Swanwick Airspace Improvement Programme
Airspace Development 5
Proposed changes to LAC West to improve ATS route connectivity

SAIP AD5
Documentation:
Stage 4 Update and Submit

Step 4A Update Design

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Issue 1.0	May 2019	Published on CAA Portal

References

Ref No	Description	Hyperlink
1	SAIP AD3 CAA web page – progress through CAP1616	Link
2	Stage 1 Assessment Meeting Presentation	Link
3	Stage 1 Assessment Meeting Minutes	Link
4	Stage 1 Design Principles	Link
5	Stage 2 Design Options	Link
6	Stage 2 Design Principle Evaluation	Link
7	Stage 2 Initial Options Safety Appraisal	Link
8	Stage 3 Consultation Strategy	Link
9	Stage 3 Options Appraisal	Link
10	Stage 3 Consultation Document	Link
11	Stage 3 Collate and Review Responses	Link to main page

Contents

1. Introduction

1.1 This document forms part of the document set required in accordance with CAP1616's guidance on the airspace change process.

1.2 This document aims to provide adequate evidence to satisfy Stage 4, Step 4A Update Design

1.3 This approach complies with the CAP1616 "we asked, you said, we did" consultation approach.
The previous Step 3D document details "we asked, you said".
This Step 4A document details "you said, we did".

2. Consideration of consultation responses which may impact the final design, and outcome

2.1 See Step 3D document[ref 11], Table 2, for a summary of responses with numbered elements which may impact the final design.
The following table describes how each element has been considered, its outcome, and NATS' explanatory response to that element.

Element Number	Response and ID	Summary of Comments	Potential impact on the proposal	Outcome and NATS' final response
1	BAL (uploaded document) NATS ref: AD5_8	Preference for the proposed larger area of controlled airspace south of Birmingham CTR, in order to maximise flexibility and capacity for vectoring traffic.	Preference for CAS option (specific consultation option)	Element 1 and Element 9 would combine in a compromise – the volume of CAS adjacent to Birmingham CTR FL65-FL105 would match the smaller dimensions of Combined Concept 2 and be Class D FUA, the upper volume of CAS would match the larger dimensions of Combined Concept 1 and be Class C H24. This allows RAF(U) to transit the larger CAS volume without coordination, addressing their concern. Other airspace users would not be disadvantaged by Class C FL105+ in the region, as both C and D require ATC clearance & compliance is mandatory, combined with the low likelihood of impact on GA aircraft FL105+ in this area.
2	BAL (uploaded document) NATS ref: AD5_8	Option 1B would be BAL's strong preference: Evenings/overnights/mornings weekdays until 1000L and H24 weekends – disestablished during weekday daytimes from 1000L until 1700L.	Preference for timing option (specific consultation option)	Element 2 is compromised by MoD Element 11, which is the same concept, but the overnight/morning period would end at 0900L instead of 1000L. NATS and BAL both prefer 1000L as per the consultation and made efforts to achieve that timing, however we accept the MoD's feedback. Weekends and Public Holidays remain included in the FUA activation period. See Step 3D document (Ref 11) para 4.9 for details.
3	Jet2 (online portal) NATS ref: AD5_9	Jet2.com fully supports the majority of this proposal on environmental and flight efficiency grounds. The proposed changes to BB routes and CAS are of significant importance to Jet2 operations; providing significant environmental benefits. Jet2 have requested for the new CAS to be available H24, which would help to offload already congested areas of airspace and routes. This would also facilitate more continuous climb and departure operations.	Would provide greater fuel savings for Birmingham operators. Would be a greater impact on MoD and other airspace users. Impacts not consulted upon.	Element 3 is not progressed due to (a) Impact on other airspace users (b) Operational complexity (NATS and MOD ATC) Element 11 is progressed instead.

Element Number	Response and ID	Summary of Comments	Potential impact on the proposal	Outcome and NATS' final response
4	British Airways (online portal) NATS ref: AD5_10	BA is generally support of AD5; recognising safety, predictability and efficiency improvements. The LL CAS and offload route changes are supported; however, BA has requested a CDR1 status in order to allow operators to flight plan the route when required. This will deliver further predictability for both Flight Crew and ATC controllers and can be achieved through a mix of a restrictive RAD rules and CDR1/3 status.	Would provide additional flightplanning option to Heathrow operators. Would commit a flight to the offload route many hours before the highly tactical offload-decision-making process is started, reducing flexibility, increasing complexity	Elements 4 and 7: The offload route will not be flightplannable. NATS continuously monitors the live situation (c.2-3 hours from the LTMA) to see if OCK-BNN offload is needed. If so, we will then identify candidate flights from the entire North Atlantic – Heathrow arrivals picture on the day. This must be entirely tactical under the sole control of NATS, in particular the Airspace Capacity Management team.
5	Individual (online portal) NATS ref: AD5_11	Does not support the proposed changes to BB CAS/ routes. Specifically, does not see any justification in creating new CAS when pilots/ operators are currently able to operate OCAS, in an unknown traffic environment. This would be to the detriment of other airspace users. Suggestion for pilots/ operators to file FPLs in order to remain inside existing CAS, if their concern is leaving CAS.	Would remove a fundamental fuel saving element of the proposal.	Element 5 is not progressed. The justification for this proposal is sound and was previously described under Stages 1,2 and 3. The proposed new CAS would be FUA and, as described later in this document, has been further reduced in both overall size and daily duration.
6	Individual (online portal) NATS ref: AD5_11	Concern that the CAS does not get lowered below FL175 and FL145 at some future date.	NATS to consider the bases of the proposed CAS volumes coloured pink	Element 6 is partially progressed – see also Element 10. NATS predicted that the southern pink block of FUA CAS, base FL145, would be used regularly by offloaded Heathrow arrivals for vectoring/sequencing into the main BNN flow. Following air traffic simulations, this volume was rarely used, thus it can be removed from this proposal. The northern pink block's base of FL175 is considered appropriate by NATS.
7	Virgin (online portal) NATS ref: AD5_12	Request for further dialogue to agree the operating parameters for the activation of the offload route. Objection to the CDR3 status – preference is predictability and therefore request is to revisit whether this route can be assigned a CDR1 status at certain times. This would be in connection with some form of "*pre-tactical cherry picking*" for specific flights that enables us to maintain this approach to planning. The offload route placement is laterally different from extant; therefore, having early notification and pre-tactical co-ordination for the offload route would be beneficial.	Would provide additional flightplanning option to Heathrow operators. Would commit a flight to the offload route many hours before the highly tactical offload-decision-making process is started, reducing flexibility, increasing complexity.	Elements 4 and 7: The offload route will not be flightplannable. NATS continuously monitors the live situation (c.2-3 hours from the LTMA) to see if OCK-BNN offload is needed. If so, we will then identify candidate flights from the entire North Atlantic – Heathrow arrivals picture on the day. This must be entirely tactical under the sole control of NATS, in particular the Airspace Capacity Management team.

