

Future Airspace Strategy Implementation North (FASI-N)  
Scottish Terminal Manoeuvring Area (ScTMA)  
ACP-2020-74

Gateway documentation:  
Stage 2 Develop & Assess

2B Options Appraisal (Phase I – Initial)



## Roles

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## 1. Introduction

1.1 This Airspace Change Proposal (ACP) is sponsored by 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 surrounding the Scottish Terminal Manoeuvring Area (ScTMA) in accordance with the Civil Aviation Authority's (CAA's) Airspace Modernisation Strategy (AMS) using Performance Based Navigation (PBN). This will provide capacity benefits through systemisation by reducing conflicts whilst also providing a reduction in fuel burn and CO<sub>2</sub> emissions.

1.2 This document forms part of the document set required for the CAP1616 airspace change process: Stage 2 Develop and Assess, Step 2B Options Appraisal (Phase 1 Initial) including Safety Considerations.

1.3 Its purpose is to consider the shortlist of airspace design options which have progressed through the Step 2A (ii) Design Principle Evaluation, to provide comparisons of each option via qualitative assessment or, if available and proportional, quantitative analysis. These assessments are based on stakeholder feedback and SME input to ensure the options are appraised in fair and unbiased manner. This document should be read in conjunction with Stage 2A documentation.

1.4 For this submission, under Stage 2 the designs have been presented as concepts with the tracks presented as indicative swathes and are not yet fully developed, i.e., the exact track locations are yet to be decided. Therefore, the analysis will be qualitative. Any values presented will be of indicative value only and used to highlight the potential of an option.

1.5 A baseline has been provided for each element which describes the extant airspace design taking into account any previously approved airspace changes. We are aware of other ongoing ACP's which may have an impact on this proposal. We will continue to work closely with the sponsors of these ACP's through all stages of the CAP1616 process to ensure our designs consider these as they progress.

1.6 This ScTMA incorporates a large volume of airspace with differing traffic demands. The ACP seeks to introduce numerous different changes considering these various demands and as such, the number of potential options detailing the holistic design for this change was vast and unmanageable. Therefore, the impacted airspace was split into 6 geographic elements each encompassing similar changes for the ATS route network and concepts considered for each element. Additionally, 3 further elements addressing the connectivity of the en-route ATS route network and the lower airspace were considered.

1.7 Following the design principle evaluation, Stage 2a, the concepts listed in Table 1 have progressed to this stage:

Element	Design Concept	Description
Eastern	Concept 4	<i>Systemised routes avoiding gliding area</i>
	Concept 8	<i>Systemised routes impacting gliding area</i>
South-Eastern	Concept 3	<i>Systemised route with lowered CAS bases</i>
Southern	Concept 3	<i>Systemised routes orientated according to traffic flow</i>
	Concept 4	<i>Systemised routes orientated according to traffic flow including a review of CAS bases</i>
South-Western	Concept 1	<i>Systemised Routes</i>
Northern	Concept 1	<i>Bi-directional route structure and review bases</i>
Central	Concept 1	<i>Provide ATS route connectivity to/between surrounding elements within existing CAS</i>
Departure Connectivity	Concept 1	<i>Provide departure connectivity from airport SID end points to adjacent elements via ATS routes within existing CAS</i>
	Concept 2	<i>Provide departure connectivity from airport SID end points to adjacent elements via ATS routes requiring new CAS</i>
Arrival Connectivity	Concept 1	<i>Provide arrival connectivity from ATS route network to airport arrival structure via STARs within existing CAS</i>
	Concept 2	<i>Provide arrival connectivity from ATS route network to airport arrival structure via STARs requiring additional CAS</i>
Arrival Structure	Concept 1	<i>Review existing holds and introduce new radial holds where required</i>

**Table 1: List of concepts which have progressed through the Design Principle evaluation.**

1.8 The other options considered have not progressed to this stage following design principle evaluation which included input from subject matter experts (SMEs), airspace design experts and stakeholder feedback. This document should be read in conjunction with the Step 2A Design Options & Design Principle Evaluation document, which gives descriptions of each option and assesses each option against the Design principles agreed in Step 1B.

## Where are we in the airspace change process?

1.9 We have completed Stage 1 Define, where we established 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 Step 2B

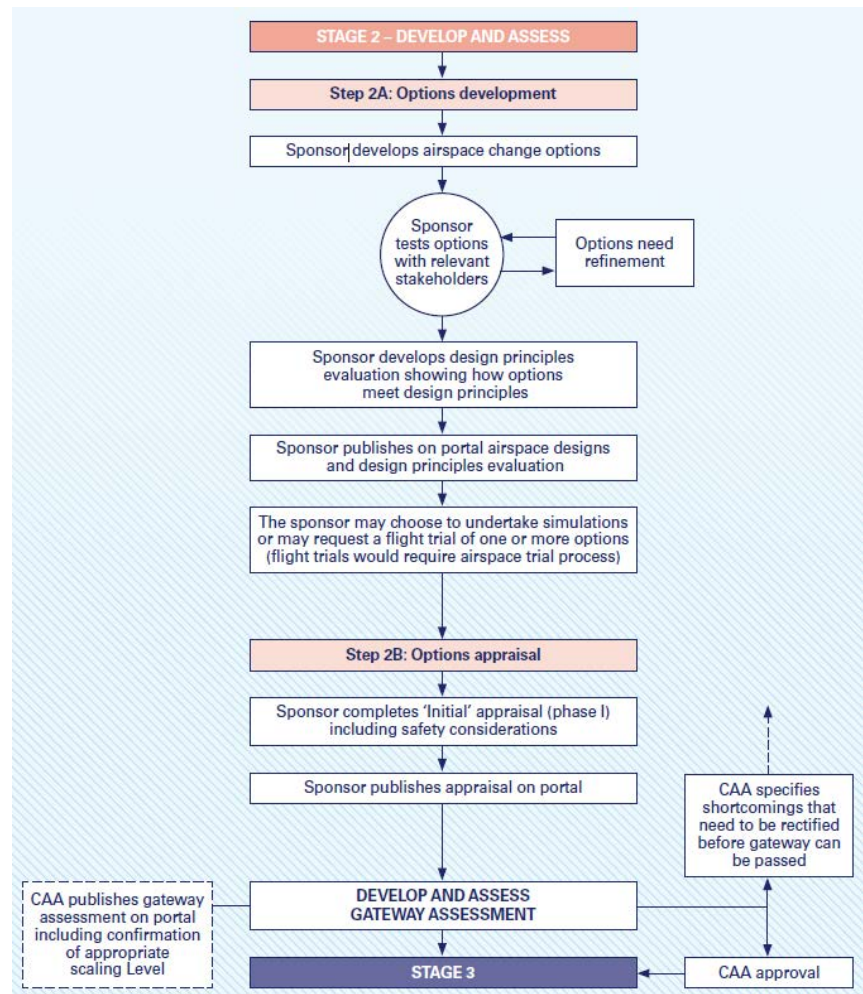


Figure 1: CAP1616 Airspace Change Process Stage 2

## 2. How to read this document – illustrations of current and potential impacts

2.1 The following tables are based on CAP1616 4<sup>th</sup> edition, Table E2, pages 201-203.

2.2 From Stage 2A one or two concepts were shortlisted for each element leading to a total of 13 concepts being considered. These are listed in Table 1 above. A separate analysis is presented for each concept and for the baseline scenario for each element as a comparison.

2.3 The changes described within this ACP will only affect the enroute network in airspace above 7,000 ft. However, the ACP will progress on the assumption of a scaled Level 1. This will continue to allow any airport led changes to be progressed consecutively.

2.4 In this document we provide tables for the 13 candidate design concepts. Note that these are compared against the baseline, do-nothing scenario.

2.5 We describe broadly what we expect the scale of impact might be, for each option.

2.6 Owing to the broad nature of the design concepts, it is not possible to provide an accurate quantitative assessment of each option. This document will therefore provide a qualitative assessment and provide some indicative quantitative assessments of potential savings which might be achieved if the design option was implemented. This initial numerical analysis is based on the broad design concepts and will be subject to

refinement before the next stage, so the numbers may change as the design is refined. This is proportionate and in line with the expectations of CAP1616 Stage 2<sup>1</sup>.

2.7 It is expected that with more detailed modelling of the designs as they develop in Stage 3, some of the qualitative assessments will be quantified.

2.8 The following assumptions are made in the Initial Options Appraisal:

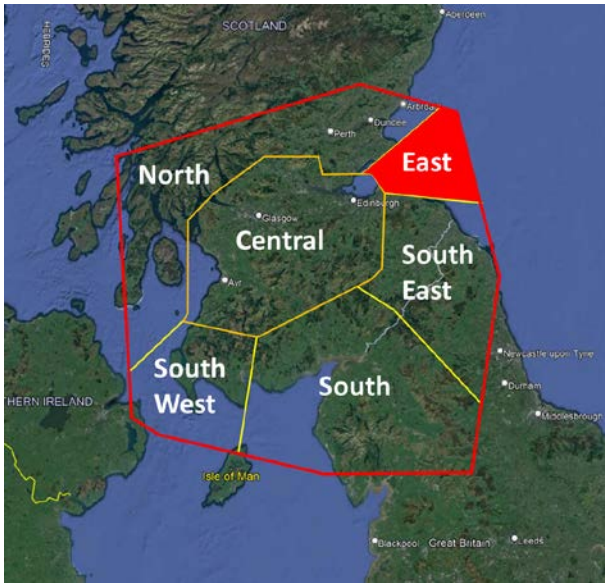
- The quantity of fuel burnt is proportional to the distance flown. i.e. increased track mileage will result in increased fuel burn
- It is more efficient to fly at a higher altitude than a lower one
- It is more beneficial to enable Continuous Descent Operations (CDO) over Continuous Climb Operations (CCO)
- A “radial hold” is analogous with a left-hand or right-hand standard “racetrack hold”
- There is a fixed correlation between fuel burnt and greenhouse gases emitted. For every 1 kg of fuel that is burnt 3.18 kg of CO<sub>2</sub> equivalent (CO<sub>2</sub>e) is emitted.

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<sup>1</sup> CAP1616, 4<sup>th</sup> edition, page 41 paragraph 133 and page 197 paragraph E12

### 3. ATS Route Design Concepts

#### Eastern Element



#### 3.1. Option 0 Do Nothing (Baseline)

Group	Impact	Level of Analysis	Evidence
Communities	Noise impact on health and quality of life	Qualitative	This proposal covers a large portion of Scotland, Northern England and extends West towards the Irish coast. This area includes the following National Parks, National Scenic areas and Areas of Outstanding Natural Beauty; Loch Lomond and the Trossachs, The Lake District, The Yorkshire Dales, Fleet Valley, East Stewarty Coast, Nith Estuary, Upper Tweeddale, Eildon and Leaderfoot, North Arran, Knapdale, Scarba, Lunga and the Garvellachs, Loch Lomond, The Trossachs, The River Earn, The River Tay, Loch Rannoch and Glen Lyon, The North Pennines, The Solway Coast, and The Northumberland Coast. This change will only impact flights above FL70 or 7,000 ft, any associated changes below this level will be included in the corresponding airports ACP. Government guidance says that 7,000ft is the maximum height at which noise is a priority for consideration. There will be no discernible change in noise impact from today.
Communities	Air quality	Qualitative	Government guidance says that aircraft flying higher than 1,000 ft are unlikely to have a significant impact on air quality <sup>2</sup> . There will be no changes in aircraft trajectories below 1,000 ft proposed in this ACP, therefore there will be no change in air quality from today.
Wider society	Greenhouse gas impact	Qualitative	The Eastern element seeks to introduce new arrival/departure connectivity to the ScTMA through the Firth of Forth (FoF). Should this new route not be introduced, aircraft will arrive/depart the ScTMA via the existing P600 and Y96 ATS routes. An aircraft departing EGPH to Scandinavia, via Y96 (the TLA 6D <sup>3</sup> SID) and exiting the UK FIR at GOREV has a flight planned distance of 330 NM and those departing via P600 (the GRICE 4D SID) between EGPH and the FIR boundary has a flight planned distance of 300.7 NM. The arrival routes are expected to offer similar savings in track mileage and have not been included. There will be no change to the existing operation and no change in the greenhouse gas impact.

<sup>2</sup> See [Air Navigation Guidance 2017](#)

<sup>3</sup> The TLA 6D Departs Edinburgh on Runway 06 and routes into the FoF before turning south. Any options departing runway 24 have not been included in the indicative values as the proposed SID routings have multiple likely options. The majority of the track mileage saving will be from the en-route section, not the SID route.



<b>Wider society</b>	Capacity/ resilience	Qualitative	The Eastern element seeks to introduce new arrival/departure connectivity to the ScTMA through the FoF. Should this new route not be introduced, aircraft will arrive/ depart the ScTMA via the existing P600 and Y96 ATS routes. Therefore, there will be no change to the existing capacity or resilience of the airspace. As traffic numbers grow in line with the forecast, effective sector capacity will become constrained, partially due to increasing controller workload. This could in turn lead to a reduction in resilience.
<b>General Aviation (GA)</b>	Access	Qualitative	This option would not introduce or release any additional CAS. Therefore, the airspace impacted by this element will remain Class G and GA access will remain unchanged.
<b>General Aviation / commercial airlines</b>	Economic impact from increased effective capacity	Qualitative	There will be no change in the economic impact from increased capacity as aircraft will continue to fly the arrival and departure routes they do today. However, as traffic numbers grow in line with the forecast, effective sector capacity will become constrained, partially due to increasing controller workload. This could in turn lead to a reduction in resilience.
<b>General Aviation / commercial airlines</b>	Fuel burn	Qualitative	There will be no change in fuel burn from today's operation as aircraft will be required to route as per today's operation. An aircraft departing EGPH to Scandinavia, via Y96 (the TLA 6D SID) and exiting the UK FIR at GOREV has a flight planned distance of 330 NM and those departing via P600 (the GRICE 4D SID) between EGPH and the FIR boundary have a flight planned distance of distance of 300.7 NM. The arrival routes are expected to offer similar savings in track mileage and have not been included.
<b>Commercial airlines</b>	Training cost	Qualitative	There would be no additional training required as there will be no change to the extant airspace or procedures.
<b>Commercial airlines</b>	Other costs	Qualitative	There would be no additional associated costs for airlines as there will be no change to the extant airspace.
<b>Airport/ Air navigation service provider</b>	Infrastructure costs	Qualitative	There would be no additional associated infrastructure costs as there will be no change to the extant airspace.
<b>Airport/ Air navigation service provider</b>	Operational costs	Qualitative	There would be no additional associated operational costs as there will be no change to the extant airspace.
<b>Airport/ Air navigation service provider</b>	Deployment costs	Qualitative	There would be no additional associated deployment costs as there will be no change to the extant airspace.

**Table 2: Options Appraisal (CAP1616), Eastern Element Baseline**

## Conclusion

The baseline “Do Nothing” Option 0 does not meet the following Design Principles:

- DP2 Operational- Resilience
- DP3 Operational- Capacity
- DP4 Technical- Interface
- DP5 Economic- Fuel burn
- DP6 Environmental- CO<sub>2</sub> emissions
- DP11 Technical- PBN
- DP12 Technical- AMS
- DP13 Operational-CCO/CDO

For further information please see the DP evaluation matrix in the [Stage 2a Design Options and Evaluation document](#).

As such this option was rejected. It is included here for comparison purposes only.



### 3.2. Concept 4. Systemised routes avoiding gliding area

Group	Impact	Level of Analysis	Evidence
Communities	Noise impact on health and quality of life	Qualitative	This proposal covers a large portion of Scotland, Northern England and extends West towards the Irish coast. This area includes the following National Parks, National Scenic areas and Areas of Outstanding Natural Beauty; Loch Lomond and the Trossachs, The Lake District, The Yorkshire Dales, Fleet Valley, East Stewartry Coast, Nith Estuary, Upper Tweeddale, Eildon and Leaderfoot, North Arran, Knapdale, Scarba, Lunga and the Garvellachs, Loch Lomond, The Trossachs, The River Earn, The River Tay, Loch Rannoch and Glen Lyon, The North Pennines, The Solway Coast, and The Northumberland Coast. This change will only impact flights above FL70 or 7,000 ft, any associated changes below this level will be included in the corresponding airports ACP. Government guidance says that 7,000ft is the maximum height at which noise is a priority for consideration. There will be no discernible change in noise impact from today.
Communities	Air quality	Qualitative	Government guidance says that aircraft flying higher than 1,000 ft are unlikely to have a significant impact on air quality <sup>4</sup> . There will be no changes in aircraft trajectories below 1,000 ft proposed in this ACP, therefore there will be no change in air quality from today.
Wider society	Greenhouse gas impact	Quantitative	The Eastern element seeks to introduce new arrival/departure connectivity to the ScTMA through the FoF. Should this concept be introduced, aircraft currently arriving/ departing the ScTMA towards Scandinavia via the existing P600 and Y96 ATS routes will be able to utilise the new route. This route for an easterly departure from EGPH currently filed via Y96 will be ~ 289.5 NM and for an easterly departure via P600 will be 273.1 NM. This is a track mileage saving of ~ 40.5 and 27.6 NM respectively. Therefore, there will be positive impact on greenhouse gas emissions. This analysis is indicative and more detailed quantitative analysis of CO <sub>2</sub> e emissions will be presented in Stage 3.
Wider society	Capacity/ resilience	Qualitative	The changes contained within this design concept introduce a new systemised route towards Scandinavia. These routes will provide an efficient deconflicted network where possible with added connectivity to Free Route Airspace (FRA) yielding capacity benefits and a reduction in air traffic control (ATC) complexity. This would increase the resilience of the ATC network.
General Aviation (GA)	Access	Qualitative	Introduction of a systemised route structure within the Eastern Element area will require an increase in CAS. The proposed airspace classification has not yet been determined. We will endeavour to use the most appropriate airspace classification and therefore it is expected that VFR traffic will be able to access subject to appropriate ATC clearance. The FASI-N ScTMA project will undertake a comprehensive review of airspace bases and classification with a view to releasing airspace that is no longer required. This will help to offset the additional new airspace required.
General Aviation / commercial airlines	Economic impact from increased effective capacity	Qualitative	The proposed changes will increase the effective capacity of the airspace. The economic impact of this would be positive, however it has not been quantified.

