBN standard compared to today's operation
Design Principle 12: Technical High The MTMA airspace design will provide a compatible and optimised interface with London Airspace Modernisation Programme LAMP interface is not applicable for the Eastern element.	MET	Minimal or no changes required for compatibility with LAMP design
Design Principle 13: Policy High Must accord with the CAA's published Airspace Modernisation Strategy (CAP1711) and any current or future plans associated with it. (Note: The CAA have stated that this DP is required by all change sponsors. CAP1711 describes what airspace modernisation must deliver including: - the need to increase aviation capacity; - growth to be sustainable; - the need to maximise the utilisation of existing runway capacity). Demonstrates alignment with more than 2/3 of the aims as set out in the AMS.	MET	Aligned with the AMS
Design Principle 14: Environmental Medium The airspace should introduce improved Continuous Climb Operations (CCO) and Continuous Descent Operations (CDO) for all Improved CCO and CDO from separated traffic flows.	MET	Positive impact on CCO and CDO

Conclusion:	**Option 1: Systemisation provides separated traffic flows, increasing capacity, resilience and predictability and reducing unplanned track miles to the benefit of environmental and economic performance. A potential reduction in CTA classification and changes to the base of CAS could improve accessibility to the airspace in this option. This option is considered a promising candidate and has been PROGRESSED to the next stage.**

Eastern Arm

Option 2: Part-systemised	Accept & Progress	Assessment matrix ref
Option 2 will look to introduce of a mix of systemised airspace structures and non-systemised route structures providing connectivity for Manchester TMA traffic routing to /from central Europe and Scandinavia. Additionally, connectivity may be required to, from and between adjacent geographical elements.		
Design Principle 1: **Safety** High The airspace will maintain or enhance current levels of Safety. This concept includes the use of systemised routes which provide separation by route design for arrival, departure and overflight flows. This reduces route conflictions and the requirement for tactical separation management and may improve operational safety.	MET	Enhanced - improvement over today's level of safety. Maintained - safety risk which could be maintained within acceptable levels to today's operation
Design Principle 2: **Operational** High The proposed airspace will maintain or enhance operational resilience of the ATC network. In addition to the benefits provided by systemisation (see Concept 1), within this concept part-systemisation could provide extra flexibility, (in airspace where the non-systemised solution is better), to further improve the resilience of the operation.	MET	Maintain or improve delay absorption
Design Principle 3: **Operational** High The proposed airspace design will yield the greatest capacity benefits from systemisation. (Note: The proposed airspace design should provide increased capacity and reduce delay. This could include the delivery of a suitable delay absorption mechanism or reducing departure intervals. Systemisation will minimise the need for ATC tactical intervention; for example, through better traffic management). In addition to the benefits provided by systemisation (see Concept 1), within this concept part-systemisation could provide extra capacity, (in airspace where the non-systemised solution is better), to further reduce delay and/ or ATC and pilot workload.	MET	Design option supports the forecast traffic loading and increases capacity
Design Principle 4: **Technical** High The MTMA airspace design will provide a compatible and optimised interface between the lower level terminal airspace; the upper Free Route Airspace (FRA) and the ATS network. (Note: The intent of this Design Principle is for the provision of a design that supports the systemisation of traffic flows: from low-level terminal traffic to high-level Free Route flows. The future design should effectively manage arrivals and departures within the TMA without impacting capacity). Part-systemisation removes the rigidity of full systemisation and can potentially provide a seamless transition to/from the other airspace environments.	MET	Minimal or no changes required for compatibility with FRA
Design Principle 5: **Economic** Medium The proposed MTMA airspace will facilitate optimised network economic performance. (Note: Economic benefits could include environmental improvements such as reduced track mileage/ emissions or revenue from increased capacity/ route charges). In addition to the benefits provided by systemisation (see Concept 1), within this concept a non-systemised solution could (in airspace where the non-systemised solution is better) reduce the burden of extending the mileage to support the systemised solution, thereby improving economic performance compared to today.	MET	Economic performance increased
Design Principle 6: **Environmental** Medium The proposed MTMA airspace will facilitate the reduction of CO2 emissions per flight. In addition to the benefits provided by systemisation (see Concept 1), within this concept a non-systemised solution could (in airspace where the non-systemised solution is better) reduce the burden of extending the mileage to support the systemised solution, thereby improving environmental performance compared to today.	MET	CO2 emissions reduced
Design Principle 7: **Environmental** Low Minimise environmental impacts to stakeholders on the ground. (Note: network changes are >7,000ft, the position of the interface with the airport's lower level routes will be determined by the airport, hence impacts below 7,000ft will be addressed in the separate airport-sponsored ACP). No change below 7000ft.	MET	No change in noise impacts below 7000ft
Design Principle 8: **Operational** Medium The MTMA airspace should be compatible with the requirements of the MoD and take into consideration the requirements of the defence industry stakeholders. (Note: Consider where impacts might be greatest by considering Military-use areas against placement of airspace structures). This concept could require increased CAS (although potentially lower additional CAS than full systemisation) and may impact the Military. Note: We will seek to use the lowest classification applicable to the airspace. No SUAs are likely to be impacted and adherence to the SUA buffer policy will be maintained.	PARTIAL	Minor impact and not safety critical
Design Principle 9: **Operational** Medium The impacts on GA, non-commercial and other civilian airspace users due to MTMA should be minimised. (Note: Consider where impacts might be greatest by considering known VFR significant areas against placement of airspace structures. This includes a wide variety of airspace users such as emergency, recreational, training and sport aviation). This concept could require increased CAS (potentially lower additional CAS than full systemisation) and may impact the GA, non commercial and other civilian airspace users, although generally they fly at lower levels underneath CAS. Note: We will seek to use the lowest classification applicable to the airspace.	PARTIAL	Minor impact and not safety critical
Design Principle 10: **Technical** Medium The classification and volume of controlled airspace required for the MTMA should be the minimum necessary to deliver an efficient airspace design, taking into account the needs of UK airspace users. (Note: This may include releasing CAS as appropriate). This concept has the potential to reduce the classification of CTAs/release CAS improving accessibility for airspace users.	MET	Improved accessibility of airspace for airspace users
Design Principle 11: **Technical** High The route network linking Airport procedures with the enroute phase of flight will be spaced to yield maximum safety, capacity and efficiency benefits by using an optimal standard of PBN. (Note: Where appropriate, the use of RNP should be considered if the fleet mix can support it). The highest appropriate level of PBN will be used.	MET	Increased PBN standard compared to today's operation
Design Principle 12: **Technical** High The MTMA airspace design will provide a compatible and optimised interface with London Airspace Modernisation Programme (LAMP) design. (Note: Closely spaced routes across the interface) LAMP interface is not applicable for the Eastern element.	MET	Minimal or no changes required for compatibility with LAMP design
Design Principle 13: **Policy** High Must accord with the CAA's published Airspace Modernisation Strategy (CAP1711) and any current or future plans associated with it. (Note: The CAA have stated that this DP is required by all change sponsors. CAP1711 describes what airspace modernisation must deliver including: - the need to increase aviation capacity; - growth to be sustainable; - the need to maximise the utilisation of existing runway capacity). Demonstrates alignment with more than 2/3 of the aims as set out in the AMS.	MET	Aligned with the AMS
Design Principle 14: **Environmental** Medium The airspace should introduce improved Continuous Climb Operations (CCO) and Continuous Descent Operations (CDO) for all aircraft. (Note: This Design Principle includes enabling continuous operations below 7,000ft, where possible). Improved CCO and CDO from separated traffic flows.	MET	Positive impact on CCO and CDO

Conclusion:	**Option 2: Part-systemisation provides the benefits of full systemisation with respect to increased capacity, resilience and predictability, reduced unplanned track miles and improved environmental and economic performance. Additionally it could provide the flexibility to interface more optimally with other airspace environments and further reduce planned track miles, in airspace where the non-systemisation solution is better. A potential reduction in CTA classification and changes to the base of CAS could improve accessibility to the airspace in this option. This option is considered a promising candidate and has been PROGRESSED to the next stage.**

Eastern Arm

Option 3: Most direct	REJECT	Assessment matrix ref
Option 3 will look to introduce direct routes providing connectivity for Manchester TMA traffic routing to /from central Europe and Scandinavia. Additionally, connectivity may be required to, from and between adjacent geographical elements.		
Design Principle 1: Safety High The airspace will maintain or enhance current levels of Safety. The use of direct routes could potentially distribute route confliction points, making it more difficult for ATC to anticipate and resolve interactions, particularly in high complexity/density traffic scenarios	PARTIAL	Diminished - Issue(s) identified could result in an elevated level of safety risk when compared to today's operation
Design Principle 2: Operational High The proposed airspace will maintain or enhance operational resilience of the ATC network. This concept could potentially increase the cognitive workload associated with ATC identifying and resolving route conflictions, therefore reducing the capacity in the system for ATC to manage/recover from high workload and abnormal scenarios.	NOT	Significant reduction in delay absorption
Design Principle 3: Operational High The proposed airspace design will yield the greatest capacity benefits from systemisation. (Note: The proposed airspace design should provide increased capacity and reduce delay. This could include the delivery of a suitable delay absorption mechanism or reducing departure intervals. Systemisation will minimise the need for ATC tactical intervention; for example, through better traffic; management). The use of direct routes could potentially distribute route confliction points, making it more difficult for ATC to anticipate and resolve interactions, particularly in high complexity/density traffic scenarios	NOT	Design option increases ATCO workload
Design Principle 4: Technical High The MTMA airspace design will provide a compatible and optimised interface between the lower level terminal airspace; the upper Free Route Airspace (FRA) and the ATS network. (Note: The intent of this Design Principle is for the provision of a design that supports the systemisation of traffic flows: from low-level terminal traffic to high-level Free Route flows. The future design should effectively manage arrivals and departures within the TMA without impacting capacity). This concept could route direct to the interface points for FRA, the ATS route network and the lower airspace environment.	MET	Minimal or no changes required for compatibility with FRA
Design Principle 5: Economic Medium The proposed MTMA airspace will facilitate optimised network economic performance. (Note: Economic benefits could include environmental improvements such as reduced track mileage/ emissions or revenue from increased capacity/ route charges). Enables, conceptually, the most direct flight plannable routings. However, it is noted that for tactical separation management ATC will need to deviate (vector) aircraft from their flight planned routings increasing contoller and pilot workload.	MET	Economic performance increased
Design Principle 6: Environmental Medium The proposed MTMA airspace will facilitate the reduction of CO2 emissions per flight. Enables, conceptually, the most direct flight plannable routings. However, it is noted that for tactical separation management ATC will need to deviate (vector) aircraft from their flight planned routings.	MET	CO2 emissions reduced
Design Principle 7: Environmental Low Minimise environmental impacts to stakeholders on the ground. (Note: network changes are >7,000ft, the position of the interface with the airport's lower level routes will be determined by the airport, hence impacts below 7,000ft will be addressed in the separate airport-sponsored ACP). No change below 7000ft.	MET	No change in noise impacts below 7000ft
Design Principle 8: Operational Medium The MTMA airspace should be compatible with the requirements of the MoD and take into consideration the requirements of the defence industry stakeholders. (Note: Consider where impacts might be greatest by considering Military-use areas against placement of airspace structures). This concept could require increased CAS (potentially more additional CAS than full systemisation) to enable the direct routes. Note: We will seek to use the lowest classification applicable to the airspace. Adherence to the SUA buffer policy will ensure that no SUAs will be impacted.	PARTIAL	Minor impact and not safety critical
Design Principle 9: Operational Medium The impacts on GA, non-commercial and other civilian airspace users due to MTMA should be minimised. (Note: Consider where impacts might be greatest by considering known VFR significant areas against placement of airspace structures. This includes a wide variety of airspace users such as emergency, recreational, training and sport aviation). This concept could require increased CAS (potentially more additional CAS than full systemisation) to enable the direct routes and may impact the GA, non commercial and other civilian airspace users, although generally they fly at lower levels underneath CAS. Note: We will seek to use the lowest classification applicable to the airspace.	PARTIAL	Minor impact and not safety critical
Design Principle 10: Technical Medium The classification and volume of controlled airspace required for the MTMA should be the minimum necessary to deliver an efficient airspace design, taking into account the needs of UK airspace users. (Note: This may include releasing CAS as appropriate). The potential to reduce the classification of CTAs/release CAS in this option is less likely due to the complexity of interactions resulting from the use of direct routes	PARTIAL	No change or minor reduction in accessibility of airspace for airspace users
Design Principle 11: Technical High The route network linking Airport procedures with the enroute phase of flight will be spaced to yield maximum safety, capacity and efficiency benefits by using an optimal standard of PBN. (Note: Where appropriate, the use of RNP should be considered if the fleet mix can support it). The highest appropriate level of PBN will be used.	MET	Increased PBN standard compared to today's operation
Design Principle 12: Technical High The MTMA airspace design will provide a compatible and optimised interface with London Airspace Modernisation Programme (LAMP) design. (Note: Closely spaced routes across the interface) LAMP interface is not applicable for the Eastern element.	MET	Minimal or no changes required for compatibility with LAMP design
Design Principle 13: Policy High Must accord with the CAA's published Airspace Modernisation Strategy (CAP1711) and any current or future plans associated with it. (Note: The CAA have stated that this DP is required by all change sponsors. CAP1711 describes what airspace modernisation must deliver including: - the need to increase aviation capacity; - growth to be sustainable; - the need to maximise the utilisation of existing runway capacity). Demonstrates alignment with fewer than 1/3 of the aims as set out in the AMS.	NOT	Not aligned with the AMS
Design Principle 14: Environmental Medium The airspace should introduce improved Continuous Climb Operations (CCO) and Continuous Descent Operations (CDO) for all aircraft. (Note: This Design Principle includes enabling continuous operations below 7,000ft, where possible). Vertical constraints (either procedural or tactical intervention by ATC) may be required to keep aircraft safely separated at the confliction points created by direct routes, disrupting continuous climb/descent profiles.	NOT	Negative impact on CCO and CDO compared with today

Conclusion:	Option 3: Most direct has 4 DPs 'NOT' met (3 of which are priority HIGH), hence this option was REJECTED and will not be progressed.

Eastern Arm

Option 4: Bi-directional	REJECT	Assessment matrix ref
Option 4 will look to introduce bi-directional routes providing connectivity for Manchester TMA traffic routing to /from central Europe and Scandinavia. Additionally, connectivity may be required to, from and between adjacent geographical elements.		
Design Principle 1: **Safety** High The airspace will maintain or enhance current levels of Safety. In the current airspace, eastbound traffic leaving the UK and westbound traffic entering the UK are procedurally separated by uni-directional routes. With bi-directional routes, westbound traffic could potentially conflict with the eastbound flow, requiring tactical separation management which may elevate the safety risk in comparison to today's operation.	PARTIAL	Diminished - Issue(s) identified could result in an elevated level of safety risk when compared to today's operation
Design Principle 2: **Operational** High The proposed airspace will maintain or enhance operational resilience of the ATC network. This concept could potentially increase the cognitive workload associated with ATC resolving westbound/eastbound route conflictions, therefore reducing the capacity in the system for ATC to manage/recover from high workload and abnormal scenarios.	NOT	Significant reduction in delay absorption
Design Principle 3: **Operational** High The proposed airspace design will yield the greatest capacity benefits from systemisation. (Note: The proposed airspace design should provide increased capacity and reduce delay. This could include the delivery of a suitable delay absorption mechanism or reducing departure intervals. Systemisation will minimise the need for ATC tactical intervention; for example, through better traffic; management). This concept could potentially increase the cognitive workload associated with ATC resolving westbound/eastbound route conflictions.	NOT	Design option increases ATCO workload
Design Principle 4: **Technical** High The MTMA airspace design will provide a compatible and optimised interface between the lower level terminal airspace; the upper Free Route Airspace (FRA) and the ATS network. (Note: The intent of this Design Principle is for the provision of a design that supports the systemisation of traffic flows: from low-level terminal traffic to high-level Free Route flows. The future design should effectively manage arrivals and departures within the TMA without impacting capacity). Bi-directional routes may create bottlenecks, increasing complexity at the interface and restricting the flow of traffic to/from other airspace environments.	NOT	Significant changes with ATS route network required for compatibility
Design Principle 5: **Economic** Medium The proposed MTMA airspace will facilitate optimised network economic performance. (Note: Economic benefits could include environmental improvements such as reduced track mileage/ emissions or revenue from increased capacity/ route charges). Enables, conceptually, more direct flight plannable routings. However, it is noted that for tactical separation management ATC will need to deviate (vector) aircraft from their flight planned routings.	MET	Economic performance increased
Design Principle 6: **Environmental** Medium The proposed MTMA airspace will facilitate the reduction of CO2 emissions per flight. Enables, conceptually, more direct flight plannable routings. However, it is noted that for tactical separation management ATC will need to deviate (vector) aircraft from their flight planned routings increasing contoller and pilot workload.	MET	CO2 emissions reduced
Design Principle 7: **Environmental** Low Minimise environmental impacts to stakeholders on the ground. (Note: network changes are >7,000ft, the position of the No change below 7000ft.	MET	No change in noise impacts below 7000ft
Design Principle 8: **Operational** Medium The MTMA airspace should be compatible with the requirements of the MoD and take into consideration the requirements of the defence industry stakeholders. (Note: Consider where impacts might be greatest by considering Military-use areas against placement of airspace structures). This concept could require increased CAS to enable bi-directional routes. Note: We will seek to use the lowest classification applicable to the airspace. No SUAs are likely to be impacted and adherence to the SUA buffer policy will be maintained.	PARTIAL	Minor impact and not safety critical
Design Principle 9: **Operational** Medium The impacts on GA, non-commercial and other civilian airspace users due to MTMA should be minimised. (Note: Consider where impacts might be greatest by considering known VFR significant areas against placement of airspace structures. This includes a wide variety of airspace users such as emergency, recreational, training and sport aviation). This concept could require increased CAS to enable bi-directional routes and may impact the GA, non commercial and other civilian airspace users, although generally they fly at lower levels underneath CAS. Note: We will seek to use the lowest classification applicable to the airspace.	PARTIAL	Minor impact and not safety critical
Design Principle 10: **Technical** Medium The classification and volume of controlled airspace required for the MTMA should be the minimum necessary to deliver an efficient airspace design, taking into account the needs of UK airspace users. (Note: This may include releasing CAS as appropriate). The potential to reduce the classification of CTAs/release CAS in this option is less likely due to the complexity of interactions resulting from the use of bi-directional routes	PARTIAL	No change or minor reduction in accessibility of airspace for airspace users
Design Principle 11: **Technical** High The route network linking Airport procedures with the enroute phase of flight will be spaced to yield maximum safety, capacity and efficiency benefits by using an optimal standard of PBN. (Note: Where appropriate, the use of RNP should be considered if the fleet mix can support it). The highest appropriate level of PBN will be used.	MET	Increased PBN standard compared to today's operation
Design Principle 12: **Technical** High The MTMA airspace design will provide a compatible and optimised interface with London Airspace Modernisation Programme (LAMP) design. (Note: Closely spaced routes across the interface) LAMP interface is not applicable for the Eastern element.	MET	Minimal or no changes required for compatibility with LAMP design
Design Principle 13: **Policy** High Must accord with the CAA's published Airspace Modernisation Strategy (CAP1711) and any current or future plans associated with it. (Note: The CAA have stated that this DP is required by all change sponsors. CAP1711 describes what airspace modernisation must deliver including: - the need to increase aviation capacity; - growth to be sustainable; - the need to maximise the utilisation of existing runway capacity). Demonstrates alignment with fewer than 1/3 of the aims as set out in the AMS.	NOT	Not aligned with the AMS
Design Principle 14: **Environmental** Medium The airspace should introduce improved Continuous Climb Operations (CCO) and Continuous Descent Operations (CDO) for all aircraft. (Note: This Design Principle includes enabling continuous operations below 7,000ft, where possible). Vertical constraints (either procedural or tactical intervention by ATC) may be required to keep aircraft safely separated at the confliction points created by bi-directional routes, disrupting continuous climb/descent profiles.	NOT	Negative impact on CCO and CDO compared with today

Conclusion:	**Option 4: Bi-directional has 5 DPs 'NOT' met (4 of which are priority HIGH), hence this option was REJECTED and will not be progressed.**

11.4. Eastern Arm DPE - Baseline Variation 2) De-notification of Doncaster Sheffield airspace

Eastern Arm

Eastern Arm Conclusion and Shortlist

The design principle evaluation of each design option presented on the previous pages and are summarised in the table below.

Design Principle / Option Name:	Option 0: Baseline (Do Nothing)	Option 1: Systemised	Option 2: Part-systemised	Option 3: Most direct	Option 4: Bi-directional
Accept / Reject	REJECT	Accept & Progress	Accept & Progress	REJECT	REJECT
Design Principle 1: Safety High The airspace will maintain or enhance current levels of Safety	MET	MET	MET	PARTIAL	PARTIAL
Design Principle 2: Operational High The proposed airspace will maintain or enhance operational resilience of the ATC network.	MET	MET	MET	NOT	NOT
Design Principle 3: Operational High The proposed airspace design will yield the greatest capacity benefits from systemisation. (Note: The proposed airspace design should provide increased capacity and reduce delay. This could include the delivery of a suitable delay absorption mechanism or reducing departure intervals. Systemisation will minimise the need for ATC tactical intervention; for example, through better traffic; management).	NOT	MET	MET	NOT	NOT
Design Principle 4: Technical High The MTMA airspace design will provide a compatible and optimised interface between the lower level terminal airspace; the upper Free Route Airspace (FRA) and the ATS network. (Note: The intent of this Design Principle is for the provision of a design that supports the systemisation of traffic flows: from low-level terminal traffic to high-level Free Route flows. The future design should effectively manage arrivals and departures within the TMA without impacting capacity).	MET	PARTIAL	MET	MET	NOT
Design Principle 5: Economic Medium The proposed MTMA airspace will facilitate optimised network economic performance. (Note: Economic benefits could include environmental improvements such as reduced track mileage/ emissions or revenue from increased capacity/ route charges).	PARTIAL	MET	MET	MET	MET
Design Principle 6: Environmental Medium The proposed MTMA airspace will facilitate the reduction of CO2 emissions per flight.	PARTIAL	MET	MET	MET	MET
Design Principle 7: Environmental Low Minimise environmental impacts to stakeholders on the ground.(Note: network changes are >7,000ft, the position of the interface with the airport's lower level routes will be determined by the airport, hence impacts below 7,000ft will be addressed in the separate airport-sponsored ACP).	MET	MET	MET	MET	MET
Design Principle 8: Operational Medium The MTMA airspace should be compatible with the requirements of the MoD and take into consideration the requirements of the defence industry stakeholders. (Note: Consider where impacts might be greatest by considering Military-use areas against placement of airspace structures).	MET	PARTIAL	PARTIAL	PARTIAL	PARTIAL
Design Principle 9: Operational Medium The impacts on GA, non-commercial and other civilian airspace users due to MTMA should be minimised. (Note: Consider where impacts might be greatest by considering known VFR significant areas against placement of airspace structures. This includes a wide variety of airspace users such as emergency, recreational, training and sport aviation).	MET	PARTIAL	PARTIAL	PARTIAL	PARTIAL
Design Principle 10: Technical Medium The classification and volume of controlled airspace required for the MTMA should be the minimum necessary to deliver an efficient airspace design, taking into account the needs of UK airspace users (Note: This may include releasing CAS as appropriate).	PARTIAL	MET	MET	PARTIAL	PARTIAL
Design Principle 11: Technical High The route network linking Airport procedures with the enroute phase of flight will be spaced to yield maximum safety, capacity and efficiency benefits by using an optimal standard of PBN. (Note: Where appropriate, the use of RNP should be considered if the fleet mix can support it).	PARTIAL	MET	MET	MET	MET
Design Principle 12: Technical High The MTMA airspace design will provide a compatible and optimised interface withLondon Airspace Modernisation Programme (LAMP) design. (Note: Closely spaced routes across the interface)	MET	MET	MET	MET	MET
Design Principle 13: Policy High Must accord with the CAA's published Airspace Modernisation Strategy (CAP1711) and any current or future plans associated with it. (Note: The CAA have stated that this DP is required by all change sponsors. CAP1711 describes what airspace modernisation must deliver including: - the need to increase aviation capacity; - growth to be sustainable; - the need to maximise the utilisation of existing runway capacity).	NOT	MET	MET	NOT	NOT
Design Principle 14: Environmental Medium The airspace should introduce improved Continuous Climb Operations (CCO) and Continuous Descent Operations (CDO) for all aircraft. (Note: This Design Principle includes enabling continuous operations below 7,000ft, where possible).	PARTIAL	MET	MET	NOT	NOT

Progression criteria: Options having any High Design Principles which are 'NOT' met (red) or 2 or more Medium Design Principles 'NOT' met or greater than 5 Design Principles 'PARTIAL' met have been rejected.

Next Steps
Option 1 Systemised and Option 2 Part-systemised will be formally appraised under the Stage 2, Step 2B Options Appraisal (Phase 1 Initial), including Safety Assessment.

