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ACP-2015-09

Gateway documentation:

Stage 2 Develop and Assess

Step 2b Options Appraisal (Phase 1 Initial) Including Safety Considerations Addendum

V1.0

Roles

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References

Ref No	**Description**	**Hyperlinks**
1.	FASIN-LJLA– progress through CAP1616	Link
2.	Stage 1: Statement of Need	Link
3.	Stage 1: Design Principles Report	Link
4.	Stage 2: Step 2ai- Options Development	Link
5.	Stage 2: Step 2aii- Design Principle Evaluation	Link
6.	Stage 2: Step 2ai and Step 2aii Design Options and Evaluation Addendum	Link
7.	Stage 2: Initial Options Appraisal including Safety Appraisal	Link
8.	CAP1616: CAA Guidance on the regulatory process for changing the notified airspace design and planned and permanent redistribution of air traffic, and on providing airspace information	Link
9.	CAA Airspace Modernisation Strategy (CAP1711)	Link

Contents

1. Introduction

This ADDENDUM should be read in conjunction with the following documents describing the additional options for consideration as well as the previous Stage 2 submission documents:

- Previously Approved Step 2ai- Options Development (Ref 4)
- Previously Approved Step 2aii- Design Principle Evaluation (Ref 5)
- Previously Approved Step 2b- Initial Options Appraisal including Safety Appraisal (Ref 7)
- Step 2ai and 2aii- Design Options and Evaluation Addendum (Ref 6)

2. About this document

This Addendum is titled Step 2b Options Appraisal (Phase 1 Initial) Including Safety Considerations Addendum. Its objective is to qualitatively appraise the indicative airspace design options progressed[1] at Step 2A(ii) in relation to an expected set of impacts[2] on listed audience groups, and includes an assessment of the baseline do-nothing option, even though this was discounted at Step 2A(ii).

It also provides brief, plain English safety statements. The options described herein are early indicative design options that will be further refined and coordinated with adjacent ANSPs in the next stage of the process.

The evidence supplied is qualitative and high level, the assessment criteria based on the opinions of subject matter experts, feedback derived from stakeholders and the evolving design work.

At this stage in the process, it would be disproportionate to assess every possible permutation of which route works with which other route, therefore each option is therefore assessed in isolation. Combining these options with those described previously into systems has the potential to mitigate overall noise impacts to a greater extent than assessed individually here, by providing respite and/or managed dispersal. These combined systems of individual routes would be developed under Stage 3 in collaboration with the sponsors of neighbouring airspace changes, their impacts analysed and described as part of the formal consultation.

This assessment compares design options with a 'frozen in time' baseline do-nothing option. The comparison only considers changes related to airspace design differences between the baseline and the option, and not external changes. For example, potential new housing or industrial developments may change community impacts over time for the baseline design and one (or more) of the design options; those potential future impacts are not considered at this stage.

This Stage 2 addendum documentation and supporting material, were submitted to the CAA in August 2023 for their consideration at the CAA Gateway Assessment on Friday 29th September 2023.

All published documents for all stages of the process can be found in the public CAA's Airspace Change portal (Link to the page for this proposal).

Note on biodiversity impacts: Airspace changes are unlikely to have an impact on biodiversity because they do not normally involve changes to ground based infrastructure[3] (habitat disturbance). None of our DPs mention the subject. No such ground based infrastructure changes are associated with this proposal, therefore this proposal is not predicted to impact biodiversity.

Note on baseline context[4]: This assessment compares design options with a 'frozen in time' baseline do-nothing option. The comparison only considers changes related to airspace design differences between the baseline and the option, and not external changes. For example, potential new housing or industrial developments may change community impacts over time for the baseline design and one (or more) of the design options; those potential future impacts are not considered at this stage.

[1] Design options that were discounted at Step 2a(ii) are not appraised here.
[2] CAP1616 Edn 4 Appendix E Table E2
[3] CAP1616 Edn 4 Appendix B paragraphs B79-B80
[4] CAP1616 Edn 4 Appendix E paragraph E22

3. Assessment criteria summary

The table below briefly summarises LJLA's approach to the key subjects for impact assessment, with one table per design option including the baseline do-nothing option already discounted. It is based on CAP1616 Table E2.

Group	Impact	Level of Analysis
Communities	Noise impact on health and quality of life	Qualitative
A qualitative assessment of changes to noise impacts compared with the do nothing baseline based on OS map population centres. A qualitative assessment of changes to tranquillity impacts, in particular focused on overflight of National Parks, Areas of Outstanding Natural Beauty and National Scenic areas, compared to the baseline.		
Communities	Air quality	Qualitative
A qualitative assessment of changes to local air quality compared with the do-nothing baseline.		
Wider society	Greenhouse gas impact	Qualitative
A qualitative assessment of changes to greenhouse gas impacts compared with the do-nothing baseline.		
Wider society	Capacity/ resilience	Qualitative
A qualitative assessment of changes to airspace capacity and resilience compared with the do-nothing baseline.		
General Aviation (GA)	Access	Qualitative
A qualitative assessment of changes to GA access to controlled airspace compared with the do-nothing baseline.		
General Aviation / commercial airlines	Economic impact from increased effective capacity	Qualitative
A qualitative assessment of changes to GA and commercial airline economic impacts from increased effective capacity compared with the do-nothing baseline.		
General Aviation / commercial airlines	Fuel burn	Qualitative
A qualitative assessment of changes to GA and commercial airline fuel burn compared with the do-nothing baseline.		
Commercial airlines	Training cost	Qualitative
A qualitative assessment of changes to commercial airline training costs compared with the do-nothing baseline.		
Commercial airlines	Other costs	Qualitative
A qualitative assessment of changes to other relevant commercial airline costs compared with the do-nothing baseline.		
Airport/ Air navigation service provider	Infrastructure costs	Qualitative
A qualitative assessment of changes to ANSP infrastructure costs compared with the do-nothing baseline.		
Airport/ Air navigation service provider	Operational costs	Qualitative
A qualitative assessment of changes to ANSP operational costs compared with the do-nothing baseline.		
Airport/ Air navigation service provider	Deployment costs	Qualitative
A qualitative assessment of ANSP deployment costs compared with the do-nothing baseline.		

Table 1: Options Appraisal (CAP1616 Table E2), Assessment criteria

4. Design Options

4.1. Option 0: Do Nothing (Baseline)

As this is an addendum that supplements the previously approved document set and to remain consistent with the original submission which provided a single IOA for the airport baseline system. The baseline assessment has not been reassessed and has been presented in a new format below for comparison purposes (Ref 7):

Group	Impact	Level of Analysis
Communities	Noise impact on health and quality of life	Qualitative
The tracks flown by aircraft using conventional procedures are less predictable; the exact route taken relies on the pilot interpreting ground-based beacon information and therefore the procedures as published often do not represent actual tracks flown and instead, aircraft are spread out over a wider area. Height restrictions (4,000 ft or below) to deconflict traffic from Manchester Airport traffic means that aircraft can spend extended time in level flight; are unable to fly with optimum power settings potentially creating more noise. ATC vectoring is required between the airways and the approach (no transition) which does not offer minimal track miles or optimum engine performance (more people exposed to noise). No current procedures overfly any Areas of Outstanding Natural Beauty, National Parks, National Scenic Areas below 7,000 ft and hence have no tranquillity impacts.		
Communities	Air quality	Qualitative
Government guidance **(ANG2017)** states that aircraft flying higher than 1,000 ft are unlikely to have a significant impact on local air quality. No changes in air quality impacts are predicted under this design option (route would be entirely above 1,000 ft).		
Wider society	Greenhouse gas impact	Qualitative
Extant procedures do not support optimum performance of aircraft and therefore predicted to have a greater environmental impact compared to proposed options; routes unpredictable in length; continuous climb/descent not supported, extended periods of level flight; radar vectoring to join airways; height restrictions and clearance delays - all contributing to higher engine settings/more track miles and greater emissions.		
Wider society	Capacity/ resilience	Qualitative
Maintaining extant procedures would maintain current capacity however resilience would be significantly affected. LJLA would fail to meet regulatory requirements, and would fail to meet the airspace modernisation priorities including coordination with FASI-N		
General Aviation (GA)	Access	Qualitative
No change to existing airspace arrangements. GA users of LJLA will continue to arrive and depart under extant operational arrangements.		
General Aviation / commercial airlines	Economic impact from increased effective capacity	Qualitative
No increase to effective capacity anticipated for continued use of extant procedure, therefore no economic benefit for GA/airlines.		
General Aviation / commercial airlines	Fuel burn	Qualitative
Fuel burn predicted to be greater (and less predictable) for conventional procedures due to height restrictions and clearance delays; potential extended track miles in level flight; tactical ATC intervention; continuous climb/descent unsupported; exact route depends on pilot/onboard system interpretation of navigation equipment.		
Commercial airlines	Training cost	Qualitative
No additional training predicted.		
Commercial airlines	Other costs	Qualitative
It is not proportionate for LJLA to assess potential other costs for commercial airlines - there may be costs associated with maintaining legacy systems to continue flying conventional navigation but there are too many variables (e.g. aircraft types, on-board system capability etc.) to consider these effectively.		