Element Number	Response and ID	Summary of Comments	Potential impact on the proposal	Outcome and NATS' final response
8	MOD (consultation mailbox) NATS ref: AD5_13	Providing that the portion in turquoise/ purple is Class C airspace, and control is not delegated from LACC	Specifying no delegation of ATS, otherwise as per consultation	Element 8 is progressed. There would be no delegation of ATS for those CAS volumes. This does not change the design *per se*.
9	MOD (consultation mailbox) NATS ref: AD5_13	Proximity of DTY Radar Corridor FL100-FL110, turn and climb could not be given if the abutting CAS was Class D (exiting the corridor westbound) Likewise would prevent expeditious routing to join the corridor eastbound if Class D abutted. Prefer the smaller Class D green volume. RAF(U) controllers are able to access Class C without coordination but not Class D.	Preference for smaller volume of CAS Option 2, and/or change of classification to Class C in order to meet the requirements for RAF(U) controllers to operate without coordination. Other airspace user groups would not be impacted or disadvantaged.	Element 1 and Element 9 would combine in a compromise – the volume of CAS adjacent to Birmingham CTR FL65-FL105 would match the smaller dimensions of Combined Concept 2 and be Class D FUA, the upper volume of CAS would match the larger dimensions of Combined Concept 1 and be Class C H24. This allows RAF(U) to transit the larger CAS volume without coordination, addressing their concern. Other airspace users would not be disadvantaged by Class C FL105+ in the region, as both C and D require ATC clearance & compliance is mandatory, combined with the low likelihood of impact on GA aircraft FL105+ in this area.
10	MOD (consultation mailbox) NATS ref: AD5_13	Airspace to the north of RAF Brize Norton would increase MoD fuel burn. Some ops require uninterrupted climb without delay on the ground. Other ops require tactical descent into specific locations.	NATS to consider the bases of the proposed CAS volumes coloured pink and light blue	Element 10 is partially progressed – see also Element 6. NATS predicted that the southern pink block of FUA CAS, base FL145, would be used regularly by offloaded Heathrow arrivals. Following air traffic simulations, this volume was rarely used, thus can be being removed from this proposal. Additionally, in simulations the light blue volume was rarely used below FL125, thus there is an opportunity to raise its base to FL125, allowing it to be combined with the abutting yellow volume with the same proposed base of FL125. This reduces complexity and reduces the impact on other airspace users.
11	MOD (consultation mailbox) NATS ref: AD5_13	The MOD would object to airspace timings as listed at Design Option 1B. However, the MOD would have no objection to this if it was adjusted by one hour (0900 local instead of 1000 local)	Potential to reduce some benefit for Birmingham traffic.	Element 11 compromises Element 2, which is the same concept, but the overnight/morning period would end at 0900 local instead of 1000. Weekends and Public Holidays remain included in the FUA activation period. See Step 3D document (Ref 11) para 4.9 for details.
12	MOD (consultation mailbox) NATS ref: AD5_13	The MOD would object to airspace timings as listed at Design Option 1B. However, the MOD would have no objection to this if it was adjusted by one hour (0900 local instead of 1000 local).	Unlikely to cause actual benefit change, due to the primacy of NWMTA which has already been accounted for in the fuel calculations.	Element 12 is progressed, see also Elements 2 and 11.

Table 1 How consultation feedback has been considered

3. Design log – including technical refinements and clarifications

Section 2 Table 1 describes each feedback Element, and details NATS' decision on whether to progress (partially, compromise, or fully) or not, informing the final design.

This section describes those changes in more detail, along with other changes which have arisen during the technical refinement of the design.

Section 4 provides an illustrative overview of the changes made.

3.1 Redefinition of FUA and H24 CAS in the vicinity of MOSUN/OKTAD, new base level change waypoint. See consultation document Figures 2, 6 and 7 and Element 10 above, regarding combining the blue volume into a larger yellow volume.

We originally proposed amending the western boundary of Cotswold CTA5 (Class A H24 FL155-FL195).

We now propose retaining the current dimensions of Cotswold CTA5, "fitting" the equivalent FUA volumes around and beneath ("new" light green volume in place of part of the consulted-upon yellow volume).

This would have the same overall lateral and vertical dimensions as the consulted upon volumes in the vicinity of OKTAD and west, with the MOSUN region having an FUA CAS base 2,000ft higher than consulted upon, reducing impact on other airspace users such as MoD and GA.

At the same time, we identified the need for an additional waypoint at the base level change between the two volumes (shown as DUCNO in the right hand chart). This was already covered in the consultation Section 7 Annex A where additional waypoints could be added for data transfer, flight-strip production and other administrative/technical reasons such as this.

Birmingham Airport has agreed to the raising of this CAS base, provided their arrivals descend to FL130 by waypoint BIFIN. Departures would be above FL130 by the base level change point DUCNO.