<sup>4</sup> See [Air Navigation Guidance 2017](#)

General Aviation / commercial airlines	Fuel burn	Quantitative	This option introduces a new arrival and departure route between the ScTMA and FRA to the East. This route is expected to enable a track mileage saving of ~27.6 – 40.5 NM per flight which will reduce the fuel burn and fuel uplift, the additional fuel required to carry extra fuel, resulting in a reduction in fuel burn. GA airspace users may incur a minor fuel disbenefit if they are unable to obtain a clearance into the airspace. This analysis is indicative and more detailed quantitative analysis of fuel burn will be presented in Stage 3.
Commercial airlines	Training cost	Qualitative	Flight procedures worldwide are updated with each aeronautical information regulation and control (AIRAC) cycle and airlines update their procedures accordingly, training as required. This proposal is not anticipated to require additional training costs for airlines.
Commercial airlines	Other costs	Qualitative	No other airline costs are foreseen.
Airport/ Air navigation service provider	Infrastructure costs	Qualitative	This proposal is not expected to change Airport or air navigation service provider (ANSP) infrastructure, beyond the initial deployment phase which will require some systems engineering amendments. However, this is dependent on the assumption that any new CAS has sufficient CNS coverage for the proposed routes. This will be confirmed prior to Stage 3.
Airport/ Air navigation service provider	Operational costs	Qualitative	This proposal is not expected to change Airport or ANSP operational costs. <sup>5</sup>
Airport/ Air navigation service provider	Deployment costs	Qualitative	This proposal for the holistic ScTMA change is expected to require air traffic controller familiarisation training, in the order of 90-100 controllers and c.50 assistants at NATS Prestwick, including extensive use of the NATS simulator facility. Support staff are required to run the simulator – planning, training staff, data preparation and testing, pseudo pilots, safety analysts, outputs to be recorded and reported etc. Some staff may only require briefings. There may be occasions where the reduced availability of operational controllers during their conversion training could mean operational rostering becomes a factor when considering continuous service delivery. The Military ANSP would also require briefing prior to deployment. This requirement will be clarified as designs mature through on-going engagement.

**Table 3: Options Appraisal (CAP1616 E2), Eastern Element Concept 4**

### Conclusion

Compared to the baseline the performance of Concept 4 offers benefit in terms of CO<sub>2</sub> emissions and fuel burn as well as improving capacity and resilience of the route network.

However, Concept 4 will require a large volume of additional CAS where there is currently no existing route structure. This additional CAS will be the minimum volume and appropriate classification to safely contain the proposed systemised routes.

In terms of Fuel burn and CO<sub>2</sub> emissions, Concept 4 is less beneficial than Concept 8, however the additional CAS will be situated away from the Northumbria gliding area, reducing the impact on the GA community.

For these reasons Concept 4 is considered viable and will be **Progressed** to Stage 3.

<sup>5</sup> For details of potentially impacted airports and ANSPs please refer to the Sage 2a documentation.

### 3.3. Concept 8. *Systemised routes impacting gliding area*

Group	Impact	Level of Analysis	Evidence
Communities	Noise impact on health and quality of life	Qualitative	This proposal covers a large portion of Scotland, Northern England and extends West towards the Irish coast. This area includes the following National Parks, National Scenic areas and Areas of Outstanding Natural Beauty; Loch Lomond and the Trossachs, The Lake District, The Yorkshire Dales, Fleet Valley, East Stewartry Coast, Nith Estuary, Upper Tweeddale, Eildon and Leaderfoot, North Arran, Knapdale, Scarba, Lunga and the Garvellachs, Loch Lomond, The Trossachs, The River Earn, The River Tay, Loch Rannoch and Glen Lyon, The North Pennines, The Solway Coast, and The Northumberland Coast. This change will only impact flights above FL70 or 7,000 ft, any associated changes below this level will be included in the corresponding airports ACP. Government guidance says that 7,000ft is the maximum height at which noise is a priority for consideration. There will be no discernible change in noise impact from today.
Communities	Air quality	Qualitative	Government guidance says that aircraft flying higher than 1,000 ft are unlikely to have a significant impact on air quality <sup>6</sup> . There will be no changes in aircraft trajectories below 1,000 ft proposed in this ACP, therefore there will be no change in air quality from today.
Wider society	Greenhouse gas impact	Qualitative	The Eastern element seeks to introduce new arrival/departure connectivity between the ScTMA and FRA through the FoF. Should this concept be introduced, aircraft currently arriving/ departing the ScTMA towards Scandinavia via the existing P600 and Y96 ATS Routes will be able to utilise the new route. This option allows the proposed route to impact or transit the Northumbria Gliding area offering additional benefit over Concept 1. This route for an easterly departure from EGPB currently filed via Y96 will be ~ 285.3 NM and for an easterly departure via P600 will be 268.9 NM. This is a track mileage saving of ~ 44.7 and 31.8 NM respectively. Therefore, there will be positive impact on greenhouse gas emissions. This analysis is indicative and more detailed quantitative analysis of CO <sub>2</sub> e emissions will be presented in Stage 3.
Wider society	Capacity/ resilience	Qualitative	The changes contained within this design concept introduce a new systemised route towards Scandinavia. These routes will provide an efficient deconflicted network where possible with added connectivity to Free Route Airspace (FRA) yielding capacity benefits and a reduction in air traffic control (ATC) complexity. This would increase the resilience of the ATC network.
General Aviation (GA)	Access	Qualitative	Introduction of a systemised route structure within the Eastern Element area will require an increase in CAS. The proposed airspace classification has not yet been determined. We will endeavour to use the most appropriate airspace classification and therefore it is expected that VFR traffic will be able to access subject to appropriate ATC clearance. This option will allow any new route to transit the Northern Northumbria gliding area. This will reduce the airspace volume available to the gliding community. However, the option exists to amend the gliding area availability increasing the combined volume when active. The FASI-N ScTMA project will undertake a comprehensive review of airspace bases and classification with a view to releasing airspace that is no longer required. This will help to offset the additional new airspace required.
General Aviation / commercial airlines	Economic impact from increased effective capacity	Qualitative	The proposed changes will increase the effective capacity of the airspace. The economic impact of this would be positive, however it has not been quantified.

<sup>6</sup> See [Air Navigation Guidance 2017](#)

General Aviation / commercial airlines	Fuel burn	Qualitative	This option introduces a new arrival and departure route between the ScTMA and FRA to the East. This route is expected to enable a track mileage saving of ~31.8 – 44.7NM per flight which will reduce the fuel burn and fuel uplift, the additional fuel required to carry extra fuel, resulting in a reduction in fuel burn. GA airspace users may incur a minor fuel disbenefit if they are unable to obtain a clearance into the airspace. This analysis is indicative and more detailed quantitative analysis of fuel burn will be presented in Stage 3.
Commercial airlines	Training cost	Qualitative	Flight procedures worldwide are updated with each aeronautical information regulation and control (AIRAC) cycle and airlines update their procedures accordingly, training as required. This proposal is not anticipated to require additional training costs for airlines.
Commercial airlines	Other costs	Qualitative	No other airline costs are foreseen.
Airport/ Air navigation service provider	Infrastructure costs	Qualitative	This proposal is not expected to change Airport or air navigation service provider (ANSP) infrastructure, beyond the initial deployment phase which will require some systems engineering amendments. However, this is dependent on the assumption that any new CAS has sufficient CNS coverage for the proposed routes. This will be confirmed prior to Stage 3.
Airport/ Air navigation service provider	Operational costs	Qualitative	This proposal is not expected to change Airport or ANSP operational costs.
Airport/ Air navigation service provider	Deployment costs	Qualitative	This proposal for the holistic ScTMA change is expected to require air traffic controller familiarisation training, in the order of 90-100 controllers and c.50 assistants at NATS Prestwick, including extensive use of the NATS simulator facility. Support staff are required to run the simulator – planning, training staff, data preparation and testing, pseudo pilots, safety analysts, outputs to be recorded and reported etc. Some staff may only require briefings. There may be occasions where the reduced availability of operational controllers during their conversion training could mean operational rostering becomes a factor when considering continuous service delivery. The Military ANSP would also require briefing prior to deployment. This requirement will be clarified as designs mature through on-going engagement.

**Table 4: Options Appraisal (CAP1616 E2) – Eastern Element Concept 8**

### Conclusion

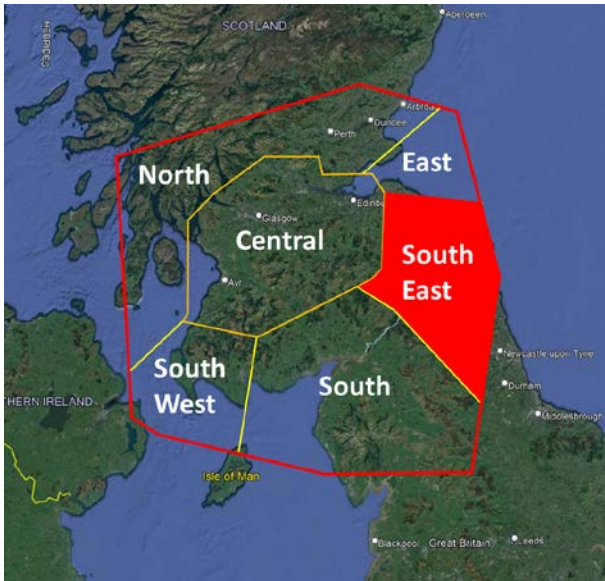
Compared to the baseline the performance of Concept 8 offers benefit in terms of CO<sub>2</sub> emissions and fuel burn as well as improving capacity and resilience of the route network.

However, Concept 8 will require a large volume of additional CAS where there is currently no existing route structure. This additional CAS will reduce the volume of the Northumbria gliding area increasing the impact on the GA community. This additional CAS will be the minimum volume and appropriate classification to safely contain the proposed systemised routes

In terms of Fuel burn and CO<sub>2</sub> emissions, Concept 8 offers an improvement on Concept 4, however this is at the expense of the GA and MoD airspace access impact. The Northumbria gliding area airspace users have been engaged on this concept. As part of this engagement NATS has been keen to identify a compromise to enable this change and may increase access to other airspace structures.

For these reasons Concept 8 is considered viable and will be **Progressed** to Stage 3.

## South-Eastern Element



### 3.4. Concept 0 Do Nothing (Baseline)

Group	Impact	Level of Analysis	Evidence
Communities	Noise impact on health and quality of life	Qualitative	This proposal covers a large portion of Scotland, Northern England and extends West towards the Irish coast. This area includes the following National Parks, National Scenic areas and Areas of Outstanding Natural Beauty; Loch Lomond and the Trossachs, The Lake District, The Yorkshire Dales, Fleet Valley, East Stewartry Coast, Nith Estuary, Upper Tweeddale, Eildon and Leaderfoot, North Arran, Knapdale, Scarba, Lunga and the Garvellachs, Loch Lomond, The Trossachs, The River Earn, The River Tay, Loch Rannoch and Glen Lyon, The North Pennines, The Solway Coast, and The Northumberland Coast. This change will only impact flights above FL70 or 7,000 ft, any associated changes below this level will be included in the corresponding airports ACP. Government guidance says that 7,000ft is the maximum height at which noise is a priority for consideration. There will be no discernible change in noise impact from today.
Communities	Air quality	Qualitative	Government guidance says that aircraft flying higher than 1,000 ft are unlikely to have a significant impact on air quality <sup>7</sup> . There will be no changes in aircraft trajectories below 1,000 ft proposed in this ACP, therefore there will be no change in air quality from today.
Wider society	Greenhouse gas impact	Qualitative	The South-Eastern element seeks review and improve the existing ATS route structure between NATEB and HAVEN. Should this route not be improved aircraft will continue to use the existing bidirectional Y96 ATS route. As a bidirectional route, arriving and departing aircraft are not deconflicted and require ATCO intervention to resolve conflicts via tactical intervention. These conflicts might be resolved by ATC issuing aircraft with headings to provide lateral separation or by delaying descent or climb instructions to keep the aircraft vertically separated. This tactical intervention increases the fuel burn and the associated emissions of an aircraft. The existing bases of CAS along Y96 prevents aircraft from flying their optimal descent profiles resulting in aircraft reaching the base of CAS and flying extended periods of level flight to remain within the confines of existing CAS. This inhibition to CDO increases aircraft fuel burn and the associated emissions of an aircraft. The do-nothing option will lead to no change to the

<sup>7</sup> See [Air Navigation Guidance 2017](#)

			existing operation and no change in the greenhouse gas impact.
Wider society	Capacity/ resilience	Qualitative	The South-Eastern element seeks review and improve the existing ATS route structure between NATEB and HAVEN. Should this route not be improved aircraft will continue to use the existing bidirectional Y96 ATS route. Therefore, there will be no change to the existing capacity or resilience of the airspace. As traffic numbers grow in line with the forecast, effective sector capacity will become constrained, partially due to increasing controller workload. This could in turn lead to a reduction in resilience.
General Aviation (GA)	Access	Qualitative	This option would not introduce or release any additional CAS. Therefore, GA access will remain unchanged.
General Aviation / commercial airlines	Economic impact from increased effective capacity	Qualitative	There will be no change in the economic impact from increased capacity as aircraft will continue to fly the arrival and departure routes they do today. However, as traffic numbers grow in line with the forecast, effective sector capacity will become constrained, partially due to increasing controller workload. This could in turn lead to a reduction in resilience.
General Aviation / commercial airlines	Fuel burn	Qualitative	There will be no change in fuel burn from today's operation as aircraft will be required to route as per today's operation.
Commercial airlines	Training cost	Qualitative	There would be no additional training required as there will be no change to the extant airspace or procedures.
Commercial airlines	Other costs	Qualitative	There would be no additional associated costs for airlines as there will be no change to the extant airspace.
Airport/ Air navigation service provider	Infrastructure costs	Qualitative	There would be no additional associated infrastructure costs as there will be no change to the extant airspace.
Airport/ Air navigation service provider	Operational costs	Qualitative	There would be no additional associated operational costs as there will be no change to the extant airspace.
Airport/ Air navigation service provider	Deployment costs	Qualitative	There would be no additional associated deployment costs as there will be no change to the extant airspace.

**Table 5: Options Appraisal (CAP1616), South-Eastern Element Baseline**

## Conclusion

The baseline “Do Nothing” Option 0 does not meet the following Design Principles:

- DP2 Operational- Resilience
- DP3 Operational- Capacity
- DP5 Economic- Fuel burn
- DP6 Environmental- CO<sub>2</sub> emissions
- DP12 Technical- AMS
- DP13 Operational-CCO/CDO

For further information please see the DP evaluation matrix in the [Stage 2a Design Options and Evaluation document](#).

As such this option was rejected. It is included here for comparison purposes only.



### 3.5 Concept 3. Systemised route with lowered CAS bases

Group	Impact	Level of Analysis	Evidence
Communities	Noise impact on health and quality of life	Qualitative	This proposal covers a large portion of Scotland, Northern England and extends West towards the Irish coast. This area includes the following National Parks, National Scenic areas and Areas of Outstanding Natural Beauty; Loch Lomond and the Trossachs, The Lake District, The Yorkshire Dales, Fleet Valley, East Stewartry Coast, Nith Estuary, Upper Tweeddale, Eildon and Leaderfoot, North Arran, Knapdale, Scarba, Lunga and the Garvellachs, Loch Lomond, The Trossachs, The River Earn, The River Tay, Loch Rannoch and Glen Lyon, The North Pennines, The Solway Coast, and The Northumberland Coast. This change will only impact flights above FL70 or 7,000 ft, any associated changes below this level will be included in the corresponding airports ACP. Government guidance says that 7,000ft is the maximum height at which noise is a priority for consideration. There will be no discernible change in noise impact from today.
Communities	Air quality	Qualitative	Government guidance says that aircraft flying higher than 1,000 ft are unlikely to have a significant impact on air quality <sup>8</sup> . There will be no changes in aircraft trajectories below 1,000 ft proposed in this ACP, therefore there will be no change in air quality from today.
Wider society	Greenhouse gas impact	Quantitative	The South-Eastern element seeks review and improve the existing ATS route structure between NATEB and HAVEN. Should this concept be introduced, systemisation will deconflict aircraft arriving and departing the ScTMA. This will result in an increase in track mileage for aircraft either arriving or departing the ScTMA and a corresponding reduction in track mileage for the other. Overall, the planned change in track mileage will be neutral. However, the removal of conflicts will result in a limited reduction in CO <sub>2</sub> emissions by removing the necessity for ATCO intervention allowing aircraft to follow their planned route more closely. Lowering the bases of controlled airspace would allow aircraft to fly optimal descent profiles further reducing CO <sub>2</sub> emissions. This analysis is qualitative and more detailed quantitative analysis of fuel burn will be presented in Stage 3.
Wider society	Capacity/ resilience	Qualitative	The introduction of a systemised route structure, deconflicting arriving and departing aircraft, would reduce the complexity of the airspace reducing controller workload and increasing capacity. Lowering the bases of CAS along this route would improve CDO. This would reduce the frequency of staggered descents leading to a reduction in controller workload and an additional increase in capacity. The additional provision of deconflicted arrival and departure routes will increase the resilience of the airspace.
General Aviation (GA)	Access	Qualitative	The introduction of a systemised airspace within this element may require a slight increase in the width of the CTA. The current CTA containing Y96 is 10 NM wide and is within a 3 NM Minimum Radar Separation environment (MRS). CAP1385, the CAA's route spacing guidance, requires parallel opposite direction tracks to be spaced 4.2 NM for in a 3 NM MRS, increasing to 6.2 NM apart in a 5 NM environment. The CAA Controlled Airspace Containment policy requires ATS routes to be 3 NM from the edge of CAS. However, following a robust safety case, this has previously been reduced. MATS Pt 2 procedures allow aircraft to be vectored within 2 NM of the edge of CAS. A systemised airspace structure would remove the necessity of vectoring to resolve conflicts and therefore we consider an argument can be made to reduce the spacing between the routes and the edge of the CTA to negate the requirement of additional CAS to accommodate the systemised structure.