Airport/ Air navigation service provider	Infrastructure costs	Qualitative
Existing infrastructure is subject to rationalisation programme - no additional infrastructure is required to maintain extant conventional procedures however maintaining access to ground-based equipment may be prohibitively expensive. Note that the GNSS approaches would also be unavailable as the missed approach references the ground-based infrastructure.		
Airport/ Air navigation service provider	Operational costs	Qualitative
No change to operational costs are attributable to maintaining the extant procedures except possibly in the case of infrastructure (see above).		
Airport/ Air navigation service provider	Deployment costs	Qualitative
If the baseline was retained, there would be no deployment, hence no associated costs. However, if the existing procedures are not replicated/replaced with PBN routes, LJLA will be required to undertake a separate ACP to align with the NATS DVOR rationalisation program of work.		

Table 2: Options Appraisal (CAP1616 Table E2), LJLA Baseline

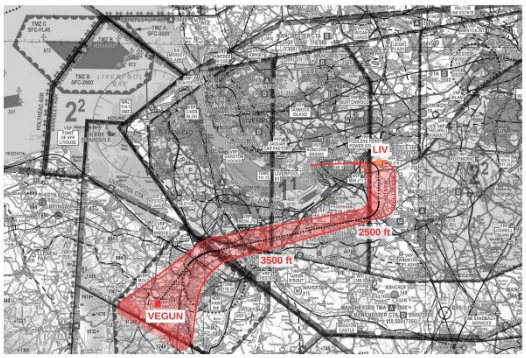
Qualitative Assessment of Design Option against Strategic Objectives of the AMS

The baseline is not a modernised option and therefore does not meet the Strategic Objectives of the AMS.

Qualitative Safety Statement

The baseline assumption is that current operations at LJLA are safe including use of the extant conventional and GNSS/RNAV procedures.

4.2. Transition Option 1: VEGUN S1



Group	Impact	Level of Analysis
Communities	Noise impact on health and quality of life	Qualitative
Aircraft arriving at LJLA, runway 27, from the southern hold are currently vectored towards the final approach fix (FAF), ~8 NM on the extended centreline from the 27 threshold. This leads to a natural dispersion of tracks over the ground overflying a large population. The introduction of a PBN transition between the holding fix (hold location) and final approach will lead to predictable tracks avoiding Chester City centre to the north and the following previously overflown towns of Buckley, Shotton, Aston and Garden City. This should lead to a reduced population overflown, albeit more often. Currently, aircraft are descended early leading to a prolonged period of level flight, typically at 2,000 ft. The proposed design seeks to smooth the descent, keeping aircraft higher for longer reducing the noise impact to stakeholders on the ground. This option will share the same base leg (final track before joining the final approach) as the extant airspace although it is anticipated that following the airspace redesign aircraft will remain higher for this leg, lessening the noise impact to stakeholders below this leg as well as those underneath the start of the final approach. This option is not expected to overfly any Areas of Outstanding Natural Beauty, National Parks, National Scenic Areas below 7,000 ft and hence have no tranquillity impacts.		
Communities	Air quality	Qualitative
Government guidance (ANG2017) states that aircraft flying higher than 1,000 ft are unlikely to have a significant impact on local air quality. No changes in air quality impacts are predicted under this design option (route would be entirely above 1,000 ft).		
Wider society	Greenhouse gas impact	Qualitative
The introduction of a PBN transition that avoids overflying high population areas, such as Chester City centre offers a relatively direct route between the holding fix and final approach fix. This option will have a comparable mileage to the current operation. Aircraft are currently descended early to remain within the correct CTA causing a disbenefit to CO_2e emissions. The proposed design is expected to maintain a higher altitude for longer, improving CDO and reducing CO_2e emissions.		
Wider society	Capacity/ resilience	Qualitative
Introduction of PBN transitions will lead to greater predictability of tracks enabling improved flight planning and resilience of the network. This option has the potential to improve the effective capacity through increased predictability, however due to the current forecast movements, any additional capacity enabled by this change will not be realised when compared to the current day operation.		
General Aviation (GA)	Access	Qualitative
Currently LJLA serves a mixture of GA and commercial aircraft. Access for GA will remain unchanged from the current day operation due to this option.		
General Aviation / commercial airlines	Economic impact from increased effective capacity	Qualitative
The effective capacity at LJLA is not a constraint on the current design. Whilst this option has the potential to increase this capacity, it is unlikely there would be an economic impact resulting from this option. This option is not expected to impact GA operations at LJLA, therefore there will be no change in GA fuel burn as a result of this option.		

General Aviation / commercial airlines	Fuel burn	Qualitative
The introduction of a PBN transition that avoids overflying high population areas, such as Chester City centre offers a relatively direct route between the holding fix and final approach fix. This option will have a comparable mileage to the current operation. Aircraft are currently descended early to remain within the correct CTA causing a disbenefit to fuel burn. The proposed design is expected to maintain a higher altitude for longer, improving CDO and reducing fuel burn. This option is not expected to impact GA operations at LJLA, therefore there will be no change in GA fuel burn as a result of this option.		
Commercial airlines	Training cost	Qualitative
Flight procedures change worldwide with each AIRAC cycle and airlines would update their procedures accordingly, training if required. This option is not anticipated to impose additional training cost impacts for airlines as PBN transitions are already widely used.		
Commercial airlines	Other costs	Qualitative
There are no other airline costs foreseen.		
Airport/ Air navigation service provider	Infrastructure costs	Qualitative
This design option is not expected to change Airport or ANSP infrastructure impacts, beyond the initial deployment phase which may require some systems engineering amendments.		
Airport/ Air navigation service provider	Operational costs	Qualitative
This design option is not expected to change Airport or ANSP operational cost impacts.		
Airport/ Air navigation service provider	Infrastructure costs	Qualitative
At this stage it is disproportionate to quantify deployment costs per design option as they would be used in arrival, departure, and runway permutations not yet detailed. However, a system change for LJLA would involve training c.25 controllers and c.10 assistants via the use of various air traffic simulators (including sim prep, management and staffing), with additional engineering costs.		

Table 3: Options Appraisal (CAP1616 Table E2), LJLA VEGUN S1

Qualitative Assessment of Design Option against Strategic Objectives of the AMS

Safety: Enhanced

Integration of diverse users, including defence: Increased use of PBN will lead to more predictable tracks requiring potentially less airspace. This will maintain or improve access to the airspace for all users.

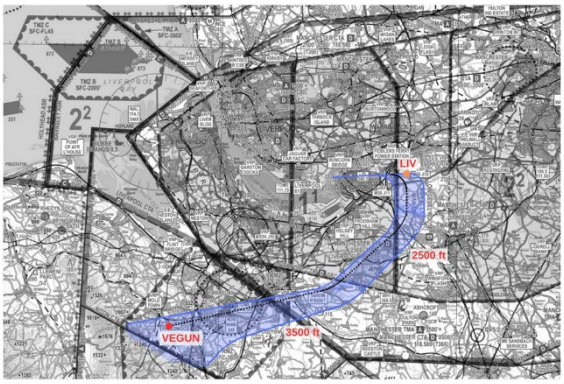
Simplification and complexity: Use of PBN transitions leads to improved track keeping and predictability, reducing ATCO and Cockpit workload.

Environmental sustainability: Improved CDO, keeping the aircraft higher for longer reduces fuel burn, CO_2 emissions of flights as well as reducing the population overflown.

Qualitative Safety Statement

The proposed swathe would require deconfliction from the LJLA departure routes to the south as well as any new departure routes that wrap around the southern edge of the airport. Runway 27 Arrivals may conflict with Manchester runway 23L/R departures and/or runway 05L/R arrivals however the inclusion of a shorter base leg and consideration of a revised IAF (aircraft require a period of stable flight prior to landing and LJLA is already close to this threshold), and altitude restrictions limit this interaction. As design work continues these interactions should be resolved through the inclusion of vertical constraints on the procedures where required. The levels shown are indicative and will be revised to provide separation and maximum benefit to stakeholders located below the flightpaths.

