INITIAL OPTIONS APPRAISAL

KEY		Reason for Category
	Carry Forward	Meets LGW objectives, has insignificant impact and is the Preferred Option for this procedure.
	Carry Forward	Meets LGW objectives but would need some mitigation
	Reject	Fails to meet one or more objectives or has a significant impact that cannot be effectively mitigated

Group	Impact	Level of Analysis	High-level Appraisal for changing the current situation	Option 0	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7
Communities	Noise impact on health and quality of life	Initial Options Appraisal: Qualitative	The current temporary RNAV will be replaced by a permanent RNAV procedures. Our aim is to find a permanent solution for Route 4 that has the least impact according to the Design Principles. RNAV procedures are predicted to reduce noise exposure versus extant conventional procedures due to the facilitation of continuous climb/descent profiles and optimum aircraft performance. However it is not always possible to deliver these characteristics and each Option has been assessed to determine whether noise is minimised through these measures. The assessment also assessed the exposure of communities to noise i.e. whether the option minimises overflight of sensitive areas, public spaces and parks, built up environments and residential areas.	The current LAM2X SID is published in the UKAIP and is the baseline option. The noise impact would remain the same as today. A qualitative assessment indicates that this option would have less significant noise impacts than option 1, 5 and 7.	The LAM1X SID was previously published in the UKAIP. Its track takes it inside the village of Capel (to the east) and outside the village of Beare Green (to the west). After flying straight ahead after take-off, the aircraft will make its first turn not below 2500ft. The flight profile of this option will seek to minimise the adverse impact of noise in the area between these 2 villages. These villages are not directly overflown, although a school and a caravan park are close to the planned flightpath. However, there is a possibility that the Route 3 SID and the Route 4 SID would be in close proximity to each other which may increase noise impacts in an area already experiencing noise impacts from Route 3 departures. Once through the turn, the aircraft will climb to not above 4500ft and track direct to SUNAV, flying to the south of Reigate and Godstone.	This option uses the same turn at Option 0, but the track adjustment is removed and a new waypoint, NEW11, is placed where the aircraft would nominally roll out of the turn. This option is flown at optimal speed. This option tracks to the east of the village of Capel but overhead the village of Beare Green. From NEW 11, just south of Reigate, the aircraft speed restriction is lifted from 220 KIAS to 250 KIAS. The procedure avoids direct overflight of sensitive areas although a school and a caravan park are close to the planned flightpath; aircraft will be between 2,500 and 3,000 ft as they pass adjacent to Capel & Beare Greene, east and west respectively. It is envisaged that there will be no adverse effect on health and quality of life from noise.	Aircraft will fly straight ahead for 3.8NM, climbing to be not below 1100ft before turning towards 3 waypoints (south of Reigate) which are placed abeam each other with the intention of providing a degree of apparent dispersion. The aircraft will climb to not below 3200ft. In the initial stages of flight, the speed is restricted to 200KIAs in the turn. Once through the turn the speed restriction is lifted to 220KIAS and then south of Redhill the restriction of 220KIA is lifted to 250KIAS and a climb to not above 4000ft. This flight profile avoids the main towns of Reigate and Redhill and avoids direct overflight of the villages of Beare Greene and Capel. There will be an element of concentration over these villages and also over Holmwood Common AONB which may result in some increased noise for these areas.	This option has 3 initial turning points at which aircraft will not turn below 1500ft to provide apparent dispersion in the turn. Following the turn, aircraft will climb to be above 3200ft at a point south of Reigate. Once south of Redhill, aircraft will climb to not above 4000ft and the speed restriction will lift from 200KIAS to 250KIAS. The dispersion will continue until south of Redhill at which point the track will route direct to SUNAV. This option reduces the noise from overflights in and around the villages of Beare Greene and Capel but may increase noise impacts in and around Leigh.	This option uses the same methodology as option 1 with the exception that the speed is reduced to 200KIAS the result of which is the waypoints being placed closer together. The track of this option takes it to the east of Capel and to the west of Beare Greene. The speed restriction is lifted to 250KIAS to the south of Redhill. This option may increase noise in and around the village of Beare Greene whilst there may be reductions in noise impacts in and around Capel and Holmwood Common AONB.	This option will result in apparent dispersion in, and following, the turn due to the placement of multiple initial and turn points. There will be some overflight of Beare Greene and Capel but aircraft will be not below 1500ft before turning and then must be not below 3200ft south of Reigate and not above 4000ft south of Redhill. This option is designed to be flown at an optimum speed of 220KIAS. It is envisaged that there will be no adverse effect on health and quality of life from noise due to dispersion of the tracks.	Option 7 is expected to produce concentrated tracks over the ground throughout the turn. Currently, this option routes to the east of Capel and skirts just to the west of Beare Greene. Aircraft should be not below 1500ft as they turn towards a waypoint just to the south of Reigate, by which aircraft should be flying not below 3200ft. At the waypoint to the east of Salfords and south of Redhill aircraft should be not above 4000ft before tracking direct to SUNAV. Due to the concentration of tracks there may be some changes to the noise impacts in and around the villages of Beare Greene, Capel and Leigh.