<sup>8</sup> See [Air Navigation Guidance 2017](#)



			Lowering the base of CAS along this route will require additional CAS although this will be the minimum required to CDO operations. This additional CAS is likely to be above FL100 and not routinely used by GA aircraft.
General Aviation / commercial airlines	Economic impact from increased effective capacity	Qualitative	The proposed changes will increase the effective capacity of the airspace. The economic impact of this would be positive, however it has not been quantified.
General Aviation / commercial airlines	Fuel burn	Quantitative	The South-Eastern element seeks review and improve the existing ATS route structure between NATEB and HAVEN. Should this concept be introduced, systemisation will deconflict aircraft arriving and departing the ScTMA. This will result in an increase in track mileage for aircraft either arriving or departing the ScTMA and a corresponding reduction in track mileage for the other. Overall, the planned change in track mileage will be neutral. However, the removal of conflicts will result in a limited reduction in additional track mileage flown by removing the necessity for ATCO intervention. This will allow aircraft to follow their planned route more closely. Lowering the bases of controlled airspace would allow aircraft to fly optimal descent profiles further reducing fuel burn. GA airspace users may incur a minor fuel disbenefit if they are unable to obtain a clearance into the airspace. This analysis is qualitative and more detailed quantitative analysis of fuel burn will be presented in Stage 3.
Commercial airlines	Training cost	Qualitative	Flight procedures worldwide are updated with each aeronautical information regulation and control (AIRAC) cycle and airlines update their procedures accordingly, training as required. This proposal is not anticipated to require additional training costs for airlines.
Commercial airlines	Other costs	Qualitative	No other airline costs are foreseen.
Airport/ Air navigation service provider	Infrastructure costs	Qualitative	This proposal is not expected to change Airport or air navigation service provider (ANSP) infrastructure, beyond the initial deployment phase which will require some systems engineering amendments. However, this is dependent on the assumption that any new CAS has sufficient CNS coverage for the proposed routes. This will be confirmed prior to Stage 3.
Airport/ Air navigation service provider	Operational costs	Qualitative	This proposal is not expected to change Airport or ANSP operational costs.
Airport/ Air navigation service provider	Deployment costs	Qualitative	This proposal for the holistic ScTMA change is expected to require air traffic controller familiarisation training, in the order of 90-100 controllers and c.50 assistants at NATS Prestwick, including extensive use of the NATS simulator facility. Support staff are required to run the simulator – planning, training staff, data preparation and testing, pseudo pilots, safety analysts, outputs to be recorded and reported etc. Some staff may only require briefings. There may be occasions where the reduced availability of operational controllers during their conversion training could mean operational rostering becomes a factor when considering continuous service delivery.  The Military ANSP would also require briefing prior to deployment. This requirement will be clarified as designs mature through on-going engagement.

**Table 6: Options Appraisal (CAP1616 E2) – South-Eastern Element Concept 3**

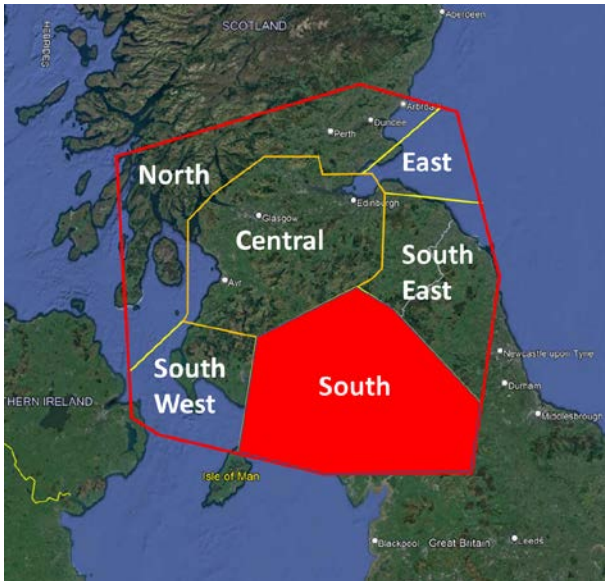
### Conclusion

Compared to the baseline, Concept 3 offers a marginal improvement in CO<sub>2</sub> emissions and fuel burn per flight through reduced conflicts and improved CDO and CCO. It would bring benefit in terms of capacity & resilience through the introduction of a systemised airway structure which would keep aircraft safe with minimal ATC intervention. However, this option might require additional CAS to contain the systemised structure as well as additional CAS to lower the base of CAS to facilitate improved CDO. This additional CAS

will enable the benefits described for this option and will be the minimum required for a safe design. The location of any additional CAS is not likely to impact GA operations as this will be above FL100

As such Concept 3 is accepted and **progressed** to Stage 3.

## Southern Element



### 3.6. Option 0 Do Nothing (Baseline)

Group	Impact	Level of Analysis	Evidence
Communities	Noise impact on health and quality of life	Qualitative	This proposal covers a large portion of Scotland, Northern England and extends West towards the Irish coast. This area includes the following National Parks, National Scenic areas and Areas of Outstanding Natural Beauty; Loch Lomond and the Trossachs, The Lake District, The Yorkshire Dales, Fleet Valley, East Stewartry Coast, Nith Estuary, Upper Tweeddale, Eildon and Leaderfoot, North Arran, Knapdale, Scarba, Lunga and the Garvellachs, Loch Lomond, The Trossachs, The River Earn, The River Tay, Loch Rannoch and Glen Lyon, The North Pennines, The Solway Coast, and The Northumberland Coast. This change will only impact flights above FL70 or 7,000 ft, any associated changes below this level will be included in the corresponding airports ACP. Government guidance says that 7,000ft is the maximum height at which noise is a priority for consideration. There will be no discernible change in noise impact from today.
Communities	Air quality	Qualitative	Government guidance says that aircraft flying higher than 1,000 ft are unlikely to have a significant impact on air quality <sup>9</sup> . There will be no changes in aircraft trajectories below 1,000 ft proposed in this ACP, therefore there will be no change in air quality from today.
Wider society	Greenhouse gas impact	Qualitative	The Southern element seeks review and improve the existing ATS route structure within the existing TALLA and Galloway sectors. These routes provide connectivity for aircraft arriving/departing from/to the South. Traffic is currently orientated with northbound routes predominantly on the Eastern side of the CTAs and southbound on the West. This reduces conflicts between aircraft routing north and those routing south. The existing route tracks are structured around the location of existing NavAids and therefore does not provide direct, great circle connectivity between the south and the ScTMA. The extant routes currently converge overhead these NavAids before diverging which adds additional track mileage, introduces conflicts requiring ATCO intervention (vectoring) to resolve, further increasing the flown track mileage. The base of CAS currently restricts CDO unnecessarily increasing CO <sub>2</sub> emissions.

<sup>9</sup> See [Air Navigation Guidance 2017](#)

			The do-nothing option will lead to no change to the existing operation and therefore no change in the greenhouse gas impact.
Wider society	Capacity/ resilience	Qualitative	The Southern element seeks review and improve the existing ATS route structure within the existing TALLA and Galloway sectors. Should this route not be improved aircraft will continue to use the existing routes. Therefore, there will be no change to the existing capacity or resilience of the airspace. As traffic numbers grow in line with the forecast, effective sector capacity will become constrained, partially due to increasing controller workload. This could in turn lead to a reduction in resilience.
General Aviation (GA)	Access	Qualitative	This option would not introduce or release any additional CAS. Therefore, access to the impacted airspace will remain unchanged.
General Aviation / commercial airlines	Economic impact from increased effective capacity	Qualitative	There will be no change in the economic impact from increased capacity as aircraft will continue to fly the routes they do today. However, as traffic numbers grow in line with the forecast, effective sector capacity will become constrained, partially due to increasing controller workload. This could in turn lead to a reduction in resilience.
General Aviation / commercial airlines	Fuel burn	Qualitative	The Southern element seeks review and improve the existing ATS route structure within the existing TALLA and Galloway sectors. These routes provide connectivity for aircraft arriving/departing from/to the South. Traffic is currently orientated with northbound routes predominantly on the Eastern side of the CTAs and southbound on the West. This reduces conflicts between aircraft routing north and those routing south. The existing route tracks are structured around the location of existing NavAids and therefore does not provide direct, great circle connectivity between the south and the ScTMA. The extant routes currently converge overhead these NavAids before diverging which adding superfluous track mileage, introduces conflicts requiring ATCO intervention (vectoring) to resolve which further increases the track mileage flown from the flight planned route. The base of CAS currently prevents optimal CDO resulting in additional fuel being burn. The do-nothing option will lead to no change to the existing operation and therefore no change in the fuel burn.
Commercial airlines	Training cost	Qualitative	There would be no additional training required as there will be no change to the extant airspace or procedures.
Commercial airlines	Other costs	Qualitative	There would be no additional associated costs for airlines as there will be no change to the extant airspace.
Airport/ Air navigation service provider	Infrastructure costs	Qualitative	There would be no additional associated infrastructure costs as there will be no change to the extant airspace.
Airport/ Air navigation service provider	Operational costs	Qualitative	There would be no additional associated operational costs as there will be no change to the extant airspace.
Airport/ Air navigation service provider	Deployment costs	Qualitative	There would be no additional associated deployment costs as there will be no change to the extant airspace.

**Table 7: Options Appraisal (CAP1616), Southern Element Baseline**

## Conclusion

The baseline “Do Nothing” Option 0 does not meet the following Design Principles:

- DP2 Operational- Resilience
- DP3 Operational- Capacity
- DP4 Technical- Interface
- DP5 Economic- Fuel burn
- DP6 Environmental- CO<sub>2</sub> emissions
- DP12 Technical- AMS

- DP13 Operational-CCO/CDO

For further information please see the DP evaluation matrix in the [Stage 2a Design Options and Evaluation document](#).

As such this option was rejected. It is included here for comparison purposes only.

### 3.7. Concept 3. Systemised routes orientated according to traffic flow

Group	Impact	Level of Analysis	Evidence
Communities	Noise impact on health and quality of life	Qualitative	This proposal covers a large portion of Scotland, Northern England and extends West towards the Irish coast. This area includes the following National Parks, National Scenic areas and Areas of Outstanding Natural Beauty; Loch Lomond and the Trossachs, The Lake District, The Yorkshire Dales, Fleet Valley, East Stewartry Coast, Nith Estuary, Upper Tweeddale, Eildon and Leaderfoot, North Arran, Knapdale, Scarba, Lunga and the Garvellachs, Loch Lomond, The Trossachs, The River Earn, The River Tay, Loch Rannoch and Glen Lyon, The North Pennines, The Solway Coast, and The Northumberland Coast. This change will only impact flights above FL70 or 7,000 ft, any associated changes below this level will be included in the corresponding airports ACP. Government guidance says that 7,000ft is the maximum height at which noise is a priority for consideration. There will be no discernible change in noise impact from today.
Communities	Air quality	Qualitative	Government guidance says that aircraft flying higher than 1,000 ft are unlikely to have a significant impact on air quality <sup>10</sup> . There will be no changes in aircraft trajectories below 1,000 ft proposed in this ACP, therefore there will be no change in air quality from today.
Wider society	Greenhouse gas impact	Quantitative	The Southern element seeks review and improve the existing ATS route. The existing route structure deconflicts arriving and departing aircraft by orientating the traffic with southbound traffic kept on the Western side and Northbound on the East. However, these existing routes are not systemised, they converge on existing NavAids adding superfluous track mileage increasing CO <sub>2</sub> emissions. Should this concept be introduced, systemisation will deconflict aircraft by design and offer more direct routes to the ScTMA from the South. It is estimated that by removing the requirement for the ATS route structure to navigate via existing NavAids, the published routes could be shortened by up to 5 NM. This reduction in track mileage will offer a corresponding reduction in CO <sub>2</sub> emissions. Furthermore, the removal of conflicts where ATS routes currently converge will result in an additional reduction in CO <sub>2</sub> emissions by removing the necessity for ATCO intervention allowing aircraft to follow their planned route more closely. This analysis is qualitative and more detailed quantitative analysis of greenhouse gas impact will be presented in Stage 3.
Wider society	Capacity/ resilience	Qualitative	The changes contained within this design option would introduce a systemised route structure between the Southern UK airspace and the ScTMA. These routes will reduce the complexity of the airspace reducing controller workload and increasing capacity and resilience. Increasing the number of ATS routes arriving/ departing the ScTMA would increase the resilience of the ATC network.
General Aviation (GA)	Access	Qualitative	This option would not introduce or release any additional CAS. Therefore, GA access will remain unchanged.
General Aviation / commercial airlines	Economic impact from increased effective capacity	Qualitative	The proposed changes will increase the effective capacity of the airspace. The economic impact of this would be positive, however it has not been quantified.

<sup>10</sup> See [Air Navigation Guidance 2017](#)

General Aviation / commercial airlines	Fuel burn	Quantitative	The Southern element seeks review and improve the existing ATS route structure within the existing TALLA and Galloway sectors. The existing route structure deconflicts arriving and departing aircraft by orientating the traffic with southbound traffic kept on the Western side and Northbound on the East. However, these existing routes are not systemised, they converge on existing NavAids adding superfluous track mileage increasing fuel burn. Should this concept be introduced, systemisation will deconflict aircraft by design and offer more direct routes to the ScTMA from the South. It is estimated that by removing the requirement for the ATS route structure to navigate via existing NavAids, the published routes could be shortened by up to 5 NM. This reduction in track mileage will offer a corresponding reduction in fuel burn. Furthermore, the removal of conflicts where ATS routes currently converge will result in an additional reduction in fuel burn by removing the necessity for ATCO intervention allowing aircraft to follow their planned route more closely. This analysis is qualitative and more detailed quantitative analysis of fuel burn will be presented in Stage 3.
Commercial airlines	Training cost	Qualitative	Flight procedures worldwide are updated with each aeronautical information regulation and control (AIRAC) cycle and airlines update their procedures accordingly, training as required. This proposal is not anticipated to require additional training costs for airlines.
Commercial airlines	Other costs	Qualitative	No other airline costs are foreseen.
Airport/ Air navigation service provider	Infrastructure costs	Qualitative	This proposal is not expected to change Airport or air navigation service provider (ANSP) infrastructure, beyond the initial deployment phase which will require some systems engineering amendments.
Airport/ Air navigation service provider	Operational costs	Qualitative	This proposal is not expected to change Airport or ANSP operational costs.
Airport/ Air navigation service provider	Deployment costs	Qualitative	This proposal for the holistic ScTMA change is expected to require air traffic controller familiarisation training, in the order of 90-100 controllers and c.50 assistants at NATS Prestwick, including extensive use of the NATS simulator facility. Support staff are required to run the simulator – planning, training staff, data preparation and testing, pseudo pilots, safety analysts, outputs to be recorded and reported etc. Some staff may only require briefings. There may be occasions where the reduced availability of operational controllers during their conversion training could mean operational rostering becomes a factor when considering continuous service delivery. The Military ANSP would also require briefing prior to deployment. This requirement will be clarified as designs mature through on-going engagement.

**Table 8: Options Appraisal (CAP1616 E2), Southern Element Concept 3**

### Conclusion

Compared to the baseline the performance of Concept 3 is better in terms of CO<sub>2</sub> emissions, fuel burn capacity and resilience. Concept 3 does not review the bases of CAS and therefore the potential benefit is limited.

The performance of Concept 3 is worse than that of Concept 4, in terms of CO<sub>2</sub> emissions and fuel burn as Concept 4 offers the opportunity to improve CDO and release CAS that is not required. The capacity & resilience benefits would be comparable to Concept 4.

For these reasons Concept 3 is **rejected** in preference to Concept 4 at this stage.