4.3. Transition Option 2: VEGUN S2



Group	Impact	Level of Analysis
Communities	Noise impact on health and quality of life	Qualitative
Aircraft when arriving at LJLA, runway 27, from the southern hold are currently vectored towards the final approach fix (FAF), ~8 NM on the extended centreline from the 27 threshold. This leads to a natural dispersion of tracks over the ground and a large population overflown. The introduction of a PBN transition between the holding fix (hold location) and final approach will lead to predictable tracks avoiding Chester City centre to the south. This should lead to a smaller population overflown, albeit more often. Currently, aircraft are descended early leading to a prolonged period of level flight, typically at 2,000 ft. The proposed design seeks to smooth the descent, keeping aircraft higher for longer reducing the noise impact to stakeholders on the ground. This option will share the same base leg (final track before joining the final approach) as the extant airspace although it is anticipated that following the airspace redesign aircraft will remain higher for this leg, lessening the noise impact to stakeholders below this leg as well as those underneath the start of the final approach. This option is not expected to overfly any Areas of Outstanding Natural Beauty, National Parks, National Scenic Areas below 7,000 ft and hence have no tranquillity impacts.		
Communities	Air quality	Qualitative
Government guidance (ANG2017) states that aircraft flying higher than 1,000 ft are unlikely to have a significant impact on local air quality. No changes in air quality impacts are predicted under this design option (route would be entirely above 1,000 ft).		
Wider society	Greenhouse gas impact	Qualitative
The introduction of a PBN transition that avoids overflying high population areas, such as Chester City centre offers a relatively direct route between the holding fix and final approach fix. This route will have a comparable mileage to the current operation. Aircraft are currently descended early to remain within the correct CTA causing a disbenefit to CO_2e emissions. The proposed design is expected maintain a higher altitude for longer, improving CDO and reducing CO_2e emissions.		
Wider society	Capacity/ resilience	Qualitative
Introduction of PBN transitions will lead to greater predictability of tracks enabling improved flight planning and resilience of the network. This option has the potential to improve the effective capacity through increased predictability, however due to the current forecast movements any additional capacity enabled by this change will not be realised when compared to the current day operation.		
General Aviation (GA)	Access	Qualitative
Currently LJLA serves a mixture of GA and commercial aircraft. Access for GA will remain unchanged from the current day operation due to this option.		
General Aviation / commercial airlines	Economic impact from increased effective capacity	Qualitative
The effective capacity at LJLA is not a constraint on the current design. Whilst this option has the potential to increase this capacity, it is unlikely there would be an economic impact resulting from this option. This option is not expected to impact GA operations at LJLA, therefore there will be no change in GA fuel burn as a result of this option.		

General Aviation / commercial airlines	Fuel burn	Qualitative
The introduction of a PBN transition that avoids overflying high population areas, such as Chester City centre offers a relatively direct route between the holding fix and final approach fix. This route will have a comparable mileage to the current operation. Aircraft are currently descended early to remain within the correct CTA causing a disbenefit to fuel burn. The proposed design is expected maintain a higher altitude for longer, improving CDO and reducing fuel burn. This option is not expected to impact GA operations at LJLA, therefore there will be no change in GA fuel burn as a result of this option.		
Commercial airlines	Training cost	Qualitative
Flight procedures change worldwide with each AIRAC cycle and airlines would update their procedures accordingly, training if required. This option is not anticipated to impose additional training cost impacts for airlines as PBN transitions are already widely used.		
Commercial airlines	Other costs	Qualitative
There are no other airline costs foreseen.		
Airport/ Air navigation service provider	Infrastructure costs	Qualitative
This design option is not expected to change Airport or ANSP infrastructure impacts, beyond the initial deployment phase which may require some systems engineering amendments.		
Airport/ Air navigation service provider	Operational costs	Qualitative
This design option is not expected to change Airport or ANSP operational cost impacts.		
Airport/ Air navigation service provider	Infrastructure costs	Qualitative
At this stage it is disproportionate to quantify deployment costs per design option as they would be used in arrival, departure and runway permutations not yet detailed. However, a system change for LJLA would involve training c.25 controllers and c.10 assistants via the use of various air traffic simulators (including sim prep, management and staffing), with additional engineering costs.		

Table 4: Options Appraisal (CAP1616 Table E2), LJLA VEGUN S2

Qualitative Assessment of Design Option against Strategic Objectives of the AMS

Safety: Enhanced

Integration of diverse users, including defence: Increased use of PBN will lead to more predictable tracks requiring potentially less airspace. This will maintain or improve access to the airspace for all users.

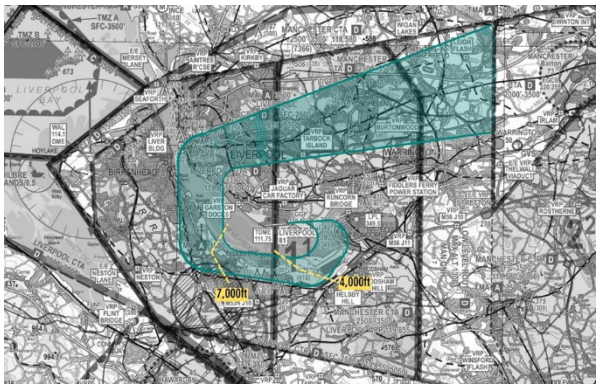
Simplification and complexity: Use of PBN transitions leads to improved track keeping and predictability, reducing ATCO and Cockpit workload.

Environmental sustainability: Improved CDO, keeping the aircraft higher for longer reduces fuel burn, CO_2 emissions of flights as well as reducing the population overflown.

Qualitative Safety Statement

The proposed swathe would require deconfliction from the LJLA departure routes to the south as well as any new departure routes that wrap around the southern edge of the airport. Runway 27 Arrivals may conflict with Manchester runway 23L/R departures and/or runway 05L/R arrivals however the inclusion of a kink to a shorter base leg and consideration of a revised IAF (aircraft require a period of stable flight prior to landing, LJLA is already close to this threshold), and altitude restrictions limit this interaction. As design work continues these interactions should be resolved through the inclusion of vertical constraints on the procedures where required. The planned altitudes shown are indicative and will be revised to provide separation and maximum benefit to stakeholders located below the flightpaths.

4.4. SID Option 1: 09 Departure Right Turn to Northeast



Group	Impact	Level of Analysis
Communities	Noise impact on health and quality of life	Qualitative
In line with LJLA noise abatement procedures, aircraft departing LJLA runway 09 are unable to turn off the extended centre line before Hale. As such, like the extant runway 09 departure routes, all proposed runway 09 departure options will encompass Hale and Hale Primary school, ~ 1.5 NM from the end of the runway, within their overflight cones[5]. On departing LJLA, this option will turn right as early as possible to minimise overflight of this area. This first right turn is a continuation of the extant REXAM 2V and/or NANTI 2V SIDs right turn, reducing the population overflown by keeping the departure routes to the west of Runcorn and north of Frodsham and Helsby population centres, overhead the river and/or industrial areas. The track continues over the Ellesmere Port industrial areas south of the River Mersey before turning east overhead Liverpool. The right turn departure limits the interaction with other traffic flows enabling an improved continuous climb profile. This climb gradient should be further benefited by selecting the optimal SID end point level to integrate with the en-route network design. This will further reduce the noise impact. Assuming a CCO, aircraft are expected to be more than 7,000 ft before turning over Liverpool City centre when using this option. This option is not expected to overfly any Areas of Outstanding Natural Beauty, National Parks, National Scenic Areas below 7,000 ft and hence have no tranquillity impacts.		
Communities	Air quality	Qualitative
Government guidance (ANG2017) states that aircraft flying higher than 1,000 ft are unlikely to have a significant impact on local air quality. No changes in air quality impacts are predicted under this design option as aircraft are expected to follow existing tracks until above 1,000 ft.		
Wider society	Greenhouse gas impact	Qualitative
Currently, LJLA runway 09 departures to the northeast fly a POL 5V or BARTN 1V SID which is a left turn departure route. This option proposed a right turn departure route and has been designed to be flown in a clockwise direction around LJLA to enable aircraft to obtain the SID end level with minimal interaction with other tracks before joining the network. This option is therefore substantially longer than what is currently flown and is likely to increase greenhouse gas emissions albeit partially offset by the improved climb profile resulting from a raised SID end level.		
Wider society	Capacity/ resilience	Qualitative
Introduction of new PBN SID to the northeast will lead to greater predictability of tracks enabling improved flight planning and resilience of the network. This option limits the interaction with other tracks leading to an improved effective capacity through increased predictability. However due to the forecast movements any additional capacity enabled by this change will not be realised when compared to the current day operation.		
General Aviation (GA)	Access	Qualitative
Currently LJLA serves a mixture of GA and commercial aircraft. Access for GA will remain unchanged from the current day operation due to this option.		

[5] The CAA defines overflight in CAP1498 as *An aircraft in flight passing an observer at an elevation angle that is greater than an agreed threshold and at an altitude below 7,000 ft.* This definition identifies that the area impacted by an aircraft's noise is proportional to its height and can be represented by an inverted cone with the aircraft at the tip and the area impacted the base.