Eastern Arm

Option 0: Baseline (Do Nothing)		REJECT	Assessment matrix ref
This option represents the existing airspace design, i.e. The "Do-Nothing" option. Keep everything as it is currently			
Design Principle 1: Safety The airspace will maintain or enhance current levels of Safety. No change to the current level of safety.	High	MET	Enhanced - improvement over today's level of safety. Maintained - safety risk could be maintained within acceptable levels of today's operation
Design Principle 2: Operational The proposed airspace will maintain or enhance operational resilience of the ATC network. No change to the current level of delay absorption or disruption recovery	High	MET	Maintain or improve delay absorption
Design Principle 3: Operational The proposed airspace design will yield the greatest capacity benefits from systemisation. (Note: The proposed airspace design should provide increased capacity and reduce delay. This could include the delivery of a suitable delay absorption mechanism or reducing departure intervals. Systemisation will minimise the need for ATC tactical intervention; for example, through better traffic; management). The current airspace is near to operating at full capacity and unable to absorb future traffic growth. Note: without EGCN airspace Leeds inbounds will be unable to descend earlier (through coordination) resulting in increased loading in this airspace, and the re-distribution of EGCN traffic is currently unknown.	High	NOT	Design option unable to support the forecast traffic loading
Design Principle 4: Technical The MTMA airspace design will provide a compatible and optimised interface between the lower level terminal airspace; the upper Free Route Airspace (FRA) and the ATS network. (Note: The intent of this Design Principle is for the provision of a design that supports the systemisation of traffic flows: from low-level terminal traffic to high-level Free Route flows. The future design should effectively manage arrivals and departures within the TMA without impacting capacity). The current airspace supports connectivity with lower level airspace, FRA and the ATS network. Changes to any of these environments will need to be designed to interface as appropriate to the existing airspace design.	High	MET	Minimal or no changes required for compatibility with FRA
Design Principle 5: Economic The proposed MTMA airspace will facilitate optimised network economic performance. (Note: Economic benefits could include environmental improvements such as reduced track mileage/ emissions or revenue from increased capacity/ route charges). No change, no impact.	Medium	PARTIAL	Economic performance as per today
Design Principle 6: Environmental The proposed MTMA airspace will facilitate the reduction of CO2 emissions per flight. No change, no impact.	Medium	PARTIAL	CO2 emissions as per today
Design Principle 7: Environmental Minimise environmental impacts to stakeholders on the ground. (Note: network changes are >7,000ft, the position of the interface with the airport's lower level routes will be determined by the airport, hence impacts below 7,000ft will be addressed in the separate airport-sponsored ACP). No change, no impact.	Low	MET	No change in noise impacts below 7000ft
Design Principle 8: Operational The MTMA airspace should be compatible with the requirements of the MoD and take into consideration the requirements of the defence industry stakeholders. (Note: Consider where impacts might be greatest by considering Military-use areas against placement of airspace structures). No change to impact the current operation; however it is noted that as traffic levels increase, ATC ability to deconflict against the military corridor may, in the future, become reduced.	Medium	MET	No impact or positive impact
Design Principle 9: Operational The impacts on GA, non-commercial and other civilian airspace users due to MTMA should be minimised. (Note: Consider where impacts might be greatest by considering known VFR significant areas against placement of airspace structures. This includes a wide variety of airspace users such as emergency, recreational, training and sport aviation). No change to impact the current operation; however it is noted that as traffic levels increase, ATC ability to provide crossing clearance for CAS may, in the future, become reduced.	Medium	MET	No impact or positive impact
Design Principle 10: Technical The classification and volume of controlled airspace required for the MTMA should be the minimum necessary to deliver an efficient airspace design, taking into account the needs of UK airspace users . (Note: This may include releasing CAS as appropriate). The CTA classifications in this region are considered disproportionately restrictive.	Medium	PARTIAL	No change or minor reduction in accessibility of airspace for airspace users
Design Principle 11: Technical The route network linking Airport procedures with the enroute phase of flight will be spaced to yield maximum safety, capacity and efficiency benefits by using an optimal standard of PBN. (Note: Where appropriate, the use of RNP should be considered if the fleet mix can support it). No change to current RNAV standards; the existing ATS routes are RNAV5 non-systemised routes.	High	PARTIAL	PBN standard as per today's operation
Design Principle 12: Technical The MTMA airspace design will provide a compatible and optimised interface with London Airspace Modernisation Programme (LAMP) design. (Note: Closely spaced routes across the interface) LAMP interface is not applicable for the Eastern element.	High	MET	Minimal or no changes required for compatibility with LAMP design
Design Principle 13: Policy Must accord with the CAA's published Airspace Modernisation Strategy (CAP1711) and any current or future plans associated with it. (Note: The CAA have stated that this DP is required by all change sponsors. CAP1711 describes what airspace modernisation must deliver including: - the need to increase aviation capacity; - growth to be sustainable; - the need to maximise the utilisation of existing runway capacity). Demonstrates alignment with fewer than 1/3 of the aims as set out in the AMS.	High	NOT	No or limited alignment with the AMS
Design Principle 14: Environmental The airspace should introduce improved Continuous Climb Operations (CCO) and Continuous Descent Operations (CDO) for all aircraft. (Note: This Design Principle includes enabling continuous operations below 7,000ft, where possible). No change, no impact.	Medium	PARTIAL	CCO and CDO as per today

Conclusion:	Option 0: Baseline (Do Nothing) represents no change to the existing airspace design. 2 DPs (priority HIGH) were 'NOT' met, hence this option was REJECTED and will not be progressed.

Eastern Arm

Option 1: Systemised	Accept & Progress	Assessment matrix ref
Option 1 will look to introduce a systemised airspace structure providing connectivity for Manchester TMA traffic routing to /from central Europe and Scandinavia. Additionally, connectivity may be required to, from and between adjacent geographical elements		
Design Principle 1: **Safety** High The airspace will maintain or enhance current levels of Safety. Systemised routes provide separation by route design for arrival, departure and overflight flows. This reduces route conflictions and the requirement for tactical separation management and may improve operational safety.	MET	Enhanced - improvement over today's level of safety. Maintained - safety risk could be maintained within acceptable levels of today's operation
Design Principle 2: **Operational** High The proposed airspace will maintain or enhance operational resilience of the ATC network. Systemised routes, separated by design, provide more efficient use of the airspace, increased capacity and predictability of the traffic flows and reduced ATC and pilot workload, potentially improving delay absorption and disruption recovery.	MET	Maintain or improve delay absorption
Design Principle 3: **Operational** High The proposed airspace design will yield the greatest capacity benefits from systemisation. (Note: The proposed airspace design should provide increased capacity and reduce delay. This could include the delivery of a suitable delay absorption mechanism or reducing departure intervals. Systemisation will minimise the need for ATC tactical intervention; for example, through better traffic; management). Systemised routes, separated by design, provide more efficient use of the airspace, increased capacity and predictability of the traffic flows and reduced ATC and pilot workload, supporting future traffic growth.	MET	Design option supports the forecast traffic loading and increases capacity
Design Principle 4: **Technical** High The MTMA airspace design will provide a compatible and optimised interface between the lower level terminal airspace; the upper Free Route Airspace (FRA) and the ATS network. (Note: The intent of this Design Principle is for the provision of a design that supports the systemisation of traffic flows: from low-level terminal traffic to high-level Free Route flows. The future design should effectively manage arrivals and departures within the TMA without impacting capacity). The systemisation concept does not provide the flexibility required to maximise the efficiency of the interface with FRA, the ATS route network and the lower airspace environment. Note: systemised routes do not support bi-directional entry/exit points.	PARTIAL	Significant changes with FRA required for compatibility
Design Principle 5: **Economic** Medium The proposed MTMA airspace will facilitate optimised network economic performance. (Note: Economic benefits could include environmental improvements such as reduced track mileage/ emissions or revenue from increased capacity/ route charges). Systemisation enables reduced tactical intervention, and therefore supports a potential reduction in unplanned track miles and improved economic performance compared to today.	MET	Economic performance increased
Design Principle 6: **Environmental** Medium The proposed MTMA airspace will facilitate the reduction of CO2 emissions per flight. Systemisation enables reduced tactical intervention, and therefore supports a potential reduction in unplanned track miles and improved environmental performance compared to today.	MET	CO2 emissions reduced
Design Principle 7: **Environmental** Low Minimise environmental impacts to stakeholders on the ground. (Note: network changes are >7,000ft, the position of the interface with the airport's lower level routes will be determined by the airport, hence impacts below 7,000ft will be addressed in the separate airport-sponsored ACP). The removal of EGCN airspace prohibits optimal descent profiles for EGNM inbounds; potential for additional CAS to enable earlier descent (as in the case where EGCN CAS exists). However, any impact below 7,000ft will be included in the EGNM airport ACP.	MET	No change in noise impacts below 7000ft
Design Principle 8: **Operational** Medium The MTMA airspace should be compatible with the requirements of the MoD and take into consideration the requirements of the defence industry stakeholders. (Note: Consider where impacts might be greatest by considering Military-use areas against placement of airspace structures). This concept could require increased CAS and may impact the Military. Note: We will seek to use the lowest classification applicable to the airspace. No SUAs are likely to be impacted and adherence to the SUA buffer policy will be maintained.	PARTIAL	Minor impact and not safety critical
Design Principle 9: **Operational** Medium The impacts on GA, non-commercial and other civilian airspace users due to MTMA should be minimised. (Note: Consider where impacts might be greatest by considering known VFR significant areas against placement of airspace structures. This includes a wide variety of airspace users such as emergency, recreational, training and sport aviation). This concept could require increased CAS and might impact the GA, non commercial and other civilian airspace users, although generally they fly at lower levels underneath CAS. We will seek to use the lowest classification applicable to the airspace.	PARTIAL	Minor impact and not safety critical
Design Principle 10: **Technical** Medium The classification and volume of controlled airspace required for the MTMA should be the minimum necessary to deliver an efficient airspace design, taking into account the needs of UK airspace users . (Note: This may include releasing CAS as appropriate). This concept has the potential to reduce the classification of CTAs improving accessibility for airspace users. Note: the overall benefit of reducing the classification of CTAs in this airspace is considered to outweigh any additional CAS requirements created by the de-notification of EGCN airspace.	MET	Improved accessibility of airspace for airspace users
Design Principle 11: **Technical** High The route network linking Airport procedures with the enroute phase of flight will be spaced to yield maximum safety, capacity and efficiency benefits by using an optimal standard of PBN. (Note: Where appropriate, the use of RNP should be considered if the fleet mix can support it). The highest appropriate level of PBN will be used.	MET	Increased PBN standard compared to today's operation
Design Principle 12: **Technical** High The MTMA airspace design will provide a compatible and optimised interface with London Airspace Modernisation Programme LAMP interface is not applicable for the Eastern element.	MET	Minimal or no changes required for compatibility with LAMP design
Design Principle 13: **Policy** High Must accord with the CAA's published Airspace Modernisation Strategy (CAP1711) and any current or future plans associated with it. (Note: The CAA have stated that this DP is required by all change sponsors. CAP1711 describes what airspace modernisation must deliver including: - the need to increase aviation capacity; - growth to be sustainable; - the need to maximise the utilisation of existing runway capacity). Demonstrates alignment with more than 2/3 of the aims as set out in the AMS.	MET	Aligned with the AMS
Design Principle 14: **Environmental** Medium The airspace should introduce improved Continuous Climb Operations (CCO) and Continuous Descent Operations (CDO) for all Improved CCO and CDO from separated traffic flows.	MET	Positive impact on CCO and CDO

Conclusion:	**Option 1: Systemisation provides separated traffic flows, increasing capacity, resilience and predictability and reducing unplanned track miles to the benefit of environmental and economic performance. A potential reduction in CTA classification and changes to the base of CAS could improve accessibility to the airspace in this option. This option is considered a promising candidate and has been PROGRESSED to the next stage.**

Eastern Arm

Option 2: Part-systemised	Accept & Progress	Assessment matrix ref
Option 2 will look to introduce of a mix of systemised airspace structures and non-systemised route structures providing connectivity for Manchester TMA traffic routing to /from central Europe and Scandinavia. Additionally, connectivity may be required to, from and between adjacent geographical elements.		
Design Principle 1: Safety High The airspace will maintain or enhance current levels of Safety. This concept includes the use of systemised routes which provide separation by route design for arrival, departure and overflight flows. This reduces route conflictions and the requirement for tactical separation management and may improve operational safety.	MET	Enhanced - improvement over today's level of safety. Maintained - safety risk which could be maintained within acceptable levels to today's operation
Design Principle 2: Operational High The proposed airspace will maintain or enhance operational resilience of the ATC network. In addition to the benefits provided by systemisation (see Concept 1), within this concept part-systemisation could provide extra flexibility, (in airspace where the non-systemised solution is better), to further improve the resilience of the operation.	MET	Maintain or improve delay absorption
Design Principle 3: Operational High The proposed airspace design will yield the greatest capacity benefits from systemisation. (Note: The proposed airspace design should provide increased capacity and reduce delay. This could include the delivery of a suitable delay absorption mechanism or reducing departure intervals. Systemisation will minimise the need for ATC tactical intervention; for example, through better traffic management). In addition to the benefits provided by systemisation (see Concept 1), within this concept part-systemisation could provide extra capacity, (in airspace where the non-systemised solution is better), to further reduce delay and/ or ATC and pilot workload.	MET	Design option supports the forecast traffic loading and increases capacity
Design Principle 4: Technical High The MTMA airspace design will provide a compatible and optimised interface between the lower level terminal airspace; the upper Free Route Airspace (FRA) and the ATS network. (Note: The intent of this Design Principle is for the provision of a design that supports the systemisation of traffic flows: from low-level terminal traffic to high-level Free Route flows. The future design should effectively manage arrivals and departures within the TMA without impacting capacity). Part-systemisation removes the rigidity of full systemisation and can potentially provide a seamless transition to/from the other airspace environments.	MET	Minimal or no changes required for compatibility with FRA
Design Principle 5: Economic Medium The proposed MTMA airspace will facilitate optimised network economic performance. (Note: Economic benefits could include environmental improvements such as reduced track mileage/ emissions or revenue from increased capacity/ route charges). In addition to the benefits provided by systemisation (see Concept 1), within this concept a non-systemised solution could (in airspace where the non-systemised solution is better) reduce the burden of extending the mileage to support the systemised solution, thereby improving economic performance compared to today.	MET	Economic performance increased
Design Principle 6: Environmental Medium The proposed MTMA airspace will facilitate the reduction of CO2 emissions per flight. In addition to the benefits provided by systemisation (see Concept 1), within this concept a non-systemised solution could (in airspace where the non-systemised solution is better) reduce the burden of extending the mileage to support the systemised solution, thereby improving environmental performance compared to today.	MET	CO2 emissions reduced
Design Principle 7: Environmental Low Minimise environmental impacts to stakeholders on the ground. (Note: network changes are >7,000ft, the position of the interface with the airport's lower level routes will be determined by the airport, hence impacts below 7,000ft will be addressed in the separate airport-sponsored ACP). The removal of EGCN airspace prohibits optimal descent profiles for EGNM inbounds; potential for additional CAS to enable earlier descent (as in the case where EGCN CAS exists). However, any impact below 7,000ft will be included in the EGNM airport ACP.	MET	No change in noise impacts below 7000ft
Design Principle 8: Operational Medium The MTMA airspace should be compatible with the requirements of the MoD and take into consideration the requirements of the defence industry stakeholders. (Note: Consider where impacts might be greatest by considering Military-use areas against placement of airspace structures). This concept could require increased CAS (although potentially lower additional CAS than full systemisation) and may impact the Military. Note: We will seek to use the lowest classification applicable to the airspace. No SUAs are likely to be impacted and adherence to the SUA buffer policy will be maintained.	PARTIAL	Minor impact and not safety critical
Design Principle 9: Operational Medium The impacts on GA, non-commercial and other civilian airspace users due to MTMA should be minimised. (Note: Consider where impacts might be greatest by considering known VFR significant areas against placement of airspace structures. This includes a wide variety of airspace users such as emergency, recreational, training and sport aviation). This concept could require increased CAS (potentially lower additional CAS than full systemisation) and may impact the GA, non commercial and other civilian airspace users, although generally they fly at lower levels underneath CAS. Note: We will seek to use the lowest classification applicable to the airspace.	PARTIAL	Minor impact and not safety critical
Design Principle 10: Technical Medium The classification and volume of controlled airspace required for the MTMA should be the minimum necessary to deliver an efficient airspace design, taking into account the needs of UK airspace users. (Note: This may include releasing CAS as appropriate). This concept has the potential to reduce the classification of CTAs improving accessibility for airspace users. Note: the overall benefit of reducing the classification of CTAs in this airspace is considered to outweigh any additional CAS requirements created by the de-notification of EGCN airspace.	MET	Improved accessibility of airspace for airspace users
Design Principle 11: Technical High The route network linking Airport procedures with the enroute phase of flight will be spaced to yield maximum safety, capacity and efficiency benefits by using an optimal standard of PBN. (Note: Where appropriate, the use of RNP should be considered if the fleet mix can support it). The highest appropriate level of PBN will be used.	MET	Increased PBN standard compared to today's operation
Design Principle 12: Technical High The MTMA airspace design will provide a compatible and optimised interface with London Airspace Modernisation Programme (LAMP) design. (Note: Closely spaced routes across the interface) LAMP interface is not applicable for the Eastern element.	MET	Minimal or no changes required for compatibility with LAMP design
Design Principle 13: Policy High Must accord with the CAA's published Airspace Modernisation Strategy (CAP1711) and any current or future plans associated with it. (Note: The CAA have stated that this DP is required by all change sponsors. CAP1711 describes what airspace modernisation must deliver including: - the need to increase aviation capacity; - growth to be sustainable; - the need to maximise the utilisation of existing runway capacity). Demonstrates alignment with more than 2/3 of the aims as set out in the AMS.	MET	Aligned with the AMS
Design Principle 14: Environmental Medium The airspace should introduce improved Continuous Climb Operations (CCO) and Continuous Descent Operations (CDO) for all aircraft. (Note: This Design Principle includes enabling continuous operations below 7,000ft, where possible). Improved CCO and CDO from separated traffic flows.	MET	Positive impact on CCO and CDO

Conclusion:	**Option 2: Part-systemisation provides the benefits of full systemisation with respect to increased capacity, resilience and predictability, reduced unplanned track miles and improved environmental and economic performance. Additionally it could provide the flexibility to interface more optimally with other airspace environments and further reduce planned track miles, in airspace where the non-systemisation solution is better. A potential reduction in CTA classification and changes to the base of CAS could improve accessibility to the airspace in this option. This option is considered a promising candidate and has been PROGRESSED to the next stage.**

Eastern Arm

Option 3: Most direct	REJECT	Assessment matrix ref
Option 3 will look to introduce direct routes providing connectivity for Manchester TMA traffic routing to /from central Europe and Scandinavia. Additionally, connectivity may be required to, from and between adjacent geographical elements.		
Design Principle 1: Safety High The airspace will maintain or enhance current levels of Safety. The use of direct routes could potentially distribute route confliction points, making it more difficult for ATC to anticipate and resolve interactions, particularly in high complexity/density traffic scenarios	PARTIAL	Diminished - Issue(s) identified could result in an elevated level of safety risk when compared to today's operation
Design Principle 2: Operational High The proposed airspace will maintain or enhance operational resilience of the ATC network. This concept could potentially increase the cognitive workload associated with ATC identifying and resolving route conflictions, therefore reducing the capacity in the system for ATC to manage/recover from high workload and abnormal scenarios.	NOT	Significant reduction in delay absorption
Design Principle 3: Operational High The proposed airspace design will yield the greatest capacity benefits from systemisation. (Note: The proposed airspace design should provide increased capacity and reduce delay. This could include the delivery of a suitable delay absorption mechanism or reducing departure intervals. Systemisation will minimise the need for ATC tactical intervention; for example, through better traffic; management). The use of direct routes could potentially distribute route confliction points, making it more difficult for ATC to anticipate and resolve interactions, particularly in high complexity/density traffic scenarios	NOT	Design option increases ATCO workload
Design Principle 4: Technical High The MTMA airspace design will provide a compatible and optimised interface between the lower level terminal airspace; the upper Free Route Airspace (FRA) and the ATS network. (Note: The intent of this Design Principle is for the provision of a design that supports the systemisation of traffic flows: from low-level terminal traffic to high-level Free Route flows. The future design should effectively manage arrivals and departures within the TMA without impacting capacity). This concept could route direct to the interface points for FRA, the ATS route network and the lower airspace environment.	MET	Minimal or no changes required for compatibility with FRA
Design Principle 5: Economic Medium The proposed MTMA airspace will facilitate optimised network economic performance. (Note: Economic benefits could include environmental improvements such as reduced track mileage/ emissions or revenue from increased capacity/ route charges). Enables, conceptually, the most direct flight plannable routings. However, it is noted that for tactical separation management ATC will need to deviate (vector) aircraft from their flight planned routings increasing contoller and pilot workload.	MET	Economic performance increased
Design Principle 6: Environmental Medium The proposed MTMA airspace will facilitate the reduction of CO_2 emissions per flight. Enables, conceptually, the most direct flight plannable routings. However, it is noted that for tactical separation management ATC will need to deviate (vector) aircraft from their flight planned routings.	MET	CO_2 emissions reduced
Design Principle 7: Environmental Low Minimise environmental impacts to stakeholders on the ground. (Note: network changes are >7,000ft, the position of the interface with the airport's lower level routes will be determined by the airport, hence impacts below 7,000ft will be addressed in the separate airport-sponsored ACP). The removal of EGCN airspace prohibits optimal descent profiles for EGNM inbounds; potential for additional CAS to enable earlier descent (as in the case where EGCN CAS exists). However, any impact below 7,000ft will be included in the EGNM airport ACP.	MET	No change in noise impacts below 7000ft
Design Principle 8: Operational Medium The MTMA airspace should be compatible with the requirements of the MoD and take into consideration the requirements of the defence industry stakeholders. (Note: Consider where impacts might be greatest by considering Military-use areas against placement of airspace structures). This concept could require increased CAS (potentially more additional CAS than full systemisation) to enable the direct routes. Note: We will seek to use the lowest classification applicable to the airspace. Adherence to the SUA buffer policy will ensure that no SUAs will be impacted.	PARTIAL	Minor impact and not safety critical
Design Principle 9: Operational Medium The impacts on GA, non-commercial and other civilian airspace users due to MTMA should be minimised. (Note: Consider where impacts might be greatest by considering known VFR significant areas against placement of airspace structures. This includes a wide variety of airspace users such as emergency, recreational, training and sport aviation). This concept could require increased CAS (potentially more additional CAS than full systemisation) to enable the direct routes and may impact the GA, non commercial and other civilian airspace users, although generally they fly at lower levels underneath CAS. Note: We will seek to use the lowest classification applicable to the airspace.	PARTIAL	Minor impact and not safety critical
Design Principle 10: Technical Medium The classification and volume of controlled airspace required for the MTMA should be the minimum necessary to deliver an efficient airspace design, taking into account the needs of UK airspace users . (Note: This may include releasing CAS as appropriate). The potential to reduce the classification of CTAs in this option is less likely due to the complexity of interactions resulting from the use of direct routes	PARTIAL	No change or minor reduction in accessibility of airspace for airspace users
Design Principle 11: Technical High The route network linking Airport procedures with the enroute phase of flight will be spaced to yield maximum safety, capacity and efficiency benefits by using an optimal standard of PBN. (Note: Where appropriate, the use of RNP should be considered if the fleet mix can support it). The highest appropriate level of PBN will be used.	MET	Increased PBN standard compared to today's operation
Design Principle 12: Technical High The MTMA airspace design will provide a compatible and optimised interface with London Airspace Modernisation Programme (LAMP) design. (Note: Closely spaced routes across the interface) LAMP interface is not applicable for the Eastern element.	MET	Minimal or no changes required for compatibility with LAMP design
Design Principle 13: Policy High Must accord with the CAA's published Airspace Modernisation Strategy (CAP1711) and any current or future plans associated with it. (Note: The CAA have stated that this DP is required by all change sponsors. CAP1711 describes what airspace modernisation must deliver including: - the need to increase aviation capacity; - growth to be sustainable; - the need to maximise the utilisation of existing runway capacity). Demonstrates alignment with fewer than 1/3 of the aims as set out in the AMS.	NOT	Not aligned with the AMS
Design Principle 14: Environmental Medium The airspace should introduce improved Continuous Climb Operations (CCO) and Continuous Descent Operations (CDO) for all aircraft. (Note: This Design Principle includes enabling continuous operations below 7,000ft, where possible). Vertical constraints (either procedural or tactical intervention by ATC) may be required to keep aircraft safely separated at the confliction points created by direct routes, disrupting continuous climb/descent profiles.	NOT	Negative impact on CCO and CDO compared with today

Conclusion:	Option 3: Most direct has 4 DPs 'NOT' met (3 of which are priority HIGH), hence this option was REJECTED and will not be progressed.

NATS

Eastern Arm

Option 4: Bi-directional	REJECT	Assessment matrix ref
Option 4 will look to introduce bi-directional routes providing connectivity for Manchester TMA traffic routing to /from central Europe and Scandinavia. Additionally, connectivity may be required to, from and between adjacent geographical elements.		
Design Principle 1: Safety High The airspace will maintain or enhance current levels of Safety. In the current airspace, eastbound traffic leaving the UK and westbound traffic entering the UK are procedurally separated by uni-directional routes. With bi-directional routes, westbound traffic could potentially conflict with the eastbound flow, requiring tactical separation management which may elevate the safety risk in comparison to today's operation.	PARTIAL	Diminished - Issue(s) identified could result in an elevated level of safety risk when compared to today's operation
Design Principle 2: Operational High The proposed airspace will maintain or enhance operational resilience of the ATC network. This concept could potentially increase the cognitive workload associated with ATC resolving westbound/eastbound route conflictions, therefore reducing the capacity in the system for ATC to manage/recover from high workload and abnormal scenarios.	NOT	Significant reduction in delay absorption
Design Principle 3: Operational High The proposed airspace design will yield the greatest capacity benefits from systemisation. (Note: The proposed airspace design should provide increased capacity and reduce delay. This could include the delivery of a suitable delay absorption mechanism or reducing departure intervals. Systemisation will minimise the need for ATC tactical intervention; for example, through better traffic; management). This concept could potentially increase the cognitive workload associated with ATC resolving westbound/eastbound route conflictions.	NOT	Design option increases ATCO workload
Design Principle 4: Technical High The MTMA airspace design will provide a compatible and optimised interface between the lower level terminal airspace; the upper Free Route Airspace (FRA) and the ATS network. (Note: The intent of this Design Principle is for the provision of a design that supports the systemisation of traffic flows: from low-level terminal traffic to high-level Free Route flows. The future design should effectively manage arrivals and departures within the TMA without impacting capacity). Bi-directional routes may create bottlenecks, increasing complexity at the interface and restricting the flow of traffic to/from other airspace environments.	NOT	Significant changes with ATS route network required for compatibility
Design Principle 5: Economic Medium The proposed MTMA airspace will facilitate optimised network economic performance. (Note: Economic benefits could include environmental improvements such as reduced track mileage/ emissions or revenue from increased capacity/ route charges). Enables, conceptually, more direct flight plannable routings. However, it is noted that for tactical separation management ATC will need to deviate (vector) aircraft from their flight planned routings increasing contoller and pilot workload.	MET	Economic performance increased
Design Principle 6: Environmental Medium The proposed MTMA airspace will facilitate the reduction of CO2 emissions per flight. Enables, conceptually, more direct flight plannable routings. However, it is noted that for tactical separation management ATC will need to deviate (vector) aircraft from their flight planned routings.	MET	CO2 emissions reduced
Design Principle 7: Environmental Low Minimise environmental impacts to stakeholders on the ground. (Note: network changes are >7,000ft, the position of the interface with the airport's lower level routes will be determined by the airport, hence impacts below 7,000ft will be addressed in the separate airport-sponsored ACP). The removal of EGCN airspace prohibits optimal descent profiles for EGNM inbounds; potential for additional CAS to enable earlier descent (as in the case where EGCN CAS exists). However, any impact below 7,000ft will be included in the EGNM airport ACP.	MET	No change in noise impacts below 7000ft
Design Principle 8: Operational Medium The MTMA airspace should be compatible with the requirements of the MoD and take into consideration the requirements of the defence industry stakeholders. (Note: Consider where impacts might be greatest by considering Military-use areas against placement of airspace structures). This concept could require increased CAS to enable bi-directional routes. Note: We will seek to use the lowest classification applicable to the airspace. No SUAs are likely to be impacted and adherence to the SUA buffer policy will be maintained.	PARTIAL	Minor impact and not safety critical
Design Principle 9: Operational Medium The impacts on GA, non-commercial and other civilian airspace users due to MTMA should be minimised. (Note: Consider where impacts might be greatest by considering known VFR significant areas against placement of airspace structures. This includes a wide variety of airspace users such as emergency, recreational, training and sport aviation). This concept could require increased CAS to enable bi-directional routes and may impact the GA, non commercial and other civilian airspace users, although generally they fly at lower levels underneath CAS. Note: We will seek to use the lowest classification applicable to the airspace.	PARTIAL	Minor impact and not safety critical
Design Principle 10: Technical Medium The classification and volume of controlled airspace required for the MTMA should be the minimum necessary to deliver an efficient airspace design, taking into account the needs of UK airspace users . (Note: This may include releasing CAS as appropriate). The potential to reduce the classification of CTAs in this option is less likely due to the complexity of interactions resulting from the use of bi-directional routes	PARTIAL	No change or minor reduction in accessibility of airspace for airspace users
Design Principle 11: Technical High The route network linking Airport procedures with the enroute phase of flight will be spaced to yield maximum safety, capacity and efficiency benefits by using an optimal standard of PBN. (Note: Where appropriate, the use of RNP should be considered if the fleet mix can support it). The highest appropriate level of PBN will be used.	MET	Increased PBN standard compared to today's operation
Design Principle 12: Technical High The MTMA airspace design will provide a compatible and optimised interface with London Airspace Modernisation Programme (LAMP) design. (Note: Closely spaced routes across the interface) LAMP interface is not applicable for the Eastern element.	MET	Minimal or no changes required for compatibility with LAMP design
Design Principle 13: Policy High Must accord with the CAA's published Airspace Modernisation Strategy (CAP1711) and any current or future plans associated with it. (Note: The CAA have stated that this DP is required by all change sponsors. CAP1711 describes what airspace modernisation must deliver including: - the need to increase aviation capacity; - growth to be sustainable; - the need to maximise the utilisation of existing runway capacity). Demonstrates alignment with fewer than 1/3 of the aims as set out in the AMS.	NOT	Not aligned with the AMS
Design Principle 14: Environmental Medium The airspace should introduce improved Continuous Climb Operations (CCO) and Continuous Descent Operations (CDO) for all aircraft. (Note: This Design Principle includes enabling continuous operations below 7,000ft, where possible). Vertical constraints (either procedural or tactical intervention by ATC) may be required to keep aircraft safely separated at the confliction points created by bi-directional routes, disrupting continuous climb/descent profiles.	NOT	Negative impact on CCO and CDO compared with today

Conclusion:	Option 4: Bi-directional has 5 DPs 'NOT' met (4 of which are priority HIGH), hence this option was REJECTED and will not be progressed.

