Future Airspace Strategy Implementation (FASI)

London Terminal Manoeuvring Area (LTMA)

Airspace Change Proposal (ACP)
ACP-2020-043
ACP-2020-044
ACP-2020-045

Stage 2 Develop and Assess
Southend Airport Arrivals Connectivity Module

To be read in conjunction with Master Document

1. Introduction

1.1 About this document

1.1.1 This document describes the arrival connectivity options for Southend airport, which have been developed using the methodology described in Section 2 of the Master document.

1.1.2 Southend is a single runway airport approximately 36 miles east of London. The airport handles mainly charter, cargo and business flights, and private aircraft flying. easyJet and Ryanair were prominent operators but ceased operations at Southend in 2021 due to negative impacts of Covid. easyJet has since resumed operations.

2. Baseline

2.1.1 This description of the current airspace around Southend should be considered the 'Do Nothing' option if no airspace change was to take place.

2.1.2 Table 1 shows actual[1] airport traffic counts from the 2019 baseline traffic year to 2022. The NERL forecast for network traffic levels is shown in the Master document Section 3.9. Airport forecasts are independent of the network and will be included within airport ACPs.

Year	Arrivals	Departures[2]	Total Movements
2019	11,588	11,235	22,823
2020	4,874	4,581	9,455
2021	2,112	1,778	3,890
2022	1,912	1,480	3,392

Table 1 Actual air traffic movements: Southend Airport 2019-2022

2.1.3 Southend has a number of arrival procedures (STARs), shown in Figure 1 and Table 2. Two holds, SPEAR & GEGMU, provide for delay absorption, although these are both below network levels.

Airport	Hold	STARs	Associated ATS Routes
Southend	GEGMU	SUMUM 1S, XAMAN 1S, KATHY 1S, SAM 1S, NEVIL 1S, SOVAT 1S	L980, L620, M189, L613, L608, Q63
	SPEAR	LISTO 1S, FINMA 1S, SILVA 1S	L15, M605, L612, P18, Q4, (U)Y124, Z197

Table 2 Current arrival connectivity for Southend

2.1.4 Southend does not have SIDs but has initial departure routes which join with the ATS route network at designated waypoints[3] (Table 3). These routes may be varied at the discretion of ATC.

Departure to	Via	Route
Northeast	L608/L620	CLN
Southeast	L9/L10/Q70	DET – DVR
South & Southwest	M189	DET – LYD
West	Q63	EVNAS – LAM – BPK – HEN – CPT
North	L10/N601	EVNAS – LAM – BPK

Table 3 Current departure connectivity for Southend

[1] This is based on CFMU actual data for 2019; this may vary from airport data.

[2] Discrepancies between arrival and departure data is due to some departure flights not utilising the ATS network and therefore not captured in the dataset.

[3] Departure routes are all below 7,000ft and will be subject to Airport ACP. NERL will ensure network connectivity.

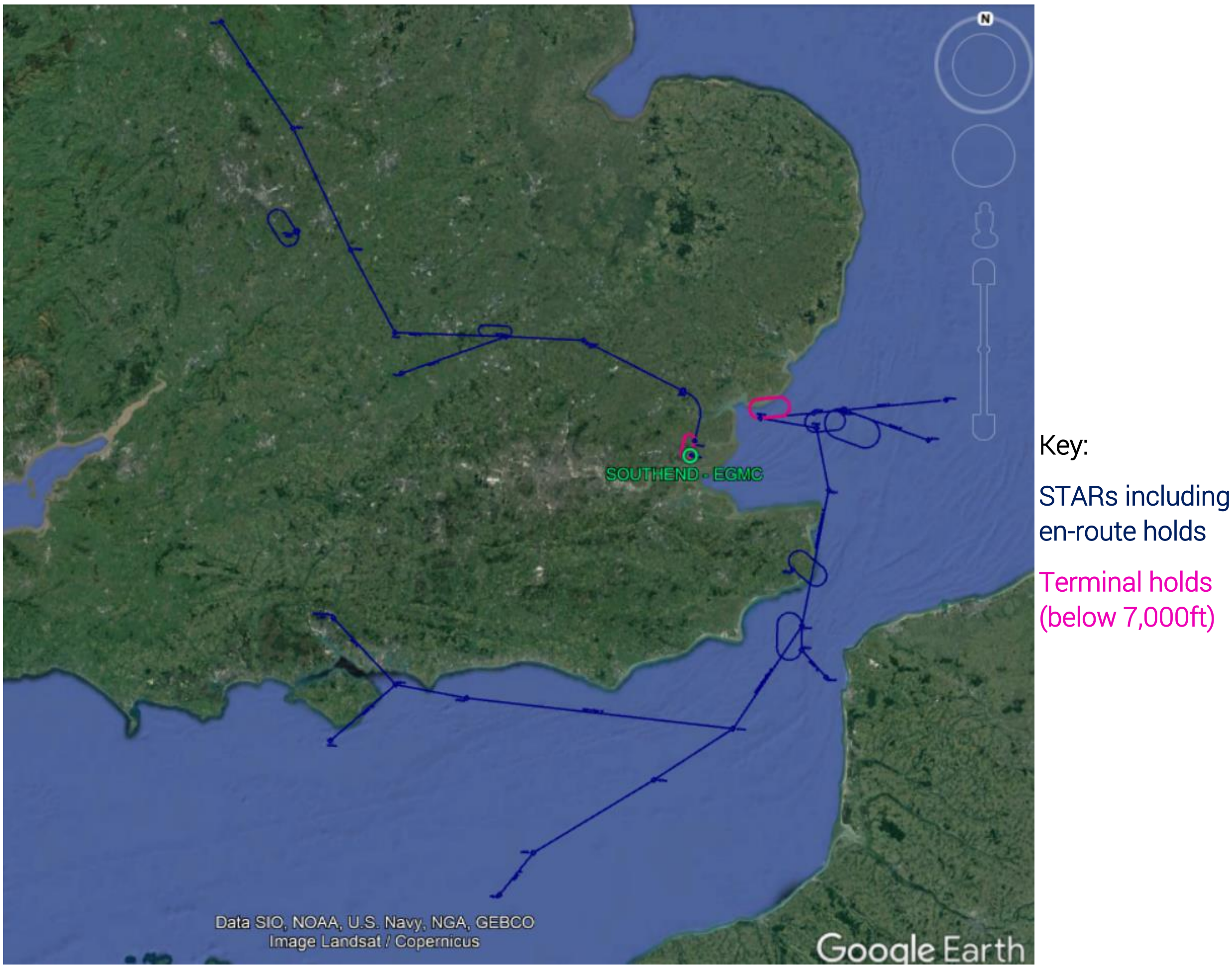


Figure 1 Current arrival procedures for Southend

2.1.5 Figure 2 shows a radar density plot of Southend arrival traffic for a typical busy summer week and indicates traffic distribution. The majority of traffic in 2019 arrived from the south and east.