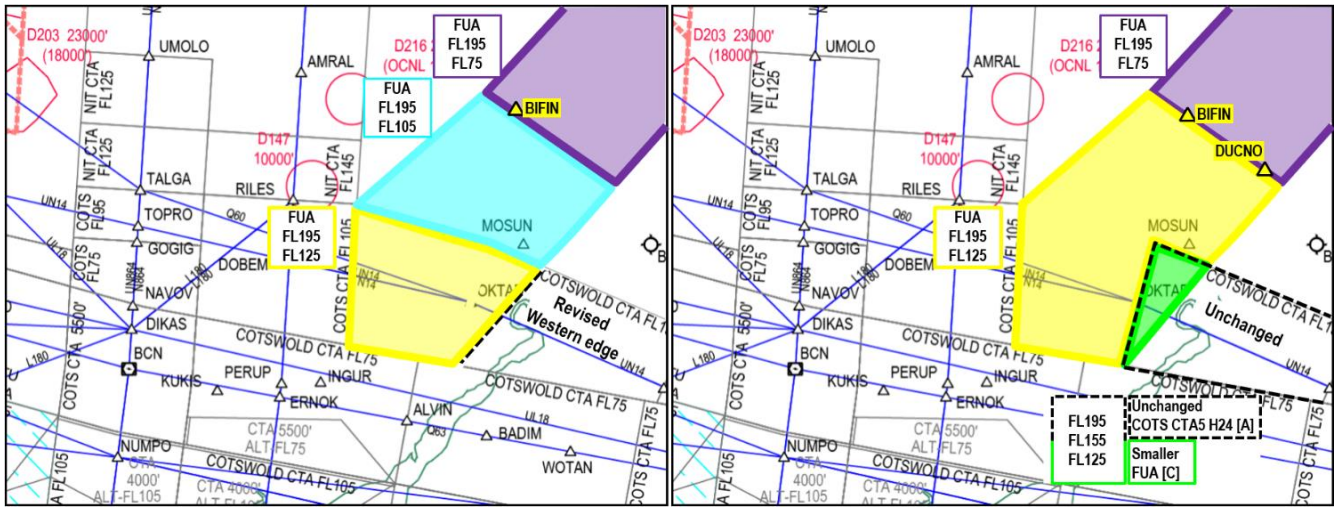

Figure 1 CAS arrangements in vicinity of MOSUN and OKTAD (L as consulted, R as proposed)

There was one consultation feedback item generally objecting to the proposed CAS arrangements. However, the above amendments to the consulted-upon CAS arrangements would reduce the disadvantage to such a stakeholder. It is consistent with DP5 (minimise negative impact on other airspace users) where a higher CAS base is considered less impactful.

3.2 FUA timing – morning period to end at 0900L instead of 1000L

Elements 2, 11 and 12 illustrate different points of view between our two major ANSP stakeholders. Birmingham airport strongly preferred the FUA availability of evenings/overnight/mornings to 1000L, and H24 at weekends. The MoD was clear that they would object to the overnight FUA period's end time of 1000L but not if that timing was adjusted to 0900L. NATS and BAL prefer 1000L as per the consultation, however, this compromise has been accepted by NATS as sponsor and BAL as major stakeholder in recognition of the achievability of this proposal – see Step 3D document (Ref 11) para 4.9 for details.

The loss of this FUA hour would cause some loss of fuel benefit (c.24t in 2020 compared with the consulted upon benefit, c.26t in 2030). The hour's difference would most likely impact flights destined to GCxx and LPxx due to current RAD restrictions in the latter period, and would not impact turboprop flights RFL160 or below at all – these flights could continue to operate as per today outside CAS at any time. (Weekends and Public Holidays remain available for H24 activation as per the consultation.)

Thus we reluctantly believe this reduction in benefit is acceptable given the overall achievability of the project, consistent with DP2 (minimise resources needed to progress the proposal, must be achievable by Dec 2019).

3.3 Waypoint location moved

We reviewed the waypoint placements and found that waypoint SEMMU would be better placed further east along the proposed Heathrow offload route Y125 between LIPGO and BERUL, in order to provide improved level planning for descent.

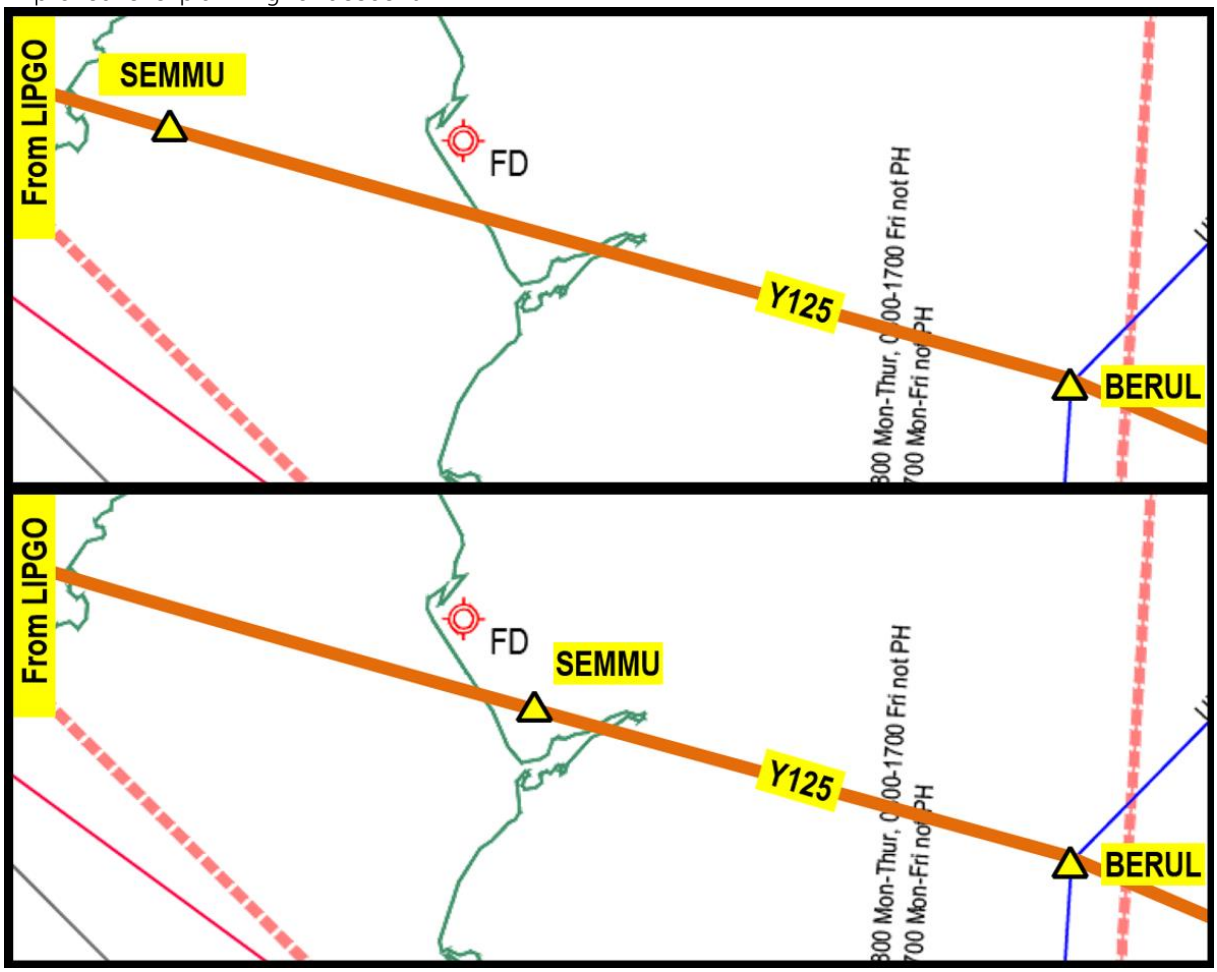

Figure 2 Consulted SEMMU placement (top), Proposed (above)

This waypoint move is technical in nature, without impact except for ATC operational planning, would not disadvantage any stakeholder, and there was no consultation feedback on the placement of waypoints.