11.5. Southern Spine DPE

Southern Spine

Southern Spine Conclusion and Shortlist

The design principle evaluation of each design option presented on the previous pages and are summarised in the table below.

Design Principle / Option Name:	Option 0: Baseline (Do Nothing)	Option 1: Systemised	Option 2: Part-systemised	Option 3: Most direct	Option 4: Bi-directional
Accept / Reject	REJECT	Accept & Progress	Accept & Progress	REJECT	REJECT
Design Principle 1: **Safety** **High** The airspace will maintain or enhance current levels of Safety.	MET	MET	MET	PARTIAL	PARTIAL
Design Principle 2: **Operational** **High** The proposed airspace will maintain or enhance operational resilience of the ATC network.	MET	MET	MET	NOT	NOT
Design Principle 3: **Operational** **High** The proposed airspace design will yield the greatest capacity benefits from systemisation. (Note: The proposed airspace design should provide increased capacity and reduce delay. This could include the delivery of a suitable delay absorption mechanism or reducing departure intervals. Systemisation will minimise the need for ATC tactical intervention; for example, through better traffic; management).	PARTIAL	MET	MET	NOT	NOT
Design Principle 4: **Technical** **High** The MTMA airspace design will provide a compatible and optimised interface between the lower level terminal airspace; the upper Free Route Airspace (FRA) and the ATS network. (Note: The intent of this Design Principle is for the provision of a design that supports the systemisation of traffic flows: from low-level terminal traffic to high-level Free Route flows. The future design should effectively manage arrivals and departures within the TMA without impacting capacity).	MET	PARTIAL	MET	MET	NOT
Design Principle 5: **Economic** **Medium** The proposed MTMA airspace will facilitate optimised network economic performance. (Note: Economic benefits could include environmental improvements such as reduced track mileage/ emissions or revenue from increased capacity/ route charges).	PARTIAL	MET	MET	MET	MET
Design Principle 6: **Environmental** **Medium** The proposed MTMA airspace will facilitate the reduction of CO2 emissions per flight.	PARTIAL	MET	MET	MET	MET
Design Principle 7: **Environmental** **Low** Minimise environmental impacts to stakeholders on the ground. (Note: network changes are >7,000ft, the position of the interface with the airport's lower level routes will be determined by the airport, hence impacts below 7,000ft will be addressed in the separate airport-sponsored ACP).	MET	MET	MET	MET	MET
Design Principle 8: **Operational** **Medium** The MTMA airspace should be compatible with the requirements of the MoD and take into consideration the requirements of the defence industry stakeholders. (Note: Consider where impacts might be greatest by considering Military-use areas against placement of airspace structures).	MET	PARTIAL	PARTIAL	PARTIAL	PARTIAL
Design Principle 9: **Operational** **Medium** The impacts on GA, non-commercial and other civilian airspace users due to MTMA should be minimised. (Note: Consider where impacts might be greatest by considering known VFR significant areas against placement of airspace structures. This includes a wide variety of airspace users such as emergency, recreational, training and sport aviation).	MET	PARTIAL	PARTIAL	PARTIAL	PARTIAL
Design Principle 10: **Technical** **Medium** The classification and volume of controlled airspace required for the MTMA should be the minimum necessary to deliver an efficient airspace design, taking into account the needs of UK airspace users . (Note: This may include releasing CAS as appropriate).	PARTIAL	MET	MET	PARTIAL	PARTIAL
Design Principle 11: **Technical** **High** The route network linking Airport procedures with the enroute phase of flight will be spaced to yield maximum safety, capacity and efficiency benefits by using an optimal standard of PBN. (Note: Where appropriate, the use of RNP should be considered if the fleet mix can support it).	PARTIAL	MET	MET	MET	MET
Design Principle 12: **Technical** **High** The MTMA airspace design will provide a compatible and optimised interface with London Airspace Modernisation Programme (LAMP) design. (Note: Closely spaced routes across the interface)	PARTIAL	PARTIAL	MET	MET	NOT
Design Principle 13: **Policy** **High** Must accord with the CAA's published Airspace Modernisation Strategy (CAP1711) and any current or future plans associated with it. (Note: The CAA have stated that this DP is required by all change sponsors. CAP1711 describes what airspace modernisation must deliver including: - the need to increase aviation capacity; - growth to be sustainable; - the need to maximise the utilisation of existing runway capacity).	NOT	MET	MET	NOT	NOT
Design Principle 14: **Environmental** **Medium** The airspace should introduce improved Continuous Climb Operations (CCO) and Continuous Descent Operations (CDO) for all aircraft. (Note: This Design Principle includes enabling continuous operations below 7,000ft, where possible).	PARTIAL	MET	MET	NOT	NOT

Progression criteria: Options having any High Design Principles which are 'NOT' met (red) or 2 or more Medium Design Principles 'NOT' met or greater than 5 Design Principles 'PARTIAL' met have been rejected.

Next Steps

Option 1 Systemised and Option 2 Part-systemised will be formally appraised under the Stage 2, Step 2B Options Appraisal (Phase 1 Initial), including Safety Assessment.

Southern Spine

Option 0: Baseline (Do Nothing)		REJECT	Assessment matrix ref
This option represents the existing airspace design, i.e. The "Do-Nothing" option. Keep everything as it is currently			
Design Principle 1: Safety The airspace will maintain or enhance current levels of Safety. No change to the current level of safety.	High	MET	Enhanced - improvement over today's level of safety. Maintained - safety risk could be maintained within acceptable levels of today's operation
Design Principle 2: Operational The proposed airspace will maintain or enhance operational resilience of the ATC network No change to the current level of delay absorption or disruption recovery	High	MET	No improvement in delay absorption
Design Principle 3: Operational The proposed airspace design will yield the greatest capacity benefits from systemisation. (Note: The proposed airspace design should provide increased capacity and reduce delay. This could include the delivery of a suitable delay absorption mechanism or reducing departure intervals. Systemisation will minimise the need for ATC tactical intervention; for example, through better traffic; management). The current airspace may accommodate future traffic growth, but provides no capacity benefit. Note: ATC workload increase is anticipated with increased traffic levels.	High	PARTIAL	Design option supports the forecast traffic loading but provides no capacity benefit
Design Principle 4: Technical The MTMA airspace design will provide a compatible and optimised interface between the lower level terminal airspace; the upper Free Route Airspace (FRA) and the ATS network. (Note: The intent of this Design Principle is for the provision of a design that supports the systemisation of traffic flows: from low-level terminal traffic to high-level Free Route flows. The future design should effectively manage arrivals and departures within the TMA without impacting capacity). The current airspace supports connectivity with lower level airspace, FRA and the ATS network. Changes to any of these environments will need to be designed to interface as appropriate to the existing airspace design.	High	MET	Minimal or no changes required for compatibility with FRA
Design Principle 5: Economic The proposed MTMA airspace will facilitate optimised network economic performance. (Note: Economic benefits could include environmental improvements such as reduced track mileage/ emissions or revenue from increased capacity/ route charges). No change, no impact.	Medium	PARTIAL	Economic performance as per today
Design Principle 6: Environmental The proposed MTMA airspace will facilitate the reduction of CO_2 emissions per flight. No change, no impact.	Medium	PARTIAL	CO_2 emissions as per today
Design Principle 7: Environmental Minimise environmental impacts to stakeholders on the ground. (Note: network changes are >7,000ft, the position of the interface with the airport's lower level routes will be determined by the airport, hence impacts below 7,000ft will be addressed in the separate airport-sponsored ACP). No change, no impact.	Low	MET	No change in noise impacts below 7000ft
Design Principle 8: Operational The MTMA airspace should be compatible with the requirements of the MoD and take into consideration the requirements of the defence industry stakeholders. (Note: Consider where impacts might be greatest by considering Military-use areas against placement of airspace structures). No change to impact the current operation; however it is noted that as traffic levels increase, ATC ability to deconflict against the military corridor may, in the future, become reduced.	Medium	MET	No impact or positive impact
Design Principle 9: Operational The impacts on GA, non-commercial and other civilian airspace users due to MTMA should be minimised. (Note: Consider where impacts might be greatest by considering known VFR significant areas against placement of airspace structures. This includes a wide variety of airspace users such as emergency, recreational, training and sport aviation). No change to impact the current operation; however it is noted that as traffic levels increase, ATC ability to provide crossing clearance for CAS may, in the future, become reduced.	Medium	MET	No impact or positive impact
Design Principle 10: Technical The classification and volume of controlled airspace required for the MTMA should be the minimum necessary to deliver an efficient airspace design, taking into account the needs of UK airspace users (Note: This may include releasing CAS as appropriate). The CTA classifications in this region are considered disproportionately restrictive.	Medium	PARTIAL	No change or minor reduction in accessibility of airspace for airspace users
Design Principle 11: Technical The route network linking Airport procedures with the enroute phase of flight will be spaced to yield maximum safety, capacity and efficiency benefits by using an optimal standard of PBN. (Note: Where appropriate, the use of RNP should be considered if the fleet mix can support it). No change to current RNAV standards; the existing ATS routes are RNAV5 non-systemised routes.	High	PARTIAL	PBN standard as per today's operation
Design Principle 12: Technical The MTMA airspace design will provide a compatible and optimised interface with London Airspace Modernisation Programme (LAMP) design. (Note: Closely spaced routes across the interface) The current airspace prohibits realisation of the full benefits of the LAMP airspace design.	High	PARTIAL	Significant changes required for LAMP design compatibility
Design Principle 13: Policy Must accord with the CAA's published Airspace Modernisation Strategy (CAP1711) and any current or future plans associated with it. (Note: The CAA have stated that this DP is required by all change sponsors. CAP1711 describes what airspace modernisation must deliver including: - the need to increase aviation capacity; - growth to be sustainable; - the need to maximise the utilisation of existing runway capacity). Demonstrates alignment with fewer than 1/3 of the aims as set out in the AMS.	High	NOT	No or limited alignment with the AMS
Design Principle 14: Environmental The airspace should introduce improved Continuous Climb Operations (CCO) and Continuous Descent Operations (CDO) for all aircraft. (Note: This Design Principle includes enabling continuous operations below 7,000ft, where possible). No change, no impact.	Medium	PARTIAL	CCO and CDO as per today

Conclusion:	**Option 0: Baseline (Do Nothing) represents no change to the existing airspace design. 1 DP (priority HIGH) was 'NOT' met, hence this option was REJECTED and will not be progressed.**

Southern Spine

Option 1: Systemised	Accept & Progress	Assessment matrix ref
Option 1 will look to introduce a systemised airspace structure providing connectivity for Manchester TMA traffic which is routing to/from the southern ATS route network. Additionally, connectivity may be required to, from, and between adjacent geographic elements.		
Design Principle 1: Safety High The airspace will maintain or enhance current levels of Safety. Systemised routes provide separation by route design for arrival, departure and overflight flows. This reduces route conflictions and the requirement for tactical separation management and may improve operational safety.	MET	Enhanced - improvement over today's level of safety. Maintained - safety risk could be maintained within acceptable levels of today's operation
Design Principle 2: Operational High The proposed airspace will maintain or enhance operational resilience of the ATC network. Systemised routes, separated by design, provide more efficient use of the airspace, increased capacity and predictability of the traffic flows and reduced ATC and pilot workload, potentially improving delay absorption and disruption recovery.	MET	Maintain or improve delay absorption
Design Principle 3: Operational High The proposed airspace design will yield the greatest capacity benefits from systemisation. (Note: The proposed airspace design should provide increased capacity and reduce delay. This could include the delivery of a suitable delay absorption mechanism or reducing departure intervals. Systemisation will minimise the need for ATC tactical intervention; for example, through better traffic; management). Systemised routes, separated by design, provide more efficient use of the airspace, increased capacity and predictability of the traffic flows and reduced ATC and pilot workload, supporting future traffic growth.	MET	Design option supports the forecast traffic loading and increases capacity
Design Principle 4: Technical High The MTMA airspace design will provide a compatible and optimised interface between the lower level terminal airspace; the upper Free Route Airspace (FRA) and the ATS network. (Note: The intent of this Design Principle is for the provision of a design that supports the systemisation of traffic flows: from low-level terminal traffic to high-level Free Route flows. The future design should effectively manage arrivals and departures within the TMA without impacting capacity). The systemisation concept does not provide the flexibility required to maximise the efficiency of the interface with FRA, the ATS route network and the lower airspace environment. Note: systemised routes do not support bi-directional entry/exit points.	PARTIAL	Significant changes with FRA required for compatibility
Design Principle 5: Economic Medium The proposed MTMA airspace will facilitate optimised network economic performance. (Note: Economic benefits could include environmental improvements such as reduced track mileage/ emissions or revenue from increased capacity/ route charges). Systemisation enables reduced tactical intervention, and therefore supports a potential reduction in unplanned track miles and improved economic performance compared to today.	MET	Economic performance increased
Design Principle 6: Environmental Medium The proposed MTMA airspace will facilitate the reduction of CO_2 emissions per flight. Systemisation enables reduced tactical intervention, and therefore supports a potential reduction in unplanned track miles and improved environmental performance compared to today.	MET	CO_2 emissions reduced
Design Principle 7: Environmental Low Minimise environmental impacts to stakeholders on the ground. (Note: network changes are >7,000ft, the position of the interface with the airport's lower level routes will be determined by the airport, hence impacts below 7,000ft will be addressed in the separate airport-sponsored ACP). No change below 7000ft.	MET	No change in noise impacts below 7000ft
Design Principle 8: Operational Medium The MTMA airspace should be compatible with the requirements of the MoD and take into consideration the requirements of the defence industry stakeholders. (Note: Consider where impacts might be greatest by considering Military-use areas against placement of airspace structures). This concept could require increased CAS and may impact the Military. Note: We will seek to use the lowest classification applicable to the airspace. No SUAs are likely to be impacted and adherence to the SUA buffer policy will be maintained.	PARTIAL	Minor impact and not safety critical
Design Principle 9: Operational Medium The impacts on GA, non-commercial and other civilian airspace users due to MTMA should be minimised. (Note: Consider where impacts might be greatest by considering known VFR significant areas against placement of airspace structures. This includes a wide variety of airspace users such as emergency, recreational, training and sport aviation). This concept could require increased CAS and might impact the GA, non commercial and other civilian airspace users, although generally they fly at lower levels underneath CAS. We will seek to use the lowest classification applicable to the airspace.	PARTIAL	Minor impact and not safety critical
Design Principle 10: Technical Medium The classification and volume of controlled airspace required for the MTMA should be the minimum necessary to deliver an efficient airspace design, taking into account the needs of UK airspace users. (Note: This may include releasing CAS as appropriate). This concept has the potential to reduce the classification of CTAs/release CAS improving accessibility for airspace users.	MET	Improved accessibility of airspace for airspace users
Design Principle 11: Technical High The route network linking Airport procedures with the enroute phase of flight will be spaced to yield maximum safety, capacity and efficiency benefits by using an optimal standard of PBN. (Note: Where appropriate, the use of RNP should be considered if the fleet mix can support it). The highest appropriate level of PBN will be used.	MET	Increased PBN standard compared to today's operation
Design Principle 12: Technical High The MTMA airspace design will provide a compatible and optimised interface with London Airspace Modernisation Programme (LAMP) design. (Note: Closely spaced routes across the interface) The systemisation concept does not provide the flexibility required to maximise the efficiency of the interface with LAMP	PARTIAL	Significant changes required for LAMP design compatibility
Design Principle 13: Policy High Must accord with the CAA's published Airspace Modernisation Strategy (CAP1711) and any current or future plans associated with it. (Note: The CAA have stated that this DP is required by all change sponsors. CAP1711 describes what airspace modernisation must deliver including: - the need to increase aviation capacity; - growth to be sustainable; - the need to maximise the utilisation of existing runway capacity). Demonstrates alignment with more than 2/3 of the aims as set out in the AMS.	MET	Aligned with the AMS
Design Principle 14: Environmental Medium The airspace should introduce improved Continuous Climb Operations (CCO) and Continuous Descent Operations (CDO) for all aircraft. (Note: This Design Principle includes enabling continuous operations below 7,000ft, where possible). Improved CCO and CDO from separated traffic flows.	MET	Positive impact on CCO and CDO

Conclusion:	**Option 1: Systemisation provides separated traffic flows, increasing capacity, resilience and predictability and reducing unplanned track miles to the benefit of environmental and economic performance. A potential reduction in CTA classification and changes to the base of CAS could improve accessibility to the airspace in this option. This option is considered a promising candidate and has been PROGRESSED to the next stage.**

Option 2: Part-systemised	Accept & Progress	Assessment matrix ref
Option 2 will look to introduce a mix of a systemised airspace structures and non-systemised route structures providing connectivity for Manchester TMA traffic which is routing to/from the southern ATS route network. Additionally, connectivity may be required to, from, and between adjacent geographic elements.		
Design Principle 1: Safety High The airspace will maintain or enhance current levels of Safety. This concept includes the use of systemised routes which provide separation by route design for arrival, departure and overflight flows. This reduces route conflictions and the requirement for tactical separation management and may improve operational safety.	MET	Enhanced - improvement over today's level of safety. Maintained - safety risk which could be maintained within acceptable levels to today's operation
Design Principle 2: Operational High The proposed airspace will maintain or enhance operational resilience of the ATC network. In addition to the benefits provided by systemisation (see Concept 1), within this concept part-systemisation could provide extra flexibility, (in airspace where the non-systemised solution is better), to further improve the resilience of the operation.	MET	Maintain or improve delay absorption
Design Principle 3: Operational High The proposed airspace design will yield the greatest capacity benefits from systemisation. (Note: The proposed airspace design should provide increased capacity and reduce delay. This could include the delivery of a suitable delay absorption mechanism or reducing departure intervals. Systemisation will minimise the need for ATC tactical intervention; for example, through better traffic; management). In addition to the benefits provided by systemisation (see Concept 1), within this concept part-systemisation could provide extra capacity, (in airspace where the non-systemised solution is better), to further reduce delay and/ or ATC and pilot workload.	MET	Design option supports the forecast traffic loading and increases capacity
Design Principle 4: Technical High The MTMA airspace design will provide a compatible and optimised interface between the lower level terminal airspace; the upper Free Route Airspace (FRA) and the ATS network. (Note: The intent of this Design Principle is for the provision of a design that supports the systemisation of traffic flows: from low-level terminal traffic to high-level Free Route flows. The future design should effectively manage arrivals and departures within the TMA without impacting capacity). Part-systemisation removes the rigidity of full systemisation and can potentially provide a seamless transition to/from the other airspace environments.	MET	Minimal or no changes required for compatibility with FRA
Design Principle 5: Economic Medium The proposed MTMA airspace will facilitate optimised network economic performance. (Note: Economic benefits could include environmental improvements such as reduced track mileage/ emissions or revenue from increased capacity/ route charges). In addition to the benefits provided by systemisation (see Concept 1), within this concept a non-systemised solution could (in airspace where the non-systemised solution is better) reduce the burden of extending the mileage to support the systemised solution, thereby improving economic performance compared to today.	MET	Economic performance increased
Design Principle 6: Environmental Medium The proposed MTMA airspace will facilitate the reduction of CO2 emissions per flight. In addition to the benefits provided by systemisation (see Concept 1), within this concept a non-systemised solution could (in airspace where the non-systemised solution is better) reduce the burden of extending the mileage to support the systemised solution, thereby improving environmental performance compared to today.	MET	CO2 emissions reduced
Design Principle 7: Environmental Low Minimise environmental impacts to stakeholders on the ground. (Note: network changes are >7,000ft, the position of the interface with the airport's lower level routes will be determined by the airport, hence impacts below 7,000ft will be addressed in the separate airport-sponsored ACP). No change below 7000ft.	MET	No change in noise impacts below 7000ft
Design Principle 8: Operational Medium The MTMA airspace should be compatible with the requirements of the MoD and take into consideration the requirements of the defence industry stakeholders. (Note: Consider where impacts might be greatest by considering Military-use areas against placement of airspace structures). This concept could require increased CAS (although potentially lower additional CAS than full systemisation) and may impact the Military. Note: We will seek to use the lowest classification applicable to the airspace. No SUAs are likely to be impacted and adherence to the SUA buffer policy will be maintained.	PARTIAL	Minor impact and not safety critical
Design Principle 9: Operational Medium The impacts on GA, non-commercial and other civilian airspace users due to MTMA should be minimised. (Note: Consider where impacts might be greatest by considering known VFR significant areas against placement of airspace structures. This includes a wide variety of airspace users such as emergency, recreational, training and sport aviation). This concept could require increased CAS (potentially lower additional CAS than full systemisation) and may impact the GA, non commercial and other civilian airspace users, although generally they fly at lower levels underneath CAS. Note: We will seek to use the lowest classification applicable to the airspace.	PARTIAL	Minor impact and not safety critical
Design Principle 10: Technical Medium The classification and volume of controlled airspace required for the MTMA should be the minimum necessary to deliver an efficient airspace design, taking into account the needs of UK airspace users. (Note: This may include releasing CAS as appropriate). This concept has the potential to reduce the classification of CTAs improving accessibility for airspace users.	MET	Improved accessibility of airspace for airspace users
Design Principle 11: Technical High The route network linking Airport procedures with the enroute phase of flight will be spaced to yield maximum safety, capacity and efficiency benefits by using an optimal standard of PBN. (Note: Where appropriate, the use of RNP should be considered if the fleet mix can support it). The highest appropriate level of PBN will be used.	MET	Increased PBN standard compared to today's operation
Design Principle 12: Technical High The MTMA airspace design will provide a compatible and optimised interface with London Airspace Modernisation Programme (LAMP) design. (Note: Closely spaced routes across the interface) Part-systemisation removes the rigidity of full systemisation and can potentially provide a seamless transition to/from the LAMP airspace environment.	MET	Minimal or no changes required for compatibility with LAMP design
Design Principle 13: Policy High Must accord with the CAA's published Airspace Modernisation Strategy (CAP1711) and any current or future plans associated with it. (Note: The CAA have stated that this DP is required by all change sponsors. CAP1711 describes what airspace modernisation must deliver including: - the need to increase aviation capacity; - growth to be sustainable; - the need to maximise the utilisation of existing runway capacity). Demonstrates alignment with more than 2/3 of the aims as set out in the AMS.	MET	Aligned with the AMS
Design Principle 14: Environmental Medium The airspace should introduce improved Continuous Climb Operations (CCO) and Continuous Descent Operations (CDO) for all aircraft. (Note: This Design Principle includes enabling continuous operations below 7,000ft, where possible). Improved CCO and CDO from separated traffic flows.	MET	Positive impact on CCO and CDO

Conclusion:	**Option 2: Part-systemisation provides the benefits of full systemisation with respect to increased capacity, resilience and predictability, reduced unplanned track miles and improved environmental and economic performance. Additionally it could provide the flexibility to interface more optimally with other airspace environments and further reduce planned track miles, in airspace where the non-systemisation solution is better. A potential reduction in CTA classification and changes to the base of CAS could improve accessibility to the airspace in this option. This option is considered a promising candidate and has been PROGRESSED to the next stage.**

Southern Spine

Option 3: Most direct		REJECT	Assessment matrix ref
Option 3 will look to introduce direct routes providing connectivity for Manchester TMA traffic which is routing to/from the southern ATS route network. Additionally, connectivity may be required to, from, and between adjacent geographic elements.			
Design Principle 1: Safety The airspace will maintain or enhance current levels of Safety. The use of direct routes could potentially distribute route confliction points, making it more difficult for ATC to anticipate and resolve interactions, particularly in high complexity/density traffic scenarios	High	PARTIAL	Diminished - Issue(s) identified could result in an elevated level of safety risk when compared to today's operation
Design Principle 2: Operational The proposed airspace will maintain or enhance operational resilience of the ATC network. This concept could potentially increase the cognitive workload associated with ATC identifying and resolving route conflictions, therefore reducing the capacity in the system for ATC to manage/recover from high workload and abnormal scenarios.	High	NOT	Significant reduction in delay absorption
Design Principle 3: Operational The proposed airspace design will yield the greatest capacity benefits from systemisation. (Note: The proposed airspace design should provide increased capacity and reduce delay. This could include the delivery of a suitable delay absorption mechanism or reducing departure intervals. Systemisation will minimise the need for ATC tactical intervention; for example, through better traffic; management). The use of direct routes could potentially distribute route confliction points, making it more difficult for ATC to anticipate and resolve interactions, particularly in high complexity/density traffic scenarios	High	NOT	Design option increases ATCO workload
Design Principle 4: Technical The MTMA airspace design will provide a compatible and optimised interface between the lower level terminal airspace; the upper Free Route Airspace (FRA) and the ATS network. (Note: The intent of this Design Principle is for the provision of a design that supports the systemisation of traffic flows: from low-level terminal traffic to high-level Free Route flows. The future design should effectively manage arrivals and departures within the TMA without impacting capacity). This concept could route direct to the interface points for FRA, the ATS route network and the lower airspace environment.	High	MET	Minimal or no changes required for compatibility with FRA
Design Principle 5: Economic The proposed MTMA airspace will facilitate optimised network economic performance. (Note: Economic benefits could include environmental improvements such as reduced track mileage/ emissions or revenue from increased capacity/ route charges). Enables, conceptually, the most direct flight plannable routings. However, it is noted that for tactical separation management ATC will need to deviate (vector) aircraft from their flight planned routings increasing contoller and pilot workload.	Medium	MET	Economic performance increased
Design Principle 6: Environmental The proposed MTMA airspace will facilitate the reduction of CO2 emissions per flight. Enables, conceptually, the most direct flight plannable routings. However, it is noted that for tactical separation management ATC will need to deviate (vector) aircraft from their flight planned routings.	Medium	MET	CO2 emissions reduced
Design Principle 7: Environmental Minimise environmental impacts to stakeholders on the ground. (Note: network changes are >7,000ft, the position of the interface with the airport's lower level routes will be determined by the airport, hence impacts below 7,000ft will be addressed in the separate airport-sponsored ACP). No change below 7000ft.	Low	MET	No change in noise impacts below 7000ft
Design Principle 8: Operational The MTMA airspace should be compatible with the requirements of the MoD and take into consideration the requirements of the defence industry stakeholders. (Note: Consider where impacts might be greatest by considering Military-use areas against placement of airspace structures). This concept could require increased CAS (potentially more additional CAS than full systemisation) to enable the direct routes. Note: We will seek to use the lowest classification applicable to the airspace. Adherence to the SUA buffer policy will ensure that no SUAs will be impacted.	Medium	PARTIAL	Minor impact and not safety critical
Design Principle 9: Operational The impacts on GA, non-commercial and other civilian airspace users due to MTMA should be minimised. (Note: Consider where impacts might be greatest by considering known VFR significant areas against placement of airspace structures. This includes a wide variety of airspace users such as emergency, recreational, training and sport aviation). This concept could require increased CAS (potentially more additional CAS than full systemisation) to enable the direct routes and may impact the GA, non commercial and other civilian airspace users, although generally they fly at lower levels underneath CAS. Note: We will seek to use the lowest classification applicable to the airspace.	Medium	PARTIAL	Minor impact and not safety critical
Design Principle 10: Technical The classification and volume of controlled airspace required for the MTMA should be the minimum necessary to deliver an efficient airspace design, taking into account the needs of UK airspace users. (Note: This may include releasing CAS as appropriate). The potential to reduce the classification of CTAs in this option is less likely due to the complexity of interactions resulting from the use of direct routes	Medium	PARTIAL	No change or minor reduction in accessibility of airspace for airspace users
Design Principle 11: Technical The route network linking Airport procedures with the enroute phase of flight will be spaced to yield maximum safety, capacity and efficiency benefits by using an optimal standard of PBN. (Note: Where appropriate, the use of RNP should be considered if the fleet mix can support it). The highest appropriate level of PBN will be used.	High	MET	Increased PBN standard compared to today's operation
Design Principle 12: Technical The MTMA airspace design will provide a compatible and optimised interface with London Airspace Modernisation Programme (LAMP) design. (Note: Closely spaced routes across the interface) This concept could route direct to the interface points providing a seamless transition to/from the LAMP airspace environment.	High	MET	Minimal or no changes required for compatibility with LAMP design
Design Principle 13: Policy Must accord with the CAA's published Airspace Modernisation Strategy (CAP1711) and any current or future plans associated with it. (Note: The CAA have stated that this DP is required by all change sponsors. CAP1711 describes what airspace modernisation must deliver including: - the need to increase aviation capacity; - growth to be sustainable; - the need to maximise the utilisation of existing runway capacity). Demonstrates alignment with fewer than 1/3 of the aims as set out in the AMS.	High	NOT	Not aligned with the AMS
Design Principle 14: Environmental The airspace should introduce improved Continuous Climb Operations (CCO) and Continuous Descent Operations (CDO) for all aircraft. (Note: This Design Principle includes enabling continuous operations below 7,000ft, where possible). Vertical constraints (either procedural or tactical intervention by ATC) may be required to keep aircraft safely separated at the confliction points created by direct routes, disrupting continuous climb/descent profiles.	Medium	NOT	Negative impact on CCO and CDO compared with today

Conclusion:	Option 3: Most direct has 4 DPs 'NOT' met (3 of which are priority HIGH), hence this option was REJECTED and will not be progressed.