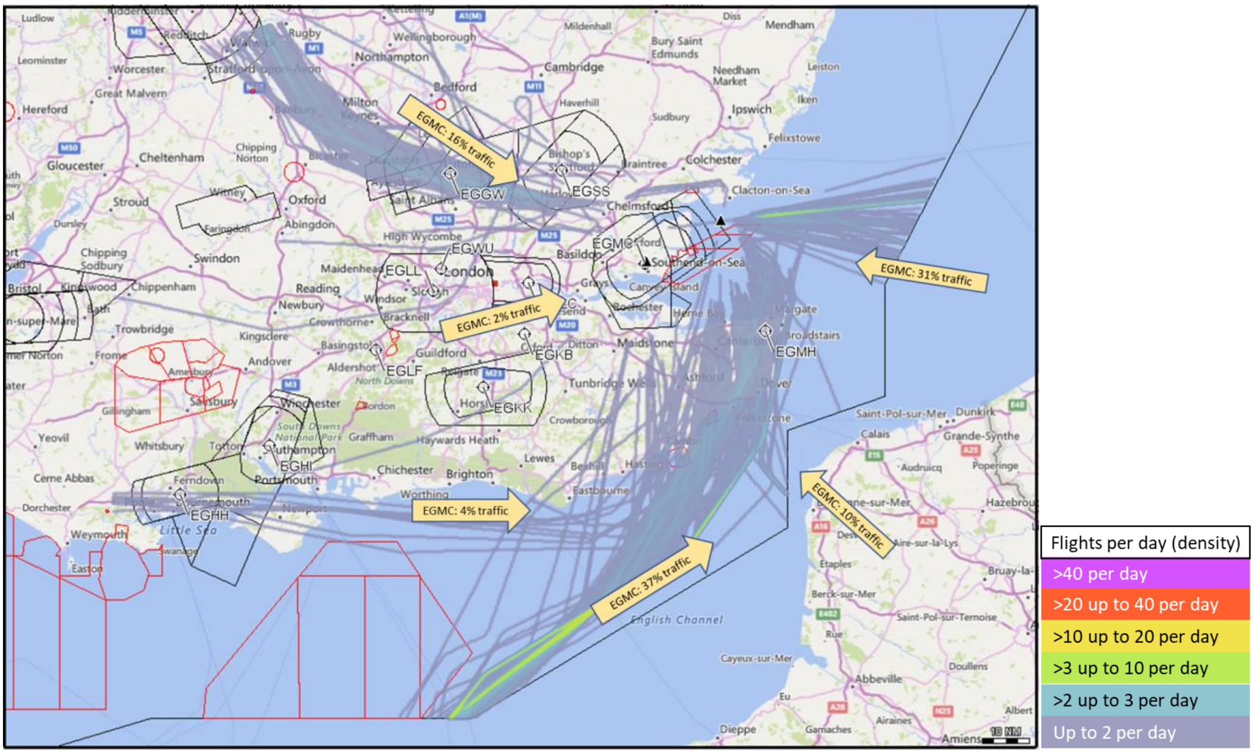


Figure 2 Southend traffic density arrivals FL245-FL70 5-11 August 2019

2.1.6 Medium jets are the most prevalent aircraft type at Southend, as shown in Table 4. easyJet was the most prevalent operator in 2019, with approximately 32% of the traffic.

Southend – Aircraft Type		
Aircraft Group	Movements	% traffic
Small Jet	2,743	12%
Medium Jet	14,718	65%
Heavy Jet	4	<1%
Turboprop/Piston/Prop	5,351	24%

Southend – Top 4 Aircraft Operator Usage		
Operator	Movements	% traffic
easyJet	7,284	32%
Ryanair	4,468	20%
Stobart Air	4,169	19%
Loganair	2,230	10%

Table 4 Aircraft type and top carriers - Southend

3. Design Development

3.1.1 Working with the airport, NERL developed 15 high-level concept options for Southend[4]. NERL has assessed that based on required traffic loading, Southend would require at least one hold, either attached to an RMA or attached to a systemised arrival structure. Initial viability assessments were produced for location and structure type and presented to stakeholders in formal engagement (Ref 7). Feedback was requested through the engagement response questionnaire.

3.1.2 'Do Nothing' is an option for Southend, as the current hold(s) are below 7,000ft. Southend's ACP would progress in accordance with their requirements below 7,000ft, and NERL would provide network connectivity for arrivals and departures. As the structure would be in Southend's ACP, NERL's geographic constraints do not apply.

3.2 Stakeholder engagement

3.2.1 We received 5 responses from 5 different stakeholders related to the Southend design concepts. Table 5 presents a summary of the feedback and how this has influenced the design.

3.2.2 Feedback recognises that Southend is a smaller airport with low traffic demand compared to others in the LTMA. This feedback has been used to inform the Design Principle Evaluation.

3.2.3 No new options were developed as a result of the stakeholder engagement and the design envelope was not amended.

Stakeholder	Feedback ('You said')	Response ('We did')
Airspace4All	Supports holds at minor airports, with direct routings, to keep track miles minimal.	Feedback was used to inform the evaluation of DP1, DP2, DP3 & DP8 for each airport.
Biggin Hill	Full engagement is required.	NERL has worked collaboratively with all FASI sponsors throughout the process, including Biggin Hill, and will continue to do so going forward. No new options and no amendment to the design envelope.
British Airways	Considering the number of movements at Southend, this must be deprioritized to facilitate Heathrow and Gatwick efficiencies.	At this stage, no airport will be prioritised over another, as we strive for a balanced network-wide design. Stage 3 development will identify prioritisation needs.
BGA	Traffic demand at Southend is low. Any network supporting structure should be proportionate to this level of traffic. Solutions appear to sensibly suggest the use of airspace over the sea.	Feedback was used to inform the evaluation of DP5 & DP6. Structures will be refined at stage 3 in proportion to the traffic demand from a specific airport. No new options and no amendment to the design envelope.
Southend Airport	With the aspirations of the airport to reach 10 million passengers, holding options above FL70 would need to be planned for. Current Southend holding options below FL70 are limited to 3 levels without coordination with TC. Therefore, an option of do nothing would not be desirable.	NERL have included a number of arrival structures, above 7,000ft, in their long list of options, as well as 'Do Nothing'. Feedback was used to inform the evaluation of DP1 and DP8. No new options and no amendment to the design envelope.

Table 5 Engagement feedback and NERL response

[4] See Master document Section 2.2 for a detailed description of this work.

3.3 Southend Design Concepts

3.3.1 Table 6 summarises the high-level qualitative considerations for potential locations for Southend arrival structures, and Table 7 summarises the viability assessment for the arrival structures suitable for Southend. These have been developed from SME input and stakeholder engagement. As described in the Master document paras 2.4.2 & 2.4.3, the concepts Holds Further Out and Trombones were removed as viable concepts at this stage. A detailed description of each structure can be found in Section 5 Appendix 1.

Location	Viability Considerations
North	An arrival structure, and associated connectivity, to the north of the airfield would likely conflict with Biggin Hill, London City and Stansted traffic.
Northeast	There is sufficient airspace to enable an arrival structure, and associated connectivity, to the northeast of the airfield, subject to deconfliction with London City and Stansted traffic and the Shoeburyness DA Complex.
East	There is sufficient airspace to enable an arrival structure, and associated connectivity, to the east of the airfield, subject to deconfliction with Biggin Hill and London City traffic and the Shoeburyness DA Complex.
Southeast	There is sufficient airspace to enable an arrival structure, and associated connectivity, to the southeast of the airfield, subject to deconfliction with Biggin Hill, Heathrow and London City traffic and the Shoeburyness DA Complex.
South	An arrival structure, and associated connectivity, to the south of the airfield would likely conflict with Biggin Hill, Gatwick and London City traffic.
Southwest	An arrival structure, and associated connectivity, to the southwest of the airfield would likely conflict with Biggin Hill, Gatwick, Heathrow, London City and Northolt traffic.
West	An arrival structure, and associated connectivity, to the west of the airfield would likely conflict with Biggin Hill, Heathrow, London City, Northolt and Stansted traffic.
Northwest	An arrival structure, and associated connectivity, to the northwest of the airfield would likely conflict with Biggin Hill, Heathrow, London City, Luton, Northolt and Stansted traffic.
Overhead	There is sufficient airspace to enable an arrival structure, and associated connectivity, overhead the airfield, subject to deconfliction Biggin Hill, Heathrow, London City and Northolt traffic and the Shoeburyness DA Complex.

Table 6 Southend Arrivals: Location viability considerations – post engagement

Structure	Viability Considerations
Optimised (inner) holds	Optimisation of the current day structures. There is sufficient airspace for optimised hold(s), and this would likely meet the runway throughput demands.
Point merge	There is sufficient airspace to suitably place a point merge. Based on traffic throughput, this may need to be a shared facility.
Switch merge	There is insufficient airspace to suitably place a switch merge.

Table 7 Southend Arrival structures: Viability considerations – post engagement

3.3.2 Figure 3 shows the Southend design envelope, developed by SMEs through collaborative workshops and formal engagement with Southend and other stakeholders. This design envelope is based on the viability considerations presented above in Table 6 & Table 7, developed through two-way engagement as shown in Table 5.