General Aviation / commercial airlines	Economic impact from increased effective capacity	Qualitative
The effective capacity at LJLA is not a constraint on the current design. Whilst this option has the potential to increase this capacity, it is unlikely there would be an economic impact resulting from this option. This option is not expected to impact GA operations at LJLA, therefore there will be no change in GA fuel burn as a result of this option.		
General Aviation / commercial airlines	Fuel burn	Qualitative
Currently, LJLA runway 09 departures to the northeast fly a POL 5V or BARTN 1V SID which is a left turn departure route. This procedure is a right turn departure route and has been designed to be flown in a clockwise direction around LJLA to enable aircraft to obtain the SID end level with minimal interaction with other tracks before joining the network. This option is therefore substantially longer than what is currently flown and is likely to increase greenhouse gas emissions albeit partially offset by the improved climb profile resulting from a raised SID end level. This option is not expected to impact GA operations at LJLA, therefore there will be no change in GA fuel burn as a result of this option.		
Commercial airlines	Training cost	Qualitative
Flight procedures change worldwide with each AIRAC cycle and airlines would update their procedures accordingly, training if required. This option is not anticipated to impose additional training cost impacts for airlines as SIDs are already widely used.		
Commercial airlines	Other costs	Qualitative
There are no other airline costs foreseen.		
Airport/ Air navigation service provider	Infrastructure costs	Qualitative
This design option is not expected to change Airport or ANSP infrastructure impacts, beyond the initial deployment phase which may require some systems engineering amendments.		
Airport/ Air navigation service provider	Operational costs	Qualitative
This design option is not expected to change Airport or ANSP operational cost impacts.		
Airport/ Air navigation service provider	Infrastructure costs	Qualitative
At this stage it is disproportionate to quantify deployment costs per design option as they would be used in arrival, departure and runway permutations not yet detailed. However, a system change for LJLA would involve training c.25 controllers and c.10 assistants via the use of various air traffic simulators (including sim prep, management and staffing), with additional engineering costs.		

Table 5: Options Appraisal (CAP1616 Table E2), SID Option 1- 09 Departure, Right Turn to NE

Qualitative Assessment of Design Option against Strategic Objectives of the AMS

Safety: Enhanced

Integration of diverse users, including defence: Increased use of PBN will lead to more predictable tracks requiring potentially less airspace. This will maintain or improve access to the airspace for all users.

Simplification and complexity: Use of PBN transitions leads to improved track keeping and predictability, reducing ATCO and Cockpit workload.

Environmental sustainability: Improved CCO, and raising the SID end point reduces fuel burn, CO_2 emissions and reduces the population overflown the noise impacts of flights using the PBN departure route. However, the wrap around nature of this option increases the track mileage and fuel burn and CO_2 emissions.

Qualitative Safety Statement

This option is not anticipated to interact with traffic departing or arriving other aerodromes before joining the network although this will need to be confirmed following the refinement of the option during the Stage 3 development work prior to the stage 3 gateway. This option will need deconflicting against LJLA arrivals as well as LJLA departures which have departed with a left turn to the West or South. The planned altitudes shown are indicative and may be revised to ensure they are achievable, provide separation from other procedures whilst maximising the benefit to stakeholders located below the flightpaths.

4.5. SID Option 2: 09 Departure Left Turn to Northeast

Group	Impact	Level of Analysis
Communities	Noise impact on health and quality of life	Qualitative
In line with LJLA noise abatement procedures, aircraft departing LJLA runway 09 are unable to turn off the extended centre line before Hale. As such, like the extant runway 09 departure routes, all proposed runway 09 departure options will encompass Hale and Hale Primary school, ~ 1.5 NM from the end of the runway, within their overflight cones. On departing LJLA, this option will turn left as early as possible to minimise this overflight. This initial left turn is similar to the extant BARTN 1V, POL 5V and WAL 2V departures. However, this option seeks to keep the tracks further west of Widnes to reduce the population overflown before turning to the east and following the M62. Whilst this option is expected to reduce the total population overflown, the final track may newly overfly residents in Rainhill and Clock Face, should the design be aligned with the northern edge of the swathe. This option is expected to interact with the Manchester traffic and may require a planned level period of flight to deconflict tracks increasing the noise impact. The current SID end point is 4,000 ft, however this redesign plans to raise the level of the SID end point. This will lead to aircraft achieving a greater altitude sooner, thus leading to a reduced noise impact. However, due to the reduced distance when compared to the right turn departure, there may be an increase in noise due to the requirement for aircraft to use an increased engine setting in order to achieve the required SID end point. This option is not expected to overfly any Areas of Outstanding Natural Beauty, National Parks, National Scenic Areas below 7,000 ft and hence have no tranquillity impacts.		
Communities	Air quality	Qualitative
Government guidance (ANG2017) states that aircraft flying higher than 1,000 ft are unlikely to have a significant impact on local air quality. No changes in air quality impacts are predicted under this design option as aircraft are expected to follow existing tracks until above 1,000 ft.		
Wider society	Greenhouse gas impact	Qualitative
Current departures to the NE route using a POL 5V or BARTN 1V which is a left turn departure route. This procedure is comparable in length to the existing routes and represents the shortest route to the network whilst minimising population overflight. Whilst this option may require a planned level period of flight to deconflict the route from neighbouring traffic flows and increased engine settings to achieve the required climb gradient, the raised SID end levels should enable improved climb profiles which will reduce greenhouse gas emissions.		
Wider society	Capacity/ resilience	Qualitative
Introduction of new PBN SID to the NE will lead to greater predictability of tracks enabling improved flight planning. However, this route is likely to interact with neighbouring traffic requiring deconfliction, either planned or tactical. This may in turn reduce the resilience of the design. This option is likely to have comparable interactions to today's operation and therefore will offer no improved effective capacity.		
General Aviation (GA)	Access	Qualitative
Currently LJLA serves a mixture of GA and commercial aircraft. Access for GA will remain unchanged from the current day operation due to this option.		

General Aviation / commercial airlines	Economic impact from increased effective capacity	Qualitative
The effective capacity at LJLA is not a constraint on the current design. This option is unlikely to deliver any increase in capacity, it is unlikely there would be an economic impact resulting from this option. This option is not expected to impact GA operations at LJLA, therefore there will be no change in GA fuel burn as a result of this option.		
General Aviation / commercial airlines	Fuel burn	Qualitative
Current departures to the NE route using a POL 5V or BARTN 1V which is a left turn departure route. This procedure is comparable in length to the existing routes and represents the shortest route to the network whilst minimising population overflight. Whilst this option may require a planned level period of flight to deconflict the route from neighbouring traffic flows and increased engine settings to achieve the required climb gradient, improved SID end levels should enable improved climb profiles which will reduce fuel burn. This option is not expected to impact GA operations at LJLA, therefore there will be no change in GA fuel burn as a result of this option		
Commercial airlines	Training cost	Qualitative
Flight procedures change worldwide with each AIRAC cycle and airlines would update their procedures accordingly, training if required. This option is not anticipated to impose additional training cost impacts for airlines as SIDs are already widely used.		
Commercial airlines	Other costs	Qualitative
There are no other airline costs foreseen.		
Airport/ Air navigation service provider	Infrastructure costs	Qualitative
This design option is not expected to change Airport or ANSP infrastructure impacts, beyond the initial deployment phase which may require some systems engineering amendments.		
Airport/ Air navigation service provider	Operational costs	Qualitative
This design option is not expected to change Airport or ANSP operational cost impacts.		
Airport/ Air navigation service provider	Infrastructure costs	Qualitative
At this stage it is disproportionate to quantify deployment costs per design option as they would be used in arrival, departure and runway permutations not yet detailed. However, a system change for LJLA would involve training c.25 controllers and c.10 assistants via the use of various air traffic simulators (including sim prep, management and staffing), with additional engineering costs.		

Table 6: Options Appraisal (CAP1616 Table E2), SID Option 2- 09 Departure, Left Turn to NE

Qualitative Assessment of Design Option against Strategic Objectives of the AMS

Safety: Enhanced

Integration of diverse users, including defence: Increased use of PBN will lead to more predictable tracks requiring potentially less airspace. This will maintain or improve access to the airspace for all users.

Simplification and complexity: Use of PBN transitions leads to improved track keeping and predictability, reducing ATCO and Cockpit workload.

Environmental sustainability: Improved CCO, and raising the SID end point reduces fuel burn, CO_2 emissions and population overflight of flights using the PBN departure route.

Qualitative Safety Statement

This option may have a potential interaction with traffic arriving at Manchester airport on either runway as well as with traffic departing Manchester airport from runway 23L/R. These interactions may require the development of a resolution, including vertical constraints on the procedures where required. This will be developed during the refinement of the option in the Stage 3 development work prior to the Stage 3 gateway. The planned altitudes shown are indicative and may be revised to ensure they are achievable, provide separation from other procedures whilst maximising the benefit to stakeholders located below the flightpaths.