Option 4: Bi-directional	REJECT	Assessment matrix ref
Option 4 will look to introduce bi-directional routes providing connectivity for Manchester TMA traffic which is routing to/from the southern ATS route network. Additionally, connectivity may be required to, from, and between adjacent geographic elements.		
Design Principle 1: Safety High The airspace will maintain or enhance current levels of Safety. In the current airspace, northbound and southbound traffic flows are procedurally separated by uni-directional routes. With bi-directional routes, northbound traffic could potentially conflict with the southbound flow, requiring tactical separation management which may elevate the safety risk in comparison to today's operation.	**PARTIAL**	Diminished - Issue(s) identified could result in an elevated level of safety risk when compared to today's operation
Design Principle 2: Operational High The proposed airspace will maintain or enhance operational resilience of the ATC network. This concept could potentially increase the cognitive workload associated with ATC resolving northbound/southbound route conflictions, therefore reducing the capacity in the system for ATC to manage/recover from high workload and abnormal scenarios.	**NOT**	Significant reduction in delay absorption
Design Principle 3: Operational High The proposed airspace design will yield the greatest capacity benefits from systemisation. (Note: The proposed airspace design should provide increased capacity and reduce delay. This could include the delivery of a suitable delay absorption mechanism or reducing departure intervals. Systemisation will minimise the need for ATC tactical intervention; for example, through better traffic; management). This concept could potentially increase the cognitive workload associated with ATC resolving northbound/southbound route conflictions.	**NOT**	Design option increases ATCO workload
Design Principle 4: Technical High The MTMA airspace design will provide a compatible and optimised interface between the lower level terminal airspace; the upper Free Route Airspace (FRA) and the ATS network. (Note: The intent of this Design Principle is for the provision of a design that supports the systemisation of traffic flows: from low-level terminal traffic to high-level Free Route flows. The future design should effectively manage arrivals and departures within the TMA without impacting capacity). Bi-directional routes may create bottlenecks, increasing complexity at the interface and restricting the flow of traffic to/from other airspace environments.	**NOT**	Option incompatible with ATS route network
Design Principle 5: Economic Medium The proposed MTMA airspace will facilitate optimised network economic performance. (Note: Economic benefits could include environmental improvements such as reduced track mileage/ emissions or revenue from increased capacity/ route charges). Enables, conceptually, more direct flight plannable routings. However, it is noted that for tactical separation management ATC will need to deviate (vector) aircraft from their flight planned routings increasing contoller and pilot workload.	**MET**	Economic performance increased
Design Principle 6: Environmental Medium The proposed MTMA airspace will facilitate the reduction of CO2 emissions per flight. Enables, conceptually, more direct flight plannable routings. However, it is noted that for tactical separation management ATC will need to deviate (vector) aircraft from their flight planned routings.	**MET**	CO2 emissions reduced
Design Principle 7: Environmental Low Minimise environmental impacts to stakeholders on the ground. (Note: network changes are >7,000ft, the position of the interface with the airport's lower level routes will be determined by the airport, hence impacts below 7,000ft will be addressed in the separate airport-sponsored ACP). No change below 7000ft.	**MET**	No change in noise impacts below 7000ft
Design Principle 8: Operational Medium The MTMA airspace should be compatible with the requirements of the MoD and take into consideration the requirements of the defence industry stakeholders. (Note: Consider where impacts might be greatest by considering Military-use areas against placement of airspace structures). This concept could require increased CAS to enable bi-directional routes. Note: We will seek to use the lowest classification applicable to the airspace. No SUAs are likely to be impacted and adherence to the SUA buffer policy will be maintained.	**PARTIAL**	Minor impact and not safety critical
Design Principle 9: Operational Medium The impacts on GA, non-commercial and other civilian airspace users due to MTMA should be minimised. (Note: Consider where impacts might be greatest by considering known VFR significant areas against placement of airspace structures. This includes a wide variety of airspace users such as emergency, recreational, training and sport aviation). This concept could require increased CAS to enable bi-directional routes and may impact the GA, non commercial and other civilian airspace users, although generally they fly at lower levels underneath CAS. Note: We will seek to use the lowest classification applicable to the airspace.	**PARTIAL**	Minor impact and not safety critical
Design Principle 10: Technical Medium The classification and volume of controlled airspace required for the MTMA should be the minimum necessary to deliver an efficient airspace design, taking into account the needs of UK airspace users. (Note: This may include releasing CAS as appropriate). The potential to reduce the classification of CTAs in this option is less likely due to the complexity of interactions resulting from the use of bi-directional routes	**PARTIAL**	No change or minor reduction in accessibility of airspace for airspace users
Design Principle 11: Technical High The route network linking Airport procedures with the enroute phase of flight will be spaced to yield maximum safety, capacity and efficiency benefits by using an optimal standard of PBN. (Note: Where appropriate, the use of RNP should be considered if the fleet mix can support it). The highest appropriate level of PBN will be used.	**MET**	Increased PBN standard compared to today's operation
Design Principle 12: Technical High The MTMA airspace design will provide a compatible and optimised interface with London Airspace Modernisation Programme (LAMP) design. (Note: Closely spaced routes across the interface) Bi-directional routes may create bottlenecks, increasing complexity at the interface and restricting the flow of traffic to/from the LAMP airspace environment.	**NOT**	Option incompatible with LAMP design
Design Principle 13: Policy High Must accord with the CAA's published Airspace Modernisation Strategy (CAP1711) and any current or future plans associated with it. (Note: The CAA have stated that this DP is required by all change sponsors. CAP1711 describes what airspace modernisation must deliver including: - the need to increase aviation capacity; - growth to be sustainable; - the need to maximise the utilisation of existing runway capacity). Demonstrates alignment with fewer than 1/3 of the aims as set out in the AMS.	**NOT**	Not aligned with the AMS
Design Principle 14: Environmental Medium The airspace should introduce improved Continuous Climb Operations (CCO) and Continuous Descent Operations (CDO) for all aircraft. (Note: This Design Principle includes enabling continuous operations below 7,000ft, where possible). Vertical constraints (either procedural or tactical intervention by ATC) may be required to keep aircraft safely separated at the confliction points created by bi-directional routes, disrupting continuous climb/descent profiles.	**NOT**	Negative impact on CCO and CDO compared with today

Conclusion:	**Option 4: Bi-directional has 6 DPs 'NOT' met (5 of which are priority HIGH), hence this option was REJECTED and will not be progressed.**

11.6. Western Arm DPE

Western Arm

Western Arm Conclusion and Shortlist

The design principle evaluation of each design option presented on the previous pages and are summarised in the table below.

Design Principle / Option Name:	Option 0: Baseline (Do Nothing)	Option 1: Systemised	Option 2: Part-systemised	Option 3: Most direct	Option 4: Bi-directional
Accept / Reject	REJECT	Accept & Progress	Accept & Progress	REJECT	REJECT
Design Principle 1: **Safety** **High** The airspace will maintain or enhance current levels of Safety.	MET	MET	MET	PARTIAL	PARTIAL
Design Principle 2: **Operational** **High** The proposed airspace will maintain or enhance operational resilience of the ATC network.	MET	MET	MET	NOT	NOT
Design Principle 3: **Operational** **High** The proposed airspace design will yield the greatest capacity benefits from systemisation. (Note: The proposed airspace design should provide increased capacity and reduce delay. This could include the delivery of a suitable delay absorption mechanism or reducing departure intervals. Systemisation will minimise the need for ATC tactical intervention; for example, through better traffic; management).	NOT	MET	MET	NOT	NOT
Design Principle 4: **Technical** **High** The MTMA airspace design will provide a compatible and optimised interface between the lower level terminal airspace; the upper Free Route Airspace (FRA) and the ATS network. (Note: The intent of this Design Principle is for the provision of a design that supports the systemisation of traffic flows: from low-level terminal traffic to high-level Free Route flows. The future design should effectively manage arrivals and departures within the TMA without impacting capacity).	MET	MET	MET	MET	NOT
Design Principle 5: **Economic** **Medium** The proposed MTMA airspace will facilitate optimised network economic performance. (Note: Economic benefits could include environmental improvements such as reduced track mileage/ emissions or revenue from increased capacity/ route charges).	PARTIAL	MET	MET	MET	MET
Design Principle 6: **Environmental** **Medium** The proposed MTMA airspace will facilitate the reduction of CO2 emissions per flight.	PARTIAL	MET	MET	MET	MET
Design Principle 7: **Environmental** **Low** Minimise environmental impacts to stakeholders on the ground. (Note: network changes are >7,000ft, the position of the interface with the airport's lower level routes will be determined by the airport, hence impacts below 7,000ft will be addressed in the separate airport-sponsored ACP).	MET	MET	MET	MET	MET
Design Principle 8: **Operational** **Medium** The MTMA airspace should be compatible with the requirements of the MoD and take into consideration the requirements of the defence industry stakeholders. (Note: Consider where impacts might be greatest by considering Military-use areas against placement of airspace structures).	MET	PARTIAL	PARTIAL	NOT	NOT
Design Principle 9: **Operational** **Medium** The impacts on GA, non-commercial and other civilian airspace users due to MTMA should be minimised. (Note: Consider where impacts might be greatest by considering known VFR significant areas against placement of airspace structures. This includes a wide variety of airspace users such as emergency, recreational, training and sport aviation).	MET	PARTIAL	PARTIAL	PARTIAL	PARTIAL
Design Principle 10: **Technical** **Medium** The classification and volume of controlled airspace required for the MTMA should be the minimum necessary to deliver an efficient airspace design, taking into account the needs of UK airspace users (Note: This may include releasing CAS as appropriate).	PARTIAL	MET	MET	NOT	PARTIAL
Design Principle 11: **Technical** **High** The route network linking Airport procedures with the enroute phase of flight will be spaced to yield maximum safety, capacity and efficiency benefits by using an optimal standard of PBN. (Note: Where appropriate, the use of RNP should be considered if the fleet mix can support it).	PARTIAL	MET	MET	MET	MET
Design Principle 12: **Technical** **High** The MTMA airspace design will provide a compatible and optimised interface with London Airspace Modernisation Programme (LAMP) design. (Note: Closely spaced routes across the interface)	MET	MET	MET	MET	NOT
Design Principle 13: **Policy** **High** Must accord with the CAA's published Airspace Modernisation Strategy (CAP1711) and any current or future plans associated with it. (Note: The CAA have stated that this DP is required by all change sponsors. CAP1711 describes what airspace modernisation must deliver including: - the need to increase aviation capacity; - growth to be sustainable; - the need to maximise the utilisation of existing runway capacity).	NOT	MET	MET	NOT	NOT
Design Principle 14: **Environmental** **Medium** The airspace should introduce improved Continuous Climb Operations (CCO) and Continuous Descent Operations (CDO) for all aircraft. (Note: This Design Principle includes enabling continuous operations below 7,000ft, where possible).	PARTIAL	MET	MET	NOT	NOT

Progression criteria: Options having any High Design Principles which are 'NOT' met (red) or 2 or more Medium Design Principles 'NOT' met or greater than 5 Design Principles 'PARTIAL' met have been rejected.

Next Steps

Option 1 Systemised and Option 2 Part-systemised will be formally appraised under the Stage 2, Step 2B Options Appraisal (Phase 1 Initial), including Safety Assessment.

Western Arm

Option 0: Baseline (Do Nothing)	REJECT	Assessment matrix ref
This option represents the existing airspace design, i.e. The "Do-Nothing" option. Keep everything as it is currently		
Design Principle 1: Safety High The airspace will maintain or enhance current levels of Safety. No change to the current level of safety.	MET	Enhanced - improvement over today's level of safety. Maintained - safety risk could be maintained within acceptable levels of today's operation
Design Principle 2: Operational High The proposed airspace will maintain or enhance operational resilience of the ATC network. No change to the current level of delay absorption or disruption recovery	MET	Maintain or improve delay absorption
Design Principle 3: Operational High The proposed airspace design will yield the greatest capacity benefits from systemisation. (Note: The proposed airspace design should provide increased capacity and reduce delay. This could include the delivery of a suitable delay absorption mechanism or reducing departure intervals. Systemisation will minimise the need for ATC tactical intervention; for example, through better traffic; management). The current airspace is near to operating at full capacity and unable to absorb future traffic growth; specifically high density/complexity traffic in the WAL, MIRSI and BARTN areas	NOT	Design option unable to support the forecast traffic loading
Design Principle 4: Technical High The MTMA airspace design will provide a compatible and optimised interface between the lower level terminal airspace; the upper Free Route Airspace (FRA) and the ATS network. (Note: The intent of this Design Principle is for the provision of a design that supports the systemisation of traffic flows: from low-level terminal traffic to high-level Free Route flows. The future design should effectively manage arrivals and departures within the TMA without impacting capacity). The current airspace supports connectivity with lower level airspace, FRA and the ATS network. Changes to any of these environments will need to be designed to interface as appropriate to the existing airspace design.	MET	Minimal or no changes required for compatibility with FRA
Design Principle 5: Economic Medium The proposed MTMA airspace will facilitate optimised network economic performance. (Note: Economic benefits could include environmental improvements such as reduced track mileage/ emissions or revenue from increased capacity/ route charges). No change, no impact.	PARTIAL	Economic performance as per today
Design Principle 6: Environmental Medium The proposed MTMA airspace will facilitate the reduction of CO2 emissions per flight. No change, no impact.	PARTIAL	CO2 emissions as per today
Design Principle 7: Environmental Low Minimise environmental impacts to stakeholders on the ground. (Note: network changes are >7,000ft, the position of the interface with the airport's lower level routes will be determined by the airport, hence impacts below 7,000ft will be addressed in the separate airport-sponsored ACP). No change, no impact.	MET	No change in noise impacts below 7000ft
Design Principle 8: Operational Medium The MTMA airspace should be compatible with the requirements of the MoD and take into consideration the requirements of the defence industry stakeholders. (Note: Consider where impacts might be greatest by considering Military-use areas against placement of airspace structures). No change to impact the current operation; however it is noted that as traffic levels increase, ATC ability to provide crossing clearance for CAS may, in the future, become reduced.	MET	No impact or positive impact
Design Principle 9: Operational Medium The impacts on GA, non-commercial and other civilian airspace users due to MTMA should be minimised. (Note: Consider where impacts might be greatest by considering known VFR significant areas against placement of airspace structures. This includes a wide variety of airspace users such as emergency, recreational, training and sport aviation). No change to impact the current operation; however it is noted that as traffic levels increase, ATC ability to provide crossing clearance for CAS may, in the future, become reduced.	MET	No impact or positive impact
Design Principle 10: Technical Medium The classification and volume of controlled airspace required for the MTMA should be the minimum necessary to deliver an efficient airspace design, taking into account the needs of UK airspace users. (Note: This may include releasing CAS as appropriate). As traffic levels increase, ATC ability to provide crossing clearance for CAS may, in the future, become reduced.	PARTIAL	No change or minor reduction in accessibility of airspace for airspace users
Design Principle 11: Technical High The route network linking Airport procedures with the enroute phase of flight will be spaced to yield maximum safety, capacity and efficiency benefits by using an optimal standard of PBN. (Note: Where appropriate, the use of RNP should be considered if the fleet mix can support it). No change to current RNAV standards; the existing ATS routes are RNAV5 non-systemised routes.	PARTIAL	PBN standard as per today's operation
Design Principle 12: Technical High The MTMA airspace design will provide a compatible and optimised interface with London Airspace Modernisation Programme (LAMP) design. (Note: Closely spaced routes across the interface) Limited additional connectivity required for compatibility with LAMP	MET	Minimal or no changes required for compatibility with LAMP design
Design Principle 13: Policy High Must accord with the CAA's published Airspace Modernisation Strategy (CAP1711) and any current or future plans associated with it. (Note: The CAA have stated that this DP is required by all change sponsors. CAP1711 describes what airspace modernisation must deliver including: - the need to increase aviation capacity; - growth to be sustainable; - the need to maximise the utilisation of existing runway capacity). Demonstrates alignment with fewer than 1/3 of the aims as set out in the AMS.	NOT	No or limited alignment with the AMS
Design Principle 14: Environmental Medium The airspace should introduce improved Continuous Climb Operations (CCO) and Continuous Descent Operations (CDO) for all aircraft. (Note: This Design Principle includes enabling continuous operations below 7,000ft, where possible). No change, no impact.	PARTIAL	CCO and CDO as per today

Conclusion:	Option 0: Baseline (Do Nothing) represents no change to the existing airspace design. 2 DPs (priority HIGH) were 'NOT' met, hence this option was REJECTED and will not be progressed.

Western Arm

Option 1: Systemised	Accept & Progress	Assessment matrix ref
Option 1 will look to extend the existing systemised airspace structures, providing connectivity for Manchester TMA traffic to route to/from Ireland, the Isle of Man and the southwest. Additionally, connectivity may be required to, from, and between adjacent geographic elements.		
Design Principle 1: Safety High The airspace will maintain or enhance current levels of Safety. Systemised routes provide separation by route design for arrival, departure and overflight flows. This reduces route conflictions and the requirement for tactical separation management and may improve operational safety.	MET	Enhanced - improvement over today's level of safety. Maintained - safety risk could be maintained within acceptable levels of today's operation
Design Principle 2: Operational High The proposed airspace will maintain or enhance operational resilience of the ATC network. Systemised routes, separated by design, provide more efficient use of the airspace, increased capacity and predictability of the traffic flows and reduced ATC and pilot workload, potentially improving delay absorption and disruption recovery.	MET	Maintain or improve delay absorption
Design Principle 3: Operational High The proposed airspace design will yield the greatest capacity benefits from systemisation. (Note: The proposed airspace design should provide increased capacity and reduce delay. This could include the delivery of a suitable delay absorption mechanism or reducing departure intervals. Systemisation will minimise the need for ATC tactical intervention; for example, through better traffic; management). Systemised routes, separated by design, provide more efficient use of the airspace, increased capacity and predictability of the traffic flows and reduced ATC and pilot workload, supporting future traffic growth.	MET	Design option supports the forecast traffic loading and increases capacity
Design Principle 4: Technical High The MTMA airspace design will provide a compatible and optimised interface between the lower level terminal airspace; the upper Free Route Airspace (FRA) and the ATS network. (Note: The intent of this Design Principle is for the provision of a design that supports the systemisation of traffic flows: from low-level terminal traffic to high-level Free Route flows. The future design should effectively manage arrivals and departures within the TMA without impacting capacity). The systemisation concept does not provide the flexibility required to maximise the efficiency of the interface with FRA, the ATS route network and the lower airspace environment. Note: systemised routes do not support bi-directional entry/exit points. However, the existing systemised route structure extends significantly into the Western element providing connectivity with FRA in this airspace and limited additional connectivity is required for compatibility with the West Airspace Deployment (LAMP Deployment 1 and Free Route Airspace Deployment 2) set to be implemented in 2023.	MET	Minimal or no changes required for compatibility with FRA
Design Principle 5: Economic Medium The proposed MTMA airspace will facilitate optimised network economic performance. (Note: Economic benefits could include environmental improvements such as reduced track mileage/ emissions or revenue from increased capacity/ route charges). Systemisation enables reduced tactical intervention, and therefore supports a potential reduction in unplanned track miles and improved economic performance compared to today.	MET	Economic performance increased
Design Principle 6: Environmental Medium The proposed MTMA airspace will facilitate the reduction of CO2 emissions per flight. Systemisation enables reduced tactical intervention, and therefore supports a potential reduction in unplanned track miles and improved environmental performance compared to today.	MET	CO2 emissions reduced
Design Principle 7: Environmental Low Minimise environmental impacts to stakeholders on the ground. (Note: network changes are >7,000ft, the position of the interface with the airport's lower level routes will be determined by the airport, hence impacts below 7,000ft will be addressed in the separate airport-sponsored ACP). No change below 7000ft.	MET	No change in noise impacts below 7000ft
Design Principle 8: Operational Medium The MTMA airspace should be compatible with the requirements of the MoD and take into consideration the requirements of the defence industry stakeholders. (Note: Consider where impacts might be greatest by considering Military-use areas against placement of airspace structures). No expected impact on CAS crossing opportunities. This concept could require increased CAS and may impact the Military. Note: We will seek to use the lowest classification applicable to the airspace. No SUAs are likely to be impacted and adherence to the SUA buffer policy will be maintained. There is a potential penetration of TRA004 (at the lower levels) which might impact the Military, although this airspace is considered to have low usage currently.	PARTIAL	Minor impact and not safety critical
Design Principle 9: Operational Medium The impacts on GA, non-commercial and other civilian airspace users due to MTMA should be minimised. (Note: Consider where impacts might be greatest by considering known VFR significant areas against placement of airspace structures. This includes a wide variety of airspace users such as emergency, recreational, training and sport aviation). This concept could require increased CAS and might impact the GA, non commercial and other civilian airspace users, although generally they fly at lower levels underneath CAS. We will seek to use the lowest classification applicable to the airspace.	PARTIAL	Minor impact and not safety critical
Design Principle 10: Technical Medium The classification and volume of controlled airspace required for the MTMA should be the minimum necessary to deliver an efficient airspace design, taking into account the needs of UK airspace users. (Note: This may include releasing CAS as appropriate). This concept has limited potential to reduce the classification of CTAs (majority of the airspace is currently Class C), although there is the potential for release of CAS.	MET	Improved accessibility of airspace for airspace users
Design Principle 11: Technical High The route network linking Airport procedures with the enroute phase of flight will be spaced to yield maximum safety, capacity and efficiency benefits by using an optimal standard of PBN. (Note: Where appropriate, the use of RNP should be considered if the fleet mix can support it). The highest appropriate level of PBN will be used.	MET	Increased PBN standard compared to today's operation
Design Principle 12: Technical High The MTMA airspace design will provide a compatible and optimised interface with London Airspace Modernisation Programme (LAMP) design. (Note: Closely spaced routes across the interface) Limited additional connectivity required for compatibility with LAMP	MET	Minimal or no changes required for compatibility with LAMP design
Design Principle 13: Policy High Must accord with the CAA's published Airspace Modernisation Strategy (CAP1711) and any current or future plans associated with it. (Note: The CAA have stated that this DP is required by all change sponsors. CAP1711 describes what airspace modernisation must deliver including: - the need to increase aviation capacity; - growth to be sustainable; - the need to maximise the utilisation of existing runway capacity). Demonstrates alignment with more than 2/3 of the aims as set out in the AMS.	MET	Aligned with the AMS
Design principle 14: Environmental Medium The airspace should introduce improved Continuous Climb Operations (CCO) and Continuous Descent Operations (CDO) for all aircraft. (Note: This Design Principle includes enabling continuous operations below 7,000ft, where possible). Improved CCO and CDO from separated traffic flows.	MET	Positive impact on CCO and CDO

Conclusion:	**Option 1: Systemisation provides separated traffic flows, increasing capacity, resilience and predictability and reducing unplanned track miles to the benefit of environmental and economic performance. Limited additional connectivity is required for compatibility with the LAMP and Free Route Airspace environments. Additional CAS may be required, however it is anticipated that the impact on Military, GA, non-commercial and other civilian airspace users will be minimal. The potential to increase accessibility of the airspace may be achieved through the release of CAS. This option is considered a promising candidate and has been PROGRESSED to the next stage.**