3.3.3 Airspace design constraints, as described in the Master document Section 3.5, are highlighted in orange. A consideration for Southend is Shoeburyness Danger Area as shown.

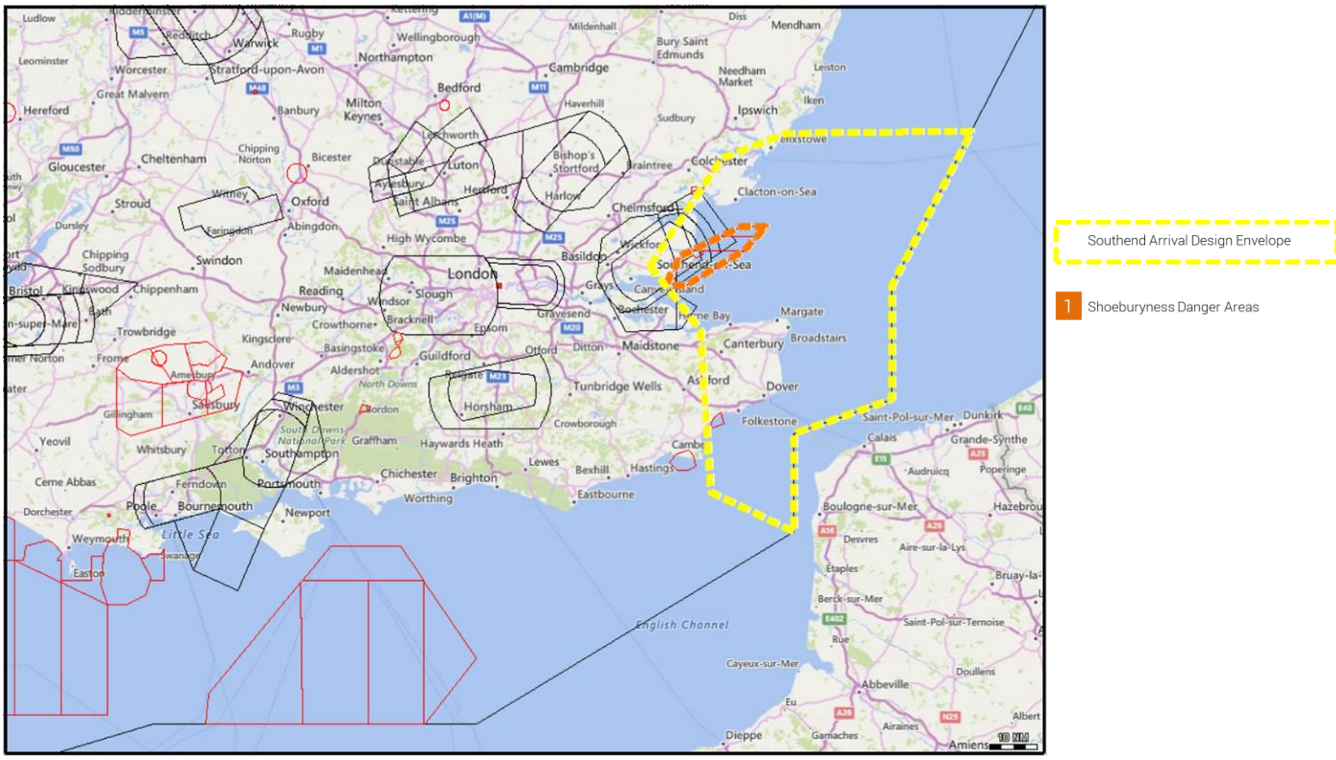


Figure 3 Southend Design Envelope and design constraints – post engagement

3.3.4 The Southend Design Concepts which were considered viable at this stage, within the Design Envelope presented, are shown in the Southend Arrival Structure Viability Assessment (Figure 4).

Arrival Structure Viability Assessment									
Arrival Structure Type	Location								
	N	NE	E	SE	S	SW	W	NW	OH
Do nothing*	✓								
Optimised (inner) hold(s)	✗	✓	✓	✓	✗	✗	✗	✗	✓
Point merge	✗	✓	✓	✓	✗	✗	✗	✗	✗
Switch merge	✗	✗	✗	✗	✗	✗	✗	✗	✗

*'Do Nothing' involves arrival structures remaining below 7,000ft so network connectivity is all that would be required.

✓ Viable Option: taken forward to DPE

✗ Not considered a viable option: eliminated at this point

Figure 4 Southend Design Options Viability Matrix

3.3.5 The viable 'Do Nothing' and 7 design options were taken forward as the comprehensive list to Design Principle Evaluation.

3.4 Design Principle Evaluation

3.4.1 Table 8 shows the DPE assessment criteria. SMEs, in this case air traffic control experts and airspace change experts, list topics associated with each DP and qualitatively test how each option would react to those topics, describing how a red/amber/green outcome is reached.

DP	Priority	Description	SME subjective assessment topics, include but not limited to	Red	Amber	Green
0	A AMS	**Safety** Safety is always the highest priority (Note: Red could not be solved by mitigation, amber may be able to be solved by mitigation).	Human performance (ATCO control-ability) Human performance (pilot fly-ability) IFP (fly-ability) Surrounding airspace users (inside/outside of CAS) Impact if ATM tools fail	Unacceptable level of safety risk	Diminished - Issue(s) identified could result in an elevated level of safety risk when compared to today's operation	Enhanced - improvement over today's level of safety. Maintained - safety risk could be maintained within acceptable levels of today's operation
1	B AMS	**Operational** The airspace will enable increased operational resilience	Network Weather avoidance Disruption in neighbouring ANSPs	Reduced resilience and capacity during disruption	Similar resilience and capacity during disruption	Increased resilience and capacity during disruption
			Airport Holding levels Delay absorption between hold and 7,000ft	Reduction in delay absorption	Delay absorption similar to today	Improve delay absorption
			Airport Time to restart after runway closure Number of aircraft off the hold	Reduction in disruption recovery	Disruption recovery similar to today	Improve disruption recovery
2	B	**Economic** Optimise network fuel performance	Track mileage Economic performance Aircraft height Method of delay absorption	Fuel performance worsened	Fuel performance similar to today	Fuel performance improved
3	B AMS	**Environmental** Optimise CO_2 emissions per flight	Track mileage GHG performance Aircraft height Method of delay absorption	CO_2 emissions worsened	CO_2 emissions similar to today	CO_2 emissions improved

DP	Priority	Description	SME subjective assessment topics, include but not limited to	Red	Amber	Green
4	C	**Environmental** Minimising of noise impacts due to LAMP influence will take place in accordance with local needs	Overall environmental impact Environmental impact below 7,000ft Impact on tranquillity (or visual intrusion)	LAMP influence not aligned with local ACP sponsors' needs	Extent of alignment not yet known	LAMP influence fully aligned with local ACP sponsors' needs
5	C	**Technical** The volume of controlled airspace required for LAMP should be the minimum necessary to deliver an efficient airspace design, taking into account the needs of the UK airspace users	Lateral footprint of CAS Vertical footprint of CAS Proportional to airport traffic levels	Airspace required not the minimum necessary to deliver an efficient design	Extent of airspace required not yet known	Airspace required the minimum necessary to deliver an efficient design
6	C AMS	**Technical** The impacts on GA and other civilian airspace users due to LAMP will be minimised	Change to boundaries of CAS Changes to CAS classification Safety based impacts	Excessive negative impacts	Negative impacts minimised but requires changes to other airspace users' activities	Negative impacts minimised, no impact, or positive impacts to other airspace users' current activities
7	C AMS	**Technical** The impacts on MoD users due to LAMP will be minimised	Overall amount of danger area available Amount of time for danger area available Flexible use airspace provision Change to access between danger areas Safety based impacts Radar corridor access	Negative impacts not minimised or would require excessive changes to current MoD operations	Negative impacts minimised but requires changes to current MoD operations Or Extent of impact not yet known	Negative impacts minimised or no negative impact on current MoD operations
8	B AMS	**Operational** Systemisation will deliver the optimal capacity and efficiency benefits (Note: This is about airspace capacity, not ground infrastructure capacity which could be the limiting factor to overall airport capacity).	Traffic throughput Sectorisation Effect on overall network capacity Effect on airports' arrival flow	Design option unable to support the forecast traffic loading for the airport and the network	Design option supports the forecast traffic loading for the airport or the network	Design option supports the forecast traffic loading beyond the reference period for both the airport and the network
			Overall ATCO workload Levels of tactical intervention (radio transmissions per flight) No increase to operations requirements Balancing out of hot spots	Design option increases ATCO workload	ATCO workload similar to today	Design option decreases ATCO workload