Communities	Air Quality	Initial Options Appraisal: Qualitative	LGW is not situated within an AQMA although the village of Horley does lie within the AQMA One of the stated benefits of the introduction of RNAV procedures is reduced environmental impact due in part to continuous climb/descent. It is predicted that the initial climb/ final approach segments of flight will be the same as extant procedures but, with the modernisation of the FASI-S airspace, it is hoped that the future air traffic situation will allow departing traffic to be given clearance to climb above stated altitude limits. This will be tested during the full options appraisal in order to quantify any change in air quality.	No changes to current tracks over the ground are proposed below 1000ft where air quality is typically measured.	No changes to current tracks over the ground are proposed below 1000ft where air quality is typically measured.	No changes to current tracks over the ground are proposed below 1000ft where air quality is typically measured.	No changes to current tracks over the ground are proposed below 1000ft where air quality is typically measured.	No changes to current tracks over the ground are proposed below 1000ft where air quality is typically measured.	No changes to current tracks over the ground are proposed below 1000ft where air quality is typically measured.	No changes to current tracks over the ground are proposed below 1000ft where air quality is typically measured.	No changes to current tracks over the ground are proposed below 1000ft where air quality is typically measured.
Wider Society	Greenhouse Gas impact	Initial Options Appraisal: Qualitative	Reduced environmental impact is one of the benefits listed by ICAO of introducing PBN, and RNAV flight procedures. The Options have been assessed individually to determine whether they have the potential to minimise emissions through optimum aircraft configuration (engine power settings), use of continuous climb/descent profiles, utilisation of shortest practical routes etc. In general, the introduction of RNAV flight procedures is predicted to reduce environmental impact over extant ground/equipment based navigation procedures.	No change to the impact on greenhouse gases.	No change to the impact on greenhouse gases.	We believe there will be no change to the impact on greenhouse gases.	This option minimises track miles but is flown at a lower speed which will result in increased emissions	The dispersion offered by this option throughout the initial swathe - from take-off to 4000ft - will help to reduce emissions. However, all 3 tracks then come together at a point to the south of Redhill to track to SUNAV so there will be increased emissions in this area. That said, fuel emissions dissipate about 3000ft so this effect will be minimum	This option is shorter in track miles than some other options but the lower speed would result in increased emissions.	The speed of this option is KIAS220 which is an efficient speed for most LGW based ac to fly and, in isolation, would result in efficient fuel burn however, because this option is longer than options 0,2,4,5 & 7 it will require more fuel and therefore increase aircraft emissions.	This option is designed with a concentrated track which will enable emissions to be kept to a minimum. Flying this option at the optimum speed and continuous turn through 180 degrees at the initial waypoint also helps to reduce emissions.