4.6. SID Option 3: 09 Departure Right Turn to South

Group	Impact	Level of Analysis
Communities	Noise impact on health and quality of life	Qualitative
In line with LJLA noise abatement procedures, aircraft departing LJLA runway 09 are unable to turn off the extended centre line before Hale. As such, like the extant runway 09 departure routes, all proposed runway 09 departure options will encompass Hale and Hale Primary school, ~ 1.5 NM from the end of the runway, within their overflight cones. On departing LJLA, this option will turn right as early as possible to minimise this overflight. This initial right turn is comparable to the extant REXAM 2V and/ or NANTI 2V departure. However, the tracks are envisaged to remain riverside of Runcorn before routing between the Helsby and Elton population centres and passing overhead Hapsford. Aircraft are expected to be more than 4,000 ft by Hapsford. The track continues South over predominantly rural areas. The current SID end point is 4,000 ft, however this redesign plans to raise the level of the SID end point. This will lead to aircraft achieving a greater altitude sooner, thus leading to a reduced noise impact. This will reduce the noise impact for southbound departures. Assuming a CCO, aircraft are anticipated to be in excess of 7,000 ft by Boughton. This option is not expected to overfly any Areas of Outstanding Natural Beauty, National Parks, National Scenic Areas below 7,000 ft and hence have no tranquillity impacts.		
Communities	Air quality	Qualitative
Government guidance (ANG2017) states that aircraft flying higher than 1,000 ft are unlikely to have a significant impact on local air quality. No changes in air quality impacts are predicted under this design option as aircraft are expected to follow existing tracks until above 1,000 ft.		
Wider society	Greenhouse gas impact	Qualitative
Current departures to the South route using a REXAM 2V and/or NANTI 2V which is a right turn departure route. This option represents the shortest route to the network whilst minimising population overflight. This option is not anticipated to interact with other traffic flows and the raised SID end levels should enable improved climb profiles which will reduce greenhouse gas emissions.		
Wider society	Capacity/ resilience	Qualitative
Introduction of new PBN SID to the south will lead to greater predictability of tracks enabling improved flight planning. This route offers direct connectivity to the planned southbound ATS network and is not anticipated to require deconfliction against planned neighbouring low-level procedures. This should enable improved climb profiles and seamless integration into the network increasing capacity and resilience.		
General Aviation (GA)	Access	Qualitative
Currently LJLA serves a mixture of GA and commercial aircraft. Access for GA will remain unchanged from the current day operation due to this option.		
General Aviation / commercial airlines	Economic impact from increased effective capacity	Qualitative
The effective capacity at LJLA is not a constraint on the current design. Whilst this option has the potential to increase this capacity, it is unlikely there would be an economic impact resulting from this option. This option is not expected to impact GA operations at LJLA, therefore there will be no change in GA fuel burn as a result of this option.		

General Aviation / commercial airlines	Fuel burn	Qualitative
Current departures to the South route using a REXAM 2V and/or NANTI 2V which is a right turn departure route. This procedure comparable in length to the existing routes and represents the shortest route to the network whilst minimising population overflight. This option is not anticipated to interact with other traffic flows and the raised SID end levels should enable improved climb profiles which will reduce fuel burn. This option is not expected to impact GA operations at LJLA, therefore there will be no change in GA fuel burn as a result of this option.		
Commercial airlines	Training cost	Qualitative
Flight procedures change worldwide with each AIRAC cycle and airlines would update their procedures accordingly, training if required. This option is not anticipated to impose additional training cost impacts for airlines as SIDs are already widely used.		
Commercial airlines	Other costs	Qualitative
There are no other airline costs foreseen.		
Airport/ Air navigation service provider	Infrastructure costs	Qualitative
This design option is not expected to change Airport or ANSP infrastructure impacts, beyond the initial deployment phase which may require some systems engineering amendments.		
Airport/ Air navigation service provider	Operational costs	Qualitative
This design option is not expected to change Airport or ANSP operational cost impacts.		
Airport/ Air navigation service provider	Infrastructure costs	Qualitative
At this stage it is disproportionate to quantify deployment costs per design option as they would be used in arrival, departure and runway permutations not yet detailed. However, a system change for LJLA would involve training c.25 controllers and c.10 assistants via the use of various air traffic simulators (including sim prep, management and staffing), with additional engineering costs.		

Table 7: Options Appraisal (CAP1616 Table E2), SID Option 3- 09 Departure, Right Turn to S

Qualitative Assessment of Design Option against Strategic Objectives of the AMS

Safety: Enhanced

Integration of diverse users, including defence: Increased use of PBN will lead to more predictable tracks requiring potentially less airspace. This will maintain or improve access to the airspace for all users.

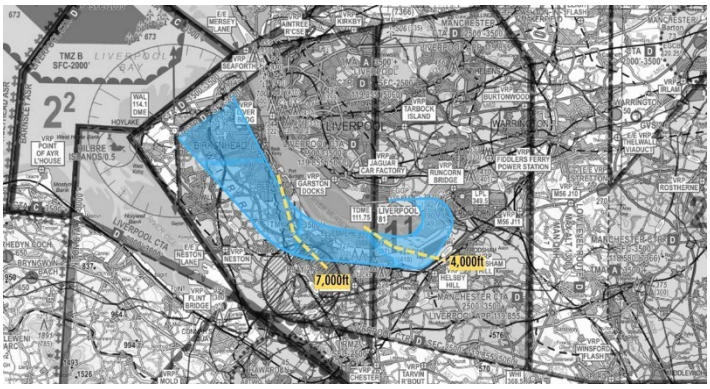
Simplification and complexity: Use of PBN transitions leads to improved track keeping and predictability, reducing ATCO and Cockpit workload.

Environmental sustainability: Improved CCO, and raising the SID end point reduces fuel burn, CO_2 emissions and population overflight of flights using the PBN departure route.

Qualitative Safety Statement

This option is not anticipated to interact with other low-level traffic. The planned altitudes shown are indicative and will be revised to ensure they are achievable, provide separation and maximise benefit to stakeholders located below the flightpaths.

4.7. SID Option 5: 09 Departure Right Turn to Northwest



Group	Impact	Level of Analysis
Communities	Noise impact on health and quality of life	Qualitative
In line with LJLA noise abatement procedures, aircraft departing LJLA runway 09 are unable to turn off the extended centre line before Hale. As such, like the extant runway 09 departure routes, all proposed runway 09 departure options will encompass Hale and Hale Primary school, ~ 1.5 NM from the end of the runway, within their overflight cones. On departing LJLA, this option will turn right as early as possible to minimise this overflight. This first right turn is a continuation of the extant REXAM 2V and/or NANTI 2V SIDs right turn, reducing the population overflown by keeping the departure routes to the west of Runcorn and north of Frodsham and Helsby population centres, overhead the river and/or industrial areas. The track continues over the Ellesmere Port industrial areas south of the River Mersey before turning northwest over Bebington and Birkenhead. The right turn departure limits the interaction with other traffic flows enabling an improved continuous climb profile. This climb gradient should be further benefited by selecting the optimal SID end point level to integrate with the en-route network design. This will further reduce the noise impact. Assuming a CCO, aircraft are expected to be more than 7000 ft before Bebington. This option is not expected to overfly any Areas of Outstanding Natural Beauty, National Parks, National Scenic Areas below 7,000 ft and hence have no tranquillity impacts.		
Communities	Air quality	Qualitative
Government guidance (ANG2017) states that aircraft flying higher than 1,000 ft are unlikely to have a significant impact on local air quality. No changes in air quality impacts are predicted under this design option as aircraft are expected to follow existing tracks until above 1,000 ft.		
Wider society	Greenhouse gas impact	Qualitative
Currently LJLA runway 09 departures to the northwest fly a WAL 2V which is a left turn departure route. This option has been designed to be flown in a clockwise direction around LJLA to enable aircraft to obtain the SID end level with minimal population overflight and interaction with other tracks before joining the network. This option is likely to be marginally longer (~3NM) than the extant procedure leading to a planned increase in greenhouse gas emissions. However, the additional greenhouse gas emissions resulting from this increased track mileage should be offset, at least partially, by the improved climb profile resulting from reduced interactions and a raised SID end level.		
Wider society	Capacity/ resilience	Qualitative
Introduction of new PBN SID to the northwest will lead to greater predictability of tracks enabling improved flight planning and resilience of the network. This option limits the interaction with other tracks leading to an improved effective capacity through increased predictability. However due to the forecast movements any additional capacity enabled by this change will not be realised when compared to the current day operation.		
General Aviation (GA)	Access	Qualitative
Currently LJLA serves a mixture of GA and commercial aircraft. Access for GA will remain unchanged from the current day operation due to this option.		