3.4 Birmingham arrivals – minor amendment to proposed STAR.

In the consultation document, the STAR was originally proposed to route FIGZI BIFIN OSKOT GROVE (see consultation document Figures 2, 6 and 7 and clarifying Figure 3 below).

We now propose to remove the slight dogleg at OSKOT, routeing FIGZI BIFIN GROVE. Technically, the removal of the dogleg shortens the route by a fraction and also allows for a reduction in the CAS required to contain the STAR, both of which are advantages (reduced impacts on other airspace users) but negligible in practice. The practical advantages, albeit small, are that the final track before the GROVE hold would become a simple 28nm long straight segment, and the CAS boundary lateral dimensions become slightly less complex at the northern vertex west of OSKOT (see CAS chart for the region, Figure 4 on page 10 below).

This amendment would not disadvantage any stakeholder and there was no consultation feedback on the STAR.

On the same chart below we have corrected the depiction of low-level Birmingham departures. We originally showed Birmingham's departure waypoint UMLUX in the wrong place in the consultation material, leading to differences in the illustrated departure routes- we apologise for this. For the avoidance of doubt, this chart correction has no impact on actual flight behaviours at low level. This proposal continues to align with Birmingham Airport's own current and proposed departure procedures. Those procedures are managed by Birmingham Airport and regulated/published by the CAA.

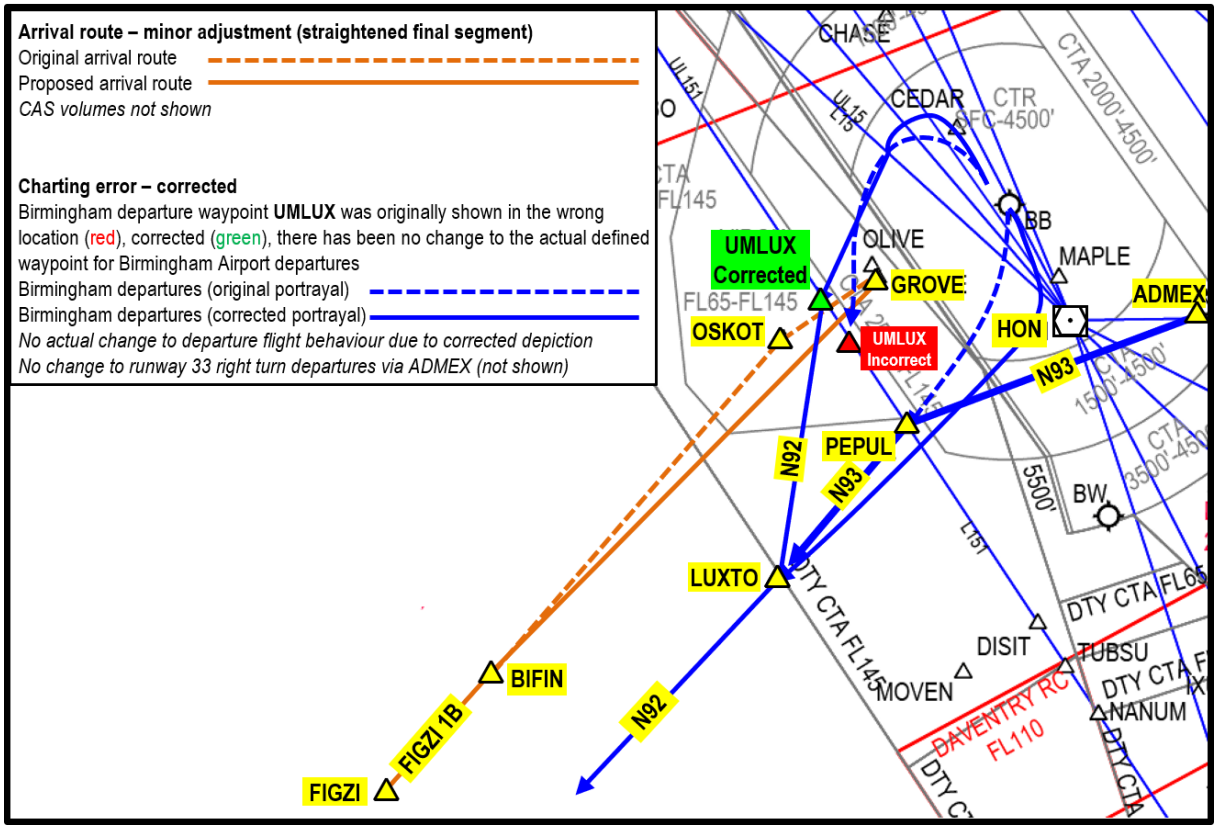

Figure 3 Amendment to Birmingham STAR FIGZI 1B, corrected depiction of low level departure routes

3.5 CAS arrangements in the vicinity of Birmingham

In the consultation we illustrated two options for CAS in the vicinity of Birmingham, Figures 1 and 6 showed Option 1 (larger volume depicted in green), Figures 2 and 7 showed Option 2 (smaller volume). Feedback Element 1 summarised Birmingham Airport's preference for Option 1's larger volume, this was also NATS' stated preference. Feedback Element 9 summarised the MoD's preference for Option 2's smaller volume, their requirement for Class C in the airspace abutting the DTY Radar Corridor, and their requirement for that Class C airspace to not be delegated to another party. (The MoD's requirements are based on RAF(U)'s standard operations where they may operate without coordination in Swanwick-operated Class C.)

NATS proposes to compromise by establishing the Option 2 volumes near Birmingham and another volume, with a higher CAS base matching Option 1, abutting to the south. This provides the best of both worlds, where Birmingham can use the main area (green FUA Class D and black H24 Class C), Swanwick TC the brown area (H24 Class C), and the MoD could fly through the brown area without coordination as per standard Swanwick RAF(U) operations. DTY Corridor transits at FL100 would also avoid the brown volume of base FL105.