### 3.8. Concept 4. Systemised routes orientated according to traffic flow including a review of CAS bases

Group	Impact	Level of Analysis	Evidence
Communities	Noise impact on health and quality of life	Qualitative	This proposal covers a large portion of Scotland, Northern England and extends West towards the Irish coast. This area includes the following National Parks, National Scenic areas and Areas of Outstanding Natural Beauty; Loch Lomond and the Trossachs, The Lake District, The Yorkshire Dales, Fleet Valley, East Stewartry Coast, Nith Estuary, Upper Tweeddale, Eildon and Leaderfoot, North Arran, Knapdale, Scarba, Lunga and the Garvellachs, Loch Lomond, The Trossachs, The River Earn, The River Tay, Loch Rannoch and Glen Lyon, The North Pennines, The Solway Coast, and The Northumberland Coast. This change will only impact flights above FL70 or 7,000 ft, any associated changes below this level will be included in the corresponding airports ACP. Government guidance says that 7,000ft is the maximum height at which noise is a priority for consideration. There will be no discernible change in noise impact from today.
Communities	Air quality	Qualitative	Government guidance says that aircraft flying higher than 1,000 ft are unlikely to have a significant impact on air quality <sup>11</sup> . There will be no changes in aircraft trajectories below 1,000 ft proposed in this ACP, therefore there will be no change in air quality from today.
Wider society	Greenhouse gas impact	Qualitative	The Southern element seeks review and improve the existing ATS route structure within the existing TALLA and Galloway sectors. The existing route structure deconflicts arriving and departing aircraft by orientating the traffic with southbound traffic kept on the Western side and Northbound on the East. However, these existing routes are not systemised, they converge on existing NavAids adding superfluous track mileage increasing greenhouse gas emissions. Should this concept be introduced, systemisation will deconflict aircraft by design and offer more direct routes to the ScTMA from the South. It is estimated that by removing the requirement for the ATS route structure to navigate via existing NavAids, the published routes could be shortened by up to 5 NM. This reduction in track mileage will offer a corresponding reduction in greenhouse gas emissions. Furthermore, the removal of conflicts where ATS routes currently converge will result in an additional reduction in fuel burn by removing the necessity for ATCO intervention allowing aircraft to follow their planned route more closely. Lowering the bases of controlled airspace would allow aircraft to fly optimal descent profiles further reducing greenhouse gas emissions. This analysis is qualitative and more detailed quantitative analysis of CO <sub>2</sub> emissions will be presented in Stage 3.
Wider society	Capacity/ resilience	Qualitative	The changes contained within this design option would introduce a systemised route structure between the Southern UK airspace and the ScTMA. These routes will reduce the complexity of the airspace reducing controller workload and increasing capacity and resilience. Lowering the bases of CAS along this route would improve CDO. This would reduce the frequency of staggered descents leading to a reduction in controller workload and an additional increase in capacity. Increasing the number of ATS routes arriving/ departing the ScTMA would increase the resilience of the ATC network.
General Aviation (GA)	Access	Qualitative	This introduction of a systemised route structure in this option will be contained within the lateral limits of the existing CAS and therefore will have a minimal impact on GA access. As part of this option, the base of CAS may be lowered as these route approach the ScTMA to enable effective CDO operations. This additional airspace will be the minimum required and will

<sup>11</sup> See [Air Navigation Guidance 2017](#)

			be contained above FL100 and is not routinely used by GA aircraft. The review of CAS will also identify any existing CAS which is no longer required and release it, i.e. airspace which is used by departing aircraft but extends below the altitude aircraft have reached. This review will ensure the minimum quantity of CAS is used to provide safe and efficient operation and help to offset any additional new airspace by releasing other airspace.
General Aviation / commercial airlines	Economic impact from increased effective capacity	Qualitative	The proposed changes will increase the effective capacity of the airspace. The economic impact of this would be positive, however it has not been quantified.
General Aviation / commercial airlines	Fuel burn	Qualitative	The Southern element seeks review and improve the existing ATS route structure within the existing TALLA and Galloway sectors. The existing route structure deconflicts arriving and departing aircraft by orientating the traffic with southbound traffic kept on the Western side and North bound traffic on the East. However, these existing routes are not systemised, they converge on existing NavAids adding superfluous track mileage increasing fuel burn. Should this concept be introduced, systemisation will further deconflict aircraft and offer more direct routes to the ScTMA from the South. It is estimated that by removing the requirement for the ATS route structure to navigate via existing NavAids, the published routes could be shortened by up to 5 NM. This reduction in track mileage will offer a corresponding reduction in fuel burn. Furthermore, the removal of conflicts where ATS routes currently converge will result in an additional reduction in fuel burn by removing the necessity for ATCO intervention allowing aircraft to follow their planned route more closely. Lowering the bases of controlled airspace would allow aircraft to fly optimal descent profiles further reducing fuel burn. GA airspace users may incur a minor fuel disbenefit if they are unable to obtain a clearance into the airspace. This analysis is qualitative and more detailed quantitative analysis of fuel burn will be presented in Stage 3.
Commercial airlines	Training cost	Qualitative	Flight procedures worldwide are updated with each aeronautical information regulation and control (AIRAC) cycle and airlines update their procedures accordingly, training as required. This proposal is not anticipated to require additional training costs for airlines.
Commercial airlines	Other costs	Qualitative	No other airline costs are foreseen.
Airport/ Air navigation service provider	Infrastructure costs	Qualitative	This proposal is not expected to change Airport or air navigation service provider (ANSP) infrastructure, beyond the initial deployment phase which will require some systems engineering amendments. However, this is dependent on the assumption that any new CAS has sufficient CNS coverage for the proposed routes. This will be confirmed prior to Stage 3.
Airport/ Air navigation service provider	Operational costs	Qualitative	This proposal is not expected to change Airport or ANSP operational running costs.
Airport/ Air navigation service provider	Deployment costs	Qualitative	This proposal for the holistic ScTMA change is expected to require air traffic controller familiarisation training, in the order of 90-100 controllers and c.50 assistants at NATS Prestwick, including extensive use of the NATS simulator facility. Support staff are required to run the simulator – planning, training staff, data preparation and testing, pseudo pilots, safety analysts, outputs to be recorded and reported etc. Some staff may only require briefings. There may be occasions where the reduced availability of operational controllers during their conversion training could mean operational rostering becomes a factor when considering continuous service delivery. The Military ANSP would also require briefing prior to deployment. This requirement will be clarified as designs mature through on-going engagement.

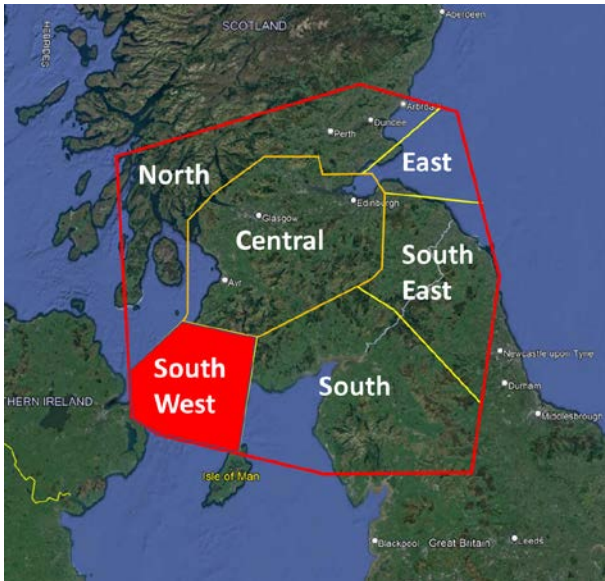
## Table 9: Options Appraisal (CAP1616 E2) – Southern Element Concept 4

**Conclusion**

Compared to the baseline the performance of Concept 4 is better in terms of CO<sub>2</sub> emissions, fuel burn, capacity and resilience. In addition to the introduction of a systemised route structure, Concept 4 reviews the bases of CAS increasing the potential benefit over Concept 3. Concept 4 offers the opportunity to improve CDO and release CAS that is no longer required. Any design presented in Concept 3 can be included within concept 4. The capacity & resilience benefits would be comparable to Concept 3.

For these reasons Concept 4 is considered viable and will be **Progressed** to Stage 3.

## South-Western Element



### 3.9. Concept 0 Do Nothing (Baseline)

Group	Impact	Level of Analysis	Evidence
Communities	Noise impact on health and quality of life	Qualitative	This proposal covers a large portion of Scotland, Northern England and extends West towards the Irish coast. This area includes the following National Parks, National Scenic areas and Areas of Outstanding Natural Beauty; Loch Lomond and the Trossachs, The Lake District, The Yorkshire Dales, Fleet Valley, East Stewartry Coast, Nith Estuary, Upper Tweeddale, Eildon and Leaderfoot, North Arran, Knapdale, Scarba, Lunga and the Garvellachs, Loch Lomond, The Trossachs, The River Earn, The River Tay, Loch Rannoch and Glen Lyon, The North Pennines, The Solway Coast, and The Northumberland Coast. This change will only impact flights above FL70 or 7,000 ft, any associated changes below this level will be included in the corresponding airports ACP. Government guidance says that 7,000ft is the maximum height at which noise is a priority for consideration. There will be no discernible change in noise impact from today.
Communities	Air quality	Qualitative	Government guidance says that aircraft flying higher than 1,000 ft are unlikely to have a significant impact on air quality <sup>12</sup> . There will be no changes in aircraft trajectories below 1,000 ft proposed in this ACP, therefore there will be no change in air quality from today.
Wider society	Greenhouse gas impact	Qualitative	The South-western element seeks review and improve the existing ATS connectivity for traffic between the ScTMA and the Irish FIR. Aircraft arriving/departing the Irish FIR do so using the systemised routes P620/ P600. These routes converge at BLACA with P620 joining P600 to form the bidirectional ATS route P600 which connects to the ScTMA. As a bidirectional route, arriving and departing aircraft are not deconflicted and require ATCO intervention to resolve conflicts via tactical intervention. These conflicts might be resolved by ATC issuing aircraft with headings to provide lateral separation or by delaying descent or climb instructions to keep the aircraft vertically separated. This tactical intervention increases the fuel burn and the associated emissions of an aircraft. The do-nothing option will lead to no change to the existing operation and no change in the greenhouse gas impact.

<sup>12</sup> See [Air Navigation Guidance 2017](#)

Wider society	Capacity/ resilience	Qualitative	The South-western element seeks review and improve the existing ATS connectivity for traffic between the ScTMA and the Irish FIR. Aircraft arriving/departing the Irish FIR do so using the systemised routes P620/ P600. These routes converge at BLACA with P620 joining P600 to form the bidirectional ATS route P600 which connects to the ScTMA. Should this route not be improved aircraft will continue to use the existing routes. Therefore, there will be no change to the existing capacity or resilience of the airspace. As traffic numbers grow in line with the forecast, effective sector capacity will become constrained, partially due to increasing controller workload. This could in turn lead to a reduction in resilience.
General Aviation (GA)	Access	Qualitative	This option would not introduce or release any additional CAS. Therefore, access to the impacted airspace will remain unchanged.
General Aviation / commercial airlines	Economic impact from increased effective capacity	Qualitative	There will be no change in the economic impact from increased capacity as aircraft will continue to fly the arrival and departure routes they do today. However, as traffic numbers grow in line with the forecast, effective sector capacity will become constrained, partially due to increasing controller workload. This could in turn lead to a reduction in resilience.
General Aviation / commercial airlines	Fuel burn	Qualitative	The South-western element seeks review and improve the existing ATS connectivity for traffic between the ScTMA and the Irish FIR. Aircraft arriving/departing the Irish FIR do so using the systemised routes P620/ P600. These routes converge at BLACA with P620 joining P600 to form the bidirectional ATS route P600 which connects to the ScTMA. As a bidirectional route, arriving and departing aircraft are not deconflicted and require ATCO intervention to resolve conflicts via tactical intervention. These conflicts might be resolved by ATC issuing aircraft with headings to provide lateral separation or by delaying descent or climb instructions to keep the aircraft vertically separated. This tactical intervention increases the fuel burn. The do-nothing option will lead to no change to the existing operation and no change in the greenhouse gas impact.
Commercial airlines	Training cost	Qualitative	There would be no additional training required as there will be no change to the extant airspace or procedures.
Commercial airlines	Other costs	Qualitative	There would be no additional associated costs for airlines as there will be no change to the extant airspace.
Airport/ Air navigation service provider	Infrastructure costs	Qualitative	There would be no additional associated infrastructure costs as there will be no change to the extant airspace.
Airport/ Air navigation service provider	Operational costs	Qualitative	There would be no additional associated operational costs as there will be no change to the extant airspace.
Airport/ Air navigation service provider	Deployment costs	Qualitative	There would be no additional associated deployment costs as there will be no change to the extant airspace.

**Table 10: Options Appraisal (CAP1616), South-Western Element Baseline**

## Conclusion

The baseline “Do Nothing” Option 0 does not meet the following Design Principles:

- DP2 Operational- Resilience
- DP3 Operational- Capacity
- DP5 Economic- Fuel burn
- DP6 Environmental- CO<sub>2</sub> emissions
- DP12 Technical- AMS
- DP13 Operational-CCO/CDO

For further information please see the DP evaluation matrix in the [Stage 2a Design Options and Evaluation document](#).

As such this option was rejected. It is included here for comparison purposes only.

### 3.10 Concept 1. Systemised routes

Group	Impact	Level of Analysis	Evidence
Communities	Noise impact on health and quality of life	Qualitative	This proposal covers a large portion of Scotland, Northern England and extends West towards the Irish coast. This area includes the following National Parks, National Scenic areas and Areas of Outstanding Natural Beauty; Loch Lomond and the Trossachs, The Lake District, The Yorkshire Dales, Fleet Valley, East Stewartry Coast, Nith Estuary, Upper Tweeddale, Eildon and Leaderfoot, North Arran, Knapdale, Scarba, Lunga and the Garvellachs, Loch Lomond, The Trossachs, The River Earn, The River Tay, Loch Rannoch and Glen Lyon, The North Pennines, The Solway Coast, and The Northumberland Coast. This change will only impact flights above FL70 or 7,000 ft, any associated changes below this level will be included in the corresponding airports ACP. Government guidance says that 7,000ft is the maximum height at which noise is a priority for consideration. There will be no discernible change in noise impact from today.
Communities	Air quality	Qualitative	Government guidance says that aircraft flying higher than 1,000 ft are unlikely to have a significant impact on air quality <sup>13</sup> . There will be no changes in aircraft trajectories below 1,000 ft proposed in this ACP, therefore there will be no change in air quality from today.
Wider society	Greenhouse gas impact	Quantitative	The extension of the P600/P620 systemised route structure to the ScTMA boundary will remove the convergence of these routes at BLACA resulting in a track mileage reduction of these routes by ~1 NM. The extension of the systemised airspace will deconflict aircraft arriving and departing the ScTMA negating the need for ATC to tactically vector aircraft to resolve conflicts and will benefit CDO and CCO. These savings will result in a reduction of greenhouse gas emissions if this concept was implemented. This analysis is qualitative and more detailed quantitative analysis of fuel burn will be presented in Stage 3.
Wider society	Capacity/ resilience	Qualitative	The introduction of a systemised route structure, deconflicting arriving and departing aircraft, would reduce the complexity of the airspace reducing controller workload and increasing capacity. The additional provision of deconflicted arrival and departure routes will increase the resilience of the airspace.
General Aviation (GA)	Access	Qualitative	The introduction of a systemised airspace within this element may require a slight increase in the width of the CTA. The current CTA containing P600 is 10 NM wide and is within a 3 NM Minimum Radar Separation environment (MRS). CAP1385, the CAA's route spacing guidance, requires parallel opposite direction tracks to be spaced 4.2 NM for in a 3 NM MRS, increasing to 6.2 NM apart in a 5 NM environment. The CAA Controlled Airspace Containment policy requires ATS routes to be 3 NM from the edge of CAS. However, following a robust safety case, this has previously been reduced. MATS Pt 2 procedures allow aircraft to be vectored within 2 NM of the edge of CAS. A systemised airspace structure would remove the necessity of vectoring to resolve conflicts and therefore we consider an argument can be made to reduce the spacing between the routes and the edge of the CTA to negate the requirement of additional CAS to accommodate the systemised structure.
General Aviation / commercial airlines	Economic impact from increased effective capacity	Qualitative	The proposed changes will increase the effective capacity of the airspace. The economic impact of this would be positive, however it has not been quantified.

<sup>13</sup> See [Air Navigation Guidance 2017](#)

General Aviation / commercial airlines	Fuel burn	Quantitative	The extension of the P600/P620 systemised route structure to the ScTMA boundary will remove the convergence of these routes at BLACA resulting in a track mileage reduction of these routes by ~1 NM. The extension of the systemised airspace will deconflict aircraft arriving and departing the ScTMA negating the need for ATC to tactically vector aircraft to resolve conflicts further reducing the track mileage flown by aircraft within this airspace. This reduction in planned/actual track mileage flown will result in a reduction in fuel burn. GA airspace users may incur a minor fuel disbenefit if they are unable to obtain a clearance into the airspace. This analysis is qualitative and more detailed quantitative analysis of fuel burn will be presented in Stage 3
Commercial airlines	Training cost	Qualitative	Flight procedures worldwide are updated with each aeronautical information regulation and control (AIRAC) cycle and airlines update their procedures accordingly, training as required. This proposal is not anticipated to require additional training costs for airlines.
Commercial airlines	Other costs	Qualitative	No other airline costs are foreseen.
Airport/ Air navigation service provider	Infrastructure costs	Qualitative	This proposal is not expected to change Airport or air navigation service provider (ANSP) infrastructure, beyond the initial deployment phase which will require some systems engineering amendments. However, this is dependent on the assumption that any new CAS has sufficient CNS coverage for the proposed routes. This will be confirmed prior to Stage 3.
Airport/ Air navigation service provider	Operational costs	Qualitative	This proposal is not expected to change Airport or ANSP operational costs.
Airport/ Air navigation service provider	Deployment costs	Qualitative	This proposal for the holistic ScTMA change is expected to require air traffic controller familiarisation training, in the order of 90-100 controllers and c.50 assistants at NATS Prestwick, including extensive use of the NATS simulator facility. Support staff are required to run the simulator – planning, training staff, data preparation and testing, pseudo pilots, safety analysts, outputs to be recorded and reported etc. Some staff may only require briefings. There may be occasions where the reduced availability of operational controllers during their conversion training could mean operational rostering becomes a factor when considering continuous service delivery. The Military ANSP would also require briefing prior to deployment. This requirement will be clarified as designs mature through on-going engagement.