Western Arm

Option 2: Part-systemised	Accept & Progress	Assessment matrix ref
Option 2 will look to extend the existing systemised airspace structures and additionally introduce non-systemised route structures providing connectivity for Manchester TMA traffic to route to/from Ireland, the Isle of Man and the southwest. Additionally, connectivity may be required to, from, and between adjacent geographic elements.		
Design Principle 1: Safety High The airspace will maintain or enhance current levels of Safety. This concept includes the use of systemised routes which provide separation by route design for arrival, departure and overflight flows. This reduces route conflictions and the requirement for tactical separation management and may improve operational safety.	MET	Enhanced - improvement over today's level of safety. Maintained - safety risk which could be maintained within acceptable levels to today's operation
Design Principle 2: Operational High The proposed airspace will maintain or enhance operational resilience of the ATC network. In addition to the benefits provided by systemisation (see Concept 1), within this concept part-systemisation could provide extra flexibility, (in airspace where the non-systemised solution is better), to further improve the resilience of the operation.	MET	Maintain or improve delay absorption
Design Principle 3: Operational High The proposed airspace design will yield the greatest capacity benefits from systemisation. (Note: The proposed airspace design should provide increased capacity and reduce delay. This could include the delivery of a suitable delay absorption mechanism or reducing departure intervals. Systemisation will minimise the need for ATC tactical intervention; for example, through better traffic; management). In addition to the benefits provided by systemisation (see Concept 1), within this concept part-systemisation could provide extra capacity, (in airspace where the non-systemised solution is better), to further reduce delay and/ or ATC and pilot workload.	MET	Design option supports the forecast traffic loading and increases capacity
Design Principle 4: Technical High The MTMA airspace design will provide a compatible and optimised interface between the lower level terminal airspace; the upper Free Route Airspace (FRA) and the ATS network. (Note: The intent of this Design Principle is for the provision of a design that supports the systemisation of traffic flows: from low-level terminal traffic to high-level Free Route flows. The future design should effectively manage arrivals and departures within the TMA without impacting capacity). Part-systemisation removes the rigidity of full systemisation and can potentially provide a seamless transition to/from the other airspace environments. Additionally, the existing systemised route structure extends significantly into the Western element providing connectivity with FRA in this airspace and limited additional connectivity is required for compatibility with the West Airspace Deployment (LAMP Deployment 1 and Free Route Airspace Deployment 2) set to be implemented in 2023.	MET	Minimal or no changes required for compatibility with FRA
Design Principle 5: Economic Medium The proposed MTMA airspace will facilitate optimised network economic performance. (Note: Economic benefits could include environmental improvements such as reduced track mileage/ emissions or revenue from increased capacity/ route charges). In addition to the benefits provided by systemisation (see Concept 1), within this concept a non-systemised solution could (in airspace where the non-systemised solution is better) reduce the burden of extending the mileage to support the systemised solution, thereby improving economic performance compared to today.	MET	Economic performance increased
Design Principle 6: Environmental Medium The proposed MTMA airspace will facilitate the reduction of CO2 emissions per flight. In addition to the benefits provided by systemisation (see Concept 1), within this concept a non-systemised solution could (in airspace where the non-systemised solution is better) reduce the burden of extending the mileage to support the systemised solution, thereby improving environmental performance compared to today.	MET	CO2 emissions reduced
Design Principle 7: Environmental Low Minimise environmental impacts to stakeholders on the ground. (Note: network changes are >7,000ft, the position of the interface with the airport's lower level routes will be determined by the airport, hence impacts below 7,000ft will be addressed in the separate airport-sponsored ACP). No change below 7000ft.	MET	No change in noise impacts below 7000ft
Design Principle 8: Operational Medium The MTMA airspace should be compatible with the requirements of the MoD and take into consideration the requirements of the defence industry stakeholders. (Note: Consider where impacts might be greatest by considering Military-use areas against placement of airspace structures). No expected impact on CAS crossing opportunities. This concept could require increased CAS (although potentially lower additional CAS than full systemisation) and may impact the Military. Note: We will seek to use the lowest classification applicable to the airspace. No SUAs are likely to be impacted and adherence to the SUA buffer policy will be maintained. There is a potential penetration of TRA004 (at the lower levels) which might impact the Military, although this airspace is considered to have low usage currently.	PARTIAL	Minor impact and not safety critical
Design Principle 9: Operational Medium The impacts on GA, non-commercial and other civilian airspace users due to MTMA should be minimised. (Note: Consider where impacts might be greatest by considering known VFR significant areas against placement of airspace structures. This includes a wide variety of airspace users such as emergency, recreational, training and sport aviation). This concept could require increased CAS (potentially lower additional CAS than full systemisation) and might impact the GA, non commercial and other civilian airspace users, although generally they fly at lower levels underneath CAS. We will seek to use the lowest classification applicable to the airspace.	PARTIAL	Minor impact and not safety critical
Design Principle 10: Technical Medium The classification and volume of controlled airspace required for the MTMA should be the minimum necessary to deliver an efficient airspace design, taking into account the needs of UK airspace users. (Note: This may include releasing CAS as appropriate). This concept has limited potential to reduce the classification of CTAs (majority of the airspace is currently Class C), although there is the potential for release of CAS.	MET	Improved accessibility of airspace for airspace users
Design Principle 11: Technical High The route network linking Airport procedures with the enroute phase of flight will be spaced to yield maximum safety, capacity and efficiency benefits by using an optimal standard of PBN. (Note: Where appropriate, the use of RNP should be considered if the fleet mix can support it). The highest appropriate level of PBN will be used.	MET	Increased PBN standard compared to today's operation
Design Principle 12: Technical High The MTMA airspace design will provide a compatible and optimised interface with London Airspace Modernisation Programme (LAMP) design. (Note: Closely spaced routes across the interface) Limited additional connectivity required for compatibility with LAMP	MET	Minimal or no changes required for compatibility with LAMP design
Design Principle 13: Policy High Must accord with the CAA's published Airspace Modernisation Strategy (CAP1711) and any current or future plans associated with it. (Note: The CAA have stated that this DP is required by all change sponsors. CAP1711 describes what airspace modernisation must deliver including: - the need to increase aviation capacity; - growth to be sustainable; - the need to maximise the utilisation of existing runway capacity). Demonstrates alignment with more than 2/3 of the aims as set out in the AMS.	MET	Aligned with the AMS
Design Principle 14: Environmental Medium The airspace should introduce improved Continuous Climb Operations (CCO) and Continuous Descent Operations (CDO) for all aircraft. (Note: This Design Principle includes enabling continuous operations below 7,000ft, where possible). Improved CCO and CDO from separated traffic flows.	MET	Positive impact on CCO and CDO

Conclusion:	**Option 2: Part-systemisation provides the benefits of full systemisation with respect to increased capacity and predictability, reduced unplanned track miles and improved environmental and economic performance. Additionally it could provide the flexibility to interface more optimally with other airspace environments and further reduce planned track miles, in airspace where the non-systemisation solution is better. Limited additional connectivity is required for compatibility with the LAMP and Free Route Airspace environments. Additional CAS may be required, however it is anticipated that the impact on Military, GA, non-commercial and other civilian airspace users will be minimal. The potential to increase accessibility of the airspace may be achieved through the release of CAS. This option is considered a promising candidate and has been PROGRESSED to the next stage.**

Western Arm

Option 3: Most direct	REJECT	Assessment matrix ref
Option 3 will look to introduce direct routes providing connectivity between the existing systemised airspace structures, and Manchester TMA traffic routing to/from Ireland, the Isle of Man and the southwest. Additionally, connectivity may be required to, from, and between adjacent geographic elements.		
Design Principle 1: **Safety** High The airspace will maintain or enhance current levels of Safety. The use of direct routes could potentially distribute route confliction points, making it more difficult for ATC to anticipate and resolve interactions, particularly in high complexity/density traffic scenarios	PARTIAL	Diminished - Issue(s) identified could result in an elevated level of safety risk when compared to today's operation
Design Principle 2: **Operational** High The proposed airspace will maintain or enhance operational resilience of the ATC network. This concept could potentially increase the cognitive workload associated with ATC identifying and resolving route conflictions, therefore reducing the capacity in the system for ATC to manage/recover from high workload and abnormal scenarios.	NOT	Significant reduction in delay absorption
Design Principle 3: **Operational** High The proposed airspace design will yield the greatest capacity benefits from systemisation. (Note: The proposed airspace design should provide increased capacity and reduce delay. This could include the delivery of a suitable delay absorption mechanism or reducing departure intervals. Systemisation will minimise the need for ATC tactical intervention; for example, through better traffic; management). The use of direct routes could potentially distribute route confliction points, making it more difficult for ATC to anticipate and resolve interactions, particularly in high complexity/density traffic scenarios	NOT	Design option increases ATCO workload
Design Principle 4: **Technical** High The MTMA airspace design will provide a compatible and optimised interface between the lower level terminal airspace; the upper Free Route Airspace (FRA) and the ATS network. (Note: The intent of this Design Principle is for the provision of a design that supports the systemisation of traffic flows: from low-level terminal traffic to high-level Free Route flows. The future design should effectively manage arrivals and departures within the TMA without impacting capacity). This concept could route direct to the interface points for FRA, the ATS route network and the lower airspace environment. Additionally, the existing systemised route structure extends significantly into the Western element providing connectivity with FRA in this airspace and limited additional connectivity is required for compatibility with the West Airspace Deployment (LAMP Deployment 1 and Free Route Airspace Deployment 2) set to be implemented in 2023.	MET	Minimal or no changes required for compatibility with FRA
Design Principle 5: **Economic** Medium The proposed MTMA airspace will facilitate optimised network economic performance. (Note: Economic benefits could include environmental improvements such as reduced track mileage/ emissions or revenue from increased capacity/ route charges). Enables, conceptually, the most direct flight plannable routings. However, it is noted that for tactical separation management ATC will need to deviate (vector) aircraft from their flight planned routings increasing contoller and pilot workload.	MET	Economic performance increased
Design Principle 6: **Environmental** Medium The proposed MTMA airspace will facilitate the reduction of CO2 emissions per flight. Enables, conceptually, the most direct flight plannable routings. However, it is noted that for tactical separation management ATC will need to deviate (vector) aircraft from their flight planned routings.	MET	CO2 emissions reduced
Design Principle 7: **Environmental** Low Minimise environmental impacts to stakeholders on the ground. (Note: network changes are >7,000ft, the position of the interface with the airport's lower level routes will be determined by the airport, hence impacts below 7,000ft will be addressed in the separate airport-sponsored ACP). No change below 7000ft.	MET	No change in noise impacts below 7000ft
Design Principle 8: **Operational** Medium The MTMA airspace should be compatible with the requirements of the MoD and take into consideration the requirements of the defence industry stakeholders. (Note: Consider where impacts might be greatest by considering Military-use areas against placement of airspace structures). This concept could require increased CAS (potentially more additional CAS than full systemisation) to enable the direct routes. Note: We will seek to use the lowest classification applicable to the airspace. Adherence to the SUA buffer policy will ensure that no SUAs will be impacted. Due to potentially increased ATC workload associated with tactical separation management and a greater distribution of route confliction points for this concept, it may be more difficult to achieve CAS crossing opportunities. Additionally, there is a potential for greater penetration of TRA004 (at the lower levels) than full systemisation, which might impact the Military.	NOT	Major impact or safety critical impact
Design Principle 9: **Operational** Medium The impacts on GA, non-commercial and other civilian airspace users due to MTMA should be minimised. (Note: Consider where impacts might be greatest by considering known VFR significant areas against placement of airspace structures. This includes a wide variety of airspace users such as emergency, recreational, training and sport aviation). This concept could require increased CAS (potentially more additional CAS than full systemisation) to enable the direct routes and may impact the GA, non commercial and other civilian airspace users, although generally they fly at lower levels underneath CAS. Note: We will seek to use the lowest classification applicable to the airspace.	PARTIAL	Minor impact and not safety critical
Design Principle 10: **Technical** Medium The classification and volume of controlled airspace required for the MTMA should be the minimum necessary to deliver an efficient airspace design, taking into account the needs of UK airspace users. (Note: This may include releasing CAS as appropriate). The use of direct routes may increase the complexity of aircraft interactions leading to a requirement to increase the classification of CTAs (majority of the airspace is currently Class C).	NOT	Major reduction in accessibility of airspace for airspace users
Design principle 11: **Technical** High The route network linking Airport procedures with the enroute phase of flight will be spaced to yield maximum safety, capacity and efficiency benefits by using an optimal standard of PBN. (Note: Where appropriate, the use of RNP should be considered if the fleet mix can support it). The highest appropriate level of PBN will be used.	MET	Increased PBN standard compared to today's operation
Design Principle 12: **Technical** High The MTMA airspace design will provide a compatible and optimised interface with London Airspace Modernisation Programme (LAMP) design. (Note: Closely spaced routes across the interface) Limited additional connectivity required for compatibility with LAMP Deployment 1 set to be implemented in 2023; this concept could route direct to the interface points providing a seamless transition to/from the LAMP airspace environment.	MET	Minimal or no changes required for compatibility with LAMP design
Design Principle 13: **Policy** High Must accord with the CAA's published Airspace Modernisation Strategy (CAP1711) and any current or future plans associated with it. (Note: The CAA have stated that this DP is required by all change sponsors. CAP1711 describes what airspace modernisation must deliver including: - the need to increase aviation capacity; - growth to be sustainable; - the need to maximise the utilisation of existing runway capacity). Demonstrates alignment with fewer than 1/3 of the aims as set out in the AMS.	NOT	Not aligned with the AMS
Design Principle 14: **Environmental** Medium The airspace should introduce improved Continuous Climb Operations (CCO) and Continuous Descent Operations (CDO) for all aircraft. (Note: This Design Principle includes enabling continuous operations below 7,000ft, where possible). Vertical constraints (either procedural or tactical intervention by ATC) may be required to keep aircraft safely separated at the confliction points created by direct routes, disrupting continuous climb/descent profiles.	NOT	Negative impact on CCO and CDO compared with today

Conclusion:	**Option 3: Most direct has 6 DPs 'NOT' met (3 of which are priority HIGH), hence this option was REJECTED and will not be progressed.**

Option 4: Bi-directional	REJECT	Assessment matrix ref
Option 4 will look to introduce bi-directional routes providing connectivity between the existing systemised airspace structures, and Manchester TMA traffic routing to/from Ireland, the Isle of Man and the southwest. Additionally, connectivity may be required to, from, and between adjacent geographic elements.		
Design Principle 1: Safety High The airspace will maintain or enhance current levels of Safety. In this concept, an increased number of bi-directional routes (compared to today) around the WAL area would potentially place eastbound traffic in conflict with the westbound flow and northbound traffic in conflict with the southbound flow, requiring tactical separation management which may elevate the safety risk in comparison to today's operation.	PARTIAL	Diminished - Issue(s) identified could result in an elevated level of safety risk when compared to today's operation
Design Principle 2: Operational High The proposed airspace will maintain or enhance operational resilience of the ATC network. This concept could potentially increase the cognitive workload associated with ATC resolving eastbound/westbound and northbound/southbound route conflictions, therefore reducing the capacity in the system for ATC to manage/recover from high workload and abnormal scenarios.	NOT	Significant reduction in delay absorption
Design Principle 3: Operational High The proposed airspace design will yield the greatest capacity benefits from systemisation. (Note: The proposed airspace design should provide increased capacity and reduce delay. This could include the delivery of a suitable delay absorption mechanism or reducing departure intervals. Systemisation will minimise the need for ATC tactical intervention; for example, through better traffic; management). This concept could potentially increase the cognitive workload associated with ATC resolving eastbound/westbound and northbound/southbound route conflictions.	NOT	Design option increases ATCO workload
Design Principle 4: Technical High The MTMA airspace design will provide a compatible and optimised interface between the lower level terminal airspace; the upper Free Route Airspace (FRA) and the ATS network. (Note: The intent of this Design Principle is for the provision of a design that supports the systemisation of traffic flows: from low-level terminal traffic to high-level Free Route flows. The future design should effectively manage arrivals and departures within the TMA without impacting capacity). Bi-directional routes may create bottlenecks, increasing complexity at the interface and restricting the flow of traffic to/from other airspace environments.	NOT	Option incompatible with ATS route network
Design Principle 5: Economic Medium The proposed MTMA airspace will facilitate optimised network economic performance. (Note: Economic benefits could include environmental improvements such as reduced track mileage/ emissions or revenue from increased capacity/ route charges). Enables, conceptually, more direct flight plannable routings. However, it is noted that for tactical separation management ATC will need to deviate (vector) aircraft from their flight planned routings increasing contoller and pilot workload.	MET	Economic performance increased
Design Principle 6: Environmental Medium The proposed MTMA airspace will facilitate the reduction of CO2 emissions per flight. Enables, conceptually, more direct flight plannable routings. However, it is noted that for tactical separation management ATC will need to deviate (vector) aircraft from their flight planned routings.	MET	CO2 emissions reduced
Design Principle 7: Environmental Low Minimise environmental impacts to stakeholders on the ground. (Note: network changes are >7,000ft, the position of the interface with the airport's lower level routes will be determined by the airport, hence impacts below 7,000ft will be addressed in the separate airport-sponsored ACP). No change below 7000ft.	MET	No change in noise impacts below 7000ft
Design Principle 8: Operational Medium The MTMA airspace should be compatible with the requirements of the MoD and take into consideration the requirements of the defence industry stakeholders. (Note: Consider where impacts might be greatest by considering Military-use areas against placement of airspace structures). This concept could require increased CAS to enable bi-directional routes. Note: We will seek to use the lowest classification applicable to the airspace. No SUAs are likely to be impacted and adherence to the SUA buffer policy will be maintained. Due to potentially increased ATC workload associated with tactical separation management and a greater distribution of route confliction points for this concept, it may be more difficult to achieve CAS crossing opportunities. There is a potential penetration of TRA004 (at the lower levels) which might impact the Military, although this airspace is considered to have low usage currently.	NOT	Major impact or safety critical impact
Design Principle 9: Operational Medium The impacts on GA, non-commercial and other civilian airspace users due to MTMA should be minimised. (Note: Consider where impacts might be greatest by considering known VFR significant areas against placement of airspace structures. This includes a wide variety of airspace users such as emergency, recreational, training and sport aviation). This concept could require increased CAS to enable bi-directional routes and may impact the GA, non commercial and other civilian airspace users, although generally they fly at lower levels underneath CAS. Note: We will seek to use the lowest classification applicable to the airspace.	PARTIAL	Minor impact and not safety critical
Design Principle 10: Technical Medium The classification and volume of controlled airspace required for the MTMA should be the minimum necessary to deliver an efficient airspace design, taking into account the needs of UK airspace users. (Note: This may include releasing CAS as appropriate). The use of bi-directional routes may increase the complexity of aircraft interactions leading to a requirement to increase the classification of CTAs (majority of the airspace is currently Class C).	PARTIAL	No change or minor reduction in accessibility of airspace for airspace users
Design Principle 11: Technical High The route network linking Airport procedures with the enroute phase of flight will be spaced to yield maximum safety, capacity and efficiency benefits by using an optimal standard of PBN. (Note: Where appropriate, the use of RNP should be considered if the fleet mix can support it). The highest appropriate level of PBN will be used.	MET	Increased PBN standard compared to today's operation
Design Principle 12: Technical High The MTMA airspace design will provide a compatible and optimised interface with London Airspace Modernisation Programme (LAMP) design. (Note: Closely spaced routes across the interface) Bi-directional routes may create bottlenecks, increasing complexity at the interface and restricting the flow of traffic to/from the LAMP airspace environment.	NOT	Option incompatible with LAMP design
Design Principle 13: Policy High Must accord with the CAA's published Airspace Modernisation Strategy (CAP1711) and any current or future plans associated with it. (Note: The CAA have stated that this DP is required by all change sponsors. CAP1711 describes what airspace modernisation must deliver including: - the need to increase aviation capacity; - growth to be sustainable; - the need to maximise the utilisation of existing runway capacity). Demonstrates alignment with fewer than 1/3 of the aims as set out in the AMS.	NOT	Not aligned with the AMS
Design Principle 14: Environmental Medium The airspace should introduce improved Continuous Climb Operations (CCO) and Continuous Descent Operations (CDO) for all aircraft. (Note: This Design Principle includes enabling continuous operations below 7,000ft, where possible). Vertical constraints (either procedural or tactical intervention by ATC) may be required to keep aircraft safely separated at the confliction points created by bi-directional routes, disrupting continuous climb/descent profiles.	NOT	Negative impact on CCO and CDO compared with today

Conclusion:	**Option 4: Bi-directional has 7 DPs 'NOT' met (5 of which are priority HIGH), hence this option was REJECTED and will not be progressed.**

11.7. Central DPE

Central

Central Conclusion and Shortlist

The design principle evaluation of each design option presented on the previous pages and are summarised in the table below.

Design Principle / Option Name:	Option 0: Baseline (Do Nothing)	Option 1: Route connectivity
Accept / Reject	REJECT	Accept & Progress
Design Principle 1: Safety (High) The airspace will maintain or enhance current levels of Safety.	MET	MET
Design Principle 2: Operational (High) The proposed airspace will maintain or enhance operational resilience of the ATC network.	MET	MET
Design Principle 3: Operational (High) The proposed airspace design will yield the greatest capacity benefits from systemisation. (Note: The proposed airspace design should provide increased capacity and reduce delay. This could include the delivery of a suitable delay absorption mechanism or reducing departure intervals. Systemisation will minimise the need for ATC tactical intervention; for example, through better traffic; management).	PARTIAL	MET
Design Principle 4: Technical (High) The MTMA airspace design will provide a compatible and optimised interface between the lower level terminal airspace; the upper Free Route Airspace (FRA) and the ATS network. (Note: The intent of this Design Principle is for the provision of a design that supports the systemisation of traffic flows: from low-level terminal traffic to high-level Free Route flows. The future design should effectively manage arrivals and departures within the TMA without impacting capacity).	PARTIAL	MET
Design Principle 5: Economic (Medium) The proposed MTMA airspace will facilitate optimised network economic performance. (Note: Economic benefits could include environmental improvements such as reduced track mileage/ emissions or revenue from increased capacity/ route charges).	PARTIAL	MET
Design Principle 6: Environmental (Medium) The proposed MTMA airspace will facilitate the reduction of CO2 emissions per flight.	PARTIAL	MET
Design Principle 7: Environmental (Low) Minimise environmental impacts to stakeholders on the ground. (Note: network changes are >7,000ft, the position of the interface with the airport's lower level routes will be determined by the airport, hence impacts below 7,000ft will be addressed in the separate airport-sponsored ACP).	MET	MET
Design Principle 8: Operational (Medium) The MTMA airspace should be compatible with the requirements of the MoD and take into consideration the requirements of the defence industry stakeholders. (Note: Consider where impacts might be greatest by considering Military-use areas against placement of airspace structures).	MET	MET
Design Principle 9: Operational (Medium) The impacts on GA, non-commercial and other civilian airspace users due to MTMA should be minimised. (Note: Consider where impacts might be greatest by considering known VFR significant areas against placement of airspace structures. This includes a wide variety of airspace users such as emergency, recreational, training and sport aviation).	MET	MET
Design Principle 10: Technical (Medium) The classification and volume of controlled airspace required for the MTMA should be the minimum necessary to deliver an efficient airspace design, taking into account the needs of UK airspace users . (Note: This may include releasing CAS as appropriate).	PARTIAL	MET
Design Principle 11: Technical (High) The route network linking Airport procedures with the enroute phase of flight will be spaced to yield maximum safety, capacity and efficiency benefits by using an optimal standard of PBN. (Note: Where appropriate, the use of RNP should be considered if the fleet mix can support it).	PARTIAL	MET
Design Principle 12: Technical (High) The MTMA airspace design will provide a compatible and optimised interface with London Airspace Modernisation Programme (LAMP) design. (Note: Closely spaced routes across the interface)	MET	MET
Design Principle 13: Policy (High) Must accord with the CAA's published Airspace Modernisation Strategy (CAP1711) and any current or future plans associated with it. (Note: The CAA have stated that this DP is required by all change sponsors. CAP1711 describes what airspace modernisation must deliver including: - the need to increase aviation capacity; - growth to be sustainable; - the need to maximise the utilisation of existing runway capacity).	NOT	MET
Design Principle 14: Environmental (Medium) The airspace should introduce improved Continuous Climb Operations (CCO) and Continuous Descent Operations (CDO) for all aircraft. (Note: This Design Principle includes enabling continuous operations below 7,000ft, where possible).	PARTIAL	PARTIAL

Progression criteria: Options having any High Design Principles which are 'NOT' met (red) or 2 or more Medium Design Principles 'NOT' met or greater than 5 Design Principles 'PARTIAL' met have been rejected.

Next Steps

Option 1 Route connectivity will be formally appraised under the Stage 2, Step 2B Options Appraisal (Phase 1 Initial), including Safety Assessment.