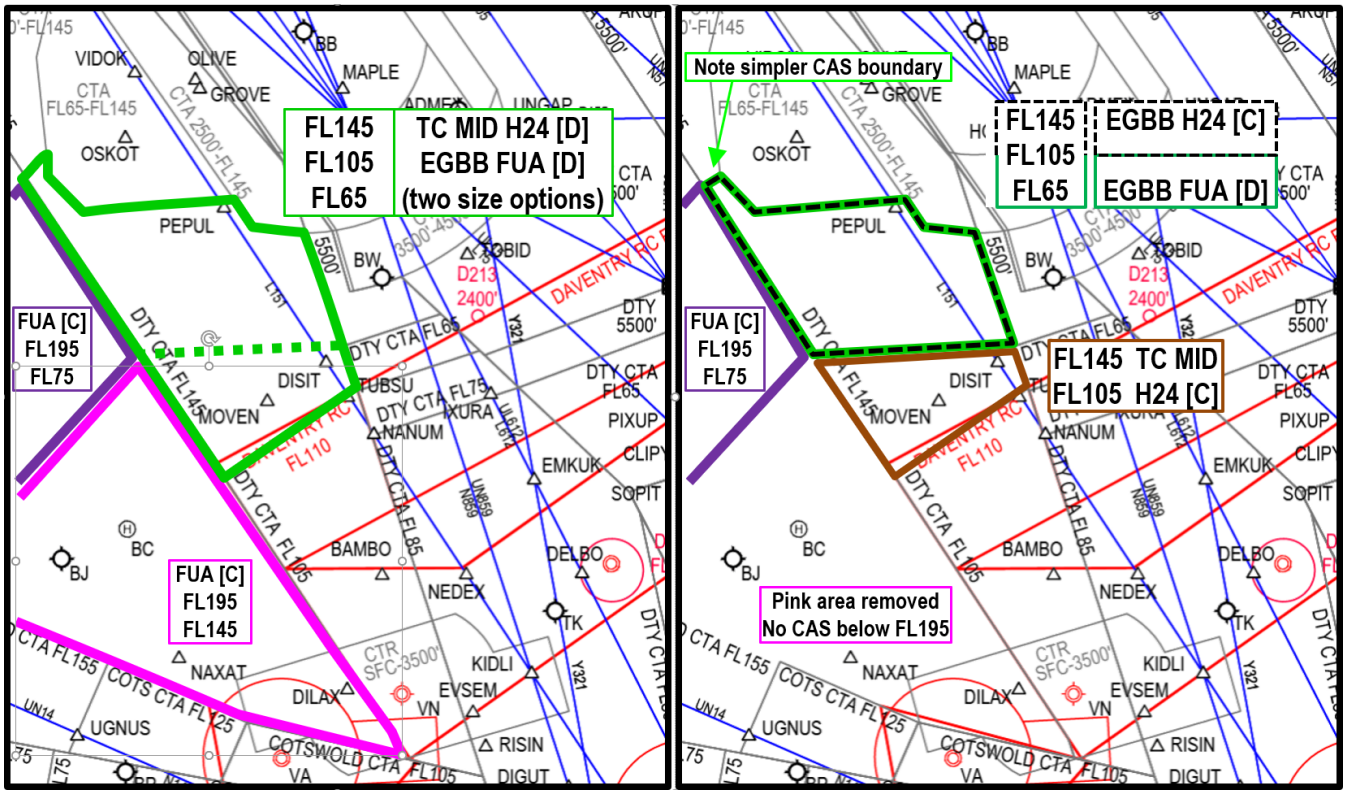

Figure 4 Consulted (left) and Proposed (right) CAS volumes near Birmingham

As noted under Element 9, other airspace users would not be disadvantaged by the proposed change of CAS FL105+ from Class D (as consulted) to Class C here. Both C and D are available to VFR flights, both require ATC clearance, and both have mandatory ATC compliance rules, combined with the overall low likelihood of impact on GA aircraft FL105+ in this area (see link to NATS' Compliance Paper providing evidence of very low GA usage above FL65 in the region, far fewer above FL105).

In Element 6 an anonymous responder raised concerns on the pink volumes of CAS, and Element 10 noted a potential MoD fuel burn increase should their Brize Norton/Fairford flights be unable to climb continuously to high FLs (though this was not an objection *per se*).

We explored these elements and can remove the southern pink volume from the proposal. This is consistent with DP5 (minimise negative impact on other airspace users).

As per para 3.3 on page 8, the right hand chart above highlights the slight reduction in CAS complexity at the northern vertex, also consistent with DP5.

3.6 TRA 002 dimensions

The MoD have agreed to the proposed change in dimensions of TRA 002 described in the consultation document (para 4.3.4 page 21). This is consistent with the consultation, and NATS thanks the MoD for that concession.

3.7 High level ATS route flows – connectivity and flow direction improvements

The flow schematics for these changes are shown under Section 4. They complement the main overview of the differences between the proposed routes described in the consultation, and the final proposal for the ACP. See Section 8 for changes in fuel benefit figures compared with the consultation.

3.7.1 Q60 westbound KOPUL UGNUS

Consultation document Figure 8, this document Figure 7 on page 15.

New waypoint UGBET added to create intersection with extant L179 west of LAM – captures more eligible traffic using L179 westbound, onto a shorter route for DIKAS further west.

Clarification of minimum RFL340 to avoid interaction with MTMA departures in S24.

3.7.2 N24 eastbound PEMOB NIGIT

Consultation document Figure 9, this document Figure 8 on page 16.

Due to an error in the fuel benefit calculation for this route, the predicted benefit cannot be accrued. This proposed route (and its erroneous benefit) is removed from the proposal. We apologise for this unfortunate error. As soon as it was discovered, we contacted the key stakeholders, explained the situation, and provided updated fuel benefit figures including those in this section of the document. For details see Step 3D document (Ref 11) para 4.8.

3.7.3 P155 eastbound MORAG HON

Consultation document Figure 10, this document Figure 9 on page 17 and Figure 10 on page 18.

Waypoint name changed from BOGOF to FACTU. Formal flightplanning restriction FL345+ to minimise potential interactions with S32/S27 LTMA traffic.

3.7.4 Q60 and L18 MORAG/LIPGO to DIKAS/UGNUS

Consultation document Figure 11, this document Figure 11 on page 19 and Figure 12 on page 20.

The consulted-upon structure would be more complex to manage in the LANON area.

The exact same route structure is proposed, but with changes to the directionality of some flows and a new minimum FL340 for Q60 (except for Dublin arrivals which use the route FL245+ provided L18 is available). The general route orientation in the area now becomes westbound via L18 LIPGO and eastbound via MORAG, with route segments east of LANON for both routes now set to bidirectional at certain times/FLs, better balancing and reducing the complexity of these flows.

These flow and level restrictions reduce some of the opportunities for savings because some lower flights were originally eligible for the shorter Q60 but must now follow the original longer route (except Dublin arrivals which remain eligible). There is thus a slightly reduced benefit.

3.7.5 L18 GAVGO DIKAS

Consultation document Figure 12, this document Figure 13 on page 21.