Table 11: Options Appraisal (CAP1616 E2) – South-Western Element Concept 1

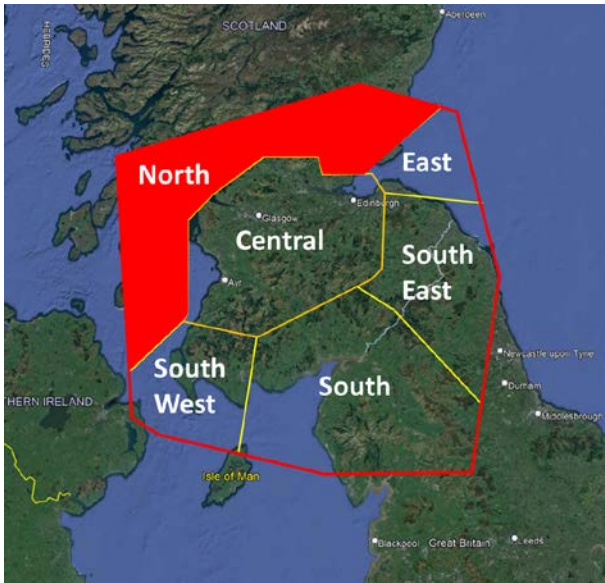
### Conclusion

Compared to the baseline, the performance of Concept 1 is better in terms of CO<sub>2</sub> emissions, fuel burn, capacity and resilience. SME input determined that the base of controlled airspace within this element was fit for future ATM requirements. Therefore, this was not considered.

As such Concept 1 is accepted and **progressed** to Stage 3.



## Northern Element



### 3.11. Concept 0 Do Nothing (Baseline)

Group	Impact	Level of Analysis	Evidence
Communities	Noise impact on health and quality of life	Qualitative	This proposal covers a large portion of Scotland, Northern England and extends West towards the Irish coast. This area includes the following National Parks, National Scenic areas and Areas of Outstanding Natural Beauty; Loch Lomond and the Trossachs, The Lake District, The Yorkshire Dales, Fleet Valley, East Stewartry Coast, Nith Estuary, Upper Tweeddale, Eildon and Leaderfoot, North Arran, Knapdale, Scarba, Lunga and the Garvellachs, Loch Lomond, The Trossachs, The River Earn, The River Tay, Loch Rannoch and Glen Lyon, The North Pennines, The Solway Coast, and The Northumberland Coast. This change will only impact flights above FL70 or 7,000 ft, any associated changes below this level will be included in the corresponding airports ACP. Government guidance says that 7,000ft is the maximum height at which noise is a priority for consideration. There will be no discernible change in noise impact from today.
Communities	Air quality	Qualitative	Government guidance says that aircraft flying higher than 1,000 ft are unlikely to have a significant impact on air quality <sup>14</sup> . There will be no changes in aircraft trajectories below 1,000 ft proposed in this ACP, therefore there will be no change in air quality from today.
Wider society	Greenhouse gas impact	Qualitative	The ATS routes included in the Northern element have a very low utilisation rate. Although they are bidirectional routes, there are not many conflicts between aircraft. When they do occur, they are relatively simple to predict and resolve limiting the benefit of a systemised structure. SME input has identified that the base of CAS within these elements can restrict CDO resulting in excess CO <sub>2</sub> emissions. The do-nothing option will lead to no change to the existing operation and no change in the greenhouse gas impact.
Wider society	Capacity/ resilience	Qualitative	No change to extant. In the long term the impact of constrained effective capacity would have a negative impact on resilience & capacity.
General Aviation (GA)	Access	Qualitative	This option would not introduce or release any additional CAS. Therefore, access to the impacted airspace will remain unchanged.

<sup>14</sup> See [Air Navigation Guidance 2017](#)

General Aviation / commercial airlines	Economic impact from increased effective capacity	Qualitative	There will be no change in the economic impact from increased capacity as aircraft will continue to fly the arrival and departure routes they do today. Traffic is not forecast to increase sufficiently for the effective sector capacity to become constrained or lead to a reduction in resilience.
General Aviation / commercial airlines	Fuel burn	Qualitative	The ATS routes included in the Northern element have a very low utilisation rate. Although they are bidirectional routes, there are not many conflicts between aircraft. When they do occur, they are relatively simple to predict and resolve limiting the benefit of a systemised structure. SME input has identified that the base of CAS within these elements can restrict CDO resulting in excess CO <sub>2</sub> emissions. The do-nothing option will lead to no change to the existing operation and no change in the greenhouse gas impact.
Commercial airlines	Training cost	Qualitative	Flight procedures worldwide are updated with each aeronautical information regulation and control (AIRAC) cycle and airlines update their procedures accordingly, training as required. This proposal is not anticipated to require additional training costs for airlines.
Commercial airlines	Other costs	Qualitative	No other airline costs are foreseen.
Airport/ Air navigation service provider	Infrastructure costs	Qualitative	This proposal is not expected to change Airport or air navigation service provider (ANSP) infrastructure, beyond the initial deployment phase which will require some systems engineering amendments.
Airport/ Air navigation service provider	Operational costs	Qualitative	This proposal is not expected to change Airport or ANSP operational costs.
Airport/ Air navigation service provider	Deployment costs	Qualitative	This proposal for the holistic ScTMA change is expected to require air traffic controller familiarisation training, in the order of 90-100 controllers and c.50 assistants at NATS Prestwick, including extensive use of the NATS simulator facility. Support staff are required to run the simulator – planning, training staff, data preparation and testing, pseudo pilots, safety analysts, outputs to be recorded and reported etc. Some staff may only require briefings. There may be occasions where the reduced availability of operational controllers during their conversion training could mean operational rostering becomes a factor when considering continuous service delivery. The Military ANSP would also require briefing prior to deployment. This requirement will be clarified as designs mature through on-going engagement.

**Table 12: Options Appraisal (CAP1616), Northern Element Baseline**

## Conclusion

The baseline “Do Nothing” Option 0 does not meet the following Design Principles:

- DP2 Operational- Resilience
- DP3 Operational- Capacity
- DP5 Economic- Fuel burn
- DP6 Environmental- CO<sub>2</sub> emissions
- DP13 Operational-CCO/CDO

For further information please see the DP evaluation matrix in the [Stage 2a Design Options and Evaluation document](#).

As such this option was rejected. It is included here for comparison purposes only.

### 3.12 Concept 1. Bi-directional route structure and review bases

Group	Impact	Level of Analysis	Evidence
Communities	Noise impact on health and quality of life	Qualitative	This proposal covers a large portion of Scotland, Northern England and extends West towards the Irish coast. This area includes the following National Parks, National Scenic areas and Areas of Outstanding Natural Beauty; Loch Lomond and the Trossachs, The Lake District, The Yorkshire Dales, Fleet Valley, East Stewartry Coast, Nith Estuary, Upper Tweeddale, Eildon and Leaderfoot, North Arran, Knapdale, Scarba, Lunga and the Garvellachs, Loch Lomond, The Trossachs, The River Earn, The River Tay, Loch Rannoch and Glen Lyon, The North Pennines, The Solway Coast, and The Northumberland Coast. This change will only impact flights above FL70 or 7,000 ft, any associated changes below this level will be included in the corresponding airports ACP. Government guidance says that 7,000ft is the maximum height at which noise is a priority for consideration. There will be no discernible change in noise impact from today.
Communities	Air quality	Qualitative	Government guidance says that aircraft flying higher than 1,000 ft are unlikely to have a significant impact on air quality <sup>15</sup> . There will be no changes in aircraft trajectories below 1,000 ft proposed in this ACP, therefore there will be no change in air quality from today.
Wider society	Greenhouse gas impact	Qualitative	This option will maintain the existing bidirectional routes and therefore does not offer a reduction in track mileage or CO <sub>2</sub> emissions over the existing structure. SME input has indicated that lowering the base of CAS is not likely to be a benefit CDO or reduce CO <sub>2</sub> emissions. This analysis is qualitative and more detailed quantitative analysis of fuel burn will be presented in Stage 3.
Wider society	Capacity/ resilience	Qualitative	This concept does not introduce a systemised airway and therefore does not share the capacity and resilience benefits this would offer. However, the ATS routes within this element have a low utilisation and any capacity gain through systemising these routes would not be realised. Reviewing the bases will ensure the airspace is more optimally used, reducing controller workload. This reduction in controller workload will increase the effective capacity and resilience of the airspace.
General Aviation (GA)	Access	Qualitative	The bases of CAS encapsulating the ATS routes contained within the Northern element will be reviewed. In some instances, it may be beneficial to lower the base as the ATS route approaches the ScTMA to enable improved CDO however SME input suggests this is unlikely. Lowering the base of the CTAs may enable improved safety by ensuring existing procedures are fully contained within CAS, i.e., the FOYLE hold (if retained). CAS may be released elsewhere within this element or downgraded improving access to GA. It is expected that within this element there will be a net reduction in CAS improving GA access.
General Aviation / commercial airlines	Economic impact from increased effective capacity	Qualitative	The proposed changes will increase the effective capacity of the airspace by reducing controller workload. However, utilisation of these Northern routes is low any additional capacity will not be realised. Therefore, economic impact of this change is likely to be neutral. However, it has not been quantified.

<sup>15</sup> See [Air Navigation Guidance 2017](#)

General Aviation / commercial airlines	Fuel burn	Qualitative	This option will maintain the existing bidirectional routes and therefore does not offer a reduction in track mileage or fuel burn over the existing airspace structure. SME input has indicated that lowering the base of CAS is not likely to be a benefit CDO or reduce fuel burn. However, GA airspace users may incur a minor fuel disbenefit if they are unable to obtain a clearance into the airspace. This analysis is qualitative and more detailed quantitative analysis of fuel burn will be presented in Stage 3.
Commercial airlines	Training cost	Qualitative	Flight procedures worldwide are updated with each aeronautical information regulation and control (AIRAC) cycle and airlines update their procedures accordingly, training as required. This proposal is not anticipated to require additional training costs for airlines.
Commercial airlines	Other costs	Qualitative	No other airline costs are foreseen.
Airport/ Air navigation service provider	Infrastructure costs	Qualitative	This proposal is not expected to change Airport or air navigation service provider (ANSP) infrastructure, beyond the initial deployment phase which will require some systems engineering amendments. However, this is dependent on the assumption that any new CAS has sufficient CNS coverage for the proposed routes. This will be confirmed prior to Stage 3.
Airport/ Air navigation service provider	Operational costs	Qualitative	This proposal is not expected to change Airport or ANSP operational costs.
Airport/ Air navigation service provider	Deployment costs	Qualitative	This proposal for the holistic ScTMA change is expected to require air traffic controller familiarisation training, in the order of 90-100 controllers and c.50 assistants at NATS Prestwick, including extensive use of the NATS simulator facility. Support staff are required to run the simulator – planning, training staff, data preparation and testing, pseudo pilots, safety analysts, outputs to be recorded and reported etc. Some staff may only require briefings. There may be occasions where the reduced availability of operational controllers during their conversion training could mean operational rostering becomes a factor when considering continuous service delivery.  The Military ANSP would also require briefing prior to deployment. This requirement will be clarified as designs mature through on-going engagement.

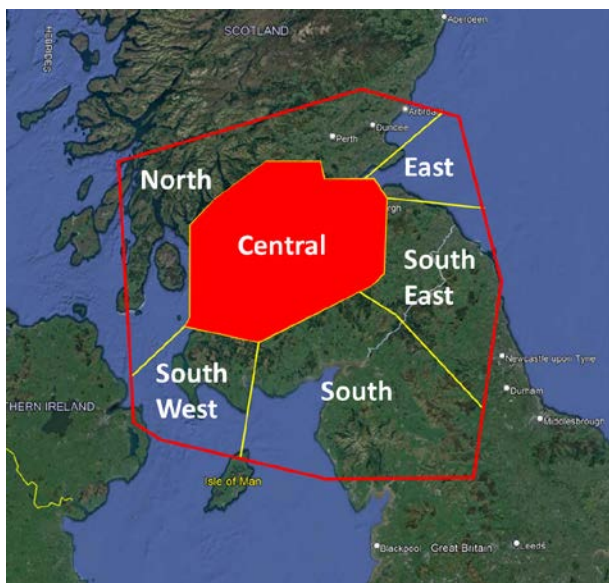
Table 13: Options Appraisal (CAP1616 E2) – Northern Element Concept 1

### Conclusion

Compared to the baseline, the performance of Option 4 is comparable in terms of CO<sub>2</sub> emissions and fuel burn. SME input has not identified any potential benefit to descent profiles into the ScTMA by lowering the bases of CAS. A review of the bases of CAS could bring benefit in terms of safety, capacity and resilience by reducing controller workload.

As such Concept 1 is accepted and **progressed** to Stage 3.

## Central Element



### 3.13. Concept 0 Do Nothing (Baseline)

Group	Impact	Level of Analysis	Evidence
Communities	Noise impact on health and quality of life	Qualitative	This proposal covers a large portion of Scotland, Northern England and extends West towards the Irish coast. This area includes the following National Parks, National Scenic areas and Areas of Outstanding Natural Beauty; Loch Lomond and the Trossachs, The Lake District, The Yorkshire Dales, Fleet Valley, East Stewartry Coast, Nith Estuary, Upper Tweeddale, Eildon and Leaderfoot, North Arran, Knapdale, Scarba, Lunga and the Garvellachs, Loch Lomond, The Trossachs, The River Earn, The River Tay, Loch Rannoch and Glen Lyon, The North Pennines, The Solway Coast, and The Northumberland Coast. This change will only impact flights above FL70 or 7,000 ft, any associated changes below this level will be included in the corresponding airports ACP. Government guidance says that 7,000ft is the maximum height at which noise is a priority for consideration. There will be no discernible change in noise impact from today.
Communities	Air quality	Qualitative	Government guidance says that aircraft flying higher than 1,000 ft are unlikely to have a significant impact on air quality <sup>16</sup> . There will be no changes in aircraft trajectories below 1,000 ft proposed in this ACP, therefore there will be no change in air quality from today.
Wider society	Greenhouse gas impact	Qualitative	The central element seeks to provide connectivity between the surrounding elements. The existing route structure is defined by ground-based NavAids and as such do not offer direct connectivity, nor is it systemised. Should this connectivity not be improved, aircraft will continue to fly via the existing routes and there will therefore be no change to the existing CO <sub>2</sub> emissions.
Wider society	Capacity/ resilience	Qualitative	The central element seeks to provide connectivity between the surrounding elements. The existing route structure is defined by ground-based NavAids and as such do not offer direct connectivity nor is it systemised to reduce conflicts. Should this connectivity not be improved, aircraft will continue to fly via the existing routes and there will therefore be no change to extant. In the long term the impact of constrained effective capacity would have a negative impact on resilience & capacity.

<sup>16</sup> See [Air Navigation Guidance 2017](#)

General Aviation (GA)	Access	Qualitative	This option would not introduce or release any additional CAS. Therefore, access to the impacted airspace will remain unchanged.
General Aviation / commercial airlines	Economic impact from increased effective capacity	Qualitative	There will be no change in the economic impact from increased capacity as aircraft will continue to fly the routes they do today. However, as traffic numbers grow in line with the forecast, effective sector capacity will become constrained, partially due to increasing controller workload. This could in turn lead to a reduction in resilience.
General Aviation / commercial airlines	Fuel burn	Qualitative	The central element seeks to provide connectivity between the surrounding elements. The existing route structure is defined by ground-based NavAids and as such do not offer direct connectivity, nor is it systemised. Should this connectivity not be improved, aircraft will continue to fly via the existing routes and there will therefore be no change to the existing fuel burn
Commercial airlines	Training cost	Qualitative	There would be no additional training required as there will be no change to the extant airspace or procedures.
Commercial airlines	Other costs	Qualitative	There would be no additional associated costs for airlines as there will be no change to the extant airspace.
Airport/ Air navigation service provider	Infrastructure costs	Qualitative	There would be no additional associated infrastructure costs as there will be no change to the extant airspace.
Airport/ Air navigation service provider	Operational costs	Qualitative	There would be no additional associated operational costs as there will be no change to the extant airspace.
Airport/ Air navigation service provider	Deployment costs	Qualitative	There would be no additional associated deployment costs as there will be no change to the extant airspace.

**Table 14: Options Appraisal (CAP1616), Central Element Baseline**

## Conclusion

The baseline “Do Nothing” Option 0 does not meet the following Design Principles:

- DP2 Operational- Resilience
- DP3 Operational- Capacity
- DP5 Economic- Fuel burn
- DP6 Environmental- CO<sub>2</sub> emissions
- DP12 Technical- AMS
- DP13 Operational-CCO/CDO

For further information please see the DP evaluation matrix in the [Stage 2a Design Options and Evaluation document](#).

As such this option was rejected. It is included here for comparison purposes only.