Central

Option 0: Baseline (Do Nothing)	REJECT	Assessment matrix ref
This option represents the existing airspace design, i.e. The "Do-Nothing" option. Keep everything as it is currently		
Design Principle 1: **Safety** High The airspace will maintain or enhance current levels of Safety. No change to the current level of safety.	MET	Enhanced - improvement over today's level of safety. Maintained - safety risk could be maintained within acceptable levels of today's operation
Design Principle 2: **Operational** High The proposed airspace will maintain or enhance operational resilience of the ATC network. No change to the current level of delay absorption or disruption recovery	MET	Maintain or improve disruption recovery
Design Principle 3: **Operational** High The proposed airspace design will yield the greatest capacity benefits from systemisation. (Note: The proposed airspace design should provide increased capacity and reduce delay. This could include the delivery of a suitable delay absorption mechanism or reducing departure intervals. Systemisation will minimise the need for ATC tactical intervention; for example, through better traffic; management). Holds within and around the MTMA region are not currently routinely used, therefore it is considered that the current airspace may accommodate future traffic growth, but provides no capacity benefit.	PARTIAL	Design option supports the forecast traffic loading but provides no capacity benefit
Design Principle 4: **Technical** High The MTMA airspace design will provide a compatible and optimised interface between the lower level terminal airspace; the upper Free Route Airspace (FRA) and the ATS network. (Note: The intent of this Design Principle is for the provision of a design that supports the systemisation of traffic flows: from low-level terminal traffic to high-level Free Route flows. The future design should effectively manage arrivals and departures within the TMA without impacting capacity). Requirement to make potentially numerous modifications (depending on the solutions for the neighbouring geographic elements) for the Central element to interface to adjacent regions. Note: these changes could be simple, but significant in number.	PARTIAL	Significant changes with ATS route network required for compatibility
Design Principle 5: **Economic** Medium The proposed MTMA airspace will facilitate optimised network economic performance. (Note: Economic benefits could include environmental improvements such as reduced track mileage/ emissions or revenue from increased capacity/ route charges). No change, no impact.	PARTIAL	Economic performance as per today
Design Principle 6: **Environmental** Medium The proposed MTMA airspace will facilitate the reduction of CO_2 emissions per flight. No change, no impact.	PARTIAL	CO_2 emissions as per today
Design Principle 7: **Environmental** Low Minimise environmental impacts to stakeholders on the ground. (Note: network changes are >7,000ft, the position of the interface with the airport's lower level routes will be determined by the airport, hence impacts below 7,000ft will be addressed in the separate airport-sponsored ACP). No change, no impact.	MET	No change in noise impacts below 7000ft
Design Principle 8: **Operational** Medium The MTMA airspace should be compatible with the requirements of the MoD and take into consideration the requirements of the defence industry stakeholders. (Note: Consider where impacts might be greatest by considering Military-use areas against placement of airspace structures). No change, no impact.	MET	No impact or positive impact
Design Principle 9: **Operational** Medium The impacts on GA, non-commercial and other civilian airspace users due to MTMA should be minimised. (Note: Consider where impacts might be greatest by considering known VFR significant areas against placement of airspace structures. This includes a wide variety of airspace users such as emergency, recreational, training and sport aviation). No change, no impact.	MET	No impact or positive impact
Design Principle 10: **Technical** Medium The classification and volume of controlled airspace required for the MTMA should be the minimum necessary to deliver an efficient airspace design, taking into account the needs of UK airspace users . (Note: This may include releasing CAS as appropriate). No change, no impact.	PARTIAL	No change or minor reduction in accessibility of airspace for airspace users
Design Principle 11: **Technical** High The route network linking Airport procedures with the enroute phase of flight will be spaced to yield maximum safety, capacity and efficiency benefits by using an optimal standard of PBN. (Note: Where appropriate, the use of RNP should be considered if the fleet mix can support it). No change to current RNAV standards; the existing ATS routes are a mixture of RNAV1 and RNAV5 non-systemised routes.	PARTIAL	PBN standard as per today's operation
Design Principle 12: **Technical** High The MTMA airspace design will provide a compatible and optimised interface with London Airspace Modernisation Programme (LAMP) design. (Note: Closely spaced routes across the interface) Limited additional connectivity required for compatibility with LAMP	MET	Minimal or no changes required for compatibility with LAMP design
Design Principle 13: **Policy** High Must accord with the CAA's published Airspace Modernisation Strategy (CAP1711) and any current or future plans associated with it. (Note: The CAA have stated that this DP is required by all change sponsors. CAP1711 describes what airspace modernisation must deliver including: - the need to increase aviation capacity; - growth to be sustainable; - the need to maximise the utilisation of existing runway capacity). Demonstrates alignment with fewer than 1/3 of the aims as set out in the AMS.	NOT	No or limited alignment with the AMS
Design Principle 14: **Environmental** Medium The airspace should introduce improved Continuous Climb Operations (CCO) and Continuous Descent Operations (CDO) for all aircraft. (Note: This Design Principle includes enabling continuous operations below 7,000ft, where possible). No change, no impact.	PARTIAL	CCO and CDO as per today

Conclusion:	**Option 0: Baseline (Do Nothing) represents no change to the existing airspace design. 1 DP (priority HIGH) was 'NOT' met, hence this option was REJECTED and will not be progressed.**

Central

Option 1: Route connectivity	Accept & Progress	Assessment matrix ref
Option 1 will look to provide route connectivity to/from the Central geographic element and the surrounding geographic elements.		
Design Principle 1: Safety High The airspace will maintain or enhance current levels of Safety. Modern navigation standards allow a re-design of the Central element which could remove the convergence of ATS routes at a single point, thereby improving safety.	MET	Enhanced - improvement over today's level of safety. Maintained - safety risk could be maintained within acceptable levels of today's operation
Design Principle 2: Operational High The proposed airspace will maintain or enhance operational resilience of the ATC network. Improved connectivity between the Central element and the surrounding elements could reduce controller and pilot workload by reducing conflictions, thereby enhancing the resilience of the ATC network.	MET	Maintain or improve delay absorption
Design Principle 3: Operational High The proposed airspace design will yield the greatest capacity benefits from systemisation. (Note: The proposed airspace design should provide increased capacity and reduce delay. This could include the delivery of a suitable delay absorption mechanism or reducing departure intervals. Systemisation will minimise the need for ATC tactical intervention; for example, through better traffic; management). Improved connectivity between the Central element and the surrounding elements could reduce controller and pilot workload by reducing conflictions, thereby increasing airspace capacity.	MET	Design option supports the forecast traffic loading and increases capacity
Design Principle 4: Technical High The MTMA airspace design will provide a compatible and optimised interface between the lower level terminal airspace; the upper Free Route Airspace (FRA) and the ATS network. (Note: The intent of this Design Principle is for the provision of a design that supports the systemisation of traffic flows: from low-level terminal traffic to high-level Free Route flows. The future design should effectively manage arrivals and departures within the TMA without impacting capacity). This concept will utilise the required combination of Systemised, Direct and Bi-directional routes to provide connectivity compatible with the surrounding airspace; limited additional connectivity required for compatibility with FRA Deployment 2 set to be implemented in 2023.	MET	Minimal or no changes required for compatibility with ATS route network
Design Principle 5: Economic Medium The proposed MTMA airspace will facilitate optimised network economic performance. (Note: Economic benefits could include environmental improvements such as reduced track mileage/ emissions or revenue from increased capacity/ route charges). Modern navigation standards allow a re-design of the Central element which could remove the convergence of ATS routes at a single point resulting in more efficient routes and therefore improved economic performance compared to today.	MET	Economic performance increased
Design Principle 6: Environmental Medium The proposed MTMA airspace will facilitate the reduction of CO_2 emissions per flight. Modern navigation standards allow a re-design of the Central element which could remove the convergence of ATS routes at a single point resulting in more efficient routes and therefore improved environmental performance compared to today.	MET	CO_2 emissions reduced
Design Principle 7: Environmental Low Minimise environmental impacts to stakeholders on the ground. (Note: network changes are >7,000ft, the position of the interface with the airport's lower level routes will be determined by the airport, hence impacts below 7,000ft will be addressed in the separate airport-sponsored ACP). No change below 7000ft.	MET	No change in noise impacts below 7000ft
Design Principle 8: Operational Medium The MTMA airspace should be compatible with the requirements of the MoD and take into consideration the requirements of the defence industry stakeholders. (Note: Consider where impacts might be greatest by considering Military-use areas against placement of airspace structures). This option will be contained within existing CAS; however there is the potential to raise the base of northern MTMA airspace - providing increased accessibility for Military and GA traffic in this region.	MET	No impact or positive impact
Design Principle 9: Operational Medium The impacts on GA, non-commercial and other civilian airspace users due to MTMA should be minimised. (Note: Consider where impacts might be greatest by considering known VFR significant areas against placement of airspace structures. This includes a wide variety of airspace users such as emergency, recreational, training and sport aviation). This option will be contained within existing CAS; however there is the potential to raise the base of northern MTMA airspace - providing increased accessibility for Military and GA traffic in this region.	MET	No impact or positive impact
Design Principle 10: Technical Medium The classification and volume of controlled airspace required for the MTMA should be the minimum necessary to deliver an efficient airspace design, taking into account the needs of UK airspace users. (Note: This may include releasing CAS as appropriate). This option will be contained within existing CAS; however there is the potential to raise the base of northern MTMA airspace - providing increased accessibility for Military and GA traffic in this region.	MET	Improved accessibility of airspace for airspace users
Design Principle 11: Technical High The route network linking Airport procedures with the enroute phase of flight will be spaced to yield maximum safety, capacity and efficiency benefits by using an optimal standard of PBN. (Note: Where appropriate, the use of RNP should be considered if the fleet mix can support it). The highest appropriate level of PBN will be used.	MET	Increased PBN standard compared to today's operation
Design Principle 12: Technical High The MTMA airspace design will provide a compatible and optimised interface with London Airspace Modernisation Programme (LAMP) design. (Note: Closely spaced routes across the interface) This concept will utilise the required combination of Systemised, Direct and Bi-directional routes to provide connectivity compatible with the surrounding airspace; limited additional connectivity required for compatibility with LAMP	MET	Minimal or no changes required for compatibility with LAMP design
Design Principle 13: Policy High Must accord with the CAA's published Airspace Modernisation Strategy (CAP1711) and any current or future plans associated with it. (Note: The CAA have stated that this DP is required by all change sponsors. CAP1711 describes what airspace modernisation must deliver including: - the need to increase aviation capacity; - growth to be sustainable; - the need to maximise the utilisation of existing runway capacity). Demonstrates alignment with more than 2/3 of the aims as set out in the AMS.	MET	Aligned with the AMS
Design Principle 14: Environmental Medium The airspace should introduce improved Continuous Climb Operations (CCO) and Continuous Descent Operations (CDO) for all aircraft. (Note: This Design Principle includes enabling continuous operations below 7,000ft, where possible). This element is for overflight provision and therefore has no impact on CDO or CCO	PARTIAL	CCO and CDO as per today

Conclusion:	**Option 1: Route connectivity allows re-design of the Central geographic element, optimising the connectivity with surrounding airspace and potentially reducing route conflictions, increasing safety, capacity, resilience and improving environmental and economic performance. The potential to raise the base of Manchester TMA airspace could provide increased accessibility for Military and GA traffic in this region. This option is considered a promising candidate and has been PROGRESSED to the next stage.**

11.8. Departure Connectivity DPE

Departure Connectivity

Departure Connectivity Conclusion and Shortlist

The design principle evaluation of each design option presented on the previous pages and are summarised in the table below.

Design Principle / Option Name:	Option 0: Baseline (Do Nothing)	Option 1: Departure connectivity without new CAS	Option 2: Departure connectivity with new CAS
Accept / Reject	REJECT	Accept & Progress	Accept & Progress
Design Principle 1: Safety (High) The airspace will maintain or enhance current levels of Safety.	MET	MET	MET
Design Principle 2: Operational (High) The proposed airspace will maintain or enhance operational resilience of the ATC network.	MET	MET	MET
Design Principle 3: Operational (High) The proposed airspace design will yield the greatest capacity benefits from systemisation. (Note: The proposed airspace design should provide increased capacity and reduce delay. This could include the delivery of a suitable delay absorption mechanism or reducing departure intervals. Systemisation will minimise the need for ATC tactical intervention; for example, through better traffic; management).	PARTIAL	MET	MET
Design Principle 4: Technical (High) The MTMA airspace design will provide a compatible and optimised interface between the lower level terminal airspace; the upper Free Route Airspace (FRA) and the ATS network. (Note: The intent of this Design Principle is for the provision of a design that supports the systemisation of traffic flows: from low-level terminal traffic to high-level Free Route flows. The future design should effectively manage arrivals and departures within the TMA without impacting capacity).	MET	MET	MET
Design Principle 5: Economic (Medium) The proposed MTMA airspace will facilitate optimised network economic performance. (Note: Economic benefits could include environmental improvements such as reduced track mileage/ emissions or revenue from increased capacity/ route charges).	PARTIAL	MET	MET
Design Principle 6: Environmental (Medium) The proposed MTMA airspace will facilitate the reduction of CO2 emissions per flight.	PARTIAL	MET	MET
Design Principle 7: Environmental (Low) Minimise environmental impacts to stakeholders on the ground. (Note: network changes are >7,000ft, the position of the interface with the airport's lower level routes will be determined by the airport, hence impacts below 7,000ft will be addressed in the separate airport-sponsored ACP).	MET	PARTIAL	PARTIAL
Design Principle 8: Operational (Medium) The MTMA airspace should be compatible with the requirements of the MoD and take into consideration the requirements of the defence industry stakeholders. (Note: Consider where impacts might be greatest by considering Military-use areas against placement of airspace structures).	MET	MET	PARTIAL
Design Principle 9: Operational (Medium) The impacts on GA, non-commercial and other civilian airspace users due to MTMA should be minimised. (Note: Consider where impacts might be greatest by considering known VFR significant areas against placement of airspace structures. This includes a wide variety of airspace users such as emergency, recreational, training and sport aviation).	MET	MET	PARTIAL
Design Principle 10: Technical (Medium) The classification and volume of controlled airspace required for the MTMA should be the minimum necessary to deliver an efficient airspace design, taking into account the needs of UK airspace users . (Note: This may include releasing CAS as appropriate).	PARTIAL	MET	MET
Design Principle 11: Technical (High) The route network linking Airport procedures with the enroute phase of flight will be spaced to yield maximum safety, capacity and efficiency benefits by using an optimal standard of PBN. (Note: Where appropriate, the use of RNP should be considered if the fleet mix can support it).	PARTIAL	MET	MET
Design Principle 12: Technical (High) The MTMA airspace design will provide a compatible and optimised interface with London Airspace Modernisation Programme (LAMP) design. (Note: Closely spaced routes across the interface)	MET	MET	MET
Design Principle 13: Policy (High) Must accord with the CAA's published Airspace Modernisation Strategy (CAP1711) and any current or future plans associated with it. (Note: The CAA have stated that this DP is required by all change sponsors. CAP1711 describes what airspace modernisation must deliver including: - the need to increase aviation capacity; - growth to be sustainable; - the need to maximise the utilisation of existing runway capacity).	NOT	MET	MET
Design Principle 14: Environmental (Medium) The airspace should introduce improved Continuous Climb Operations (CCO) and Continuous Descent Operations (CDO) for all aircraft. (Note: This Design Principle includes enabling continuous operations below 7,000ft, where possible).	PARTIAL	MET	MET

Progression criteria: Options having any High Design Principles which are 'NOT' met (red) or 2 or more Medium Design Principles 'NOT' met or greater than 5 Design Principles 'PARTIAL' met have been rejected.

Next Steps

Option 1 Departure Connectivity without new CAS and Option 2 Departure Connectivity with new CAS will be formally appraised under the Stage 2, Step 2B Options Appraisal (Phase 1 Initial), including Safety Assessment.

Departure Connectivity

Option 0: Baseline (Do Nothing)	REJECT	Assessment matrix ref
This option represents the existing airspace design, i.e. The "Do-Nothing" option. Keep everything as it is currently		
Design Principle 1: Safety High The airspace will maintain or enhance current levels of Safety. No change to the current level of safety.	MET	Enhanced - improvement over today's level of safety. Maintained - safety risk could be maintained within acceptable levels of today's operation
Design Principle 2: Operational High The proposed airspace will maintain or enhance operational resilience of the ATC network. No change to the current level of delay absorption or disruption recovery	MET	Maintain or improve delay absorption
Design Principle 3: Operational High The proposed airspace design will yield the greatest capacity benefits from systemisation. (Note: The proposed airspace design should provide increased capacity and reduce delay. This could include the delivery of a suitable delay absorption mechanism or reducing departure intervals. Systemisation will minimise the need for ATC tactical intervention; for example, through better traffic; management). Any new SIDs will need to connect to the existing route structure (ATS route/link route/flight plannable DCT) which could limit capacity	PARTIAL	Design option supports the forecast traffic loading but provides no capacity benefit
Design Principle 4: Technical High The MTMA airspace design will provide a compatible and optimised interface between the lower level terminal airspace; the upper Free Route Airspace (FRA) and the ATS network. (Note: The intent of this Design Principle is for the provision of a design that supports the systemisation of traffic flows: from low-level terminal traffic to high-level Free Route flows. The future design should effectively manage arrivals and departures within the TMA without impacting capacity). The current airspace supports connectivity with lower level airspace, FRA and the ATS network. Changes to any of these environments will need to be designed to interface as appropriate to the existing airspace design.	MET	Minimal or no changes required for compatibility with lower level airspace
Design Principle 5: Economic Medium The proposed MTMA airspace will facilitate optimised network economic performance. (Note: Economic benefits could include environmental improvements such as reduced track mileage/ emissions or revenue from increased capacity/ route charges). No change, no impact.	PARTIAL	Economic performance as per today
Design Principle 6: Environmental Medium The proposed MTMA airspace will facilitate the reduction of CO2 emissions per flight. No change, no impact.	PARTIAL	CO2 emissions as per today
Design Principle 7: Environmental Low Minimise environmental impacts to stakeholders on the ground. (Note: network changes are >7,000ft, the position of the interface with the airport's lower level routes will be determined by the airport, hence impacts below 7,000ft will be addressed in the separate airport-sponsored ACP). No change, no impact.	MET	No change in noise impacts below 7000ft
Design Principle 8: Operational Medium The MTMA airspace should be compatible with the requirements of the MoD and take into consideration the requirements of the defence industry stakeholders. (Note: Consider where impacts might be greatest by considering Military-use areas against placement of airspace structures). No change, no impact.	MET	No impact or positive impact
Design Principle 9: Operational Medium The impacts on GA, non-commercial and other civilian airspace users due to MTMA should be minimised. (Note: Consider where impacts might be greatest by considering known VFR significant areas against placement of airspace structures. This includes a wide variety of airspace users such as emergency, recreational, training and sport aviation). No change, no impact.	MET	No impact or positive impact
Design Principle 10: Technical Medium The classification and volume of controlled airspace required for the MTMA should be the minimum necessary to deliver an efficient airspace design, taking into account the needs of UK airspace users. (Note: This may include releasing CAS as appropriate). No change, no impact.	PARTIAL	No change or minor reduction in accessibility of airspace for airspace users
Design Principle 11: Technical High The route network linking Airport procedures with the enroute phase of flight will be spaced to yield maximum safety, capacity and efficiency benefits by using an optimal standard of PBN. (Note: Where appropriate, the use of RNP should be considered if the fleet mix can support it). No change to current RNAV standards; existing ATS route connectivity including link routes to SIDs are currently a mixture of RNAV5 and RNAV1. DCTs do not have an associated RNAV standard.	PARTIAL	PBN standard as per today's operation
Design Principle 12: Technical High The MTMA airspace design will provide a compatible and optimised interface with London Airspace Modernisation Programme (LAMP) design. (Note: Closely spaced routes across the interface) LAMP interface is not applicable for the departure connectivity.	MET	Minimal or no changes required for compatibility with LAMP design
Design Principle 13: Policy High Must accord with the CAA's published Airspace Modernisation Strategy (CAP1711) and any current or future plans associated with it. (Note: The CAA have stated that this DP is required by all change sponsors. CAP1711 describes what airspace modernisation must deliver including: - the need to increase aviation capacity; - growth to be sustainable; - the need to maximise the utilisation of existing runway capacity). Demonstrates alignment with fewer than 1/3 of the aims as set out in the AMS.	NOT	No or limited alignment with the AMS
Design Principle 14: Environmental Medium The airspace should introduce improved Continuous Climb Operations (CCO) and Continuous Descent Operations (CDO) for all aircraft. (Note: This Design Principle includes enabling continuous operations below 7,000ft, where possible). No change, no impact.	PARTIAL	CCO and CDO as per today

Conclusion:	Option 0: Baseline (Do Nothing) represents no change to the existing airspace design. 1 DP (priority HIGH) was 'NOT' met, hence this option was REJECTED and will not be progressed.

Departure Connectivity

Option 1: Departure connectivity without new CAS	Accept & Progress	Assessment matrix ref
Option 1 will look to provide departure connectivity from SID end points to the route network without requiring new CAS		
Design Principle 1: Safety High The airspace will maintain or enhance current levels of Safety. The design will ensure that, as a minimum, safety will be maintained. It is noted that safety improvement is a key driver of airspace design/change.	MET	Enhanced - improvement over today's level of safety. Maintained - safety risk could be maintained within acceptable levels of today's operation
Design Principle 2: Operational High The proposed airspace will maintain or enhance operational resilience of the ATC network. The design could improve the efficiency of the SID/route network interface potentially enabling more direct routes and reducing route conflictions, thereby reducing controller and pilot workload and improving delay absorption and disruption recovery.	MET	Maintain or improve disruption recovery
Design Principle 3: Operational High The proposed airspace design will yield the greatest capacity benefits from systemisation. (Note: The proposed airspace design should provide increased capacity and reduce delay. This could include the delivery of a suitable delay absorption mechanism or reducing departure intervals. Systemisation will minimise the need for ATC tactical intervention; for example, through better traffic; management). The design could improve the efficiency of the SID/route network interface potentially enabling more direct routes and reducing route conflictions, thereby reducing controller and pilot workload and increasing capacity.	MET	Design option supports the forecast traffic loading and increases capacity
Design Principle 4: Technical High The MTMA airspace design will provide a compatible and optimised interface between the lower level terminal airspace; the upper Free Route Airspace (FRA) and the ATS network. (Note: The intent of this Design Principle is for the provision of a design that supports the systemisation of traffic flows: from low-level terminal traffic to high-level Free Route flows. The future design should effectively manage arrivals and departures within the TMA without impacting capacity). This concept will be designed to provide connectivity compatible with the surrounding airspace including any existing/new airport SIDs.	MET	Minimal or no changes required for compatibility with lower level airspace
Design Principle 5: Economic Medium The proposed MTMA airspace will facilitate optimised network economic performance. (Note: Economic benefits could include environmental improvements such as reduced track mileage/ emissions or revenue from increased capacity/ route charges). Where the SID does not connect directly to the route network, the departure connectivity will be designed to ensure more direct routes and reduced confliction points enabling continuous climb profiles; therefore improving economic performance compared to today.	MET	Economic performance increased
Design Principle 6: Environmental Medium The proposed MTMA airspace will facilitate the reduction of CO_2 emissions per flight. Where the SID does not connect directly to the route network, the departure connectivity will be designed to ensure more direct routes and reduced confliction points enabling continuous climb profiles; therefore improving environmental performance compared to today.	MET	CO_2 emissions reduced
Design Principle 7: Environmental Low Minimise environmental impacts to stakeholders on the ground. (Note: network changes are >7,000ft, the position of the interface with the airport's lower level routes will be determined by the airport, hence impacts below 7,000ft will be addressed in the separate airport-sponsored ACP). In this concept, the potential to change the SID/route network interface may have the consequential impact of altering aircraft tracks below 7000ft. However, changes to the interface with the lower airspace will be determined in collaboration with the airports and any changes below 7000ft will be included in the corresponding airport-sponsored ACP.	PARTIAL	Change, but no net detrimental impacts on noise below 7000ft
Design Principle 8: Operational Medium The MTMA airspace should be compatible with the requirements of the MoD and take into consideration the requirements of the defence industry stakeholders. (Note: Consider where impacts might be greatest by considering Military-use areas against placement of airspace structures). This concept requires no additional CAS; no impact on the Military	MET	No impact or positive impact
Design Principle 9: Operational Medium The impacts on GA, non-commercial and other civilian airspace users due to MTMA should be minimised. (Note: Consider where impacts might be greatest by considering known VFR significant areas against placement of airspace structures. This includes a wide variety of airspace users such as emergency, recreational, training and sport aviation). This concept requires no additional CAS; no impact on GA, non-commercial or other civilian airspace users.	MET	No impact or positive impact
Design Principle 10: Technical Medium The classification and volume of controlled airspace required for the MTMA should be the minimum necessary to deliver an efficient airspace design, taking into account the needs of UK airspace users. (Note: This may include releasing CAS as appropriate). The design could improve the efficiency of the SID/route network interface potentially allowing for the release of some CAS, increasing accessibility for airspace users.	MET	Improved accessibility of airspace for airspace users
Design Principle 11: Technical High The route network linking Airport procedures with the enroute phase of flight will be spaced to yield maximum safety, capacity and efficiency benefits by using an optimal standard of PBN. (Note: Where appropriate, the use of RNP should be considered if the fleet mix can support it). The highest appropriate level of PBN will be used.	MET	Increased PBN standard compared to today's operation
Design Principle 12: Technical High The MTMA airspace design will provide a compatible and optimised interface with London Airspace Modernisation Programme (LAMP) design. (Note: Closely spaced routes across the interface) LAMP interface is not applicable for the departure connectivity.	MET	Minimal or no changes required for compatibility with LAMP design
Design Principle 13: Policy High Must accord with the CAA's published Airspace Modernisation Strategy (CAP1711) and any current or future plans associated with it. (Note: The CAA have stated that this DP is required by all change sponsors. CAP1711 describes what airspace modernisation must deliver including: - the need to increase aviation capacity; - growth to be sustainable; - the need to maximise the utilisation of existing runway capacity). Demonstrates alignment with more than 2/3 of the aims as set out in the AMS.	MET	Aligned with the AMS
Design Principle 14: Environmental Medium The airspace should introduce improved Continuous Climb Operations (CCO) and Continuous Descent Operations (CDO) for all aircraft. (Note: This Design Principle includes enabling continuous operations below 7,000ft, where possible). The design could improve the efficiency of the SID/route network interface, potentially enabling more continuous climbs and, through separation with arrival routes, improved descent profiles. Note: benefits to climb/descent profiles will be limited by the extant base of CAS.	MET	Positive impact on CCO and CDO

Conclusion:	**Option 1: Departure connectivity without new CAS, could improve the efficiency of the SID/route network interface potentially enabling more direct routes and reducing route conflictions, increasing capacity and resilience and enabling more continuous climb/descent profiles to the benefit of environmental and economic performance. It is noted that the realisation of benefits may be limited by the extant base of CAS in this concept, however this option is considered a promising candidate and has been PROGRESSED to the next stage.**

Departure Connectivity

Option 2: Departure connectivity with new CAS	Accept & Progress	Assessment matrix ref
Option 2 will look to provide departure connectivity from SID end points to the route network requiring new CAS		
Design Principle 1: Safety (High) The airspace will maintain or enhance current levels of Safety. The design will ensure that, as a minimum, safety will be maintained. It is noted that safety improvement is a key driver of airspace design/change. Note: with additional CAS, there is the potential to further separate conflicting arrival/departure route flows, increasing safety.	MET	Enhanced - improvement over today's level of safety. Maintained - safety risk could be maintained within acceptable levels of today's operation
Design Principle 2: Operational (High) The proposed airspace will maintain or enhance operational resilience of the ATC network. The design could improve the efficiency of the SID/route network interface potentially enabling more direct routes and reduced confliction points, thereby reducing controller and pilot workload and improving delay absorption and disruption recovery	MET	Maintain or improve disruption recovery
Design Principle 3: Operational (High) The proposed airspace design will yield the greatest capacity benefits from systemisation. (Note: The proposed airspace design should provide increased capacity and reduce delay. This could include the delivery of a suitable delay absorption mechanism or reducing departure intervals. Systemisation will minimise the need for ATC tactical intervention; for example, through better traffic; management). The design could improve the efficiency of the SID/route network interface potentially enabling more direct routes and reduced confliction points, thereby reducing controller and pilot workload and increasing capacity.	MET	Design option supports the forecast traffic loading and increases capacity
Design Principle 4: Technical (High) The MTMA airspace design will provide a compatible and optimised interface between the lower level terminal airspace; the upper Free Route Airspace (FRA) and the ATS network. (Note: The intent of this Design Principle is for the provision of a design that supports the systemisation of traffic flows: from low-level terminal traffic to high-level Free Route flows. The future design should effectively manage arrivals and departures within the TMA without impacting capacity). This concept will be designed to provide connectivity compatible with the surrounding airspace including any existing/new airport SIDs.	MET	Minimal or no changes required for compatibility with lower level airspace
Design Principle 5: Economic (Medium) The proposed MTMA airspace will facilitate optimised network economic performance. (Note: Economic benefits could include environmental improvements such as reduced track mileage/ emissions or revenue from increased capacity/ route charges). Where the SID does not connect directly to the route network, the departure connectivity will be designed to ensure more direct routes and reduced confliction points enabling continuous climb profiles; therefore improving economic performance compared to today. Note: the design will not be limited to existing CAS	MET	Economic performance increased
Design Principle 6: Environmental (Medium) The proposed MTMA airspace will facilitate the reduction of CO_2 emissions per flight. Where the SID does not connect directly to the route network, the departure connectivity will be designed to ensure more direct routes and reduced confliction points enabling continuous climb profiles; therefore improving environmental performance compared to today.	MET	CO_2 emissions reduced
Design Principle 7: Environmental (Low) Minimise environmental impacts to stakeholders on the ground. (Note: network changes are >7,000ft, the position of the interface with the airport's lower level routes will be determined by the airport, hence impacts below 7,000ft will be addressed in the separate airport-sponsored ACP). In this concept, the potential to change the SID/route network interface may have the consequential impact of altering aircraft tracks below 7000ft. However, changes to the interface with the lower airspace will be determined in collaboration with the airports and any changes below 7000ft will be included in the corresponding airport-sponsored ACP.	PARTIAL	Change, but no net detrimental impacts on noise below 7000ft
Design Principle 8: Operational (Medium) The MTMA airspace should be compatible with the requirements of the MoD and take into consideration the requirements of the defence industry stakeholders. (Note: Consider where impacts might be greatest by considering Military-use areas against placement of airspace structures). This concept could require increased CAS and may impact the Military. Note: We will seek to use the lowest classification applicable to the airspace. No SUAs are likely to be impacted and adherence to the SUA buffer policy will be maintained.	PARTIAL	Minor impact and not safety critical
Design Principle 9: Operational (Medium) The impacts on GA, non-commercial and other civilian airspace users due to MTMA should be minimised. (Note: Consider where impacts might be greatest by considering known VFR significant areas against placement of airspace structures. This includes a wide variety of airspace users such as emergency, recreational, training and sport aviation). This concept could require increased CAS and might impact the GA, non commercial and other civilian airspace users, although generally they fly at lower levels underneath CAS. We will seek to use the lowest classification applicable to the airspace	PARTIAL	Minor impact and not safety critical
Design Principle 10: Technical (Medium) The classification and volume of controlled airspace required for the MTMA should be the minimum necessary to deliver an efficient airspace design, taking into account the needs of UK airspace users. (Note: This may include releasing CAS as appropriate). This option may require additional controlled airspace, however the design could improve the efficiency of the SID/route network interface potentially allowing for the release of some CAS, increasing accessibility for airspace users.	MET	Improved accessibility of airspace for airspace users
Design Principle 11: Technical (High) The route network linking Airport procedures with the enroute phase of flight will be spaced to yield maximum safety, capacity and efficiency benefits by using an optimal standard of PBN. (Note: Where appropriate, the use of RNP should be considered if the fleet mix can support it). The highest appropriate level of PBN will be used.	MET	Increased PBN standard compared to today's operation
Design Principle 12: Technical (High) The MTMA airspace design will provide a compatible and optimised interface with London Airspace Modernisation Programme (LAMP) design. (Note: Closely spaced routes across the interface) LAMP interface is not applicable for the departure connectivity.	MET	Minimal or no changes required for compatibility with LAMP design
Design Principle 13: Policy (High) Must accord with the CAA's published Airspace Modernisation Strategy (CAP1711) and any current or future plans associated with it. (Note: The CAA have stated that this DP is required by all change sponsors. CAP1711 describes what airspace modernisation must deliver including: - the need to increase aviation capacity; - growth to be sustainable; - the need to maximise the utilisation of existing runway capacity). Demonstrates alignment with more than 2/3 of the aims as set out in the AMS.	MET	Aligned with the AMS
Design Principle 14: Environmental (Medium) The airspace should introduce improved Continuous Climb Operations (CCO) and Continuous Descent Operations (CDO) for all aircraft. (Note: This Design Principle includes enabling continuous operations below 7,000ft, where possible). The design could improve the efficiency of the SID/route network interface, potentially enabling more continuous climbs and, through separation with arrival routes, improved descent profiles. Note: benefits to climb/descent profiles will not be limited by the extant base of CAS.	MET	Positive impact on CCO and CDO

Conclusion:	**Option 1: Departure connectivity with new CAS, could improve the efficiency of the SID/route network interface without being constrained by the extant base of CAS, potentially enabling more direct routes and reducing route conflictions, increasing capacity and resilience and enabling more continuous climb/descent profiles to the benefit of environmental and economic performance. The use of additional CAS may impact the Military, GA, non-commercial and other airspace users, however the impact is considered minor only. Additionally, there may be the potential to release some CAS increasing accessibility for airspace users. This option is considered a promising candidate and has been PROGRESSED to the next stage.**

11.9. Arrival Connectivity DPE

Arrival Connectivity

Arrival Connectivity Conclusion and Shortlist

The design principle evaluation of each design option presented on the previous pages and are summarised in the table below.