General Aviation / commercial airlines	Economic impact from increased effective capacity	Qualitative
The effective capacity at LJLA is not a constraint on the current design. Whilst this option has the potential to increase this capacity, it is unlikely there would be an economic impact resulting from this option. This option is not expected to impact GA operations at LJLA, therefore there will be no change in GA fuel burn as a result of this option.		
General Aviation / commercial airlines	Fuel burn	Qualitative
Currently LJLA runway 09 departures to the northwest fly a WAL 2V which is a left turn departure route. This procedure has been designed to be flown in a clockwise direction around LJLA to enable aircraft to obtain the SID end level with minimal population overflight and interaction with other tracks before joining the network. This option is likely to be marginally longer (~3NM) than the extant procedure leading to a predicted increase in fuel burn. However, the additional fuel burn resulting from this increased track mileage should be partially offset by the improved climb profile resulting from reduced interactions and a raised SID end level. This option is not expected to impact GA operations at LJLA, therefore there will be no change in GA fuel burn as a result of this option.		
Commercial airlines	Training cost	Qualitative
Flight procedures change worldwide with each AIRAC cycle and airlines would update their procedures accordingly, training if required. This option is not anticipated to impose additional training cost impacts for airlines as SIDs are already widely used.		
Commercial airlines	Other costs	Qualitative
There are no other airline costs foreseen.		
Airport/ Air navigation service provider	Infrastructure costs	Qualitative
This design option is not expected to change Airport or ANSP infrastructure impacts, beyond the initial deployment phase which may require some systems engineering amendments.		
Airport/ Air navigation service provider	Operational costs	Qualitative
This design option is not expected to change Airport or ANSP operational cost impacts.		
Airport/ Air navigation service provider	Infrastructure costs	Qualitative
At this stage it is disproportionate to quantify deployment costs per design option as they would be used in arrival, departure and runway permutations not yet detailed. However, a system change for LJLA would involve training c.25 controllers and c.10 assistants via the use of various air traffic simulators (including sim prep, management and staffing), with additional engineering costs.		

Table 8: Options Appraisal (CAP1616 Table E2), SID Option 5- 09 Departure, Right Turn to NW

Qualitative Assessment of Design Option against Strategic Objectives of the AMS

Safety: Enhanced

Integration of diverse users, including defence: Increased use of PBN will lead to more predictable tracks requiring potentially less airspace. This will maintain or improve access to the airspace for all users.

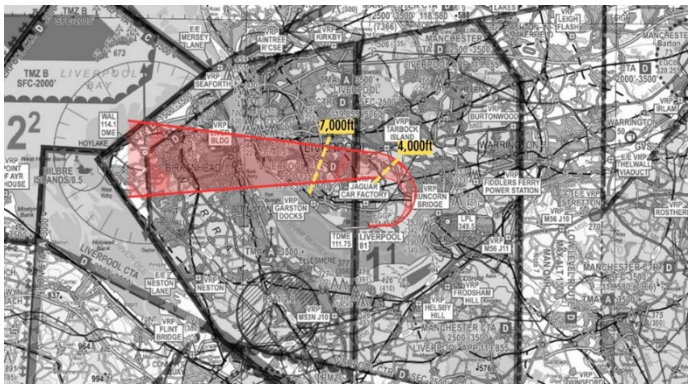
Simplification and complexity: Use of PBN transitions leads to improved track keeping and predictability, reducing ATCO and Cockpit workload.

Environmental sustainability: Improved CCO, and raising the SID end point reduces fuel burn, CO_2 emissions and reduces the population overflown the noise impacts of flights using the PBN departure route. However, the wrap around nature of this option marginally increases the track mileage and fuel burn and CO_2 emissions.

Qualitative Safety Statement

This option is likely to interact with aircraft arriving at LJLA from the south which will require the development of a resolution through the inclusion of vertical constraints on the procedures. The planned altitudes shown are indicative and may be revised to ensure they are achievable, provide separation from other procedures whilst maximising the benefit to stakeholders located below the flightpaths.

4.8. SID Option 6: 09 Departure Left Turn to West



Group	Impact	Level of Analysis
Communities	Noise impact on health and quality of life	Qualitative
In line with LJLA noise abatement procedures, aircraft departing LJLA runway 09 are unable to turn off the extended centre line before Hale. As such, like the extant runway 09 departure routes, all proposed runway 09 departure options will encompass Hale and Hale Primary school, ~ 1.5 NM from the end of the runway, within their overflight cones. On departing LJLA, this option will turn left as early as possible to minimise this overflight. This initial left turn is similar to the extant BARTN 1V and WAL 2V departures. However, this option seeks to keep the tracks further west of Widnes to reduce the population overflown before continuing towards the northwest. This option will overfly similar populations, including Netherley, Halewood, Woolton, Calderstones, Allerton and Liverpool city to the extant WAL 2V. The current SID end point is 4,000 ft, however this redesign plans to raise the level of the SID end point. This will lead to aircraft achieving a greater altitude sooner, thus reducing the noise impact for those stakeholders overflown should this SID end at 4,000 ft. This option is anticipated to reach 7,000 ft in the region of Mossley Hill, reducing the planned overflight of Liverpool at 4,000 ft. This option is not expected to overfly any Areas of Outstanding Natural Beauty, National Parks, National Scenic Areas below 7,000 ft and hence have no tranquillity impacts.		
Communities	Air quality	Qualitative
Government guidance (ANG2017) states that aircraft flying higher than 1,000 ft are unlikely to have a significant impact on local air quality. No changes in air quality impacts are predicted under this design option as aircraft are expected to follow existing tracks until above 1,000 ft.		
Wider society	Greenhouse gas impact	Qualitative
Current departures to the northwest route using a WAL 2V which is a left turn departure route. This option is comparable in length to the extant WAL 2V route and represents the shortest distance to the network. This option is not anticipated to interact with other traffic flows and therefore an improved CCO profile can be achieved through raising SID end level. This should reduce the greenhouse gas impact for aircraft departing to the northwest.		
Wider society	Capacity/ resilience	Qualitative
Introduction of new PBN SID to the northwest will lead to greater predictability of tracks enabling improved flight planning. This route offers direct connectivity to the planned ATS network and is not anticipated to require deconfliction against planned neighbouring low-level procedures. This should enable improved climb profiles and seamless integration into the network increasing capacity and resilience.		
General Aviation (GA)	Access	Qualitative
Currently LJLA serves a mixture of GA and commercial aircraft. Access for GA will remain unchanged from the current day operation due to this option.		
General Aviation / commercial airlines	Economic impact from increased effective capacity	Qualitative
The effective capacity at LJLA is not a constraint on the current design. Whilst this option has the potential to increase this capacity, it is unlikely there would be an economic impact resulting from this option. This option is not expected to impact GA operations at LJLA, therefore there will be no change in GA fuel burn as a result of this option.		

General Aviation / commercial airlines	Fuel burn	Qualitative
Current departures to the northwest route using a WAL 2V which is a left turn departure route. This option is comparable in length to the extant WAL 2V route and represents the shortest distance to the network. This option is not anticipated to interact with other traffic flows and therefore an improved CCO profile can be achieved through raising SID end level. This should reduce the total fuel burn for aircraft departing to the northwest. This option is not expected to impact GA operations at LJLA, therefore there will be no change in GA fuel burn as a result of this option.		
Commercial airlines	Training cost	Qualitative
Flight procedures change worldwide with each AIRAC cycle and airlines would update their procedures accordingly, training if required. This option is not anticipated to impose additional training cost impacts for airlines as SIDs are already widely used.		
Commercial airlines	Other costs	Qualitative
There are no other airline costs foreseen.		
Airport/ Air navigation service provider	Infrastructure costs	Qualitative
This design option is not expected to change Airport or ANSP infrastructure impacts, beyond the initial deployment phase which may require some systems engineering amendments.		
Airport/ Air navigation service provider	Operational costs	Qualitative
This design option is not expected to change Airport or ANSP operational cost impacts.		
Airport/ Air navigation service provider	Infrastructure costs	Qualitative
At this stage it is disproportionate to quantify deployment costs per design option as they would be used in arrival, departure and runway permutations not yet detailed. However, a system change for LJLA would involve training c.25 controllers and c.10 assistants via the use of various air traffic simulators (including sim prep, management and staffing), with additional engineering costs.		

Table 9: Options Appraisal (CAP1616 Table E2), SID Option 6- 09 Departure, Left Turn to NW

Qualitative Assessment of Design Option against Strategic Objectives of the AMS

Safety: Enhanced

Integration of diverse users, including defence: Increased use of PBN will lead to more predictable tracks requiring potentially less airspace. This will maintain or improve access to the airspace for all users.

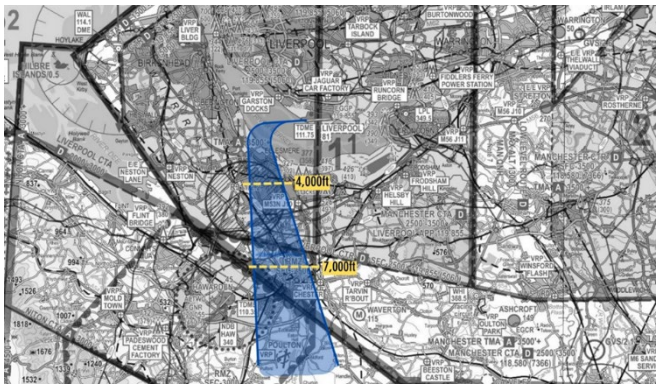
Simplification and complexity: Use of PBN transitions leads to improved track keeping and predictability, reducing ATCO and Cockpit workload.