### 3.14 Concept 1. Provide ATS route connectivity to/between surrounding elements within existing CAS

Group	Impact	Level of Analysis	Evidence
Communities	Noise impact on health and quality of life	Qualitative	This proposal covers a large portion of Scotland, Northern England and extends West towards the Irish coast. This area includes the following National Parks, National Scenic areas and Areas of Outstanding Natural Beauty; Loch Lomond and the Trossachs, The Lake District, The Yorkshire Dales, Fleet Valley, East Stewartry Coast, Nith Estuary, Upper Tweeddale, Eildon and Leaderfoot, North Arran, Knapdale, Scarba, Lunga and the Garvellachs, Loch Lomond, The Trossachs, The River Earn, The River Tay, Loch Rannoch and Glen Lyon, The North Pennines, The Solway Coast, and The Northumberland Coast. This change will only impact flights above FL70 or 7,000 ft, any associated changes below this level will be included in the corresponding airports ACP. Government guidance says that 7,000ft is the maximum height at which noise is a priority for consideration. There will be no discernible change in noise impact from today.
Communities	Air quality	Qualitative	Government guidance says that aircraft flying higher than 1,000 ft are unlikely to have a significant impact on air quality <sup>17</sup> . There will be no changes in aircraft trajectories below 1,000 ft proposed in this ACP, therefore there will be no change in air quality from today.
Wider society	Greenhouse gas impact	Quantitative	Concept 1 will enable more direct routings between the surrounding elements. This will reduce the flight plannable track mileage and greenhouse gas impact. This analysis is qualitative and more detailed quantitative analysis of fuel burn will be presented in Stage 3.
Wider society	Capacity/ resilience	Qualitative	The changes contained within this design concept introduce numerous new routes, some of which may be systemised. These routes will provide an efficient deconflicted network where possible connecting the various elements of this change yielding capacity benefits and a reduction in ATC complexity. This would increase the resilience of the ATC network.
General Aviation (GA)	Access	Qualitative	This element sits atop the existing ScTMA airspace. The proposed changes will not require any additional airspace or release any existing airspace. Therefore, there will be minimal impact to GA access to the extant Controlled Airspace (CAS) within this element.
General Aviation / commercial airlines	Economic impact from increased effective capacity	Qualitative	The proposed changes will increase the effective capacity of the airspace. The economic impact of this would be positive, however it has not been quantified.
General Aviation / commercial airlines	Fuel burn	Quantitative	Concept 1 will enable more direct routings between the surrounding elements. This will reduce the flight plannable track mileage and fuel burn. This analysis is qualitative and more detailed quantitative analysis of fuel burn will be presented in Stage 3.
Commercial airlines	Training cost	Qualitative	Flight procedures worldwide are updated with each aeronautical information regulation and control (AIRAC) cycle and airlines update their procedures accordingly, training as required. This proposal is not anticipated to require additional training costs for airlines.
Commercial airlines	Other costs	Qualitative	No other airline costs are foreseen.
Airport/ Air navigation service provider	Infrastructure costs	Qualitative	This proposal is not expected to change Airport or air navigation service provider (ANSP) infrastructure, beyond the initial deployment phase which will require some systems engineering amendments.
Airport/ Air navigation service provider	Operational costs	Qualitative	This proposal is not expected to change Airport or ANSP operational costs.

<sup>17</sup> See [Air Navigation Guidance 2017](#)



Airport/ Air navigation service provider	Deployment costs	Qualitative	
			<p>This proposal for the holistic ScTMA change is expected to require air traffic controller familiarisation training, in the order of 90-100 controllers and c.50 assistants at NATS Prestwick, including extensive use of the NATS simulator facility. Support staff are required to run the simulator – planning, training staff, data preparation and testing, pseudo pilots, safety analysts, outputs to be recorded and reported etc. Some staff may only require briefings. There may be occasions where the reduced availability of operational controllers during their conversion training could mean operational rostering becomes a factor when considering continuous service delivery.</p> <p>The Military ANSP would also require briefing prior to deployment. This requirement will be clarified as designs mature through on-going engagement.</p>

**Table 15: Options Appraisal (CAP1616 E2) – Central Element Concept 1**

**Conclusion**

Compared to the baseline, the performance of Concept 1 is better in terms of CO<sub>2</sub> emissions and fuel burn. A reduction in controller workload should lead to an increase in capacity and resilience.

As such Concept 1 is accepted and progressed to Stage 3.

## 4. Airport Arrival and Departure Design Concepts

### Departure Connectivity

#### 4.1. Option 0 Do Nothing (Baseline)

Group	Impact	Level of Analysis	Evidence
Communities	Noise impact on health and quality of life	Qualitative	This proposal covers a large portion of Scotland, Northern England and extends West towards the Irish coast. This area includes the following National Parks, National Scenic areas and Areas of Outstanding Natural Beauty; Loch Lomond and the Trossachs, The Lake District, The Yorkshire Dales, Fleet Valley, East Stewartry Coast, Nith Estuary, Upper Tweeddale, Eildon and Leaderfoot, North Arran, Knapdale, Scarba, Lunga and the Garvellachs, Loch Lomond, The Trossachs, The River Earn, The River Tay, Loch Rannoch and Glen Lyon, The North Pennines, The Solway Coast, and The Northumberland Coast. This change will only impact flights above FL70 or 7,000 ft, any associated changes below this level will be included in the corresponding airports ACP. Government guidance says that 7,000ft is the maximum height at which noise is a priority for consideration. There will be no discernible change in noise impact from today.
Communities	Air quality	Qualitative	Government guidance says that aircraft flying higher than 1,000 ft are unlikely to have a significant impact on air quality <sup>18</sup> . There will be no changes in aircraft trajectories below 1,000 ft proposed in this ACP, therefore there will be no change in air quality from today.
Wider society	Greenhouse gas impact	Qualitative	The departure connectivity element seeks to provide connectivity from ScTMA airport SIDs to the ATS network. Currently this connectivity to the ATS network is provided through link routes and or flight plannable directs. Should there be no change, connectivity will be as per the extant and greenhouse gas impact will remain unchanged. However, the existing connectivity has room for improvement, i.e., link routes could provide track mileage savings and subsequent CO <sub>2</sub> savings by joining the network later.
Wider society	Capacity/ resilience	Qualitative	The departure connectivity element seeks to provide connectivity from ScTMA airport SIDs (these are being updated through separate airport sponsored ACPs) to the ATS network. Currently connectivity to the ATS network is provided through link routes and or flight plannable directs. Should there be no change, the capacity and resilience of the network will not change. The baseline does not provide connectivity to any newly proposed SIDs further limiting capacity. However, in the long term the impact of constrained effective capacity would have a negative impact on resilience & capacity.
General Aviation (GA)	Access	Qualitative	This option would not introduce or release any additional CAS. Therefore, access to the impacted airspace will remain unchanged.
General Aviation / commercial airlines	Economic impact from increased effective capacity	Qualitative	There will be no change in the economic impact from increased capacity as aircraft will continue to fly the routes they do today. However, as traffic numbers grow in line with the forecast, effective sector capacity will become constrained, partially due to increasing controller workload. This could in turn lead to a reduction in resilience.

<sup>18</sup> See [Air Navigation Guidance 2017](#)

General Aviation / commercial airlines	Fuel burn	Qualitative	The departure connectivity element seeks to provide connectivity from ScTMA airport SIDs to the ATS network. Currently this connectivity to the ATS network is provided through link routes and or flight plannable directs. Should there be no change, connectivity will be as per the extant and fuel burn will remain unchanged. However, the existing connectivity has room for improvement, i.e., link routes could provide track mileage savings and subsequent reduction in fuel burn by joining the network later.
Commercial airlines	Training cost	Qualitative	There would be no additional training required as there will be no change to the extant airspace or procedures.
Commercial airlines	Other costs	Qualitative	There would be no additional associated costs for airlines as there will be no change to the extant airspace.
Airport/ Air navigation service provider	Infrastructure costs	Qualitative	There would be no additional associated infrastructure costs as there will be no change to the extant airspace.
Airport/ Air navigation service provider	Operational costs	Qualitative	There would be no additional associated operational costs as there will be no change to the extant airspace.
Airport/ Air navigation service provider	Deployment costs	Qualitative	There would be no additional associated deployment costs as there will be no change to the extant airspace.

**Table 16: Options Appraisal (CAP1616), Departure Connectivity Element Baseline**

### Conclusion

The baseline “Do Nothing” Option 0 does not meet the following Design Principles:

- DP2 Operational- Resilience
- DP3 Operational- Capacity
- DP5 Economic- Fuel burn
- DP6 Environmental- CO<sub>2</sub> emissions
- DP13 Operational-CCO/CDO

For further information please see the DP evaluation matrix in the [Stage 2a Design Options and Evaluation document](#).

As such this option was rejected. It is included here for comparison purposes only.

#### 4.2. Concept 1. Systemisation – Provide departure connectivity from airport SID end points to adjacent elements via ATS routes within existing CAS

Group	Impact	Level of Analysis	Evidence
Communities	Noise impact on health and quality of life	Qualitative	This proposal covers a large portion of Scotland, Northern England and extends West towards the Irish coast. This area includes the following National Parks, National Scenic areas and Areas of Outstanding Natural Beauty; Loch Lomond and the Trossachs, The Lake District, The Yorkshire Dales, Fleet Valley, East Stewartry Coast, Nith Estuary, Upper Tweeddale, Eildon and Leaderfoot, North Arran, Knapdale, Scarba, Lunga and the Garvellachs, Loch Lomond, The Trossachs, The River Earn, The River Tay, Loch Rannoch and Glen Lyon, The North Pennines, The Solway Coast, and The Northumberland Coast. This change will only impact flights above FL70 or 7,000 ft, any associated changes below this level will be included in the corresponding airports ACP. Government guidance says that 7,000ft is the maximum height at which noise is a priority for consideration. There will be no discernible change in noise impact from today.
Communities	Air quality	Qualitative	Government guidance says that aircraft flying higher than 1,000 ft are unlikely to have a significant impact on air quality <sup>19</sup> . There will be no changes in aircraft trajectories below 1,000 ft proposed in this ACP, therefore there will be no change in air quality from today.
Wider society	Greenhouse gas impact	Quantitative	Concept 1 will provide efficient connectivity to all SID end points proposed in the corresponding airport ACP's to the UK ATS route network within the confines of existing CAS. This concept will seek to provide connectivity which minimises the track mileage of the entire route reducing the greenhouse gas impact. However, by remaining within the confines of existing CAS this benefit is limited.
Wider society	Capacity/ resilience	Qualitative	Concept 1 will provide efficient connectivity to all SID end points proposed in the corresponding airport ACP's to the UK ATS route network within the confines of existing CAS. Any additional connectivity will increase the capacity of the ATS network. Where this connectivity joins to a systemised route structure, departing aircraft will be deconflicted and therefore controller workload will be reduced. This will further enhance the capacity and resilience of the ATS route network.
General Aviation (GA)	Access	Qualitative	This option would not introduce or release any additional CAS. Therefore, access to the impacted airspace will remain unchanged.
General Aviation / commercial airlines	Economic impact from increased effective capacity	Qualitative	The proposed changes will increase the effective capacity of the airspace. The economic impact of this would be positive, however it has not been quantified.
General Aviation / commercial airlines	Fuel burn	Quantitative	Concept 1 will provide efficient connectivity to all SID end points proposed in the corresponding airport ACP's to the UK ATS route network within the confines of existing CAS. This concept will seek to provide connectivity which minimises the track mileage of the entire route reducing the total fuel burn. However, by remaining within the confines of existing CAS this benefit is limited.
Commercial airlines	Training cost	Qualitative	Flight procedures worldwide are updated with each aeronautical information regulation and control (AIRAC) cycle and airlines update their procedures accordingly, training as required. This proposal is not anticipated to require additional training costs for airlines.
Commercial airlines	Other costs	Qualitative	No other airline costs are foreseen.
Airport/ Air navigation service provider	Infrastructure costs	Qualitative	This proposal is not expected to change Airport or air navigation service provider (ANSP) infrastructure, beyond the

<sup>19</sup> See [Air Navigation Guidance 2017](#)

			initial deployment phase which will require some systems engineering amendments.
Airport/ Air navigation service provider	Operational costs	Qualitative	This proposal is not expected to change Airport or ANSP operational costs.
Airport/ Air navigation service provider	Deployment costs	Qualitative	This proposal for the holistic ScTMA change is expected to require air traffic controller familiarisation training, in the order of 90-100 controllers and c.50 assistants at NATS Prestwick, including extensive use of the NATS simulator facility. Support staff are required to run the simulator – planning, training staff, data preparation and testing, pseudo pilots, safety analysts, outputs to be recorded and reported etc. Some staff may only require briefings. There may be occasions where the reduced availability of operational controllers during their conversion training could mean operational rostering becomes a factor when considering continuous service delivery. The Military ANSP would also require briefing prior to deployment. This requirement will be clarified as designs mature through on-going engagement.

**Table 17: Options Appraisal (CAP1616 E2), Departure Connectivity Element Concept 1**

**Conclusion**

Compared to the baseline, Concept 1 offers an improvement in terms of CO<sub>2</sub> emissions, fuel burn, capacity and resilience. Where the airports SIDs connect to a systemised airway, arriving and departing aircraft will remain deconflicted allowing improved CCO and CDO and reducing controller workload. Concept 1 does not require additional CAS and therefore minimises the impact the MoD or GA community when compared to the baseline. However, whilst this option does offer an environmental and economic benefit over the baseline, this is limited by keeping the options within the confines of existing CAS.

The benefit of Concept 1 in terms of safety, CO<sub>2</sub> emissions and fuel burn are worse than that of Concept 2. The capacity & resilience benefits would be comparable to Concept 2. Concept 2 does not prohibit any designs captured by concept 1.

For these reasons Concept 1 is **rejected** in preference to Concept 2 at this stage.

#### 4.3. Concept 2. Systemisation – Provide departure connectivity from airport SID end points to adjacent elements via ATS routes requiring new CAS

Group	Impact	Level of Analysis	Evidence
Communities	Noise impact on health and quality of life	Qualitative	This proposal covers a large portion of Scotland, Northern England and extends West towards the Irish coast. This area includes the following National Parks, National Scenic areas and Areas of Outstanding Natural Beauty; Loch Lomond and the Trossachs, The Lake District, The Yorkshire Dales, Fleet Valley, East Stewartry Coast, Nith Estuary, Upper Tweeddale, Eildon and Leaderfoot, North Arran, Knapdale, Scarba, Lunga and the Garvellachs, Loch Lomond, The Trossachs, The River Earn, The River Tay, Loch Rannoch and Glen Lyon, The North Pennines, The Solway Coast, and The Northumberland Coast. This change will only impact flights above FL70 or 7,000 ft, any associated changes below this level will be included in the corresponding airports ACP. Government guidance says that 7,000ft is the maximum height at which noise is a priority for consideration. There will be no discernible change in noise impact from today.
Communities	Air quality	Qualitative	Government guidance says that aircraft flying higher than 1,000 ft are unlikely to have a significant impact on air quality <sup>20</sup> . There will be no changes in aircraft trajectories below 1,000 ft proposed in this ACP, therefore there will be no change in air quality from today.
Wider society	Greenhouse gas impact	Quantitative	Concept 2 will provide efficient connectivity to all SID end points proposed in the corresponding airport ACP's to the UK ATS route network without having to remain within the confines of existing CAS. This concept will seek to provide connectivity which minimises the track mileage of the entire route reducing the greenhouse gas impact. By considering additional CAS additional track mileage can be saved further reducing the greenhouse gas impact over Concept 1.
Wider society	Capacity/ resilience	Qualitative	Concept 2 will provide efficient connectivity to all SID end points proposed in the corresponding airport ACP's to the UK ATS route network without having to remain within the confines of existing CAS. Any additional connectivity will increase the capacity of the ATS network. Where this connectivity joins to a systemised route structure, departing aircraft will be deconflicted and therefore controller workload will be reduced. This will further enhance the capacity and resilience of the ATS route network.
General Aviation (GA)	Access	Qualitative	This option would require additional CAS. Therefore, GA access to the impacted airspace will be reduced.
General Aviation / commercial airlines	Economic impact from increased effective capacity	Qualitative	The proposed changes will increase the effective capacity of the airspace. The economic impact of this would be positive, however it has not been quantified.
General Aviation / commercial airlines	Fuel burn	Quantitative	Concept 2 will provide efficient connectivity to all SID end points proposed in the corresponding airport ACP's to the UK ATS route network without having to remain within the confines of existing CAS. This concept will seek to provide connectivity which minimises the track mileage of the entire route reducing the fuel burn. GA airspace users may incur a minor fuel disbenefit if they are unable to obtain a clearance into the airspace. By considering additional CAS additional track mileage can be saved further reducing the fuel burn over Concept 1.
Commercial airlines	Training cost	Qualitative	Flight procedures worldwide are updated with each aeronautical information regulation and control (AIRCAC) cycle and airlines update their procedures accordingly, training as required. This proposal is not anticipated to require additional training costs for airlines.

<sup>20</sup> See [Air Navigation Guidance 2017](#)

Commercial airlines	Other costs	Qualitative	No other airline costs are foreseen.
Airport/ Air navigation service provider	Infrastructure costs	Qualitative	This proposal is not expected to change Airport or air navigation service provider (ANSP) infrastructure, beyond the initial deployment phase which will require some systems engineering amendments. However, this is dependent on the assumption that any new CAS has sufficient CNS coverage for the proposed routes. This will be confirmed prior to Stage 3.
Airport/ Air navigation service provider	Operational costs	Qualitative	This proposal is not expected to change Airport or ANSP operational costs.
Airport/ Air navigation service provider	Deployment costs	Qualitative	This proposal for the holistic ScTMA change is expected to require air traffic controller familiarisation training, in the order of 90-100 controllers and c.50 assistants at NATS Prestwick, including extensive use of the NATS simulator facility. Support staff are required to run the simulator – planning, training staff, data preparation and testing, pseudo pilots, safety analysts, outputs to be recorded and reported etc. Some staff may only require briefings. There may be occasions where the reduced availability of operational controllers during their conversion training could mean operational rostering becomes a factor when considering continuous service delivery. The Military ANSP would also require briefing prior to deployment. This requirement will be clarified as designs mature through on-going engagement.