Design Principle / Option Name:	Option 0: Baseline (Do Nothing)	Option 1: Arrival connectivity without new CAS	Option 2: Arrival connectivity with new CAS
Accept / Reject	REJECT	Accept & Progress	Accept & Progress
Design Principle 1: Safety — **High** The airspace will maintain or enhance current levels of Safety.	MET	MET	MET
Design Principle 2: Operational — **High** The proposed airspace will maintain or enhance operational resilience of the ATC network.	MET	MET	MET
Design Principle 3: Operational — **High** The proposed airspace design will yield the greatest capacity benefits from systemisation. (Note: The proposed airspace design should provide increased capacity and reduce delay. This could include the delivery of a suitable delay absorption mechanism or reducing departure intervals. Systemisation will minimise the need for ATC tactical intervention; for example, through better traffic; management).	PARTIAL	MET	MET
Design Principle 4: Technical — **High** The MTMA airspace design will provide a compatible and optimised interface between the lower level terminal airspace; the upper Free Route Airspace (FRA) and the ATS network. (Note: The intent of this Design Principle is for the provision of a design that supports the systemisation of traffic flows: from low-level terminal traffic to high-level Free Route flows. The future design should effectively manage arrivals and departures within the TMA without impacting capacity).	MET	MET	MET
Design Principle 5: Economic — **Medium** The proposed MTMA airspace will facilitate optimised network economic performance. (Note: Economic benefits could include environmental improvements such as reduced track mileage/ emissions or revenue from increased capacity/ route charges).	PARTIAL	MET	MET
Design Principle 6: Environmental — **Medium** The proposed MTMA airspace will facilitate the reduction of CO2 emissions per flight.	PARTIAL	MET	MET
Design Principle 7: Environmental — **Low** Minimise environmental impacts to stakeholders on the ground. (Note: network changes are >7,000ft, the position of the interface with the airport's lower level routes will be determined by the airport, hence impacts below 7,000ft will be addressed in the separate airport-sponsored ACP).	MET	PARTIAL	PARTIAL
Design Principle 8: Operational — **Medium** The MTMA airspace should be compatible with the requirements of the MoD and take into consideration the requirements of the defence industry stakeholders. (Note: Consider where impacts might be greatest by considering Military-use areas against placement of airspace structures).	MET	MET	PARTIAL
Design Principle 9: Operational — **Medium** The impacts on GA, non-commercial and other civilian airspace users due to MTMA should be minimised. (Note: Consider where impacts might be greatest by considering known VFR significant areas against placement of airspace structures. This includes a wide variety of airspace users such as emergency, recreational, training and sport aviation).	MET	MET	PARTIAL
Design Principle 10: Technical — **Medium** The classification and volume of controlled airspace required for the MTMA should be the minimum necessary to deliver an efficient airspace design, taking into account the needs of UK airspace users (Note: This may include releasing CAS as appropriate).	PARTIAL	PARTIAL	PARTIAL
Design Principle 11: Technical — **High** The route network linking Airport procedures with the enroute phase of flight will be spaced to yield maximum safety, capacity and efficiency benefits by using an optimal standard of PBN. (Note: Where appropriate, the use of RNP should be considered if the fleet mix can support it).	PARTIAL	MET	MET
Design Principle 12: Technical — **High** The MTMA airspace design will provide a compatible and optimised interface with London Airspace Modernisation Programme (LAMP) design. (Note: Closely spaced routes across the interface)	MET	MET	MET
Design Principle 13: Policy — **High** Must accord with the CAA's published Airspace Modernisation Strategy (CAP1711) and any current or future plans associated with it. (Note: The CAA have stated that this DP is required by all change sponsors. CAP1711 describes what airspace modernisation must deliver including: - the need to increase aviation capacity; - growth to be sustainable; - the need to maximise the utilisation of existing runway capacity).	NOT	MET	MET
Design Principle 14: Environmental — **Medium** The airspace should introduce improved Continuous Climb Operations (CCO) and Continuous Descent Operations (CDO) for all aircraft. (Note: This Design Principle includes enabling continuous operations below 7,000ft, where possible).	PARTIAL	MET	MET

Progression criteria: Options having any High Design Principles which are 'NOT' met (red) or 2 or more Medium Design Principles 'NOT' met or greater than 5 Design Principles 'PARTIAL' met have been rejected.

Next Steps

Concept 1 Arrival Connectivity without new CAS and Concept 2 Arrival Connectivity with new CAS will be formally appraised under the Stage 2, Step 2B Options Appraisal (Phase 1 Initial), including Safety Assessment.

Arrival Connectivity

Option 0: Baseline (Do Nothing)	REJECT	Assessment matrix ref
This option represents the existing airspace design, i.e. The "Do-Nothing" option. Keep everything as it is currently		
Design Principle 1: **Safety** High The airspace will maintain or enhance current levels of Safety. No change to the current level of safety.	MET	Enhanced - improvement over today's level of safety. Maintained - safety risk could be maintained within acceptable levels of today's operation
Design Principle 2: **Operational** High The proposed airspace will maintain or enhance operational resilience of the ATC network. No change to the current level of delay absorption or disruption recovery	MET	Maintain or improve delay absorption
Design Principle 3: **Operational** High The proposed airspace design will yield the greatest capacity benefits from systemisation. (Note: The proposed airspace design should provide increased capacity and reduce delay. This could include the delivery of a suitable delay absorption mechanism or reducing departure intervals. Systemisation will minimise the need for ATC tactical intervention; for example, through better traffic; management). The current airspace may accommodate future traffic growth, but provides no capacity benefit. Note: ATC workload increase is anticipated with increased traffic levels.	PARTIAL	Design option supports the forecast traffic loading but provides no capacity benefit
Design Principle 4: **Technical** High The MTMA airspace design will provide a compatible and optimised interface between the lower level terminal airspace; the upper Free Route Airspace (FRA) and the ATS network. (Note: The intent of this Design Principle is for the provision of a design that supports the systemisation of traffic flows: from low-level terminal traffic to high-level Free Route flows. The future design should effectively manage arrivals and departures within the TMA without impacting capacity). The current airspace supports connectivity with lower level airspace, FRA and the ATS network. Changes to any of these environments will need to be designed to interface as appropriate to the existing airspace design.	MET	Minimal or no changes required for compatibility with FRA
Design Principle 5: **Economic** Medium The proposed MTMA airspace will facilitate optimised network economic performance. (Note: Economic benefits could include environmental improvements such as reduced track mileage/ emissions or revenue from increased capacity/ route charges). No change, no impact.	PARTIAL	Economic performance as per today
Design Principle 6: **Environmental** Medium The proposed MTMA airspace will facilitate the reduction of CO2 emissions per flight. No change, no impact.	PARTIAL	CO2 emissions as per today
Design Principle 7: **Environmental** Low Minimise environmental impacts to stakeholders on the ground. (Note: network changes are >7,000ft, the position of the interface with the airport's lower level routes will be determined by the airport, hence impacts below 7,000ft will be addressed in the separate airport-sponsored ACP). No change, no impact.	MET	No change in noise impacts below 7000ft
Design Principle 8: **Operational** Medium The MTMA airspace should be compatible with the requirements of the MoD and take into consideration the requirements of the defence industry stakeholders. (Note: Consider where impacts might be greatest by considering Military-use areas against placement of airspace structures). No change, no impact.	MET	No impact or positive impact
Design Principle 9: **Operational** Medium The impacts on GA, non-commercial and other civilian airspace users due to MTMA should be minimised. (Note: Consider where impacts might be greatest by considering known VFR significant areas against placement of airspace structures. This includes a wide variety of airspace users such as emergency, recreational, training and sport aviation). No change, no impact.	MET	No impact or positive impact
Design Principle 10: **Technical** Medium The classification and volume of controlled airspace required for the MTMA should be the minimum necessary to deliver an efficient airspace design, taking into account the needs of UK airspace users . (Note: This may include releasing CAS as appropriate). No change, no impact.	PARTIAL	No change or minor reduction in accessibility of airspace for airspace users
Design Principle 11: **Technical** High The route network linking Airport procedures with the enroute phase of flight will be spaced to yield maximum safety, capacity and efficiency benefits by using an optimal standard of PBN. (Note: Where appropriate, the use of RNP should be considered if the fleet mix can support it). No change to current RNAV standards; the existing STARs/arrival routes are a mixture of RNAV5 and RNAV1 non-systemised routes.	PARTIAL	PBN standard as per today's operation
Design Principle 12: **Technical** High The MTMA airspace design will provide a compatible and optimised interface with London Airspace Modernisation Programme (LAMP) design. (Note: Closely spaced routes across the interface) Limited additional connectivity required for compatibility with LAMP	MET	Minimal or no changes required for compatibility with LAMP design
Design Principle 13: **Policy** High Must accord with the CAA's published Airspace Modernisation Strategy (CAP1711) and any current or future plans associated with it. (Note: The CAA have stated that this DP is required by all change sponsors. CAP1711 describes what airspace modernisation must deliver including: - the need to increase aviation capacity; - growth to be sustainable; - the need to maximise the utilisation of existing runway capacity). Demonstrates alignment with fewer than 1/3 of the aims as set out in the AMS.	NOT	No or limited alignment with the AMS
Design Principle 14: **Environmental** Medium The airspace should introduce improved Continuous Climb Operations (CCO) and Continuous Descent Operations (CDO) for all aircraft. (Note: This Design Principle includes enabling continuous operations below 7,000ft, where possible). No change, no impact.	PARTIAL	CCO and CDO as per today

Conclusion:	**Option 0: Baseline (Do Nothing) represents no change to the existing airspace design. 1 DP (priority HIGH) was 'NOT' met, hence this option was REJECTED and will not be progressed.**

Arrival Connectivity

Option 1: Arrival connectivity without new CAS	Accept & Progress	Assessment matrix ref
Option 1 will look to provide arrival connectivity from the route network to airport arrival structures via STARs/arrival routes without requiring new CAS		
Design Principle 1: Safety High The airspace will maintain or enhance current levels of Safety. The design will ensure that, as a minimum, safety will be maintained. It is noted that safety improvement is a key driver of airspace design/change.	MET	Enhanced - improvement over today's level of safety. Maintained - safety risk could be maintained within acceptable levels of today's operation
Design Principle 2: Operational High The proposed airspace will maintain or enhance operational resilience of the ATC network. The design could improve the efficiency of STAR/arrival route profiles, potentially reducing controller and pilot workload and improving delay absorption and disruption recovery.	MET	Maintain or improve delay absorption
Design Principle 3: Operational High The proposed airspace design will yield the greatest capacity benefits from systemisation. (Note: The proposed airspace design should provide increased capacity and reduce delay. This could include the delivery of a suitable delay absorption mechanism or reducing departure intervals. Systemisation will minimise the need for ATC tactical intervention; for example, through better traffic; management). The design could improve the efficiency of STAR/arrival route profiles, potentially reducing controller and pilot workload and increasing capacity.	MET	Design option decreases ATCO workload
Design Principle 4: Technical High The MTMA airspace design will provide a compatible and optimised interface between the lower level terminal airspace; the upper Free Route Airspace (FRA) and the ATS network. (Note: The intent of this Design Principle is for the provision of a design that supports the systemisation of traffic flows: from low-level terminal traffic to high-level Free Route flows. The future design should effectively manage arrivals and departures within the TMA without impacting capacity). This concept will be designed to provide connectivity compatible with the surrounding airspace including any existing/new delay absorption structures; limited additional connectivity required for compatibility with FRA Deployment 2 set to be implemented in 2023.	MET	Minimal or no changes required for compatibility with FRA
Design Principle 5: Economic Medium The proposed MTMA airspace will facilitate optimised network economic performance. (Note: Economic benefits could include environmental improvements such as reduced track mileage/ emissions or revenue from increased capacity/ route charges). The design could improve the efficiency of STAR/arrival route profiles, potentially reducing planned track miles and allowing improved fuel planning for operators; thereby improving economic performance compared to today	MET	Economic performance increased
Design Principle 6: Environmental Medium The proposed MTMA airspace will facilitate the reduction of CO_2 emissions per flight. The design could improve the efficiency of STAR/arrival route profiles, potentially reducing planned track miles and allowing for improved environmental performance compared to today	MET	CO_2 emissions reduced
Design Principle 7: Environmental Low Minimise environmental impacts to stakeholders on the ground. (Note: network changes are >7,000ft, the position of the interface with the airport's lower level routes will be determined by the airport, hence impacts below 7,000ft will be addressed in the separate airport-sponsored ACP). In this concept, the potential to change STARs/arrival routes may have the consequential impact of altering aircraft tracks below 7000ft. However, changes to the interface with the lower airspace will be determined in collaboration with the airports and any changes below 7000ft will be included in the corresponding airport-sponsored ACP.	PARTIAL	Change, but no net detrimental impacts on noise below 7000ft
Design Principle 8: Operational Medium The MTMA airspace should be compatible with the requirements of the MoD and take into consideration the requirements of the defence industry stakeholders. (Note: Consider where impacts might be greatest by considering Military-use areas against placement of airspace structures). Re-designing the lateral profile of the STARs to enable more efficient tracks may create increased crossing opportunities for Military traffic to traverse the CTAs.	MET	No impact or positive impact
Design Principle 9: Operational Medium The impacts on GA, non-commercial and other civilian airspace users due to MTMA should be minimised. (Note: Consider where impacts might be greatest by considering known VFR significant areas against placement of airspace structures. This includes a wide variety of airspace users such as emergency, recreational, training and sport aviation). This concept requires no additional CAS; no impact on GA, non-commercial or other civilian airspace users.	MET	No impact or positive impact
Design Principle 10: Technical Medium The classification and volume of controlled airspace required for the MTMA should be the minimum necessary to deliver an efficient airspace design, taking into account the needs of UK airspace users. (Note: This may include releasing CAS as appropriate). No change no impact.	PARTIAL	No change or minor reduction in accessibility of airspace for airspace users
Design Principle 11: Technical High The route network linking Airport procedures with the enroute phase of flight will be spaced to yield maximum safety, capacity and efficiency benefits by using an optimal standard of PBN. (Note: Where appropriate, the use of RNP should be considered if the fleet mix can support it). The highest appropriate level of PBN will be used.	MET	Increased PBN standard compared to today's operation
Design Principle 12: Technical High The MTMA airspace design will provide a compatible and optimised interface with London Airspace Modernisation Programme (LAMP) design. (Note: Closely spaced routes across the interface) Limited additional connectivity required for compatibility with LAMP	MET	Minimal or no changes required for compatibility with LAMP design
Design Principle 13: Policy High Must accord with the CAA's published Airspace Modernisation Strategy (CAP1711) and any current or future plans associated with it. (Note: The CAA have stated that this DP is required by all change sponsors. CAP1711 describes what airspace modernisation must deliver including: - the need to increase aviation capacity; - growth to be sustainable; - the need to maximise the utilisation of existing runway capacity). Demonstrates alignment with more than 2/3 of the aims as set out in the AMS.	MET	Aligned with the AMS
Design Principle 14: Environmental Medium The airspace should introduce improved Continuous Climb Operations (CCO) and Continuous Descent Operations (CDO) for all aircraft. (Note: This Design Principle includes enabling continuous operations below 7,000ft, where possible). The design could improve the efficiency of STAR/arrival routes profiles, potentially enabling more continuous descents and, through separation with departure routes, improved climb profiles. Note: benefits to climb/descent profiles will be limited by the extant base of CAS.	MET	Positive impact on CCO and CDO

Conclusion:	**Option 1: Arrival connectivity without new CAS, could improve the efficiency of STAR/Standard Inbound Route profiles, increasing capacity, resilience and predictability, reducing planned track miles and enabling more continuous climb/descent profiles to the benefit of environmental and economic performance. It is noted that the realisation of benefits may be limited by the extant base of CAS in this concept, however this option is considered a promising candidate and has been PROGRESSED to the next stage.**

Arrival Connectivity

Option 2: Arrival connectivity with new CAS	Accept & Progress	Assessment matrix ref
Option 2 will look to provide arrival connectivity from the route network to airport arrival structures via STARs/arrival routes requiring new CAS		
Design Principle 1: Safety High The airspace will maintain or enhance current levels of Safety. The design will ensure that, as a minimum, safety will be maintained. It is noted that safety improvement is a key driver of airspace design/change.	MET	Enhanced - improvement over today's level of safety. Maintained - safety risk could be maintained within acceptable levels of today's operation
Design Principle 2: Operational High The proposed airspace will maintain or enhance operational resilience of the ATC network. The design could improve the efficiency of STAR/arrival route profiles, potentially reducing controller and pilot workload and improving delay absorption and disruption recovery.	MET	Maintain or improve delay absorption
Design Principle 3: Operational High The proposed airspace design will yield the greatest capacity benefits from systemisation. (Note: The proposed airspace design should provide increased capacity and reduce delay. This could include the delivery of a suitable delay absorption mechanism or reducing departure intervals. Systemisation will minimise the need for ATC tactical intervention; for example, through better traffic; management). The design could improve the efficiency of STAR/arrival route profiles, potentially reducing controller and pilot workload and increasing capacity.	MET	Design option decreases ATCO workload
Design Principle 4: Technical High The MTMA airspace design will provide a compatible and optimised interface between the lower level terminal airspace; the upper Free Route Airspace (FRA) and the ATS network. (Note: The intent of this Design Principle is for the provision of a design that supports the systemisation of traffic flows: from low-level terminal traffic to high-level Free Route flows. The future design should effectively manage arrivals and departures within the TMA without impacting capacity). This concept will be designed to provide connectivity compatible with the surrounding airspace including any existing/new delay absorption structures; limited additional connectivity required for compatibility with FRA Deployment 2 set to be implemented in 2023.	MET	Minimal or no changes required for compatibility with FRA
Design Principle 5: Economic Medium The proposed MTMA airspace will facilitate optimised network economic performance. (Note: Economic benefits could include environmental improvements such as reduced track mileage/ emissions or revenue from increased capacity/ route charges). The design could improve the efficiency of STAR/arrival route profiles, potentially reducing planned track miles and allowing improved fuel planning for operators; thereby improving economic performance compared to today	MET	Economic performance increased
Design Principle 6: Environmental Medium The proposed MTMA airspace will facilitate the reduction of CO2 emissions per flight. The design could improve the efficiency of STAR/arrival route profiles, potentially reducing planned track miles and allowing for improved environmental performance compared to today	MET	CO2 emissions reduced
Design Principle 7: Environmental Low Minimise environmental impacts to stakeholders on the ground. (Note: network changes are >7,000ft, the position of the interface with the airport's lower level routes will be determined by the airport, hence impacts below 7,000ft will be addressed in the separate airport-sponsored ACP). In this concept, the potential to change STARs/arrival routes may have the consequential impact of altering aircraft tracks below 7000ft. However, changes to the interface with the lower airspace will be determined in collaboration with the airports and any changes below 7000ft will be included in the corresponding airport-sponsored ACP.	PARTIAL	Change, but no net detrimental impacts on noise below 7000ft
Design Principle 8: Operational Medium The MTMA airspace should be compatible with the requirements of the MoD and take into consideration the requirements of the defence industry stakeholders. (Note: Consider where impacts might be greatest by considering Military-use areas against placement of airspace structures). This concept could require increased CAS and may impact the Military. Note: We will seek to use the lowest classification applicable to the airspace. No SUAs are likely to be impacted and adherence to the SUA buffer policy will be maintained.	PARTIAL	Minor impact and not safety critical
Design Principle 9: Operational Medium The impacts on GA, non-commercial and other civilian airspace users due to MTMA should be minimised. (Note: Consider where impacts might be greatest by considering known VFR significant areas against placement of airspace structures. This includes a wide variety of airspace users such as emergency, recreational, training and sport aviation). This concept could require increased CAS and might impact the GA, non commercial and other civilian airspace users, although generally they fly at lower levels underneath CAS. We will seek to use the lowest classification applicable to the airspace. Specifically, there is the potential to lower the base of the Holyhead 3 CTA to enable more continuous descent for EGGP arrivals; this is unlikely to have significant impact on GA as the airspace is over the sea and there is little utilisation by GA currently. Additionally, there is the potential for additional CAS south of Niton 7 to allow arrivals to EGNR and EGGP to remain inside CAS (today they request a Deconfliction service if they descend outside of CAS).	PARTIAL	Minor impact and not safety critical
Design Principle 10: Technical Medium The classification and volume of controlled airspace required for the MTMA should be the minimum necessary to deliver an efficient airspace design, taking into account the needs of UK airspace users. (Note: This may include releasing CAS as appropriate). This concept has limited potential to reduce the classification of CTAs	PARTIAL	No change or minor reduction in accessibility of airspace for airspace users
Design Principle 11: Technical High The route network linking Airport procedures with the enroute phase of flight will be spaced to yield maximum safety, capacity and efficiency benefits by using an optimal standard of PBN. (Note: Where appropriate, the use of RNP should be considered if the fleet mix can support it). The highest appropriate level of PBN will be used.	MET	Increased PBN standard compared to today's operation
Design Principle 12: Technical High The MTMA airspace design will provide a compatible and optimised interface with London Airspace Modernisation Programme (LAMP) design. (Note: Closely spaced routes across the interface) Limited additional connectivity required for compatibility with LAMP	MET	Minimal or no changes required for compatibility with LAMP design
Design Principle 13: Policy High Must accord with the CAA's published Airspace Modernisation Strategy (CAP1711) and any current or future plans associated with it. (Note: The CAA have stated that this DP is required by all change sponsors. CAP1711 describes what airspace modernisation must deliver including: - the need to increase aviation capacity; - growth to be sustainable; - the need to maximise the utilisation of existing runway capacity). Demonstrates alignment with more than 2/3 of the aims as set out in the AMS.	MET	Aligned with the AMS
Design Principle 14: Environmental Medium The airspace should introduce improved Continuous Climb Operations (CCO) and Continuous Descent Operations (CDO) for all aircraft. (Note: This Design Principle includes enabling continuous operations below 7,000ft, where possible). The design could provide optimisation of STAR/arrival routes profiles, without being constrained by the extant base of CAS, potentially enabling more continuous descents and, through separation with departure routes, improved climb profiles.	MET	Positive impact on CCO and CDO

Conclusion:	**Option 2: Arrival connectivity with new CAS, could improve the efficiency of STAR/Standard Inbound Route profiles, without being constrained by the extant base of CAS, increasing capacity, resilience and predictability, reducing planned track miles and enabling more continuous climb/descent profiles to the benefit of environmental and economic performance. The use of additional CAS may impact the Military, GA, non-commercial and other airspace users, however the impact is considered minor only. This option is considered a promising candidate and has been PROGRESSED to the next stage.**

11.10. Arrival Structures DPE

Arrival Structures Conclusion and Shortlist

The design principle evaluation of each design option presented on the previous pages and are summarised in the table below.