DP	Priority	Description	SME subjective assessment topics, include but not limited to	Red	Amber	Green
9	B AMS	Technical The main route network linking airport procedures with the En Route phase of flight will be spaced to yield maximum safety and efficiency benefits by using an appropriate standard of PBN (Note: The main route network is considered as FL70 - FL245. Approach structures are not considered as 'the main route network').	Airspace requirement vs. RNAV rating Required aircraft equipage standards	PBN standard applied to route spacing would decrease efficiency and safety	PBN standard applied to route spacing would limit efficiency and safety benefits	PBN standard applied to route spacing is likely to maximise efficiency and safety benefits
10	A	Policy Must accord with the CAA's published Airspace Modernisation Strategy (CAP1711) and any current or future plans associated with it.	AMS "Ends" Strategic Objectives Safety (DP0) Integration of diverse users (DP6 and DP7) Simplification (DP1, DP8 and DP9) Environmental sustainability (DP3)	No or limited alignment with the AMS	Partial alignment with the AMS	Aligned with the AMS

Table 8 Design Principle Evaluation Assessment Criteria

3.4.2 Table 9 shows the AMS assessment criteria which are used to determine the overall RAG status for DP10.

DP10 outcome	Criteria for DP0, DP1, DP3, DP6, DP7, DP8 and DP9
Red	DP0 (Safety) is red OR 2 other DPs are red
Amber	All other colour combinations not covered by Red or Green
Green	2 DPs are green and 0 are red OR 3 DPs are green and 1 is red

Table 9 - AMS Assessment Criteria

3.4.3 The criteria in Table 10 describe how each option's overall combination of reds/ambers/greens lead to the option progressing to the next step or to rejection and discounting from further development.

DP Priority	Criteria for Rejection Status
A	1 red OR 1 amber
B	2 reds
C	2 reds

Table 10 - Accept / Reject Criteria

3.4.4 Each design option has been assessed against the Design Principles. The following code is used for each design option. Airport (e.g. MC) - Structure Type (e.g. Inner Hold: IH/Point Merge: PM) - Location (e.g. Northeast: NE). DN = Do Nothing. DM = Do Minimum.

DP	Priority	MC - DN	MC - IH - NE	MC - IH - E
RESULT		ACCEPT	ACCEPT	ACCEPT
DP0 Safety	A AMS	Maintained: Similar operation to today	Maintained: Holds are used elsewhere in current day operations and are known to be safe	Maintained: Holds are used elsewhere in current day operations and are known to be safe
DP1 Operational (Delay Absorption)	B AMS	Arrival structure will remain below 7,000ft. There will be no change to delay absorption above 7,000ft	Would provide increased levels of delay absorption	Would provide increased levels of delay absorption
DP1 Operational (Disruption Recovery)	B AMS	Arrival structure will remain below 7,000ft. There will be no change to disruption recovery above 7,000ft	Holds will be slightly further from runway, but overall disruption recovery similar to today	Holds will be slightly further from runway. Extended track miles required to avoid DA. Overall disruption recovery worsened than today
DP2 Economic (Fuel)	B	Arrival structure will remain below 7,000ft. There will be no change to fuel performance above 7,000ft	Optimised concept aligned with airport traffic flows, therefore improved fuel performance	Optimised concept aligned with airport traffic flows. Extended track miles to avoid DA. Therefore, fuel performance neutral
DP3 Environmental (CO_2)	B AMS	Arrival structure will remain below 7,000ft. There will be no change to CO_2 emissions per flight above 7,000ft	Optimised concept of current day operation aligned with airport traffic flows, therefore CO_2 emissions per flight improved	Optimised concept aligned with airport traffic flows. Extended track miles to avoid DA. Therefore, fuel performance neutral
DP4 Environmental (Noise)	C	Impact on routes (and noise distribution) below 7,000ft not known at this point	Impact on routes (and noise distribution) below 7,000ft not known at this point	Impact on routes (and noise distribution) below 7,000ft not known at this point
DP5 Technical (CAS)	C	Today's operation, no change from baseline above 7,000ft	Design likely to be within current day CAS; ability to return CAS will be assessed in Stage 3	Design likely to be within current day CAS; ability to return CAS will be assessed in Stage 3
DP6 Technical (Other Users)	C AMS	Today's operation, no change from baseline above 7,000ft	Likely to be in current day CAS, no anticipated change in impacts	Likely to be in current day CAS, no anticipated change in impacts
DP7 Technical (MoD)	C AMS	Operation is known not to impact MoD currently, therefore no change in impact	Assumes design would not impact Shoeburyness DA Complex. Therefore, no negative impact on current MoD operations	Assumes design would not impact Shoeburyness DA Complex. Therefore, no negative impact on current MoD operations
DP8 Operational (Capacity)	B AMS	Aligns with network traffic flows and concept can support the airport required arrival loading	Aligns with network traffic flows and concept can support the airport required arrival loading	Aligns with network traffic flows and concept can support the airport required arrival loading
DP8 Operational (Efficiency)	B AMS	Similar concept to today's operation, therefore no change in ATCO workload anticipated	Addition of holds above 7,000ft. This would likely be managed with no anticipated change to ATCO workload	Addition of holds above 7,000ft. This would likely be managed with no anticipated change to ATCO workload
DP9 Technical (Route Spacing)	B AMS	Does not fully utilise the performance capabilities of modern aircraft	Structure will be designed, in collaboration with the airport, to the highest appropriate PBN standard enabling efficient spacing between routes	Structure will be designed, in collaboration with the airport, to the highest appropriate PBN standard enabling efficient spacing between routes
DP10 Policy (AMS)	A	Green: DP0, DP7, DP8 Amber: DP1, DP1, DP3, DP6, DP8 Red: DP9	Green: DP0, DP1, DP3, DP7, DP8, DP9 Amber: DP1, DP6, DP8 Red: None	Green: DP0, DP1, DP7, DP8, DP9 Amber: DP3, DP6, DP8 Red: DP1