Wider Society	Capacity and resilience	Initial Options Appraisal: Qualitative	The implementation of PBN is currently the highest priority for the global aviation community. It is expected that these procedures will 'dove tail' into the FASI-S airspace redesign thereby delivering the benefits foreseen by the introduction of PBN in terms of increasing airspace capacity leading to more predictable routes, fewer on-ground and in-air delays experienced by airlines. The completion of the entire route from airport to destination via PBN leads to a more effective route structure.	Maintaining the extant procedure would maintain current capacity. It should be noted that additional routing options within the London TMA may be available once PBN has been adopted from the airport. This will provide additional capacity and more importantly, flexibility and will likely reduce the need for aircraft to hold on the ground.	The two 90° turns will increase the departure separation required thus reducing the optimal number of ATMs on the runway. Continuous demand for route 4 options will result in increased ground holding if this option is chosen.	ATC will need to increase the departure separation than is currently used therefore reducing the number of ATMs on the runway.	ATC will need to increase the departure separation than is currently used therefore reducing the number of ATMs on the runway.	ATC will need to increase the departure separation that is currently used therefore reducing the number of ATMs on the runway.	This option, because of the two 90° turns, will increase departure separation. ATC will be required to increase departure separation in order to provide a safe operation thus reducing the optimal number of ATMs on the runway. This would result in an increased workload for both LGW tower and TC radar controllers.	This option, because of the 3 individual way points, may not maintain capacity at LGW. ATC will need to increase departure separation to compensate for ac flying the inside route against the optimal route or the outside route. There is also no guarantee that opposite direction traffic flying south of the swathe would be separated either. This would result in more tactical co-ordination with TC and thereby increased workload for both LGW tower and TC radar controllers.	It is anticipated that this option will dovetail with the FASI-S designs to enable integration with the en-route airspace structure and will allow LGW ATC to maintain consistent departure separation which will provide a predictable flow of air traffic and reduce the workload of the controllers both at LGW and Terminal Control ATC.
General Aviation	Access	Initial Options Appraisal: Qualitative	No change to existing airspace arrangements. Procedure wholly contained within extant CAS; no change to GA access to airspace. GA users of LGW will continue to arrive and depart under extant operational arrangements. Access to the runway may be slightly improved via a reduction in on-ground and in-air delays brought about by the introduction of PBN.	No change to existing airspace arrangements. GA users of LGW will continue to arrive and depart under extant operational arrangements.	No change to existing airspace arrangements. GA users of LGW will continue to arrive and depart under extant operational arrangements.	No change to existing airspace arrangements. GA users of LGW will continue to arrive and depart under extant operational arrangements.	No change to existing airspace arrangements. GA users of LGW will continue to arrive and depart under extant operational arrangements.	No change to existing airspace arrangements. GA users of LGW will continue to arrive and depart under extant operational arrangements.	No change to existing airspace arrangements. GA users of LGW will continue to arrive and depart under extant operational arrangements.	No change to existing airspace arrangements. GA users of LGW will continue to arrive and depart under extant operational arrangements.	No change to existing airspace arrangements. GA users of LGW will continue to arrive and depart under extant operational arrangements.
General Aviation / commercial airlines	Economic impact from increased effective capacity	Initial Options Appraisal: Qualitative	There may be an economic benefit to airlines in the context of being an enabler for increased air transport movements, passenger numbers and cargo tonnage carried. That said, it is not proportionate for LGW to predict the precise economic benefit to commercial airlines using the new procedure as any increase in individual airline capacity will depend on private commercial business characteristics. It is also not proportionate for LGW to assess the economic benefit to the GA community however they are expected to benefit from increased predictability of commercial airline movements which is predicted to lead to reduced on-ground and in-air delays for all users which may have a positive impact on GA costs.	It is not a requirement of this ACP to increase capacity at LGW and therefore no economic benefit is expected to be realised for commercial airliners or GA users.	It is not a requirement of this ACP to increase capacity at LGW and therefore no economic benefit is expected to be realised for commercial airliners or GA users.	It is not a requirement of this ACP to increase capacity at LGW and therefore no economic benefit is expected to be realised for commercial airliners or GA users.	It is not a requirement of this ACP to increase capacity at LGW. Indeed, it is likely that this option would reduce capacity due to the requirement of increased departure separation and would therefore have a negative effect on passenger numbers and cargo tonnage carried.	It is not a requirement of this ACP to increase capacity at LGW. Indeed, it is likely that this option would reduce capacity due to the requirement of increased departure separation and would therefore have a negative effect on passenger numbers and cargo tonnage carried.	It is not a requirement of this ACP to increase capacity at LGW. Indeed, it is likely that this option would reduce capacity due to the requirement of increased departure separation and would therefore have a negative effect on passenger numbers and cargo tonnage carried.	It is not a requirement of this ACP to increase capacity at LGW and therefore no economic benefit is expected to be realised for commercial airliners or GA users.	It is not a requirement of this ACP to increase capacity at LGW and therefore no economic benefit is expected to be realised for commercial airliners or GA users.