Arrival Structures

Design Principle / Option Name:	Option 0: Baseline (Do Nothing)	Option 1: Radial holds	Option 2: New linear delay absorption structures	Option 3: New radial holds and new linear delay absorption structures
Accept / Reject	REJECT	Accept & Progress	REJECT	REJECT
Design Principle 1: Safety High The airspace will maintain or enhance current levels of Safety.	MET	MET	MET	MET
Design Principle 2: Operational High The proposed airspace will maintain or enhance operational resilience of the ATC network.	MET	MET	PARTIAL	PARTIAL
Design Principle 3: Operational High The proposed airspace design will yield the greatest capacity benefits from systemisation. (Note: The proposed airspace design should provide increased capacity and reduce delay. This could include the delivery of a suitable delay absorption mechanism or reducing departure intervals. Systemisation will minimise the need for ATC tactical intervention; for example, through better traffic; management).	PARTIAL	MET	MET	MET
Design Principle 4: Technical High The MTMA airspace design will provide a compatible and optimised interface between the lower level terminal airspace; the upper Free Route Airspace (FRA) and the ATS network. (Note: The intent of this Design Principle is for the provision of a design that supports the systemisation of traffic flows: from low-level terminal traffic to high-level Free Route flows. The future design should effectively manage arrivals and departures within the TMA without impacting capacity).	MET	MET	PARTIAL	PARTIAL
Design Principle 5: Economic Medium The proposed MTMA airspace will facilitate optimised network economic performance. (Note: Economic benefits could include environmental improvements such as reduced track mileage/ emissions or revenue from increased capacity/ route charges).	PARTIAL	MET	MET	MET
Design Principle 6: Environmental Medium The proposed MTMA airspace will facilitate the reduction of CO2 emissions per flight.	PARTIAL	MET	MET	MET
Design Principle 7: Environmental Low Minimise environmental impacts to stakeholders on the ground.(Note: network changes are >7,000ft, the position of the interface with the airport's lower level routes will be determined by the airport, hence impacts below 7,000ft will be addressed in the separate airport-sponsored ACP).	MET	PARTIAL	PARTIAL	PARTIAL
Design Principle 8: Operational Medium The MTMA airspace should be compatible with the requirements of the MoD and take into consideration the requirements of the defence industry stakeholders. (Note: Consider where impacts might be greatest by considering Military-use areas against placement of airspace structures).	MET	PARTIAL	NOT	NOT
Design Principle 9: Operational Medium The impacts on GA, non-commercial and other civilian airspace users due to MTMA should be minimised. (Note: Consider where impacts might be greatest by considering known VFR significant areas against placement of airspace structures. This includes a wide variety of airspace users such as emergency, recreational, training and sport aviation).	MET	PARTIAL	NOT	NOT
Design Principle 10: Technical Medium The classification and volume of controlled airspace required for the MTMA should be the minimum necessary to deliver an efficient airspace design, taking into account the needs of UK airspace users (Note: This may include releasing CAS as appropriate).	PARTIAL	PARTIAL	NOT	NOT
Design Principle 11: Technical High The route network linking Airport procedures with the enroute phase of flight will be spaced to yield maximum safety, capacity and efficiency benefits by using an optimal standard of PBN. (Note: Where appropriate, the use of RNP should be considered if the fleet mix can support it).	PARTIAL	MET	MET	MET
Design Principle 12: Technical High The MTMA airspace design will provide a compatible and optimised interface withLondon Airspace Modernisation Programme (LAMP) design. (Note: Closely spaced routes across the interface)	MET	MET	MET	MET
Design Principle 13: Policy High Must accord with the CAA's published Airspace Modernisation Strategy (CAP1711) and any current or future plans associated with it. (Note: The CAA have stated that this DP is required by all change sponsors. CAP1711 describes what airspace modernisation must deliver including: - the need to increase aviation capacity; - growth to be sustainable; - the need to maximise the utilisation of existing runway capacity).	PARTIAL	MET	MET	MET
Design Principle 14: Environmental Medium The airspace should introduce improved Continuous Climb Operations (CCO) and Continuous Descent Operations (CDO) for all aircraft. (Note: This Design Principle includes enabling continuous operations below 7,000ft, where possible).	PARTIAL	MET	MET	MET

Progression criteria: Options having any High Design Principles which are 'NOT' met (red) or 2 or more Medium Design Principles 'NOT' met or greater than 5 Design Principles 'PARTIAL' met have been rejected.

Next Steps
Option 1 Radial holds will be formally appraised under the Stage 2, Step 2B Options Appraisal (Phase 1 Initial), including Safety Assessment.

Arrival Structures

Option 0: Baseline (Do Nothing)	REJECT	Assessment matrix ref
This option represents the existing airspace design, i.e. The "Do-Nothing" option. Keep everything as it is currently		
Design Principle 1: Safety — High The airspace will maintain or enhance current levels of Safety. No change to the current level of safety.	MET	Enhanced - improvement over today's level of safety. Maintained - safety risk could be maintained within acceptable levels of today's operation
Design Principle 2: Operational — High The proposed airspace will maintain or enhance operational resilience of the ATC network. No change to the current level of delay absorption or disruption recovery	MET	Maintain or improve delay absorption
Design Principle 3: Operational — High The proposed airspace design will yield the greatest capacity benefits from systemisation. (Note: The proposed airspace design should provide increased capacity and reduce delay. This could include the delivery of a suitable delay absorption mechanism or reducing departure intervals. Systemisation will minimise the need for ATC tactical intervention; for example, through better traffic; management). Limited requirement, based on current traffic levels, for holding in this airspace, therefore likely to be able to support future growth in arrival flows	PARTIAL	Design option supports the forecast traffic loading but provides no capacity benefit
Design Principle 4: Technical — High The MTMA airspace design will provide a compatible and optimised interface between the lower level terminal airspace; the upper Free Route Airspace (FRA) and the ATS network. (Note: The intent of this Design Principle is for the provision of a design that supports the systemisation of traffic flows: from low-level terminal traffic to high-level Free Route flows. The future design should effectively manage arrivals and departures within the TMA without impacting capacity). Current holds are compatible with STARs/arrival routes and lower airspace.	MET	Minimal or no changes required for compatibility with ATS route network
Design Principle 5: Economic — Medium The proposed MTMA airspace will facilitate optimised network economic performance. (Note: Economic benefits could include environmental improvements such as reduced track mileage/ emissions or revenue from increased capacity/ route charges). No change, no impact.	PARTIAL	Economic performance as per today
Design Principle 6: Environmental — Medium The proposed MTMA airspace will facilitate the reduction of CO2 emissions per flight. No change, no impact.	PARTIAL	CO2 emissions as per today
Design Principle 7: Environmental — Low Minimise environmental impacts to stakeholders on the ground. (Note: network changes are >7,000ft, the position of the interface with the airport's lower level routes will be determined by the airport, hence impacts below 7,000ft will be addressed in the separate airport-sponsored ACP). No change, no impact.	MET	No change in noise impacts below 7000ft
Design Principle 8: Operational — Medium The MTMA airspace should be compatible with the requirements of the MoD and take into consideration the requirements of the defence industry stakeholders. (Note: Consider where impacts might be greatest by considering Military-use areas against placement of airspace structures). No change, no impact.	MET	No impact or positive impact
Design Principle 9: Operational — Medium The impacts on GA, non-commercial and other civilian airspace users due to MTMA should be minimised. (Note: Consider where impacts might be greatest by considering known VFR significant areas against placement of airspace structures. This includes a wide variety of airspace users such as emergency, recreational, training and sport aviation). No change, no impact.	MET	No impact or positive impact
Design Principle 10: Technical — Medium The classification and volume of controlled airspace required for the MTMA should be the minimum necessary to deliver an efficient airspace design, taking into account the needs of UK airspace users . (Note: This may include releasing CAS as appropriate). No change, no impact.	PARTIAL	No change or minor reduction in accessibility of airspace for airspace users
Design Principle 11: Technical — High The route network linking Airport procedures with the enroute phase of flight will be spaced to yield maximum safety, capacity and efficiency benefits by using an optimal standard of PBN. (Note: Where appropriate, the use of RNP should be considered if the fleet mix can support it). No change to current RNAV standards; existing holds are a mixture of RNAV5 and RNAV1.	PARTIAL	PBN standard as per today's operation
Design Principle 12: Technical — High The MTMA airspace design will provide a compatible and optimised interface with London Airspace Modernisation Programme (LAMP) design. (Note: Closely spaced routes across the interface) LAMP interface is not applicable for the arrival structures.	MET	Minimal or no changes required for compatibility with LAMP design
Design Principle 13: Policy — High Must accord with the CAA's published Airspace Modernisation Strategy (CAP1711) and any current or future plans associated with it. (Note: The CAA have stated that this DP is required by all change sponsors. CAP1711 describes what airspace modernisation must deliver including: - the need to increase aviation capacity; - growth to be sustainable; - the need to maximise the utilisation of existing runway capacity). Demonstrates alignment with 1/3 - 2/3 of the aims as set out in the AMS.	PARTIAL	Partially aligned with the AMS
Design Principle 14: Environmental — Medium The airspace should introduce improved Continuous Climb Operations (CCO) and Continuous Descent Operations (CDO) for all aircraft. (Note: This Design Principle includes enabling continuous operations below 7,000ft, where possible). No change, no impact.	PARTIAL	CCO and CDO as per today

Conclusion:	**Option 0: Baseline (Do Nothing) represents no change to the existing airspace design. 7 DPs were 'NOT' met, hence this option was REJECTED and will not be progressed.**

Arrival Structures

Option 1: Radial holds	Accept & Progress	Assessment matrix ref
For Option 1, existing holds will be reviewed and kept, amended, or removed. Additional radial holding structures will be introduced where required.		
Design Principle 1: **Safety** High The airspace will maintain or enhance current levels of Safety. Within this option, existing holds can be kept to maintain safety or amended to enhance safety. An existing hold will not be removed unless it can be demonstrated safety is either maintained or improved. New radial holds could be designed (position and orientation) to reduce route conflictions resulting from aircraft routing to sub-optimal holding locations, thereby enhancing safety.	MET	Enhanced - improvement over today's level of safety. Maintained - safety risk could be maintained within acceptable levels of today's operation
Design Principle 2: **Operational** High The proposed airspace will maintain or enhance operational resilience of the ATC network. Existing holds could be realigned/relocated to create additional space for routes, and potentially reduce route confliction points, thereby increasing capacity and reducing controller workload. In this option, additional delay absorption could be provided by new holds, designed in more optimal locations, providing additional capacity for airfields arrivals.	MET	Maintain or improve delay absorption
Design Principle 3: **Operational** High The proposed airspace design will yield the greatest capacity benefits from systemisation. (Note: The proposed airspace design should provide increased capacity and reduce delay. This could include the delivery of a suitable delay absorption mechanism or reducing departure intervals. Systemisation will minimise the need for ATC tactical intervention; for example, through better traffic; management). Existing holds could be realigned/relocated to create additional space for routes, and potentially reduce route confliction points, thereby increasing capacity and reducing controller workload. In this option, additional delay absorption could be provided by new holds, designed in more optimal locations, providing additional capacity for airfields arrivals.	MET	Design option decreases ATCO workload
Design Principle 4: **Technical** High The MTMA airspace design will provide a compatible and optimised interface between the lower level terminal airspace; the upper Free Route Airspace (FRA) and the ATS network. (Note: The intent of this Design Principle is for the provision of a design that supports the systemisation of traffic flows: from low-level terminal traffic to high-level Free Route flows. The future design should effectively manage arrivals and departures within the TMA without impacting capacity). Any changes to holds/new holds will be designed to be compatible with current/new arrival routes, and also in collaboration with the airport stakeholders to ensure they remain compatible with the lower airspace and deconflicted against the departure routes.	MET	Minimal or no changes required for compatibility with lower level airspace
Design Principle 5: **Economic** Medium The proposed MTMA airspace will facilitate optimised network economic performance. (Note: Economic benefits could include environmental improvements such as reduced track mileage/ emissions or revenue from increased capacity/ route charges). In instances where there are arrival delays, revised/new holding structures will be more optimally located, potentially reducing track miles and enabling improved economic performance compared to today.	MET	Economic performance increased
Design Principle 6: **Environmental** Medium The proposed MTMA airspace will facilitate the reduction of CO2 emissions per flight. In instances where there are arrival delays, revised/new holding structures will be more optimally located, potentially reducing track miles and enabling improved environmental performance compared to today.	MET	CO2 emissions reduced
Design Principle 7: **Environmental** Low Minimise environmental impacts to stakeholders on the ground. (Note: network changes are >7,000ft, the position of the interface with the airport's lower level routes will be determined by the airport, hence impacts below 7,000ft will be addressed in the separate airport-sponsored ACP). In this option, the potential to introduce new radial holds and/or optimise current holds may have the consequential impact of altering aircraft tracks below 7000ft. However, changes to holding facilities will be determined in collaboration with the airports and any changes below 7000ft will be included in the corresponding airport-sponsored ACP.	PARTIAL	Change, but no net detrimental impacts on noise below 7000ft
Design Principle 8: **Operational** Medium The MTMA airspace should be compatible with the requirements of the MoD and take into consideration the requirements of the defence industry stakeholders. (Note: Consider where impacts might be greatest by considering Military-use areas against placement of airspace structures). This option could require increased CAS and may impact the Military. Note: We will seek to use the lowest classification applicable to the airspace. No SUAs are likely to be impacted and adherence to the SUA buffer policy will be maintained.	PARTIAL	Minor impact and not safety critical
Design Principle 9: **Operational** Medium The impacts on GA, non-commercial and other civilian airspace users due to MTMA should be minimised. (Note: Consider where impacts might be greatest by considering known VFR significant areas against placement of airspace structures. This includes a wide variety of airspace users such as emergency, recreational, training and sport aviation). This option could require increased CAS and might impact the GA, non commercial and other civilian airspace users. We will seek to use the lowest classification applicable to the airspace.	PARTIAL	Minor impact and not safety critical
Design Principle 10: **Technical** Medium The classification and volume of controlled airspace required for the MTMA should be the minimum necessary to deliver an efficient airspace design, taking into account the needs of UK airspace users. (Note: This may include releasing CAS as appropriate). No opportunities identified to allow the release of CAS/reduction in airspace classification in this option.	PARTIAL	No change or minor reduction in accessibility of airspace for airspace users
Design Principle 11: **Technical** High The route network linking Airport procedures with the enroute phase of flight will be spaced to yield maximum safety, capacity and efficiency benefits by using an optimal standard of PBN. (Note: Where appropriate, the use of RNP should be considered if the fleet mix can support it). The highest appropriate level of PBN will be used.	MET	PBN standard as per today's operation
Design Principle 12: **Technical** High The MTMA airspace design will provide a compatible and optimised interface with London Airspace Modernisation Programme (LAMP) design. (Note: Closely spaced routes across the interface) LAMP interface is not applicable for the arrival structures.	MET	Minimal or no changes required for compatibility with LAMP design
Design Principle 13: **Policy** High Must accord with the CAA's published Airspace Modernisation Strategy (CAP1711) and any current or future plans associated with it. (Note: The CAA have stated that this DP is required by all change sponsors. CAP1711 describes what airspace modernisation must deliver including: - the need to increase aviation capacity; - growth to be sustainable; - the need to maximise the utilisation of existing runway capacity). Demonstrates alignment with more than 2/3 of the aims as set out in the AMS.	MET	Aligned with the AMS
Design Principle 14: **Environmental** Medium The airspace should introduce improved Continuous Climb Operations (CCO) and Continuous Descent Operations (CDO) for all aircraft. (Note: This Design Principle includes enabling continuous operations below 7,000ft, where possible). More optimal positioning/orientation of holds could deconflict arrival/departure traffic enabling more continuous profiles.	MET	Positive impact on CCO and CDO

Conclusion:	**Option 1: Radial holds, could create additional space for routes, reduce route confliction points, enable more continuous profiles and reduce track miles potentially improving capacity, environmental and economic performance, and reducing controller workload. There is the potential requirement for increased CAS in this option, however this is considered minor and not safety critical. This option is considered a promising candidate and has been PROGRESSED to the next stage.**

NATS

Arrival Structures

Option 2: New linear delay absorption structures	REJECT	Assessment matrix ref
For Option 2, existing holds will be reviewed and kept, amended, or removed. In addition, at least one linear delay absorption structure (i.e., point merge, trombone etc) will be introduced, where required.		
Design Principle 1: Safety High The airspace will maintain or enhance current levels of Safety. As with Option 1 for the optimisation of existing radial holds. Additionally, linear delay absorption structures can (conceptually) reduce the requirement for tactical vectoring, and improve the predictability of sequenced arrival flows, potentially reducing ATC and cockpit workload and improving situation awareness, thereby improving safety.	MET	Enhanced - improvement over today's level of safety. Maintained - safety risk could be maintained within acceptable levels of today's operation
Design Principle 2: Operational High The proposed airspace will maintain or enhance operational resilience of the ATC network. Point Merge transition procedures require traditional radial holds at the end of the STAR, (see the Policy for Point Merge and Trombone Transition Procedures, Aug 2015) to accommodate situations where 'delay is not determined'. The volume of airspace required for both the Point Merge and the accompanying radial hold limits the airspace available to impement a systemised route structure thereby impacting the overall efficiency, capacity and resilience of the ATC network.	PARTIAL	Minor reduction in disruption recovery
Design Principle 3: Operational High The proposed airspace design will yield the greatest capacity benefits from systemisation. (Note: The proposed airspace design should provide increased capacity and reduce delay. This could include the delivery of a suitable delay absorption mechanism or reducing departure intervals. Systemisation will minimise the need for ATC tactical intervention; for example, through better traffic; management). As with Option 1 for the optimisation of existing radial holds. Additionally, linear delay absorption structures can (conceptually) reduce the requirement for tactical vectoring, and improve the predictability of sequenced arrival flows, potentially reducing ATC workload, thereby increasing capacity.	MET	Design option decreases ATCO workload
Design Principle 4: Technical High The MTMA airspace design will provide a compatible and optimised interface between the lower level terminal airspace; the upper Free Route Airspace (FRA) and the ATS network. (Note: The intent of this Design Principle is for the provision of a design that supports the systemisation of traffic flows: from low-level terminal traffic to high-level Free Route flows. The future design should effectively manage arrivals and departures within the TMA without impacting capacity). Linear delay absorption structures such as Point Merge require the airport to introduce fixed Merge Points to enable the benefits from arrival sequencing.	PARTIAL	Significant changes with lower level airspace required for compatibility
Design Principle 5: Economic Medium The proposed MTMA airspace will facilitate optimised network economic performance. (Note: Economic benefits could include environmental improvements such as reduced track mileage/ emissions or revenue from increased capacity/ route charges). The location of the structure (distance from the airfield) may limit any reduction in track miles, creating fuel inefficiencies.	NOT	Economic performance reduced
Design Principle 6: Environmental Medium The proposed MTMA airspace will facilitate the reduction of CO2 emissions per flight. The location of the structure (distance from the airfield) may limit any reduction in track miles, creating environmental inefficiencies.	NOT	CO2 emissions increased
Design Principle 7: Environmental Low Minimise environmental impacts to stakeholders on the ground. (Note: network changes are >7,000ft, the position of the interface with the airport's lower level routes will be determined by the airport, hence impacts below 7,000ft will be addressed in the separate airport-sponsored ACP). In this option, the potential to optimise current holds and to introduce linear delay absorption structures may have the consequential impact of altering aircraft tracks below 7000ft. However, changes to holding facilities/delay absorption structures will be determined in collaboration with the airports and any changes below 7000ft will be included in the corresponding airport-sponsored ACP.	PARTIAL	Change, but no net detrimental impacts on noise below 7000ft
Design Principle 8: Operational Medium The MTMA airspace should be compatible with the requirements of the MoD and take into consideration the requirements of the defence industry stakeholders. (Note: Consider where impacts might be greatest by considering Military-use areas against placement of airspace structures). SMEs have identified that, given the complexity of the airspace surrounding the airfields, any linear delay absorption structure will need to be located some distance away from the airfields and would likely require increased CAS. As such the location of these structures could significantly impact the Military, GA, non-commercial and other airspace users. It is noted that potentially the time-banded use of these structures could provide some level of mitigation (but not completely) for the negative impact on the wider aviation community.	NOT	Major impact or safety critical impact
Design Principle 9: Operational Medium The impacts on GA, non-commercial and other civilian airspace users due to MTMA should be minimised. (Note: Consider where impacts might be greatest by considering known VFR significant areas against placement of airspace structures. This includes a wide variety of airspace users such as emergency, recreational, training and sport aviation). SMEs have identified that, given the complexity of the airspace surrounding the airfields, any linear delay absorption structure will need to be located some distance away from the airfields and would likely require increased CAS. As such the location of these structures could significantly impact the Military, GA, non-commercial and other airspace users. It is noted that potentially the time-banded use of these structures could provide some level of mitigation (but not completely) for the negative impact on the wider aviation community.	NOT	Major impact or safety critical impact
Design Principle 10: Technical Medium The classification and volume of controlled airspace required for the MTMA should be the minimum necessary to deliver an efficient airspace design, taking into account the needs of UK airspace users. (Note: This may include releasing CAS as appropriate). Potentially a significant amount of airspace, and additional CAS, will be required to support any linear delay absorption structures.	NOT	Major reduction in accessibility of airspace for airspace users
Design Principle 11: Technical High The route network linking Airport procedures with the enroute phase of flight will be spaced to yield maximum safety, capacity and efficiency benefits by using an optimal standard of PBN. (Note: Where appropriate, the use of RNP should be considered if the fleet mix can support it). The highest appropriate level of PBN will be used.	MET	Increased PBN standard compared to today's operation
Design Principle 12: Technical High The MTMA airspace design will provide a compatible and optimised interface with London Airspace Modernisation Programme (LAMP) design. (Note: Closely spaced routes across the interface) LAMP interface is not applicable for the arrival structures.	MET	Minimal or no changes required for compatibility with LAMP design
Design Principle 13: Policy High Must accord with the CAA's published Airspace Modernisation Strategy (CAP1711) and any current or future plans associated with it. (Note: The CAA have stated that this DP is required by all change sponsors. CAP1711 describes what airspace modernisation must deliver including: - the need to increase aviation capacity; - growth to be sustainable; - the need to maximise the utilisation of existing runway capacity). Demonstrates alignment with 1/3 - 2/3 of the aims as set out in the AMS.	PARTIAL	Partial alignment with the AMS
Design Principle 14: Environmental Medium The airspace should introduce improved Continuous Climb Operations (CCO) and Continuous Descent Operations (CDO) for all aircraft. (Note: This Design Principle includes enabling continuous operations below 7,000ft, where possible). The optimisation of departure profiles could potentially be limited by the requirement to remain deconflicted against the large volume of airspace occupied by any linear delay absorption structure.	NOT	Negative impact on CCO and CDO compared with today

Conclusion:	Option 2: New linear delay absorption structures, has 6 DPs 'NOT' met (priority MEDIUM), hence this option was REJECTED and will not be progressed.

Arrival Structures

Option 3: New radial holds and new linear delay absorption structures	REJECT	Assessment matrix ref
For Option 3, existing holds will be reviewed and kept, amended, or removed. In addition, at least one radial hold and at least one linear delay absorption structure will be introduced, where required.		
Design Principle 1: Safety High The airspace will maintain or enhance current levels of Safety. May increase route conflictions and therefore the complexity of the airspace, increasing controller workload, therefore reducing safety	PARTIAL	Diminished - Issue(s) identified could result in an elevated level of safety risk when compared to today's operation
Design Principle 2: Operational High The proposed airspace will maintain or enhance operational resilience of the ATC network. May increase route conflictions and therefore the complexity of the airspace, increasing controller workload, therefore reducing the resilience of the ATC network	PARTIAL	Minor reduction in disruption recovery
Design Principle 3: Operational High The proposed airspace design will yield the greatest capacity benefits from systemisation. (Note: The proposed airspace design should provide increased capacity and reduce delay. This could include the delivery of a suitable delay absorption mechanism or reducing departure intervals. Systemisation will minimise the need for ATC tactical intervention; for example, through better traffic; management). May increase route conflictions and therefore the complexity of the airspace, increasing controller workload, therefore reducing capacity.	NOT	Design option increases ATCO workload
Design Principle 4: Technical High The MTMA airspace design will provide a compatible and optimised interface between the lower level terminal airspace; the upper Free Route Airspace (FRA) and the ATS network. (Note: The intent of this Design Principle is for the provision of a design that supports the systemisation of traffic flows: from low-level terminal traffic to high-level Free Route flows. The future design should effectively manage arrivals and departures within the TMA without impacting capacity). Linear delay absorption structures such as Point Merge require the airport to introduce fixed Merge Points to enable the benefits from arrival sequencing.	PARTIAL	Significant changes with lower level airspace required for compatibility
Design Principle 5: Economic Medium The proposed MTMA airspace will facilitate optimised network economic performance. (Note: Economic benefits could include environmental improvements such as reduced track mileage/ emissions or revenue from increased capacity/ route charges). The location of the structure (distance from the airfield) may limit any reduction in track miles, creating fuel inefficiencies.	NOT	Economic performance reduced
Design Principle 6: Environmental Medium The proposed MTMA airspace will facilitate the reduction of CO2 emissions per flight. The location of the structure (distance from the airfield) may limit any reduction in track miles, creating environmental inefficiencies	NOT	CO2 emissions increased
Design Principle 7: Environmental Low Minimise environmental impacts to stakeholders on the ground. (Note: network changes are >7,000ft, the position of the interface with the airport's lower level routes will be determined by the airport, hence impacts below 7,000ft will be addressed in the separate airport-sponsored ACP). In this option, the potential to optimise existing holds and to introduce new radial holds and new linear delay absorption structures may have the consequential impact of altering aircraft tracks below 7000ft. However, changes to holding facilities/delay absorption structures will be determined in collaboration with the airports and any changes below 7000ft will be included in the corresponding airport-sponsored ACP.	PARTIAL	Change, but no net detrimental impacts on noise below 7000ft
Design Principle 8: Operational Medium The MTMA airspace should be compatible with the requirements of the MoD and take into consideration the requirements of the defence industry stakeholders. (Note: Consider where impacts might be greatest by considering Military-use areas against placement of airspace structures). SMEs have identified that, given the complexity of the airspace surrounding the airfields, any linear delay absorption structure will need to be located some distance away from the airfields and would likely require increased CAS. As such the location of these structures could significantly impact the Military, GA, non-commercial and other airspace users. It is noted that potentially the time-banded use of these structures could provide some level of mitigation (but not completely) for the negative impact on the wider aviation community.	NOT	Major impact or safety critical impact
Design Principle 9: Operational Medium The impacts on GA, non-commercial and other civilian airspace users due to MTMA should be minimised. (Note: Consider where impacts might be greatest by considering known VFR significant areas against placement of airspace structures. This includes a wide variety of airspace users such as emergency, recreational, training and sport aviation). SMEs have identified that, given the complexity of the airspace surrounding the airfields, any linear delay absorption structure will need to be located some distance away from the airfields and would likely require increased CAS. As such the location of these structures could significantly impact the Military, GA, non-commercial and other airspace users. It is noted that potentially the time-banded use of these structures could provide some level of mitigation (but not completely) for the negative impact on the wider aviation community.	NOT	Major impact or safety critical impact
Design Principle 10: Technical Medium The classification and volume of controlled airspace required for the MTMA should be the minimum necessary to deliver an efficient airspace design, taking into account the needs of UK airspace users. (Note: This may include releasing CAS as appropriate). Potentially a significant amount of airspace, and additional CAS, will be required to support any linear delay absorption structures.	NOT	Major reduction in accessibility of airspace for airspace users
Design Principle 11: Technical High The route network linking Airport procedures with the enroute phase of flight will be spaced to yield maximum safety, capacity and efficiency benefits by using an optimal standard of PBN. (Note: Where appropriate, the use of RNP should be considered if the fleet mix can support it). The highest appropriate level of PBN will be used.	MET	Increased PBN standard compared to today's operation
Design Principle 12: Technical High The MTMA airspace design will provide a compatible and optimised interface with London Airspace Modernisation Programme (LAMP) design. (Note: Closely spaced routes across the interface) LAMP interface is not applicable for the arrival structures.	MET	Minimal or no changes required for compatibility with LAMP design
Design Principle 13: Policy High Must accord with the CAA's published Airspace Modernisation Strategy (CAP1711) and any current or future plans associated with it. (Note: The CAA have stated that this DP is required by all change sponsors. CAP1711 describes what airspace modernisation must deliver including: - the need to increase aviation capacity; - growth to be sustainable; - the need to maximise the utilisation of existing runway capacity). Demonstrates alignment with fewer than 1/3 of the aims as set out in the AMS.	NOT	No or limited alignment with the AMS
Design principle 14: Environmental Medium The airspace should introduce improved Continuous Climb Operations (CCO) and Continuous Descent Operations (CDO) for all aircraft. (Note: This Design Principle includes enabling continuous operations below 7,000ft, where possible). The optimisation of departure profiles could potentially be limited by the requirement to remain deconflicted against the large volume of airspace occupied by any linear delay absorption structure.	NOT	Negative impact on CCO and CDO compared with today

Conclusion:	**Option 3: New radial holds and new linear delay absorption structures, has 8 DPs 'NOT' met (2 of which are priority HIGH), hence this option was REJECTED and will not be progressed.**

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