DP	Priority	MC - IH - SE	MC - IH - OH	MC - PM - NE (Maybe shared)
RESULT		ACCEPT	REJECT	REJECT
DP0 Safety	A AMS	Maintained: Holds are used elsewhere in current day operations and are known to be safe	Maintained: Holds are used elsewhere in current day operations and are known to be safe	Maintained: PM are used elsewhere in current day operations and are known to be safe
DP1 Operational (Delay Absorption)	B AMS	Would provide increased levels of delay absorption	Would provide increased levels of delay absorption	Would provide increased levels of delay absorption
DP1 Operational (Disruption Recovery)	B AMS	Holds will be slightly further from runway, but overall disruption recovery similar to today	Holds will be slightly further from runway, but overall disruption recovery similar to today	Additional distance from hold to runway could delay recovery following disruption
DP2 Economic (Fuel)	B	Optimised concept aligned with airport traffic flows, therefore improved fuel performance	Fuel performance worsened as aircraft route overhead then track away to lose height on descent, increasing track miles	Fuel performance worsened due to extended track miles to complete the PM structure
DP3 Environmental (CO_2)	B AMS	Optimised concept of current day operation aligned with airport traffic flows, therefore CO_2 emissions per flight improved	CO_2 emissions worsened as aircraft route overhead then track away to lose height on descent, increasing track miles	CO_2 emissions worsened due to extended track miles to complete the PM structure
DP4 Environmental (Noise)	C	Impact on routes (and noise distribution) below 7,000ft not known at this point	Impact on routes (and noise distribution) below 7,000ft not known at this point	Impact on routes (and noise distribution) below 7,000ft not known at this point
DP5 Technical (CAS)	C	Design likely to be within current day CAS; ability to return CAS will be assessed in Stage 3	Design likely to be within current day CAS; ability to return CAS will be assessed in Stage 3	Design likely to be within current day CAS; ability to return CAS will be assessed in Stage 3
DP6 Technical (Other Users)	C AMS	Likely to be in current day CAS, no anticipated change in impacts	Likely to be in current day CAS, no anticipated change in impacts	Likely to be in current day CAS, no anticipated change in impacts
DP7 Technical (MoD)	C AMS	Assumes design would not impact Shoeburyness DA Complex. Therefore, no negative impact on current MoD operations	Assumes design would not impact Shoeburyness DA Complex. Therefore, no negative impact on current MoD operations	Assumes design would not impact Shoeburyness DA Complex. Therefore, no negative impact on current MoD operations
DP8 Operational (Capacity)	B AMS	Aligns with network traffic flows and concept can support the airport required arrival loading	Aligns with network traffic flows and concept can support the airport required arrival loading	Supports the required airport arrival loading, however, negatively impacts capacity of eastbound network traffic flows
DP8 Operational (Efficiency)	B AMS	Addition of holds above 7,000ft. Increase complexity southeast of Southend. Overall, increase in ATCO workload	Addition of holds above 7,000ft. This would likely be managed with no anticipated change to ATCO workload	All traffic could be required to be worked by NERL, therefore may increase ATCO workload
DP9 Technical (Route Spacing)	B AMS	Structure will be designed, in collaboration with the airport, to the highest appropriate PBN standard enabling efficient spacing between routes	Structure will be designed, in collaboration with the airport, to the highest appropriate PBN standard enabling efficient spacing between routes	Structure will be designed, in collaboration with the airport, to the highest appropriate PBN standard enabling efficient spacing between routes
DP10 Policy (AMS)	A	Green: DP0, DP1, DP3, DP7, DP8, DP9 Amber: DP1, DP6 Red: DP8	Green: DP0, DP1, DP7, DP8, DP9 Amber: DP1, DP6, DP8 Red: DP3	Green: DP0, DP1, DP7, DP9 Amber: DP6, DP8 Red: DP1, DP3, DP8

DP	Priority	MC - PM - E (Maybe shared)	MC - PM - SE (Maybe shared)
RESULT		REJECT	REJECT
DP0 Safety	A AMS	Maintained: PM are used elsewhere in current day operations and are known to be safe	Maintained: PM are used elsewhere in current day operations and are known to be safe
DP1 Operational (Delay Absorption)	B AMS	Would provide increased levels of delay absorption	Would provide increased levels of delay absorption
DP1 Operational (Disruption Recovery)	B AMS	Additional distance from hold to runway could delay recovery following disruption	Additional distance from hold to runway could delay recovery following disruption
DP2 Economic (Fuel)	B	Worsened due to extended track miles to complete PM structure. Aligns with airport traffic flows. Overall, worsened	Worsened due to extended track miles to complete PM structure. Aligns with airport traffic flows. Overall, worsened
DP3 Environmental (CO_2)	B AMS	Worsened due to extended track miles to complete PM structure. Aligns with airport traffic flows. Overall, CO_2 emissions worsened	Worsened due to extended track miles to complete PM structure. Aligns with airport traffic flows. Overall, CO_2 emissions worsened
DP4 Environmental (Noise)	C	Impact on routes (and noise distribution) below 7,000ft not known at this point	Impact on routes (and noise distribution) below 7,000ft not known at this point
DP5 Technical (CAS)	C	Design likely to be within current day CAS; ability to return CAS will be assessed in Stage 3	Design likely to be within current day CAS; ability to return CAS will be assessed in Stage 3
DP6 Technical (Other Users)	C AMS	Likely to be in current day CAS, no anticipated change in impacts	Likely to be in current day CAS, no anticipated change in impacts
DP7 Technical (MoD)	C AMS	Assumes design would not impact Shoeburyness DA Complex. Therefore, no negative impact on current MoD operations	Assumes design would not impact Shoeburyness DA Complex. Therefore, no negative impact on current MoD operations
DP8 Operational (Capacity)	B AMS	Aligns with network traffic flows and concept can support the airport required arrival loading	Supports the required airport arrival loading, however, negatively impacts capacity of southeast network traffic flows
DP8 Operational (Efficiency)	B AMS	All traffic would likely be required to be worked by NERL, therefore increase to ATCO workload	All traffic would likely be required to be worked by NERL, therefore increase to ATCO workload
DP9 Technical (Route Spacing)	B AMS	Structure will be designed, in collaboration with the airport, to the highest appropriate PBN standard enabling efficient spacing between routes	Structure will be designed, in collaboration with the airport, to the highest appropriate PBN standard enabling efficient spacing between routes
DP10 Policy (AMS)	A	Green: DP0, DP1, DP7, DP8, DP9 Amber: DP6 Red: DP1, DP3, DP8	Green: DP0, DP1, DP7, DP9 Amber: DP6, DP8 Red: DP1, DP3, DP8

Table 11 Design Principle Evaluation

3.4.5 4 design options were assessed as not meeting the DPs and were rejected at this stage. 'Do Nothing' is a viable option and was progressed with the remaining 3 design options to Initial Options Appraisal.

3.5 Initial Options Appraisal

Table 12 shows the assessment criteria used to complete the initial appraisal of each shortlisted option.

Group	Impact
Communities	Noise impact on health and quality of life
A qualitative assessment of changes to noise impacts compared with the 'Do Nothing' baseline. A qualitative assessment of changes to tranquillity impacts compared with the 'Do Nothing' baseline.	
Communities	Air Quality
A qualitative assessment of changes to local air quality compared with the 'Do Nothing' baseline.	
Wider Society	Greenhouse Gas Impacts
A qualitative assessment of changes to greenhouse gas impacts compared with the 'Do Nothing' baseline.	
Wider Society	Capacity / Resilience
A qualitative assessment of changes to airspace capacity and resilience compared with the 'Do Nothing' baseline.	
General Aviation (GA)	Access
A qualitative assessment of changes to GA access compared with the 'Do Nothing' baseline.	
GA/Commercial Airlines	Economic Impact from Increased Effective Capacity
A qualitative assessment of changes to GA and commercial operator economic impacts from increased effective capacity compared with the 'Do Nothing' baseline.	
GA/Commercial Airlines	Fuel Burn
A qualitative assessment of changes to GA and commercial operator fuel burn impacts compared with the 'Do Nothing' baseline.	
Commercial Airlines	Training Costs
A qualitative assessment of changes to commercial operator training costs compared with the 'Do Nothing' baseline.	
Commercial Airlines	Other Costs
A qualitative assessment of changes to other relevant commercial operator costs compared with the 'Do Nothing' baseline.	
Airport / ANSP	Infrastructure Costs
A qualitative assessment of changes to airport and ANSP infrastructure costs compared with the 'Do Nothing' baseline.	
Airport / ANSP	Operational Costs
A qualitative assessment of changes to airport and ANSP operational costs compared with the 'Do Nothing' baseline.	
Airport / ANSP	Deployment Costs
A qualitative assessment of changes to airport and ANSP deployment costs compared with the 'Do Nothing' baseline.	
All	Performance against the vision and parameters/strategic objectives of the AMS
A qualitative assessment of how the design option performs, considering the AMS objectives of improved capacity, reduced CO_2, minimal impact on other users, maintaining or enhancing safety, and facilitation of defence and security objectives, compared with the 'Do Nothing' baseline.	