Table 18: Options Appraisal (CAP1616 E2), Departure Connectivity Element Concept 2

### Conclusion

Compared to the baseline and Concept 1 the performance of Concept 2 offers an improvement in terms of safety, CO<sub>2</sub> emissions, fuel burn, capacity and resilience. Where the airports SIDs connect to a systemised airway, arriving and departing aircraft will remain deconflicted allowing improved CCO and CDO and reducing controller workload. However, this additional benefit comes at the potential expense of requiring additional CAS, primarily impacting the MoD or GA community. The GA community and MoD have been engaged on this concept. As part of this engagement NATS has been keen to identify a compromise to enable this change and may increase access to other airspace structures.

As such Concept 2 is accepted and **progressed** to Stage 3.



## Arrival Connectivity

### 4.4. Option 0 Do Nothing (Baseline)

Group	Impact	Level of Analysis	Evidence
Communities	Noise impact on health and quality of life	Qualitative	This proposal covers a large portion of Scotland, Northern England and extends West towards the Irish coast. This area includes the following National Parks, National Scenic areas and Areas of Outstanding Natural Beauty; Loch Lomond and the Trossachs, The Lake District, The Yorkshire Dales, Fleet Valley, East Stewartry Coast, Nith Estuary, Upper Tweeddale, Eildon and Leaderfoot, North Arran, Knapdale, Scarba, Lunga and the Garvellachs, Loch Lomond, The Trossachs, The River Earn, The River Tay, Loch Rannoch and Glen Lyon, The North Pennines, The Solway Coast, and The Northumberland Coast. This change will only impact flights above FL70 or 7,000 ft, any associated changes below this level will be included in the corresponding airports ACP. Government guidance says that 7,000ft is the maximum height at which noise is a priority for consideration. There will be no discernible change in noise impact from today.
Communities	Air quality	Qualitative	Government guidance says that aircraft flying higher than 1,000 ft are unlikely to have a significant impact on air quality <sup>21</sup> . There will be no changes in aircraft trajectories below 1,000 ft proposed in this ACP, therefore there will be no change in air quality from today.
Wider society	Greenhouse gas impact	Qualitative	The arrival connectivity element seeks to provide connectivity from the ATS route network to airport holding facilities. Currently this connectivity is provided through STARs and or arrival procedures published within the relevant airports AIP. Should there be no change, connectivity will be as per the extant and greenhouse gas impact will remain unchanged. However, the existing connectivity has room for improvement, i.e., introduction of new STARs which redistribute traffic to alternate holding structures deconflicting busy airspace leading to more predictable route planning.
Wider society	Capacity/ resilience	Qualitative	The arrival connectivity element seeks to provide connectivity from the ATS route network to airport holding facilities. Currently this connectivity is provided through STARs and or arrival procedures published within the relevant airports AIP. Should there be no change, the capacity and resilience of the network will not change. The baseline does not provide connectivity to any newly proposed holding structures further limiting capacity. However, in the long term the impact of constrained effective capacity would have a negative impact on resilience & capacity.
General Aviation (GA)	Access	Qualitative	This option would not introduce or release any additional CAS. Therefore, access to the impacted airspace will remain unchanged.
General Aviation / commercial airlines	Economic impact from increased effective capacity	Qualitative	There will be no change in the economic impact from increased capacity as aircraft will continue to fly the routes they do today. However, as traffic numbers grow in line with the forecast, effective sector capacity will become constrained, partially due to increasing controller workload. This could in turn lead to a reduction in resilience.

<sup>21</sup> See [Air Navigation Guidance 2017](#)

General Aviation / commercial airlines	Fuel burn	Qualitative	The arrival connectivity element seeks to provide connectivity from the ATS route network to airport holding facilities. Currently this connectivity is provided through STARs and or arrival procedures published within the relevant airports AIP. Should there be no change, connectivity will be as per the extant and fuel burn will remain unchanged. However, the existing connectivity has room for improvement, i.e., introduction of new STARs which redistribute traffic to alternate holding structures deconflicting busy airspace leading to more predictable route planning.
Commercial airlines	Training cost	Qualitative	There would be no additional training required as there will be no change to the extant airspace or procedures.
Commercial airlines	Other costs	Qualitative	There would be no additional associated costs for airlines as there will be no change to the extant airspace.
Airport/ Air navigation service provider	Infrastructure costs	Qualitative	There would be no additional associated infrastructure costs as there will be no change to the extant airspace.
Airport/ Air navigation service provider	Operational costs	Qualitative	There would be no additional associated operational costs as there will be no change to the extant airspace.
Airport/ Air navigation service provider	Deployment costs	Qualitative	There would be no additional associated deployment costs as there will be no change to the extant airspace.

**Table 19: Options Appraisal (CAP1616), Arrival Connectivity Element Baseline**

### Conclusion

The baseline “Do Nothing” Option 0 does not meet the following Design Principles:

- DP2 Operational- Resilience
- DP3 Operational- Capacity
- DP5 Economic- Fuel burn
- DP6 Environmental- CO<sub>2</sub> emissions
- DP13 Operational-CCO/CDO

For further information please see the DP evaluation matrix in the [Stage 2a Design Options and Evaluation document](#).

As such this option was rejected. It is included here for comparison purposes only.

#### 4.5. Concept 1. Systemisation – Provide arrival connectivity from ATS route network to airport arrival structure via STARs within existing CAS

Group	Impact	Level of Analysis	Evidence
Communities	Noise impact on health and quality of life	Qualitative	This proposal covers a large portion of Scotland, Northern England and extends West towards the Irish coast. This area includes the following National Parks, National Scenic areas and Areas of Outstanding Natural Beauty; Loch Lomond and the Trossachs, The Lake District, The Yorkshire Dales, Fleet Valley, East Stewartry Coast, Nith Estuary, Upper Tweeddale, Eildon and Leaderfoot, North Arran, Knapdale, Scarba, Lunga and the Garvellachs, Loch Lomond, The Trossachs, The River Earn, The River Tay, Loch Rannoch and Glen Lyon, The North Pennines, The Solway Coast, and The Northumberland Coast. This change will only impact flights above FL70 or 7,000 ft, any associated changes below this level will be included in the corresponding airports ACP. Government guidance says that 7,000ft is the maximum height at which noise is a priority for consideration. There will be no discernible change in noise impact from today.
Communities	Air quality	Qualitative	Government guidance says that aircraft flying higher than 1,000 ft are unlikely to have a significant impact on air quality <sup>22</sup> . There will be no changes in aircraft trajectories below 1,000 ft proposed in this ACP, therefore there will be no change in air quality from today.
Wider society	Greenhouse gas impact	Quantitative	Concept 1 will provide efficient connectivity to airport holding structures through STARs. The location of the holds will be included within this change but will be determined through collaboration with the airports as they need to be suitably located for the ATS route structure and the airports approach procedure. The STARs proposed at stage 3 will follow the most efficient route available minimising the greenhouse gas emissions. However, by remaining within the confines of existing CAS this benefit is limited.
Wider society	Capacity/ resilience	Qualitative	Concept 1 will provide efficient connectivity between the ATS route network and the ScTMA airport holding facilities within the confines of existing CAS. Any additional connectivity following the introduction of additional holding facilities will increase the capacity of the ATS network. Where this connectivity comes from systemised route structure, arriving aircraft will be deconflicted from departing aircraft and therefore controller workload will be reduced. This will further enhance the capacity and resilience of the ATS route network.
General Aviation (GA)	Access	Qualitative	This option would not introduce or release any additional CAS. Therefore, access to the impacted airspace will remain unchanged.
General Aviation / commercial airlines	Economic impact from increased effective capacity	Qualitative	The proposed changes will increase the effective capacity of the airspace. The economic impact of this would be positive, however it has not been quantified.
General Aviation / commercial airlines	Fuel burn	Quantitative	Concept 1 will provide efficient connectivity to airport holding structures through STARs. The location of the holds will be included within this change but will be determined through collaboration with the airports as they need to be suitably located for the ATS route structure and the airports approach procedure. The STARs proposed at Stage 3 will follow the most efficient route available minimising the fuel burn. However, by remaining within the confines of existing CAS this benefit is limited.
Commercial airlines	Training cost	Qualitative	Flight procedures worldwide are updated with each aeronautical information regulation and control (AIRAC) cycle and airlines update their procedures accordingly, training as required. This proposal is not anticipated to require additional training costs for airlines.

<sup>22</sup> See [Air Navigation Guidance 2017](#)

Commercial airlines	Other costs	Qualitative	No other airline costs are foreseen.
Airport/ Air navigation service provider	Infrastructure costs	Qualitative	This proposal is not expected to change Airport or air navigation service provider (ANSP) infrastructure, beyond the initial deployment phase which will require some systems engineering amendments.
Airport/ Air navigation service provider	Operational costs	Qualitative	This proposal is not expected to change Airport or ANSP operational costs.
Airport/ Air navigation service provider	Deployment costs	Qualitative	This proposal for the holistic ScTMA change is expected to require air traffic controller familiarisation training, in the order of 90-100 controllers and c.50 assistants at NATS Prestwick, including extensive use of the NATS simulator facility. Support staff are required to run the simulator – planning, training staff, data preparation and testing, pseudo pilots, safety analysts, outputs to be recorded and reported etc. Some staff may only require briefings. There may be occasions where the reduced availability of operational controllers during their conversion training could mean operational rostering becomes a factor when considering continuous service delivery. The Military ANSP would also require briefing prior to deployment. This requirement will be clarified as designs mature through on-going engagement.

**Table 20: Options Appraisal (CAP1616 E2), Arrival Connectivity Element Concept 1**

### Conclusion

Compared to the baseline, Concept 1 offers an improvement in terms of CO<sub>2</sub> emissions, fuel burn, capacity and resilience. Where a STAR commences at systemised airway, arriving and departing aircraft will remain deconflicted allowing improved CCO and CDO and reducing controller workload. Concept 1 does not require additional CAS and therefore minimises the impact to the MoD or GA community compared to the baseline. However, whilst this option does offer an environmental and economic benefit over the baseline, this is limited by keeping the options inside of existing CAS.

The benefit of Concept 1 in terms of safety, CO<sub>2</sub> emissions and fuel burn are worse than that of Concept 2. The capacity & resilience benefits would be comparable to Concept 2. Concept 2 does not prohibit any designs captured by concept 1.

For these reasons Concept 1 is **rejected** in preference to Concept 2 at this stage.

#### 4.6. Concept 2. Systemisation – Provide arrival connectivity from ATS route network to airport arrival structure via STARs requiring additional CAS

Group	Impact	Level of Analysis	Evidence
Communities	Noise impact on health and quality of life	Qualitative	This proposal covers a large portion of Scotland, Northern England and extends West towards the Irish coast. This area includes the following National Parks, National Scenic areas and Areas of Outstanding Natural Beauty; Loch Lomond and the Trossachs, The Lake District, The Yorkshire Dales, Fleet Valley, East Stewartry Coast, Nith Estuary, Upper Tweeddale, Eildon and Leaderfoot, North Arran, Knapdale, Scarba, Lunga and the Garvellachs, Loch Lomond, The Trossachs, The River Earn, The River Tay, Loch Rannoch and Glen Lyon, The North Pennines, The Solway Coast, and The Northumberland Coast. This change will only impact flights above FL70 or 7,000 ft, any associated changes below this level will be included in the corresponding airports ACP. Government guidance says that 7,000ft is the maximum height at which noise is a priority for consideration. There will be no discernible change in noise impact from today.
Communities	Air quality	Qualitative	Government guidance says that aircraft flying higher than 1,000 ft are unlikely to have a significant impact on air quality <sup>23</sup> . There will be no changes in aircraft trajectories below 1,000 ft proposed in this ACP, therefore there will be no change in air quality from today.
Wider society	Greenhouse gas impact	Quantitative	Concept 2 will provide efficient connectivity between the UK ATS route network and the airport holding structures through STARs without having to remain within the confines of existing CAS. This concept will seek to provide connectivity which minimises the track mileage of the entire route reducing the greenhouse gas impact. By removing the CAS restriction additional track mileage can be saved further reducing the greenhouse gas impact over Concept 1.
Wider society	Capacity/ resilience	Qualitative	Concept 2 will provide efficient connectivity between the UK ATS route network and the airport holding structures through STARs without having to remain within the confines of existing CAS. Any additional connectivity will increase the capacity of the ATS network. Where this connectivity comes from systemised route structure, arriving aircraft will be deconflicted from departing aircraft and therefore controller workload will be reduced. This will further enhance the capacity and resilience of the ATS route network.
General Aviation (GA)	Access	Qualitative	This option would require additional CAS. Therefore, GA access to the impacted airspace will be reduced.
General Aviation / commercial airlines	Economic impact from increased effective capacity	Qualitative	The proposed changes will increase the effective capacity of the airspace. The economic impact of this would be positive, however it has not been quantified.
General Aviation / commercial airlines	Fuel burn	Quantitative	Concept 2 will provide efficient connectivity between the UK ATS route network and the airport holding structures through STARs without having to remain within the confines of existing CAS. This concept will seek to provide connectivity which minimises the track mileage of the entire route reducing the fuel burn. However, GA airspace users may incur a minor fuel disbenefit if they are unable to obtain a clearance into the airspace. By removing the CAS restriction additional track mileage can be saved further reducing the fuel burn over Concept 1.
Commercial airlines	Training cost	Qualitative	Flight procedures worldwide are updated with each aeronautical information regulation and control (AIRCAC) cycle and airlines update their procedures accordingly, training as required. This proposal is not anticipated to require additional training costs for airlines.

<sup>23</sup> See [Air Navigation Guidance 2017](#)

Commercial airlines	Other costs	Qualitative	No other airline costs are foreseen.
Airport/ Air navigation service provider	Infrastructure costs	Qualitative	This proposal is not expected to change Airport or air navigation service provider (ANSP) infrastructure, beyond the initial deployment phase which will require some systems engineering amendments. However, this is dependent on the assumption that any new CAS has sufficient CNS coverage for the proposed routes. This will be confirmed prior to Stage 3.
Airport/ Air navigation service provider	Operational costs	Qualitative	This proposal is not expected to change Airport or ANSP operational costs.
Airport/ Air navigation service provider	Deployment costs	Qualitative	This proposal for the holistic ScTMA change is expected to require air traffic controller familiarisation training, in the order of 90-100 controllers and c.50 assistants at NATS Prestwick, including extensive use of the NATS simulator facility. Support staff are required to run the simulator – planning, training staff, data preparation and testing, pseudo pilots, safety analysts, outputs to be recorded and reported etc. Some staff may only require briefings. There may be occasions where the reduced availability of operational controllers during their conversion training could mean operational rostering becomes a factor when considering continuous service delivery. The Military ANSP would also require briefing prior to deployment. This requirement will be clarified as designs mature through on-going engagement.

Table 21: Options Appraisal (CAP1616 E2), Arrival Connectivity Element Concept 2

### Conclusion

Compared to the baseline and Concept 1 the performance of Concept 2 offers an improvement in terms of safety, CO<sub>2</sub> emissions, fuel burn, capacity and resilience. Where a STAR commences at systemised airspace, arriving and departing aircraft will remain deconflicted allowing improved CCO and CDO reducing controller workload. However, this additional benefit comes at the potential expense of requiring additional CAS, impacting the MoD or GA community. The GA community and MoD have been engaged on this concept. As part of this engagement NATS has been keen to identify a compromise to enable this change and may increase access to other airspace structures.

As such Concept 2 is accepted and **progressed** to Stage 3.

## Arrival Structure

### 4.7. Option 0 Do Nothing (Baseline)

Group	Impact	Level of Analysis	Evidence
Communities	Noise impact on health and quality of life	Qualitative	This proposal covers a large portion of Scotland, Northern England and extends West towards the Irish coast. This area includes the following National Parks, National Scenic areas and Areas of Outstanding Natural Beauty; Loch Lomond and the Trossachs, The Lake District, The Yorkshire Dales, Fleet Valley, East Stewartry Coast, Nith Estuary, Upper Tweeddale, Eildon and Leaderfoot, North Arran, Knapdale, Scarba, Lunga and the Garvellachs, Loch Lomond, The Trossachs, The River Earn, The River Tay, Loch Rannoch and Glen Lyon, The North Pennines, The Solway Coast, and The Northumberland Coast. This change will only impact flights above FL70 or 7,000 ft, any associated changes below this level will be included in the corresponding airports ACP. Government guidance says that 7,000ft is the maximum height at which noise is a priority for consideration. There will be no discernible change in noise impact from today.
Communities	Air quality	Qualitative	Government guidance says that aircraft flying higher than 1,000 ft are unlikely to have a significant impact on air quality <sup>24</sup> . There will be no changes in aircraft trajectories below 1,000 ft proposed in this ACP, therefore there will be no change in air quality from today.
Wider society	Greenhouse gas impact	Qualitative	The arrival structure element seeks to provide airspace structures which can be used to absorb delay of arriving aircraft as needed, i.e. a hold. There are 7 existing holds serving the three main ScTMA airfields within the en-route environment. Holds are used when aircraft are unable to commence their approach into the airport, if a delay is not required aircraft can bypass the hold and continue their approach immediately from the end of the STAR. If no change is introduced the existing holding facilities will remain and aircraft will continue to use them as required therefore there would be no change in greenhouse gas impact.
Wider society	Capacity/ resilience	Qualitative	The arrival structure element seeks to provide airspace structures which can be used to absorb delay of arriving aircraft as needed, i.e. a hold. There are 7 existing holds serving the three main ScTMA airfields within the en-route environment which offer sufficient holding for the extant airspace design and forecast use. Should there be no change, the capacity and resilience of the network will not change. However, the location of the existing holds are not optimally positioned for the proposed changes included within this ACP, which could limit future capacity.
General Aviation (GA)	Access	Qualitative	This option would not introduce or release any additional CAS. Therefore, access to the impacted airspace will remain unchanged.
General Aviation / commercial airlines	Economic impact from increased effective capacity	Qualitative	There will be no change in the economic impact from increased capacity as aircraft will continue to use the existing holds as required. However, as traffic numbers grow in line with the forecast, effective sector capacity will become constrained, partially due to increasing controller workload. This could in turn lead to a reduction in resilience.