General Aviation / commercial airlines	Fuel burn	Initial Options Appraisal: Qualitative	Each option has been assessed against other options based on whether any factors of the design might contribute to increased fuel burn. In general the introduction of RNAV procedures and associated predictability of tracks, continuous climb/descent, reduction in tactical intervention is predicted to result in reduced fuel burn versus the baseline.	Track length 25.1NM. This is the extant procedure flown at optimum speed.	Track length 27NM. This option is 1.9NM longer than the current LAM2X SID and is the previously flown LAM1X SID. Aircraft make their first turn not below 2500ft which will increase fuel burn.	Track Length 25.9NM. This option is 0.8NM longer than the current SID LAM2X and replicates the same turn. It is flown at the optimum speed so fuel burn is efficient.	Track Length inside 26.3NM, optimal 26.3NM, outside 26.4NM. This option is 1.2NM longer than SID LAM2X (Option 0) and therefore may require more fuel. This option introduces two 90° turns so may not offer the most direct route; it is flown at a less than optimal speed so may result in more fuel burn.	Track Length 25.8NM inside, optimal 26.3NM, outside 26.7NM. This option is 1.2NM longer than the LAM2X SID (Option 0) and therefore may result in an increased fuel burn.	Track Length 26.3NM. This Option is 1.2NM longer than the LAM2X SID (Option 0). Combined with a non-optimal speed at which aircraft fly the procedure results in a higher fuel burn and increased emissions.	Track Length inside 25.8NM, optimal 26.6NM, outside 27.3NM. This option is 1.5NM longer than the current LAM2X SID (Option 0), based on the optimal track length of 26.6NM and therefore will require more fuel which will result in higher fuel burn and increased emissions.	Track Length 25.1NM. This option is the same length as the current temporary LAM2X SID (Option 0) and will require no more fuel than is currently burnt.
Commercial airlines	Training costs	Initial Options Appraisal: Qualitative	It is not expected that Pilot/Crew Training will be required to enable pilots to flight the new RNAV procedures as they are already in service at LGW.	No additional training predicted.	No additional training predicted.	No additional training predicted.	No additional training predicted.	No additional training predicted.	No additional training predicted.	No additional training predicted.	No additional training predicted.
Commercial airlines	Other costs	Initial Options Appraisal: Qualitative	Other costs to commercial airlines may include updates to Flight Management Systems (FMS), navigation databases and operating procedures, increased pilot hire costs versus training etc. It is not proportionate for LGW to assess the 'other costs' to commercial airlines of flying RNAV procedures due to significant variables; some airlines may already be 'PBN ready' whereas others may not.	It is not proportionate for LGW 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.	It is not proportionate for LGW 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.	It is not proportionate for LGW 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.	It is not proportionate for LGW 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.	It is not proportionate for LGW 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.	It is not proportionate for LGW 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.	It is not proportionate for LGW 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.	It is not proportionate for LGW 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.

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Airport / Air navigation service provider	Infrastructure costs	Initial Options Appraisal: Qualitative	All options relate to the implementation of PBN and no additional infrastructure is required. The introduction of PBN reduces the reliance on infrastructure, in particular ground based navigation aids are no longer needed. The foundation for PBN is 'area navigation' or RNAV; aircraft arriving and departing LGW using the proposed RNAV procedures will do so based on their performance based navigation capability.	No additional infrastructure required (see High Level Appraisal of PBN/RNAV).	No additional infrastructure required (see High Level Appraisal of PBN/RNAV).	No additional infrastructure required (see High Level Appraisal of PBN/RNAV).	No additional infrastructure required (see High Level Appraisal of PBN/RNAV).	No additional infrastructure required (see High Level Appraisal of PBN/RNAV).	No additional infrastructure required (see High Level Appraisal of PBN/RNAV).	No additional infrastructure required (see High Level Appraisal of PBN/RNAV).	No additional infrastructure required (see High Level Appraisal of PBN/RNAV).
Airport / Air navigation service provider	Operational costs	Initial Options Appraisal: Qualitative	ICAO list 'Improved Operational Efficiency' as a benefit delivered by the introduction of PBN. In general LGW predicts that operational efficiency will improve and that there may be potential for a net reduction in operational costs. This will be considered further at Full Options Appraisal stage.	No change to operational costs are attributable to maintaining the extant procedures.	No change to operational costs are envisaged.	No change to operational costs are envisaged.	No change to operational costs are envisaged.	No change to operational costs are envisaged.	No change to operational costs are envisaged.	No change to operational costs are envisaged.	No change to operational costs are envisaged.