This route was proposed as an administrative decoupling of L18 from UL9, originally consulted upon to be eastbound only. This aligned with the originally consulted upon Q60/L18 route structure described in the previous para 3.7.4 above, however it did not provide adequate westbound connectivity with the revised flow directions described later in that same paragraph. Thus the directionality of this route has been amended for connectivity and flow direction purpose. It enables the flows in the previous paragraph but does not provide a defined fuel benefit itself, in the same way the originally consulted upon decoupled route enabled the flows in the originally consulted upon Q60/L18 structure.

3.8 Additional 5LNC waypoints and other administrative ATS network items

As per Section 7 page 29 of the consultation document, waypoints will be introduced as Free Route Airspace pre-enablers. These waypoints will be along straight segments of existing ATS routes which would be modified accordingly, are technical/administrative in nature (such as removal of U from adjacent upper routes and transfer of data from ENR3.2 to ENR3.3), and would have no stakeholder impact. The Airspace Design Definition (ADD) details all these items and will be supplied as part of the ACP submission Step 4B.

3.9 Military primacy

For the avoidance of doubt, there are no changes to the North Wales Military Training Area dimensions or hours of operation, and the MoD retains primacy.

4. Revised Design – schematic diagrams

The figures on the next pages allow a comparison between the consulted-upon schematics of how each traffic flow will be handled, and the post-consultation final design with these changes illustrated (including charts illustrating the changes in high level ATS routes discussed under para 3.7 above).