<sup>24</sup> See [Air Navigation Guidance 2017](#)



General Aviation / commercial airlines	Fuel burn	Qualitative	The arrival structure element seeks to provide airspace structures which can be used to absorb delay of arriving aircraft as needed, i.e. a hold. There are 7 existing holds serving the three main ScTMA airfields within the en-route environment. Holds are used when aircraft are unable to commence their approach into the airport, if a delay is not required aircraft can bypass the hold and continue their approach immediately from the end of the STAR. If no change is introduced the existing holding facilities will remain and aircraft will continue to use them as required therefore there would be no change in fuel burn
Commercial airlines	Training cost	Qualitative	There would be no additional training required as there will be no change to the extant airspace or procedures.
Commercial airlines	Other costs	Qualitative	There would be no additional associated costs for airlines as there will be no change to the extant airspace.
Airport/ Air navigation service provider	Infrastructure costs	Qualitative	There would be no additional associated infrastructure costs as there will be no change to the extant airspace.
Airport/ Air navigation service provider	Operational costs	Qualitative	There would be no additional associated operational costs as there will be no change to the extant airspace.
Airport/ Air navigation service provider	Deployment costs	Qualitative	There would be no additional associated deployment costs as there will be no change to the extant airspace.

**Table 22: Options Appraisal (CAP1616), Arrival Structure Element Baseline**

### Conclusion

The baseline “Do Nothing” Option 0 does not meet the following Design Principles:

- DP2 Operational- Resilience
- DP3 Operational- Capacity
- DP5 Economic- Fuel burn
- DP6 Environmental- CO<sub>2</sub> emissions
- DP12 Technical- AMS
- DP13 Operational-CCO/CDO

For further information please see the DP evaluation matrix in the [Stage 2a Design Options and Evaluation document](#).

As such this option was rejected. It is included here for comparison purposes only.

#### 4.8. Concept 1. Review existing holds and introduce new radial holds where required

Group	Impact	Level of Analysis	Evidence
Communities	Noise impact on health and quality of life	Qualitative	This proposal covers a large portion of Scotland, Northern England and extends West towards the Irish coast. This area includes the following National Parks, National Scenic areas and Areas of Outstanding Natural Beauty; Loch Lomond and the Trossachs, The Lake District, The Yorkshire Dales, Fleet Valley, East Stewartry Coast, Nith Estuary, Upper Tweeddale, Eildon and Leaderfoot, North Arran, Knapdale, Scarba, Lunga and the Garvellachs, Loch Lomond, The Trossachs, The River Earn, The River Tay, Loch Rannoch and Glen Lyon, The North Pennines, The Solway Coast, and The Northumberland Coast. This change will only impact flights above FL70 or 7,000 ft, any associated changes below this level will be included in the corresponding airports ACP. Government guidance says that 7,000ft is the maximum height at which noise is a priority for consideration. There will be no discernible change in noise impact from today.
Communities	Air quality	Qualitative	Government guidance says that aircraft flying higher than 1,000 ft are unlikely to have a significant impact on air quality <sup>25</sup> . There will be no changes in aircraft trajectories below 1,000 ft proposed in this ACP, therefore there will be no change in air quality from today.
Wider society	Greenhouse gas impact	Quantitative	Concept 1 will review the existing holds and introduce new radial holds as required. The holds are required to absorb delay which cannot be absorbed during the previous stages of flight. The location or number of holds will not impact on the frequency of aircraft holding, although the location could reduce the track mileage and associated greenhouse gas impact if the holding structure is placed between the ATS route and the airport. Subject to trade-offs and constraints at stage 3, we will aim to position holds to deliver maximum environmental benefit.
Wider society	Capacity/ resilience	Qualitative	Concept 1 will review the existing holds and introduce new radial holds as required. The holds are required to absorb delay which cannot be absorbed during the previous stages of flight. The location of the holds will increase the resilience of the airspace as they will be aligned with the arrival routes they serve. The introduction of additional holds, such as one serving arrivals through the FoF will reduce controller workload increasing capacity. Additional holding facilities will increase the resilience of the ATS network by potentially redistributing traffic with the ScTMA.
General Aviation (GA)	Access	Qualitative	Where holds are retained within existing CAS, there will be no impact on GA. However, should additional airspace be required for a new hold, such as one serving FoF arrivals additional airspace will be required to ensure the hold is fully contained within CAS. This additional CAS may impact GA operations.
General Aviation / commercial airlines	Economic impact from increased effective capacity	Qualitative	The proposed changes will increase the effective capacity of the airspace. The economic impact of this would be positive, however it has not been quantified.
General Aviation / commercial airlines	Fuel burn	Quantitative	Concept 1 will review the existing holds and introduce new radial holds as required. The holds are required to absorb delay which cannot be absorbed during the previous stages of flight. The location or number of holds will not impact on the frequency of aircraft holding, although the location could reduce track mileage and fuel burn if the holding structure is placed between the ATS route and the airport. Should additional CAS be required GA airspace users may incur a minor fuel disbenefit if they are unable to obtain a clearance into the airspace.
Commercial airlines	Training cost	Qualitative	Flight procedures worldwide are updated with each aeronautical information regulation and control (AIRAC) cycle

<sup>25</sup> See [Air Navigation Guidance 2017](#)

			and airlines update their procedures accordingly, training as required. This proposal is not anticipated to require additional training costs for airlines.
Commercial airlines	Other costs	Qualitative	No other airline costs are foreseen.
Airport/ Air navigation service provider	Infrastructure costs	Qualitative	This proposal is not expected to change Airport or air navigation service provider (ANSP) infrastructure, beyond the initial deployment phase which will require some systems engineering amendments. However, this is dependent on the assumption that any new CAS has sufficient CNS coverage for the proposed routes. This will be confirmed prior to Stage 3.
Airport/ Air navigation service provider	Operational costs	Qualitative	This proposal is not expected to change Airport or ANSP operational costs.
Airport/ Air navigation service provider	Deployment costs	Qualitative	This proposal for the holistic ScTMA change is expected to require air traffic controller familiarisation training, in the order of 90-100 controllers and c.50 assistants at NATS Prestwick, including extensive use of the NATS simulator facility. Support staff are required to run the simulator – planning, training staff, data preparation and testing, pseudo pilots, safety analysts, outputs to be recorded and reported etc. Some staff may only require briefings. There may be occasions where the reduced availability of operational controllers during their conversion training could mean operational rostering becomes a factor when considering continuous service delivery. The Military ANSP would also require briefing prior to deployment. This requirement will be clarified as designs mature through on-going engagement.

**Table 23: Options Appraisal (CAP1616 E2), Arrival Structure Element Concept 1**

### Conclusion

Holds are contingency structures which are required by design at the end of a STAR. They are used when aircraft need to be delayed, for example when it is not possible to continue the approach. As such, this option is comparable in terms of fuel burn and CO<sub>2</sub> emissions to the baseline as both use radial holds to offer this contingency. In the event aircraft need to hold, the hold location can introduce benefit if it is optimally situated between the ATS route and the airport. In this concept the location of the hold will align as closely as possible with the ATS network minimising the impact if used. Additional holding structures, such as one serving arrivals through the FoF will increase the capacity and resilience of the airspace.

As such Concept 1 is accepted and **progressed** to Stage 3.

## 5. Options Appraisal Overview

5.1 13 concepts across 9 elements were carried forward from the DP evaluation to the Initial Options Appraisal (IOA).

5.2 The Eastern, Southern, Arrival Connectivity and Departure Connectivity elements all brought forward 2 concepts to the IOA. The other elements presented only a single concept to the IOA.

5.3 As a result of the qualitative IOA, it was concluded that:

- the Southern element Concept 3 should be rejected in preference of Concept 4. Any option considered in Concept 3 could be included in Concept 4. However, as Concept 4 provides greater opportunity to deliver environmental and economic benefits, Concept 3 was rejected.
- The Arrival Connectivity and Departure Connectivity concepts 1 are rejected in preference to concept 2. Any options considered in Concept 1 can be included in Concept 2 as Concept 2. However, as Concept 2 provides greater opportunity to deliver safety, environmental and economic benefits, the Concept 1's were rejected.
- All other concepts brought forward will be progressed to stage 3
- Within the Eastern, Arrival Connectivity and Departure Connectivity elements, the progressed concepts differed by the requirement of additional CAS. This additional CAS would enable additional benefit but would impact our stakeholders. The impacted stakeholders have been engaged and are open to considering these concepts subject to continued engagement and design refinement. Any enabling compromises will be detailed within the Stage 3 documentation.

5.4 We are aware that the concepts discussed involve a wide range of stakeholders with potentially conflicting requirements. These stakeholders will be continually engaged throughout the CAP1616 process to ensure their requirements are considered.

5.5 The remaining concepts will be refined and defined before being joined together, subject to compatibility with each other during Stage 3 to produce holistic airspace solutions.

5.6 These solutions will be consulted upon at Stage 3.

## 6. Safety Assessment

This section provides a brief, qualitative overview of the impact of the holistic change on aviation safety.

### 6.1 Options Appraisal Safety Assessment – Baseline

The current operation uses a published route structure and airline operators flight-plan to follow available ATS routes as published in the UK AIP or flight planned Directs (DCT) as published in the Route Availability Document (RAD).

Flights into and out of the airspace volume are managed via published waypoints between adjacent sectors. Transfer of traffic between these sectors is often conducted via the use of standing agreements and established coordination procedures as detailed in specific sections of MATS pt. 2.

The published routes are largely predicated on ground based DVORs based upon an outdated airspace design and traffic needs to be tactically deconflicted by Air Traffic Controllers. This creates a high workload environment with a lack of overall predictability for airlines. The airspace also has a number of inefficiencies; restrictive standing agreements, restrictive controlled airspace base levels, restrictive route options and limited access to North Sea area except via NATEB.

The airspace below FL 255 operates within a 3nm separation environment, however, transfer of traffic to airports is based upon a 5nm separation requirement unless coordinated.

In addition to flights following routes, some may be instructed to take a more direct path through the airspace. This is done in a tactical manner by Air Traffic Controllers based on their judgement that a different path can be followed safely. and may be provided with a UK FIS as appropriate.

### 6.2 Options Appraisal Safety Assessment – Options Development

Project activities so far have included a questionnaire directed at Prestwick (PC) ATCOs and workshops held with Glasgow and Edinburgh airports. Feedback from these has enabled a range of concepts to be assessed through visualisation simulations based upon iterative development and an Airspace Safety Review (ASR) workshop. A second series of visualisation simulations have been conducted based on the feedback received through the initial set and taking into account direct feedback from stakeholders.

Key elements of the proposed change include systemised routes designed to improve traffic flow and increase capacity, as well as new arrival and departure route connectivity requiring additional CAS.

A qualitative high-level safety appraisal indicates that nothing is presently foreseen, in any of the proposed options for ScTMA, that appears to have the potential to preclude maintenance of the existing level of safety performance undertaken within the current operation.

### 6.3 Summary

The initial findings from workshops at the time of this Safety Statement are described in the following subsections. Due to the nature of airspace analysis, the individual elements of the designs have been assessed holistically.

#### *Visualisation Simulations*

Based on feedback from the workshops held with Glasgow and Edinburgh, feedback from the ATCO questionnaire and drawing on previous design work, concepts were created which contained a number of new design elements. These were presented to ScTMA ATCOs and airfield sponsors by means of visualisation simulations. These were held at Prestwick Centre in the SPACE research and development facility and used realistic traffic samples to represent the design concepts on a radar display. Traffic samples taken from a busy day in 2019 were used to show how aircraft would travel through the new airspace. It allowed the new design concepts to be understood and interactions between aircraft to be seen. It also facilitated discussion around sectorisation, coordination sequences and general opinions and ideas about the suitability of the designs and how they could be improved. There were 2 visualisation simulations which ran for 3 weeks each through January, February and March of 2022. 90% of all ScTMA ATCOs attended the first simulation and around 70% the second. The output of these simulations will be used to create and refine the designs that will be taken to real time development simulations scheduled for September 2022.

### *Airspace Safety Review*

The Airspace Safety Review has so far concluded the proposed design options could result in a small improvement in safety. It should be noted that the review does not, at this stage, explicitly state that the current design proposals can be safely implemented and recommends further ASR workshops be conducted in the event of the progression of particular design solutions.

### *Safety Assessment*

The proposed ScTMA design is predicted to provide a small safety benefit. At this stage, Safety do not foresee safety issues associated to any of the design elements. However, a further safety assessment is required in order for a reliable net safety benefit/disbenefit to be realised.

## **6.4 Future activities**

Subject to safety analysis, a safety strategy will be captured within the Safety Assurance Plan. Appropriate safety cases will be written, as will an analysis of CAP 1385 route separation criteria, as well as the relevant containment policies, of each route segment against adjacent proposed routes.

Further analysis and activities will be conducted on the proposed design options that will include:

- Hazard Analysis (Pre Dev/Post Dev)
- Development Simulations

Work is ongoing to provide detailed quantitative safety assessments for subsequent CAP 1616 stages. At this time, there are no indications to suggest any of the current options would be unsafely implemented. However, until the proposed routes are defined and finalised, Safety cannot definitively reach a 'safe/not safe' conclusion.

## 7. Conclusions and next steps

7.1 The Statement of Need for this proposal can be summarised:

### *Current Situation*

*Conventional procedures serving Edinburgh airport are not PBN and will soon be made obsolete by the planned decommissioning of several conventional navigation beacons.*

### *Issue to be addressed*

*Consideration of traffic flows between Glasgow and Edinburgh. Introduction of improved holding arrangements and ATS routes will reduce conflicts by systemising the traffic, also reducing fuel burn & CO2 emissions for flights using these routes. New routes and STARs may be required to provide network connectivity for new SIDs/ Arrival transitions as proposed by Edinburgh airport.*

*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.*

7.2 The airspace impacted by the ScTMA change was split into 6 geographical elements to address the ATS route network as well as an additional 3 elements to address the airport connectivity. Concepts were proposed for each element which aligned with the Statement of Need and evaluated against the design principles developed in Step 1B. In total 28 concepts were considered and shared with our stakeholders. Stakeholder feedback as well as input from SMEs was incorporated into the design concepts and the resulting concepts, along with a Do-nothing option for each element were evaluated against the design principles developed during Step 1B. This evaluation is detailed in Step 2A and used to determine which design concepts were suitable for progression. Following the design principle evaluation, 13 concepts across the 9 elements remained and were subjected to a subsequent initial options appraisal (IOA, Step 2B).

7.3 From this IOA, we concluded that one concept from the southern element could be removed as it did not introduce any additional options over the remaining southern option element. The remaining concepts, which will be used to formulate the system wide design options consulted upon in Stage 3 are listed in Table 24.

Element	Design Concept	Description
Eastern	Concept 4	<i>Systemised routes avoiding gliding area</i>
	Concept 8	<i>Systemised routes impacting gliding area</i>
South-Eastern	Concept 3	<i>Systemised route with lowered CAS bases</i>
Southern	Concept 4	<i>Systemised routes orientated according to traffic flow including a review of CAS bases</i>
South-Western	Concept 1	<i>Systemised Routes</i>
Northern	Concept 1	<i>Bi-directional route structure and review bases</i>
Central	Concept 1	<i>Provide ATS route connectivity to/between surrounding elements within existing CAS</i>
Departure Connectivity	Concept 2	<i>Provide departure connectivity from airport SID end points to adjacent elements via ATS routes requiring new CAS</i>
Arrival Connectivity	Concept 2	<i>Provide arrival connectivity from ATS route network to airport arrival structure via STARs requiring additional CAS</i>
Arrival Structure	Concept 1	<i>Review existing holds and introduce new radial holds where required</i>

Table 24: Finalised Concepts which will be used to build the holistic design options consulted on.



- 7.4 We thank all stakeholders who were able to participate in the Stage 2 engagement and look forward to their continued involvement with the development of this proposal.
- 7.5 It is not proportional for NATS to state their preferred option at this stage as this dependent on understanding the holistic system wide design. These options will be developed in greater detail in stage 3 and presented for consultation.
- 7.6 Subject to CAA approval at Stage 2, the ACP will progress to Stage 3 during which detailed consultation is undertaken on those options progressed. The time frame following the Stage 2 gateway is yet to be decided and will be determined in consultation with ACOG to ensure adherence with the Masterplan.
- 7.7 At Stage 3 we will further develop our remaining design concepts into feasible design solutions. At which stage we will indicate our preferred design. In line with the Masterplan NERL reserves the right to revive a design concept eliminated at Stage 2 if the progressed option is found to be incompatible with the concepts progressed for the other elements.
- 7.8 The development of holistic design solutions will enable more quantitative as opposed to qualitative analysis including fuel burn, and WebTAG CO<sub>2</sub>e emissions analysis. All benefits and impacts will be monetised at this stage such that the overall benefit/impacts can be assessed. This information will be included in the consultation material we prepare for our formal consultation process.

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