Table 12 Initial Options Appraisal Assessment Criteria

MC – DN Qualitative Initial Impacts Assessment	PROGRESSED
Group	**Impact**
Communities	Noise impact on health and quality of life
ANG (2017) states "at or above 7,000ft…minimising of noise is no longer a priority CAP1616 instructs sponsors to consider noise and tranquillity impacts where the proposal has the potential to change overflight of inhabited areas, AONBs and NPs below 7,000ft.. No change in airspace design – no changes to impacts.	
Communities	Air Quality
ANG (2017) states "emissions from aircraft above 1,000ft are unlikely to have a significant impact on local air quality". No change in airspace design – no changes to impacts.	
Wider Society	Greenhouse Gas Impacts
Southend's current arrival structure is below 7,000ft; with the 'Do Nothing' option there will be no change to GHG above 7,000ft. Any GHG impacts as a result of changes to their arrival structure, below 7,000ft, can be found in the airport's ACP.	
Wider Society	Capacity / Resilience
Southend's current arrival structure is below 7,000ft; with the 'Do Nothing' option there will be no change to capacity or resilience above 7,000ft. Other non-airspace constraints may hinder overall capacity and economic gains at Southend. Any capacity or resilience impacts as a result of changes to their arrival structure, below 7,000ft, can be found in the airport's ACP.	
General Aviation (GA)	Access
Southend's current arrival structure is below 7,000ft; with the 'Do Nothing' option there will be no change to CAS above 7,000ft. Therefore, no change to GA access expected. Any GA impacts as a result of changes to their arrival structure, below 7,000ft, can be found in the airport's ACP.	
GA/Commercial Airlines	Economic Impact from Increased Effective Capacity
Southend's current arrival structure is below 7,000ft; with the 'Do Nothing' option there will be no change to capacity above 7,000ft. Therefore, no change in economic benefits expected. Other non-airspace constraints may hinder overall capacity and economic gains at Southend. Aligns with network traffic flows, which enables potential capacity gains across the LTMA from an improved network design. This could positively impact all LTMA traffic – commercial and GA. Any capacity impacts as a result of changes to their arrival structure, below 7,000ft, can be found in the airport's ACP.	
GA/Commercial Airlines	Fuel Burn
Southend's current arrival structure is below 7,000ft; with the 'Do Nothing' option there will be no change to fuel burn above 7,000ft for commercial and GA. Any fuel burn impacts as a result of changes to their arrival structure, below 7,000ft, can be found in the airport's ACP.	
Commercial Airlines	Training Costs
Flight procedures change worldwide with each AIRAC cycle and operators would update their procedures accordingly, training staff if required. If this baseline system was retained, the same flight procedures would be used, and training cost impacts would not change. Any training costs as a result of changes to their arrival structure, below 7,000ft, can be found in the airport's ACP.	
Commercial Airlines	Other Costs
No change in airspace design above 7,000ft – no changes to other commercial operator costs. Any other costs to commercial operators as a result of changes to their arrival structure, below 7,000ft, can be found in the airport's ACP.	
Airport / ANSP	Infrastructure Costs
No change in airspace design above 7,000ft – no changes to infrastructure costs. If this baseline system was retained, the same infrastructure would continue to be used in the same way, with no additional costs. Any infrastructure costs as a result of changes to their arrival structure, below 7,000ft, can be found in the airport's ACP.	
Airport / ANSP	Operational Costs
No change in airspace design above 7,000ft – no changes to infrastructure costs. If this baseline system was retained, the same infrastructure would continue to be used in the same way, with no additional operational costs. Any operational costs as a result of changes to their arrival structure, below 7,000ft, can be found in the airport's ACP.	
Airport / ANSP	Deployment Costs
If this baseline system was retained, there would be no deployment above 7,000ft, hence no associated costs. Any deployment costs as a result of changes to their arrival structure, below 7,000ft, can be found in the airport's ACP.	
AMS	Performance against the vision and parameters/strategic objectives of the AMS
In the 'Do Nothing' there will be no change in airspace design above 7,000ft as Southend's current hold is below 7,000ft and out of scope for this ACP. Any changes to the arrival structure, below 7,000ft, can be found in the airport's ACP; these changes would have to align with the AMS.	

Qualitative Safety Assessment
A high-level safety appraisal for this proposed option indicates that if the baseline system was retained, the existing level of safety performance undertaken within the current operation would be at least maintained. A safety assessment as a result of changes to their arrival structure, below 7,000ft, can be found in the airport's ACP.
Conclusion from IOA
Compared to the baseline, there would be no change above 7,000ft, except for the provision of network connectivity. Any changes below 7,000ft can be found in the airport's ACP. Therefore, MC – DN is progressed to Stage 3 for further development.

Table 13 MC-DN Initial Options Appraisal

MC – IH - NE Qualitative Initial Impacts Assessment	PROGRESSED
Group	**Impact**
Communities	Noise impact on health and quality of life
ANG (2017) states "at or above 7,000ft…minimising of noise is no longer a priority". CAP1616 instructs sponsors to consider noise and tranquillity impacts where the proposal has the potential to change overflight of inhabited areas, AONBs and NPs below 7,000ft. In this network-level proposal, changes would not occur below 7,000ft therefore these impacts are not considered.	
Communities	Air Quality
ANG (2017) states "emissions from aircraft above 1,000ft are unlikely to have a significant impact on local air quality". Changes would occur at or above 7,000ft, thus in accordance with ANG (2017) there would be no change in local air quality impacts.	
Wider Society	Greenhouse Gas Impacts
This design option is an optimised version of today which will involve holding at higher levels (above 7,000ft) and orientating optimally for airport and network traffic flows. Overall, it could reduce GHG emissions through improved aircraft trajectories compared with the baseline.	
Wider Society	Capacity / Resilience
Capacity: This option could maintain airport capacity, providing a similar number holding levels as the baseline below 7,000ft. This location aligns with network traffic flows so could maintain network capacity compared with the baseline. Other non-airspace constraints may hinder overall capacity and economic gains at Southend Resilience: Holds within the network will be higher up and therefore slightly further from the runway than the baseline, as holds are currently below 7,000ft. However, this should have negligible impact on disruption recovery. This option would increase the number of holding levels, therefore it could increase delay absorption compared with the baseline.	
General Aviation (GA)	Access
A holding facility to the northeast would likely be within current day CAS. As a result, the access impact on GA traffic is unlikely to change compared with the baseline.	
GA/Commercial Airlines	Economic Impact from Increased Effective Capacity
Aligns with network traffic flows, which could enable capacity gains across the LTMA from an improved network design. A holding facility above 7,000ft could enable more flights to operate, which is expected to provide an economic benefit over the baseline for commercial traffic. Other non-airspace constraints may hinder overall capacity and economic gains at Southend. The additional required airspace to deconflict arrival structures could create negative economic impacts for all LTMA traffic from extended track mileage. This could negatively impact all LTMA traffic – commercial and GA.	
GA/Commercial Airlines	Fuel Burn
This design option is an optimised version of today which will involve holding at higher levels (above 7,000ft) and orientating optimally for airport and network traffic flows. However, a new holding facility could create network inefficiencies, with additional airspace required leading to extended track distance and increased fuel burn to deconflict the arrival structures. This location aligns with network traffic flows, so potential inefficiencies could be negligible. Overall, it could reduce fuel burn through improved aircraft trajectories compared with the baseline. This could positively impact all LTMA traffic – commercial and GA.	
Commercial Airlines	Training Costs
Flight procedures change worldwide with each AIRAC cycle and operators would update their procedures accordingly, training staff if required. This option is not anticipated to impose additional training cost impacts for operators.	
Commercial Airlines	Other Costs
No other operator costs are foreseen.	
Airport / ANSP	Infrastructure Costs
This design option is not expected to change airport or ANSP infrastructure impacts, beyond the initial deployment phase which will require some systems engineering adjustments.	
Airport / ANSP	Operational Costs
This design option is not expected to change airport or ANSP operational cost impacts.	
Airport / ANSP	Deployment Costs
At this stage it is disproportionate to attempt to quantify deployment costs per design option. However, a large LTMA system change would involve training a large number of controllers and assistants via the use of various air traffic simulators (including sim prep, management, and staffing), with additional system engineering costs.	
AMS	Performance against the vision and parameters/strategic objectives of the AMS
• Safety: maintained • Simplification: could improve delay absorption, maintain disruption recovery, maintain airport capacity, maintain network capacity, and maintain ATCO workload. Will utilise aircraft performance capabilities • Integration of diverse users: continues to integrate defence and security and GA, subject to constraints of the design • Environmental sustainability: could reduce CO_2 emissions	

Qualitative Safety Assessment
A high-level safety appraisal for this proposed option indicates that an inner hold to the northeast would at least maintain current safety performance. There are multiple holds within current UK airspace which have a proven safety performance. An arrival structure in this location would need to deconflict with London City and Stansted departure traffic.
Conclusion from IOA
Compared to the baseline, this option could improve delay absorption, fuel burn, and CO_2 emissions. It would maintain safety and any current MoD access. It could maintain delay absorption, airport capacity, network capacity, and ATCO workload. The negative impact on transiting GA traffic may be worse than the baseline. Therefore, MC – IH – NE is progressed to Stage 3 for further development.