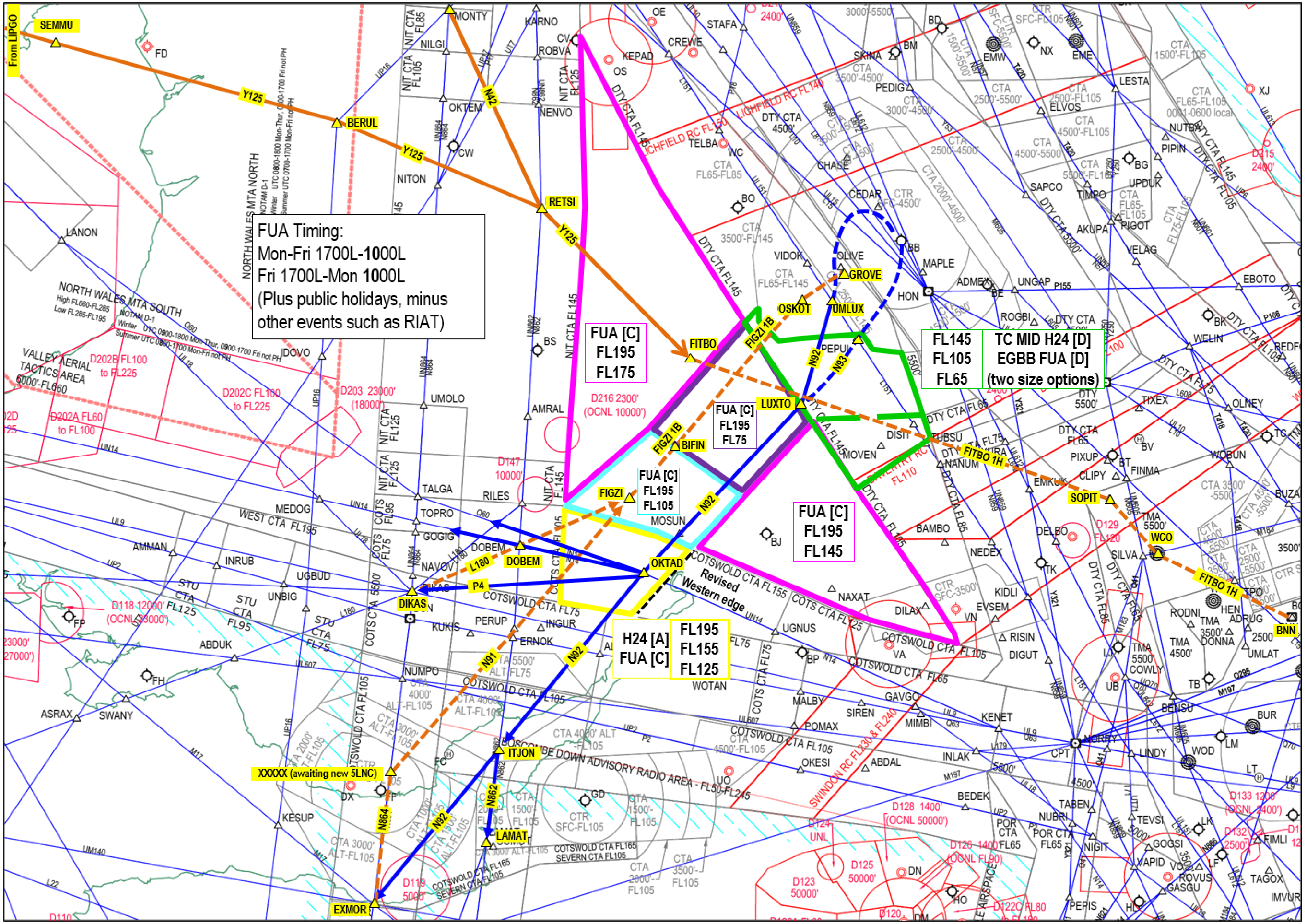

Figure 5: Consultation – Routes and CAS associated with Birmingham and Heathrow

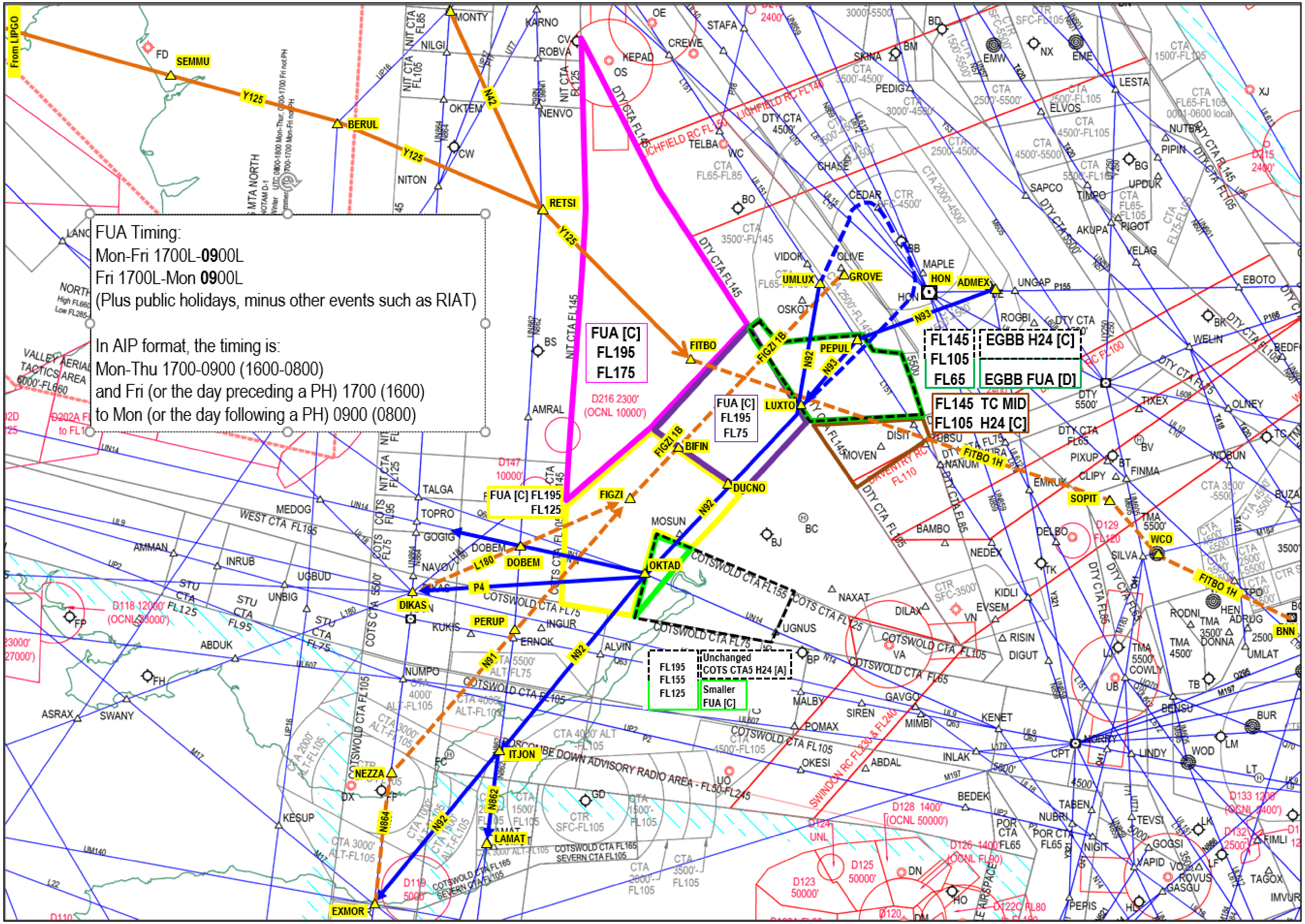

Figure 6: Final proposal - Routes and CAS associated with Birmingham and Heathrow

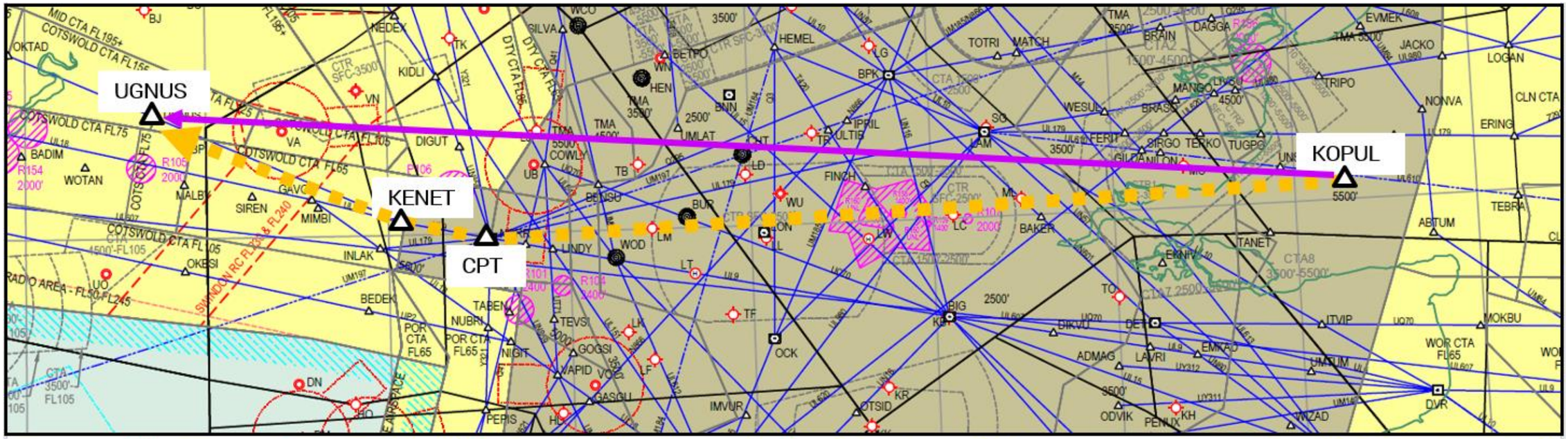

Figure 7 Q60 westbound KOPUL UGNUS as consulted upon (top) and final proposal (above) allowing intersection with eastbound L179 traffic – see para 3.7.1