Airport / Air navigation service provider	Deployment costs	Initial Options Appraisal: Qualitative	Deployment costs are attributable to the introduction of PBN/RNAV procedures rather than the individual IFP options themselves. As LGW already has introduced PBN/RNAV procedures, the only additional deployment costs associated with the majority of these options would be Aerodrome documentation and procedures updates (e.g. MATS Pt2 updates, chart updates, payment to CAA, Procedure Validation and Simulator Costs).	No additional deployment costs for this option as it is the current flown RNAV SID	Deployment costs for this option may be higher due to changes in operational procedures in order to ensure a safe & efficient ATC service.	Deployment costs for this option may be higher due to changes in operational procedures in order to ensure a safe & efficient ATC service.	Deployment costs for this option may be higher due to changes in operational procedures in order to ensure a safe & efficient ATC service.	Deployment costs for this option may be higher due to changes in operational procedures in order to ensure a safe & efficient ATC service.	Deployment costs for this option may be higher due to changes in operational procedures in order to ensure a safe & efficient ATC service.	Deployment costs for this option may be higher due to changes in operational procedures in order to ensure a safe & efficient ATC service.	Deployment costs are predicted to be minimal (changes to documentation etc).
Safety Assessment	Safety Assessment	Initial Options Appraisal: Qualitative	One benefit of the introduction of PBN is the improvement in safety and in fact ICAO declare it as is one of the primary reasons for a state to implement PBN. An individual safety assessment has been carried out for each option but in general, LGW's intention to maintain RNAV SIDs delivers a safety benefit to the airport and its users.	The baseline assumption is that current operations at LGW are safe including use of the extant conventional and GNSS/RNAV procedures.	ATC may need to increase departure separation on the runway in order for this to be a safe operating procedure; this would result in a decrease in the runway capacity.	There is a view that this option would conflict with following aircraft also using this LGW Route 4 SID. The design incorporates a degree of dispersion during the turn. Aircraft on the "inside" of the dispersion swathe may come into conflict with aircraft on outside of the dispersion swathe. Additionally, aircraft will likely choose different points at which to roll out to SUNAV, dependent upon aircraft type/performance and wind. The design does not account for prevailing wind direction.	There is a view from ATC that this option would conflict with following aircraft also using this LGW Route 4 SID. The design includes 3 waypoints placed abeam each other at a distance of 278m with the intention of providing a degree of managed dispersion. This results in several potential routes that an aircraft may take, however this cannot be scheduled or planned. ATC will not know the aircraft's intention. There will be an increase in the workload for both ATC and the Flight Crew; worst case may result in a loss of horizontal and/or vertical separation between aircraft.	There is a view that this option would conflict with following aircraft also using this LGW Route 4 SID. The design utilises three initial turning points placed sequentially 400m apart. This results in several potential routes that an aircraft may take and a degree of dispersion. However, the choice of turning point cannot be predicted. ATC will not know the aircraft's intention. The SID design also does not account for prevailing wind direction.	There is a view from ATC that this option would conflict with following aircraft also using the LGW Route 4 SID. The design results in a minimal degree of dispersion during the turn. However, this could be exacerbated by the lower speed limit impacting the flight crew workload. The dispersal is too wide increasing the risk of a loss of aircraft separation	There is a view from ATC that this option would conflict with following aircraft also using the LGW Route 4 SID. The design utilises three initial turning points placed sequentially 400m apart, followed by 3 waypoints placed abeam each other after the turn. This results in several potential routes that an aircraft may take and a large degree of dispersion. However, the choice of turning point and waypoint cannot be predicted. This option would increase Flight Crew and/or ATC workloads a result of the uncertainty in potential route, thus increasing the risk of a loss of horizontal and/or vertical separation	There were no safety risks highlighted for this option during the Safety Assessment. ATC commented that it would allow the traffic to be managed more efficiently and offers a very low probability of any loss of separation between subsequent departures. The near continuous turn provides consistency of track and therefore separation is easier to assess from an ATC perspective.