Table 14 MC-IH-NE Initial Options Appraisal

MC – IH - E Qualitative Initial Impacts Assessment	PROGRESSED
Group	**Impact**
Communities	Noise impact on health and quality of life
ANG (2017) states "at or above 7,000ft…minimising of noise is no longer a priority". CAP1616 instructs sponsors to consider noise and tranquillity impacts where the proposal has the potential to change overflight of inhabited areas, AONBs and NPs below 7,000ft. In this network-level proposal, changes would not occur below 7,000ft therefore these impacts are not considered.	
Communities	Air Quality
ANG (2017) states "emissions from aircraft above 1,000ft are unlikely to have a significant impact on local air quality". Changes would occur at or above 7,000ft, thus in accordance with ANG (2017) there would be no change in local air quality impacts.	
Wider Society	Greenhouse Gas Impacts
This design option is an optimised version of today which will involve holding at higher levels (above 7,000ft) and orientating optimally for airport and network traffic flows. Extended track miles due to DA avoidance. Overall, it could maintain GHG emissions compared with the baseline.	
Wider Society	Capacity / Resilience
Capacity: This option could maintain airport capacity, providing the same number of holds as the baseline below 7,000ft. This location aligns with network traffic flows so could maintain network capacity compared with the baseline. Other non-airspace constraints may hinder overall capacity and economic gains at Southend. Resilience: Holds within the network will be higher up and therefore slightly further from the runway than the baseline, as holds are currently below 7,000ft. However, this should have negligible impact on disruption recovery. This option would increase the number of holding levels, therefore it could increase delay absorption compared with the baseline.	
General Aviation (GA)	Access
A holding facility to the east would likely be within current day CAS. As a result, the access impact on GA traffic is unlikely to change compared with the baseline.	
GA/Commercial Airlines	Economic Impact from Increased Effective Capacity
Aligns with network traffic flows, which could enable capacity gains across the LTMA from an improved network design. A holding facility above 7,000ft could enable more flights to operate, which is expected to provide an economic benefit over the baseline for commercial traffic; however, other non-airspace constraints may hinder overall capacity and economic gains at Southend. The additional required airspace to deconflict arrival structures could create negative economic impacts for all LTMA traffic from extended track mileage. This could negatively impact all LTMA traffic – commercial and GA.	
GA/Commercial Airlines	Fuel Burn
This design option is an optimised version of today which will involve holding at higher levels (above 7,000ft) and orientated optimally for airport and network traffic flows. Airport arrivals may have extended track miles due to DA avoidance. A new holding facility could create network inefficiencies, with additional airspace required leading to extended track distance and increased fuel burn to deconflict the arrival structures. However, this location aligns with network traffic flows, so potential inefficiencies could be negligible. Overall, it could maintain fuel burn compared with the baseline for all LTMA traffic – commercial and GA.	
Commercial Airlines	Training Costs
Flight procedures change worldwide with each AIRAC cycle and operators would update their procedures accordingly, training staff if required. This option is not anticipated to impose additional training cost impacts for operators.	
Commercial Airlines	Other Costs
No other operator costs are foreseen.	
Airport / ANSP	Infrastructure Costs
This design option is not expected to change airport or ANSP infrastructure impacts, beyond the initial deployment phase which will require some systems engineering adjustments.	
Airport / ANSP	Operational Costs
This design option is not expected to change airport or ANSP operational cost impacts.	
Airport / ANSP	Deployment Costs
At this stage it is disproportionate to attempt to quantify deployment costs per design option. However, a large LTMA system change would involve training a large number of controllers and assistants via the use of various air traffic simulators (including sim prep, management, and staffing), with additional system engineering costs.	
AMS	Performance against the vision and parameters/strategic objectives of the AMS
• Safety: this option maintains safety • Simplification: Could improve delay absorption, maintain airport capacity, maintain network capacity, and maintain ATCO workload. Could worsen disruption recovery. Will utilise aircraft performance capabilities • Integration of diverse users: continues to integrate defence and security and GA, subject to constraints of the design • Environmental sustainability: could maintain CO_2 emissions	

Qualitative Safety Assessment
A high-level safety appraisal for this proposed option indicates that an inner hold to the east would at least maintain current safety performance. There are multiple holds within current UK airspace which have a proven safety performance. An arrival structure in this location would need to deconflict with other Biggin Hill and London City arrival traffic.
Conclusion from IOA
Compared to the baseline, this option could improve delay absorption and could maintain delay absorption, fuel burn, CO_2 emissions, airport capacity, network capacity, and ATCO workload. The negative impact on transiting GA traffic may be worse than the baseline. Therefore, MC – IH – E is progressed to Stage 3 for further development.