Environmental sustainability: Improved CCO, and raising the SID end point reduces fuel burn, CO_2 emissions. However, population overflown is comparable to the extant WAL 2V departure route.

Qualitative Safety Statement

This option is likely to interact with aircraft arriving at LJLA from the north. This interaction will require the development of a resolution through the inclusion of vertical constraints on the procedures. The planned altitudes shown are indicative and may be revised to ensure they are achievable, provide separation from other procedures whilst maximising the benefit to stakeholders located below the flightpaths.

4.9. SID Option 7: 27 Departure Left Turn to South



Group	Impact	Level of Analysis
Communities	Noise impact on health and quality of life	Qualitative
Aircraft departing LJLA runway 27 to the south currently fly either a NANTI 2T or REXAM 2T which overflies the Eastham Country Park, 3.2 NM on the extended centre line after departure. The expected network design will require a southbound departure to join the network ~ halfway between the REXAM and NANTI way points, in the vicinity of the Wrexham Industrial estate. Like the extant NANTI 2T departure route, this option will turn south early overhead the River Mersey, prior to reaching the Eastham Country Park minimising this overflight before continuing south overhead the Rivacre Valley Country Park, Whitby (on the Eastern edge of the swathe) or the Capenhurst enrichment plant (on the Western edge of the swathe) before continuing over predominantly rural areas. This is the most direct route to the expected network entry point. Currently the LJLA SIDs terminate at 4,000 ft, however this redesign is likely to raise the level of the SID end point. This will lead to aircraft achieving a greater altitude sooner, thus reducing the noise impact for those stakeholders overflown should this SID end at 4,000 ft. This option is not anticipated to interact with other low-level tracks and therefore, assuming a CCO, aircraft expected anticipated to reach be 4,000 ft north of Capenhurst and 7,000 ft by Chester. This option is not expected to overfly any Areas of Outstanding Natural Beauty, National Parks, National Scenic Areas below 7,000 ft and hence have no tranquillity impacts.		
Communities	Air quality	Qualitative
Government guidance (ANG2017) states that aircraft flying higher than 1,000 ft are unlikely to have a significant impact on local air quality. No changes in air quality impacts are predicted under this design option as aircraft are expected to follow existing tracks until above 1,000 ft.		
Wider society	Greenhouse gas impact	Qualitative
Current departures to the south route using a NANTI 2T or REXAM 2T which are left turn departure routes. This procedure represents the shortest route to the network and should minimise the population overflown by keeping to the western edge of the swathe. This option is not anticipated to interact with other low level traffic flows and the raised SID end levels should enable improved climb profiles reducing greenhouse gas emissions.		
Wider society	Capacity/ resilience	Qualitative
Introduction of new PBN SID to the south will lead to greater predictability of tracks enabling improved flight planning. This route offers direct connectivity to the planned southbound ATS network and is not anticipated to require deconfliction against planned neighbouring low-level procedures. This should enable improved climb profiles and seamless integration into the network increasing capacity and resilience.		
General Aviation (GA)	Access	Qualitative
Currently LJLA serves a mixture of GA and commercial aircraft. Access for GA will remain unchanged from the current day operation due to this option.		

General Aviation / commercial airlines	Economic impact from increased effective capacity	Qualitative
The effective capacity at LJLA is not a constraint on the current design. Whilst this option has the potential to increase this capacity, it is unlikely there would be an economic impact resulting from this option. This option is not expected to impact GA operations at LJLA, therefore there will be no change in GA fuel burn as a result of this option.		
General Aviation / commercial airlines	Fuel burn	Qualitative
Current departures to the south route using a NANTI 2T or REXAM 2T which are left turn departure routes. This procedure represents the shortest route to the network and should minimise the population overflown by keeping to the western edge of the swathe. This option is not anticipated to interact with other low level traffic flows and the raised SID end levels should enable improved climb profiles reducing fuel burn. This option is not expected to impact GA operations at LJLA, therefore there will be no change in GA fuel burn as a result of this option.		
Commercial airlines	Training cost	Qualitative
Flight procedures change worldwide with each AIRAC cycle and airlines would update their procedures accordingly, training if required. This option is not anticipated to impose additional training cost impacts for airlines as SIDs are already widely used.		
Commercial airlines	Commercial airlines	Commercial airlines
There are no other airline costs foreseen.		
Airport/ Air navigation service provider	Airport/ Air navigation service provider	Airport/ Air navigation service provider
This design option is not expected to change Airport or ANSP infrastructure impacts, beyond the initial deployment phase which may require some systems engineering amendments.		
Airport/ Air navigation service provider	Airport/ Air navigation service provider	Airport/ Air navigation service provider
This design option is not expected to change Airport or ANSP operational cost impacts.		
Airport/ Air navigation service provider	Airport/ Air navigation service provider	Airport/ Air navigation service provider
At this stage it is disproportionate to quantify deployment costs per design option as they would be used in arrival, departure and runway permutations not yet detailed. However, a system change for LJLA would involve training c.25 controllers and c.10 assistants via the use of various air traffic simulators (including sim prep, management and staffing), with additional engineering costs.		

Table 10: Options Appraisal (CAP1616 Table E2), SID Option 7- 27 Departure, Left Turn to S

Qualitative Assessment of Design Option against Strategic Objectives of the AMS

Safety: Enhanced

Integration of diverse users, including defence: Increased use of PBN will lead to more predictable tracks requiring potentially less airspace. This will maintain or improve access to the airspace for all users.

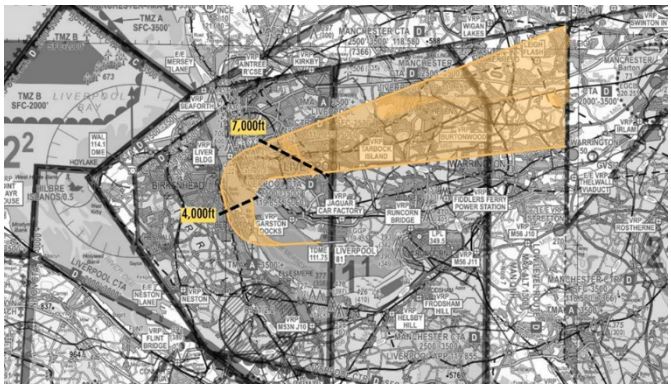
Simplification and complexity: Use of PBN transitions leads to improved track keeping and predictability, reducing ATCO and Cockpit workload.

Environmental sustainability: Improved CCO, and raising the SID end point reduces fuel burn, CO_2 emissions and the noise impacts of flights using the PBN departure route. However, this option overflies new populations and the combination of flights from 2 existing SIDs into a single departure route would increase the frequency of this overflight.

Qualitative Safety Statement

This option is likely to interact with aircraft arriving at LJLA from the south and flying the proposed transitions. This interaction may require the development of a resolution through the inclusion of vertical constraints on the procedures. The planned altitudes shown are indicative and may be revised to ensure they are achievable, provide separation from other procedures whilst maximising the benefit to stakeholders located below the flightpaths. This option is planned to overfly the Capenhurst (R311) restricted area and will require assurance that it is not overflown below 2,200 ft.

4.10. SID Option 8: 27 Departure Right Turn to NE



Group	Impact	Level of Analysis
Communities	Noise impact on health and quality of life	Qualitative
Aircraft departing LJLA runway 27 to the northeast currently fly a BARTN 1T. Like the BARTN 1T departure, the early right turn, overhead the River Mersey, will minimise any overflight to population south of the river. The Western edge of the swathe overflies the eastern edge of the Eastham country Park, 3.2 NM on the extended centreline. This option will follow a track analogous to the extant BARTN 1T SID which terminates at 4,000 ft. However, this option plans to raise the SID endpoint, which should allow aircraft to achieve a greater altitude sooner improving CCO, thus reducing the noise impact for those stakeholders overflown. This option is not expected to overfly any Areas of Outstanding Natural Beauty, National Parks, National Scenic Areas below 7,000 ft and hence have no tranquillity impacts.		
Communities	Air quality	Qualitative
Government guidance (ANG2017) states that aircraft flying higher than 1,000 ft are unlikely to have a significant impact on local air quality. No changes in air quality impacts are predicted under this design option as aircraft are expected to follow existing tracks until above 1,000 ft.		
Wider society	Greenhouse gas impact	Qualitative
This option follows a route analogous to the extant BARTN 1T SID. This option may interact with other low level traffic flows requiring a tactical or planned resolution leading to a period of level flight. However, this option plans to increase the SID end altitude which will enable improved climb profiles reducing greenhouse gas emissions.		
Wider society	Capacity/ resilience	Qualitative
This procedure will follow a track similar to the extant BARTN 1T SID. Whist this option should enable improved climb profiles with reduced controller interaction it does not offer a marked improvement in capacity or resilience.		
General Aviation (GA)	Access	Qualitative
Currently LJLA serves a mixture of GA and commercial aircraft. Access for GA will remain unchanged from the current day operation due to this option.		
General Aviation / commercial airlines	Economic impact from increased effective capacity	Qualitative
The effective capacity at LJLA is not a constraint on the current design. This option is unlikely to deliver any increase in capacity, it is unlikely there would be an economic impact resulting from this option. This option is not expected to impact GA operations at LJLA, therefore there will be no change in GA fuel burn as a result of this option.		
General Aviation / commercial airlines	Fuel burn	Qualitative
This option follows a route analogous to the extant BARTN 1T SID. This option may interact with other low level traffic flows requiring a tactical or planned resolution leading to a period of level flight. However, this option plans to increase the SID end altitude which will enable improved climb profiles reducing fuel burn. This option is not expected to impact GA operations at LJLA, therefore there will be no change in GA fuel burn because of this option.		