Table 15 MC-IH-E Initial Options Appraisal

<table>
<tr><th>MC – IH - SE Qualitative Initial Impacts Assessment</th><th>PROGRESSED</th></tr>
<tr><th>Group</th><th>Impact</th></tr>
<tr><td>Communities</td><td>Noise impact on health and quality of life</td></tr>
<tr><td colspan="2">ANG (2017) states “at or above 7,000ft…minimising of noise is no longer a priority”. CAP1616 instructs sponsors to consider noise and tranquillity impacts where the proposal has the potential to change overflight of inhabited areas, AONBs and NPs below 7,000ft. In this network-level proposal, changes would not occur below 7,000ft therefore these impacts are not considered.</td></tr>
<tr><td>Communities</td><td>Air Quality</td></tr>
<tr><td colspan="2">ANG (2017) states “emissions from aircraft above 1,000ft are unlikely to have a significant impact on local air quality”. Changes would occur at or above 7,000ft, thus in accordance with ANG (2017) there would be no change in local air quality impacts.</td></tr>
<tr><td>Wider Society</td><td>Greenhouse Gas Impacts</td></tr>
<tr><td colspan="2">This design option is an optimised version of today which will involve holding at higher levels (above 7,000ft) and orientated optimally for airport and network traffic flows. Overall, it could reduce GHG emissions through improved aircraft trajectories compared with the baseline.</td></tr>
<tr><td>Wider Society</td><td>Capacity / Resilience</td></tr>
<tr><td colspan="2">Capacity: This option could maintain airport capacity, providing the same number of holds as the baseline below 7,000ft. This location aligns with network traffic flows so could maintain network capacity compared with the baseline. Other non-airspace constraints may hinder overall capacity and economic gains at Southend.
Resilience: Holds within the network will be higher up and therefore slightly further from the runway than the baseline, as holds are currently below 7,000ft. However, this should have negligible impact on disruption recovery. This option could increase the number of holding levels, therefore it could increase delay absorption compared with the baseline.</td></tr>
<tr><td>General Aviation (GA)</td><td>Access</td></tr>
<tr><td colspan="2">A holding facility to the southeast would likely be within current day CAS. As a result, the access impact on GA traffic is unlikely to change compared with the baseline.</td></tr>
<tr><td>GA/Commercial Airlines</td><td>Economic Impact from Increased Effective Capacity</td></tr>
<tr><td colspan="2">Aligns with network traffic flows, which could enable capacity gains across the LTMA from an improved network design. A holding facility above 7,000ft could enable more flights to operate, which is expected to provide an economic benefit over the baseline for commercial traffic; however, other non-airspace constraints may hinder overall capacity and economic gains at Southend. The additional required airspace to deconflict arrival structures could create negative economic impacts for all LTMA traffic from extended track mileage. This could negatively impact all LTMA traffic – commercial and GA.</td></tr>
<tr><td>GA/Commercial Airlines</td><td>Fuel Burn</td></tr>
<tr><td colspan="2">This design option is an optimised version of today which will involve holding at higher levels (above 7,000ft) and orientating optimally for airport and network traffic flows. However, a new holding facility could create network inefficiencies, with additional airspace required leading to extended track distance and increased fuel burn to deconflict the arrival structures. This location aligns with network traffic flows, so potential inefficiencies could be negligible. Overall, it could reduce fuel burn through improved aircraft trajectories compared with the baseline. This could positively impact all LTMA traffic – commercial and GA.</td></tr>
<tr><td>Commercial Airlines</td><td>Training Costs</td></tr>
<tr><td colspan="2">Flight procedures change worldwide with each AIRAC cycle and operators would update their procedures accordingly, training staff if required. This option is not anticipated to impose additional training cost impacts for operators.</td></tr>
<tr><td>Commercial Airlines</td><td>Other Costs</td></tr>
<tr><td colspan="2">No other operator costs are foreseen.</td></tr>
<tr><td>Airport / ANSP</td><td>Infrastructure Costs</td></tr>
<tr><td colspan="2">This design option is not expected to change airport or ANSP infrastructure impacts, beyond the initial deployment phase which will require some systems engineering adjustments.</td></tr>
<tr><td>Airport / ANSP</td><td>Operational Costs</td></tr>
<tr><td colspan="2">This design option is not expected to change airport or ANSP operational cost impacts.</td></tr>
<tr><td>Airport / ANSP</td><td>Deployment Costs</td></tr>
<tr><td colspan="2">At this stage it is disproportionate to attempt to quantify deployment costs per design option. However, a large LTMA system change would involve training a large number of controllers and assistants via the use of various air traffic simulators (including sim prep, management, and staffing), with additional system engineering costs.</td></tr>
<tr><td>AMS</td><td>Performance against the vision and parameters/strategic objectives of the AMS</td></tr>
<tr><td colspan="2">• Safety: maintained
• Simplification: could improve delay absorption, maintain disruption recovery, maintain airport capacity, and maintain network capacity. Could worsen ATCO workload. Will utilise aircraft performance capabilities
• Integration of diverse users: continues to integrate defence and security and GA, subject to constraints of the design
• Environmental sustainability: could reduce CO_2 emissions</td></tr>
</table>

Qualitative Safety Assessment
A high-level safety appraisal for this proposed option indicates that an inner hold to the southeast would at least maintain current safety performance. There are multiple holds within current UK airspace which have a proven safety performance. An arrival structure in this location would need to deconflict with all Biggin Hill and London City traffic as well as Heathrow departures. It would also add complexity to an already complex area, resulting in increased ATCO workload.
Conclusion from IOA
Compared to the baseline, this option could improve delay absorption, fuel burn, and CO_2 emissions. It would maintain safety and any current MoD access. It could maintain airport capacity and network capacity. The negative impact on transiting GA traffic and ATCO workload may be worse than the baseline. Therefore, MC – IH – SE is progressed to Stage 3 for further development.

Table 16 MC-IH-SE Initial Options Appraisal

4. Step 2B Conclusion and Next Steps

4.1.1 There is not yet enough detailed quantified data to make a statement on preferred option(s). Compromises and trade-offs may be necessary between airports taking part in the FASI regional airspace change. Appropriate quantitative assessments and trade-offs will be carried out as part of Stage 3 to allow a preferred option to be selected prior to consultation.

4.1.2 This table provides a summary of design option concepts for Southend, showing how the number of design options has changed through the design development stages as described above.

Module	Initial Long List	Comprehensive List	Progress to IOA	Progress to Stage 3
Southend	15	8	4	4

Table 17 Count of Design Option Concepts for each module through option development stages

4.1.3 These shortlisted options have been carried forward to Stage 3:

Southend Option Concepts progressed to Stage 3
'Do Nothing'
Inner Holds – Northeast
Inner Holds – East
Inner Holds - Southeast

Table 18 Summary of design options progressed to Stage 3

5. APPENDIX 1: Arrival Structure Concepts

5.1.1 Arrival structure types identified as being viable options for potential airspace designs across the LTMA airports:

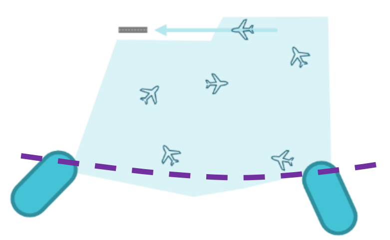
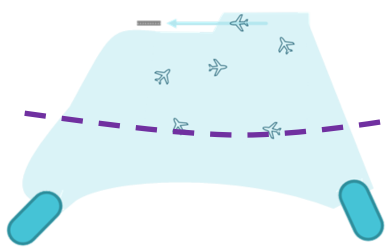
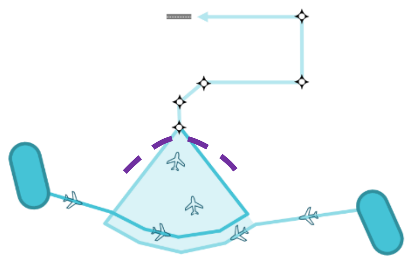
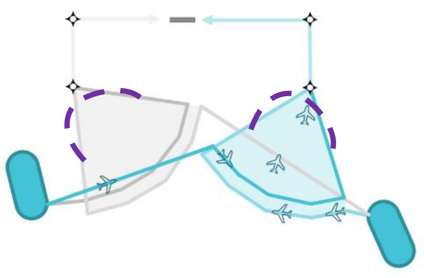
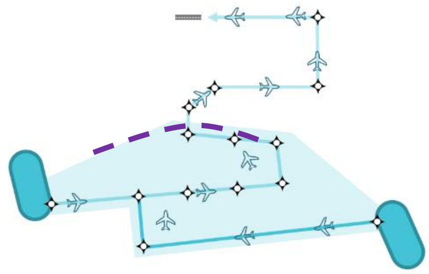
Structure	Diagram	Description
Optimised[5] Holds Illustration of network/airport boundary (indicative c.7,000ft)		A holding pattern is used to delay aircraft from landing, in a vertically separated stack. ATC control entry to, and exit from, the stack; and aircraft are vectored to the runway or may use a transition. Linked with either a traditional Radar Manoeuvring Area (RMA) or Transitions. This design is for holds within c.30nm of the airport.
Holds Further Out Illustration of network/airport boundary (indicative c.7,000ft)		As above but would typically be higher. This design is for holds c.30nm-60nm from the airport.
Point Merge Illustration of network/airport boundary (indicative c.7,000ft)		Point merge (PM) is a systemised method for sequencing arrival flows, allowing controllers to sequence and merge arrivals without vectoring, whilst enabling continuous descent operations and maintaining runway throughput. This design has a fixed location regarding the merge legs and merge point.
Switch Merge Illustration of network/airport boundary (indicative c.7,000ft)		SM is a concept not currently in UK operation, whereby two separate PM structures exist within a given airspace volume to serve different runway directions for the same airport. The merge legs and merge point (the tip of each triangle) is angled to favour the runway in use, but only one of the merge structures is in operation at any time; they are 'switched' when the runway direction changes. The holds do not change.
Trombone Illustration of network/airport boundary (indicative c.7,000ft)		A 'snake-like' PBN transition which can be closed (fixed) which aircraft must fly; or open, whereby tactical flexibility is retained with defined short cuts.

Figure 5 Arrival structure concepts (at and above 7,000ft)

End of document

[5] See paragraph 2.2.10 of Master document for explanation of 'Optimised'