Commercial airlines	Training cost	Qualitative
Flight procedures change worldwide with each AIRAC cycle and airlines would update their procedures accordingly, training if required. This option is not anticipated to impose additional training cost impacts for airlines as SIDs are already widely used.		
Commercial airlines	Commercial airlines	Commercial airlines
There are no other airline costs foreseen.		
Airport/ Air navigation service provider	Airport/ Air navigation service provider	Airport/ Air navigation service provider
This design option is not expected to change Airport or ANSP infrastructure impacts, beyond the initial deployment phase which may require some systems engineering amendments.		
Airport/ Air navigation service provider	Airport/ Air navigation service provider	Airport/ Air navigation service provider
This design option is not expected to change Airport or ANSP operational cost impacts.		
Airport/ Air navigation service provider	Airport/ Air navigation service provider	Airport/ Air navigation service provider
At this stage it is disproportionate to quantify deployment costs per design option as they would be used in arrival, departure and runway permutations not yet detailed. However, a system change for LJLA would involve training c.25 controllers and c.10 assistants via the use of various air traffic simulators (including sim prep, management and staffing), with additional engineering costs.		

Table 11: Options Appraisal (CAP1616 Table E2), SID Option 8- 27 Departure, Right Turn to NE

Qualitative Assessment of Design Option against Strategic Objectives of the AMS

Safety: Enhanced

Integration of diverse users, including defence: Increased use of PBN will lead to more predictable tracks requiring potentially less airspace. This will maintain or improve access to the airspace for all users.

Simplification and complexity: Use of PBN transitions leads to improved track keeping and predictability, reducing ATCO and Cockpit workload.

Environmental sustainability: Improved CCO, and raising the SID end point reduces fuel burn, CO_2 emissions and the noise impacts of flights using the PBN departure route.

Qualitative Safety Statement

This option may interact with aircraft arriving at LJLA from the north. This interaction may require the development of a resolution through the inclusion of vertical constraints on the procedures. The planned altitudes shown are indicative and may be revised to ensure they are achievable, provide separation from other procedures whilst maximising the benefit to stakeholders located below the flightpaths.

5. Conclusion and next Steps

The LJLA Airspace Change process started in February 2018 at Stage 1 with a Statement of Need, continued with the development of Design Principles (DPs) via stakeholder engagement, and progressed through the CAA's regulatory Stage 1 Gateway Assessment.

LJLA has previously passed through Stages 2 and 3 of the CAP1616 process but has elected to return to Stage 2 in a radical process to ensure the LJLA submission aligns with the national program of work following the maturing status of the other sponsors within the MTMA cluster. It was agreed with the CAA that the previously-submitted options remain valid and do not need to be revisited.

This Stage 2 addendum is to discuss options not included in the previously-approved Stage 2 submission.

In this Stage 2 addendum, following discussions with ACOG, NERL and Manchester Airport, additional airspace design options were created, described, engaged upon and formally evaluated against the DPs (Step 2Ai and Step 2aii Addendum). The additional design options progressing through Step 2Aii were subjected to a qualitative Initial Options Appraisal (Step 2B) including an assessment of safety considerations for these new options.

The Initial Options Appraisal (Step 2B) does not discount any of the new design options progressed at Step 2Aii Design Principle Evaluation. However, it also does not consider combinations of these design options or combinations with the previously approved options that may provide respite from overflight when organised into systems; these will be developed during Stage 3.

This Step 2B addendum is in addition to the previously approved Stage 2B documentation and is the final document of Stage 2 of the airspace change process, published on the airspace change portal in late August 2023 for CAA regulatory process compliance assessment at the September Gateway.

The UK Airspace Modernisation Strategy (AMS) allows for design options discounted at Stage 2 to be reintroduced at Stage 3 if necessary, during the Master Plan integration process where multiple ACP sponsors are all at the same stage, and it will be possible for a wider holistic overview to be considered.

There is not yet enough detailed quantified data for LJLA to make a statement on preferred option(s). Appropriate quantitative assessments will be carried out as part of Stage 3, and these will be monetised where possible. These will include:

- Noise modelling analysis to Category C standards[6] ; we do not anticipate this category to change throughout the ACP process
- Fuel/CO_2 modelling analysis using the most recent appropriate version of Eurocontrol's Base of Aircraft Data (BADA) as the data source, which will be processed via a fast-time simulation application.

The results will be subsequently assessed using the Government's transport analysis tools to provide a monetised output; these are known as WebTAG.

A cost-benefit analysis will be performed, and a preferred option (or combination of options) will be stated. Compromises and trade-offs may be necessary between airports taking part in the FASIN regional airspace change. These will be guided by the advice and tools provided by the Airspace Change Organising Group ACOG, the independent team tasked with coordinating the redesign of the UK's airspace.

This Step 2B addendum document defines the new options to be added to the previously agreed shortlist of airspace design options. There are 2 additional arrival design options and 7 additional departure design options, summarised in Table 18 in Section 6 of Step 2ai and Step 2aii- Options Development and Design Principle Evaluation Addendum (Ref 6).

[6] Defined in CAP2091 CAA Policy on Minimum Standards for Noise Modelling

Subject to passing the Stage 2 Gateway Assessment, this proposal will move on to Stage 3 Consult. Stage 3 will take the options presented in these addendums as well as the previously approved options to develop a LJLA System design. This will involve significant preparation, development, collaboration and coordination with the sponsors of adjacent ACPs and ACOG, as well as further stakeholder engagement.

As a regional multi-airport airspace change, there are a wide range of stakeholders with conflicting requirements over a large area. There may be intermediate airspace change process phases over a long period, and it is possible that there may be more than one change in the same area as individual airport systems (or partial systems) progress to become a fully integrated regional network of air routes.

A date for the Stage 3 Gateway Assessment has not yet been set. For the latest information on this proposal, please subscribe to email updates on the CAA's airspace change portal (link to the page for this proposal).

6. List of Design Principles

DP	Priority	Category	Description
1	1	Safety	Procedures must be designed to meet acceptable levels of flight safety
2	2	Environmental	Procedures must be designed to minimise aircraft emissions to reduce air pollution
3	3	Environmental	Procedures should be designed to avoid overflight of sensitive areas, e.g. hospitals, schools, country parks, high risk industrial sites
4	=4 (4a)	Environmental	Procedures must be designed to minimise the impact of noise below 7,000ft
5	=4 (4b)	Operational	Procedures should be designed to be technically flyable and maintain existing operational performance, and capacity
6	6	Operational	Procedures should be designed to enable more continuous climbs
7	=7 (7a)	Technical	Procedures should be designed to fit within existing airspace constraints and boundaries
8	=7 (7b)	Operational	Procedures should be designed to enable more continuous descents
9	9	Operational	Procedures should be designed that minimise the number of track miles flown
10	10	Technical	If the design of the new procedures requires a smaller volume of airspace, airspace design or classification should be altered for the benefit of other airspace users
11	11	Operational	Procedures should be developed to allow for alternative routes to offer respite
12	=12 (12a)	Operational	Procedures should be designed to minimise the need for aircraft vectoring to reduce Air Traffic Controllers (ATCOs) workload
13	=12 (12b)	Environmental	Procedures should be designed to concentrate routes to minimise the numbers overflown
14	14	Technical	Procedures should be designed to ensure predictability of tracks for consistency of operations
15	15	Operational	Procedures should be designed to include alternative routes to avoid other aviation operators
16[7]	=1	AMS	Must accord with the CAA's published Airspace Modernisation Strategy (CAP1711) and any current or future plans associated with it. (Note: The CAA have stated that this DP is required by all change sponsors. CAP1711 describes what airspace modernisation must deliver including: - the need to increase aviation capacity; - growth to be sustainable - the need to maximise the utilisation of existing runway capacity)

[7] DP16 was added following the DP evaluation of the original options at the request of the CAA. The options previously published have not formally been evaluated against this Design Principle.