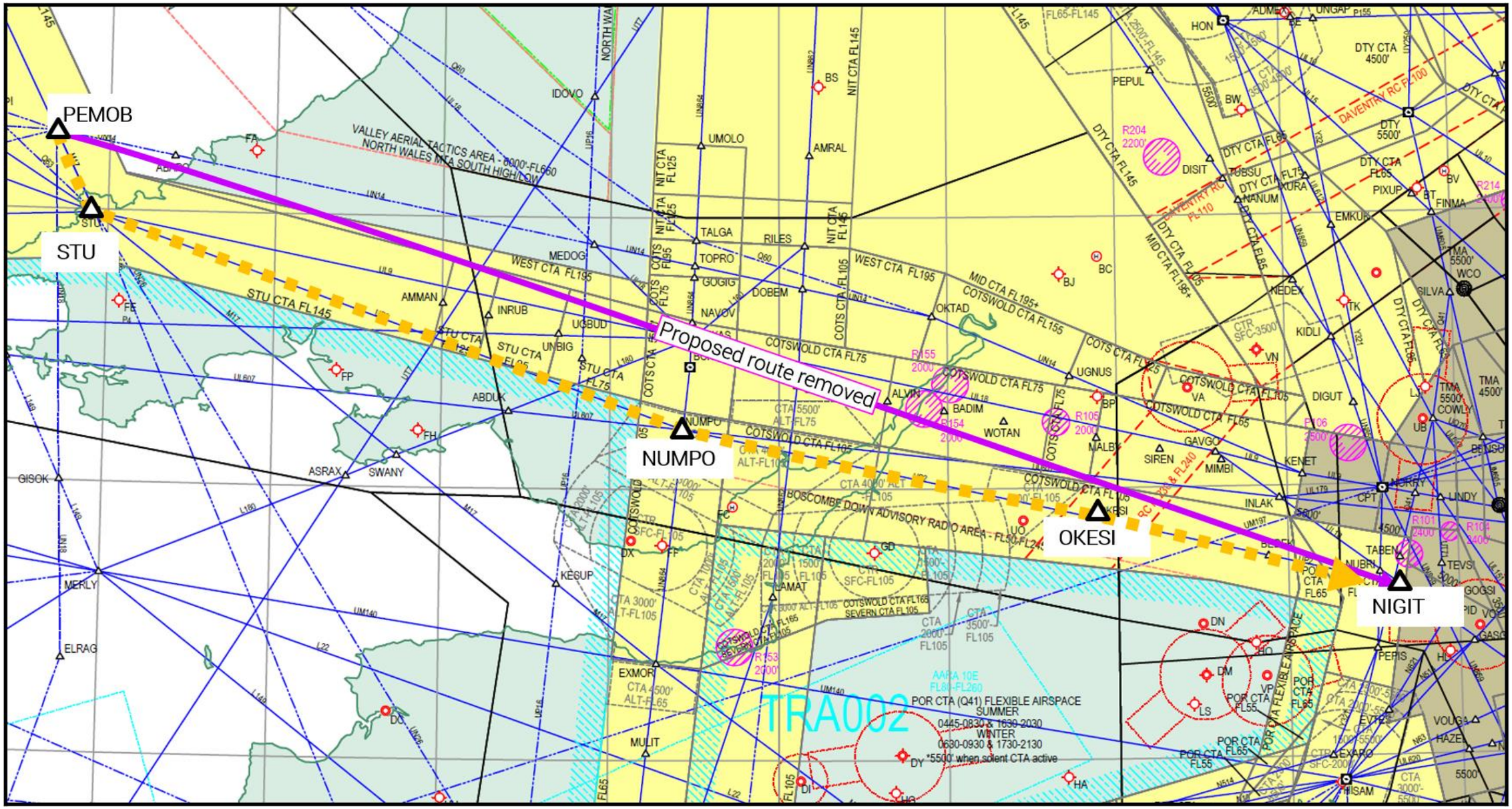

Figure 8 N24 eastbound PEMOB NIGIT (proposed route removed) – see para 3.7.2

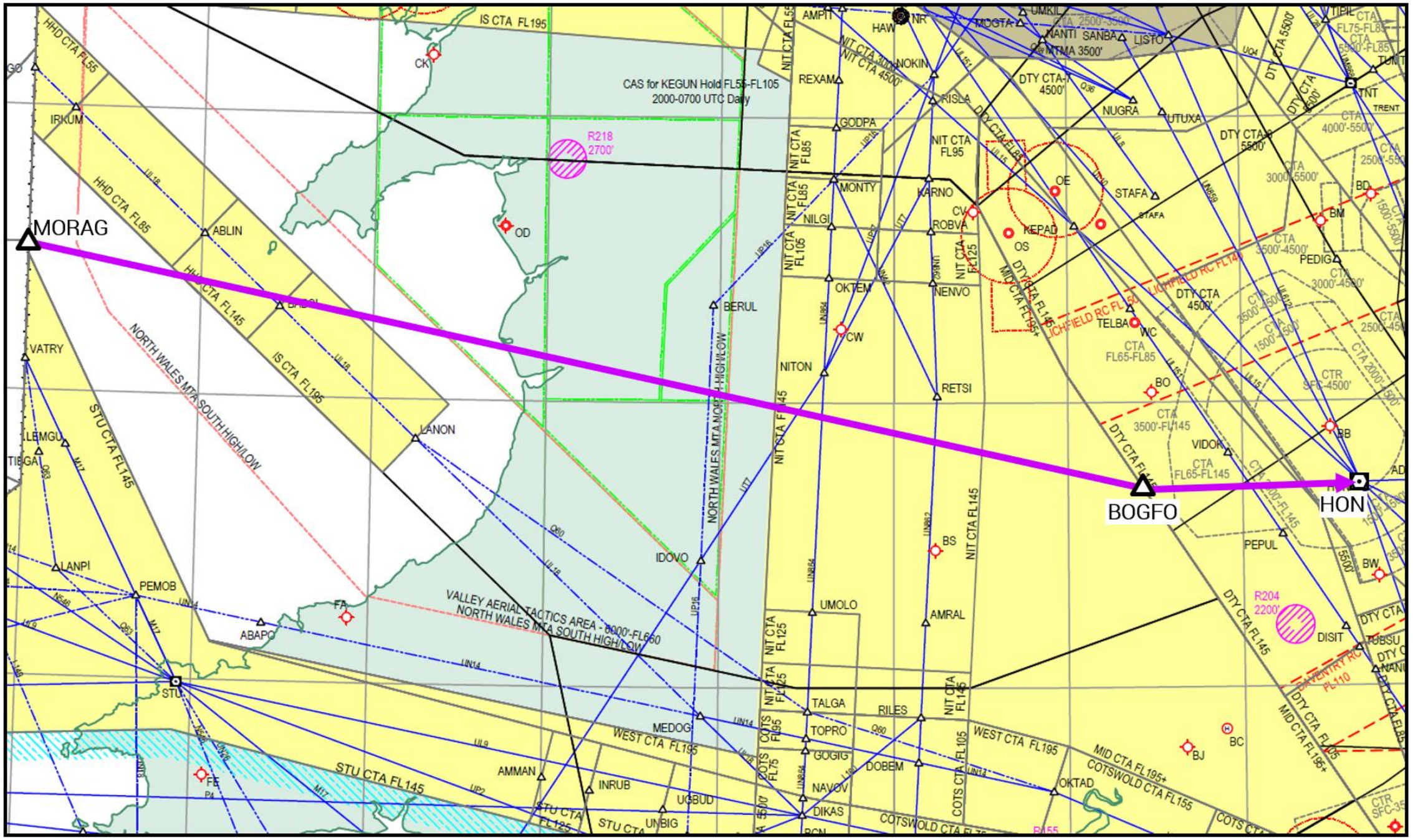

Figure 9 P155 eastbound MORAG HON as consulted upon – see para 3.7.3

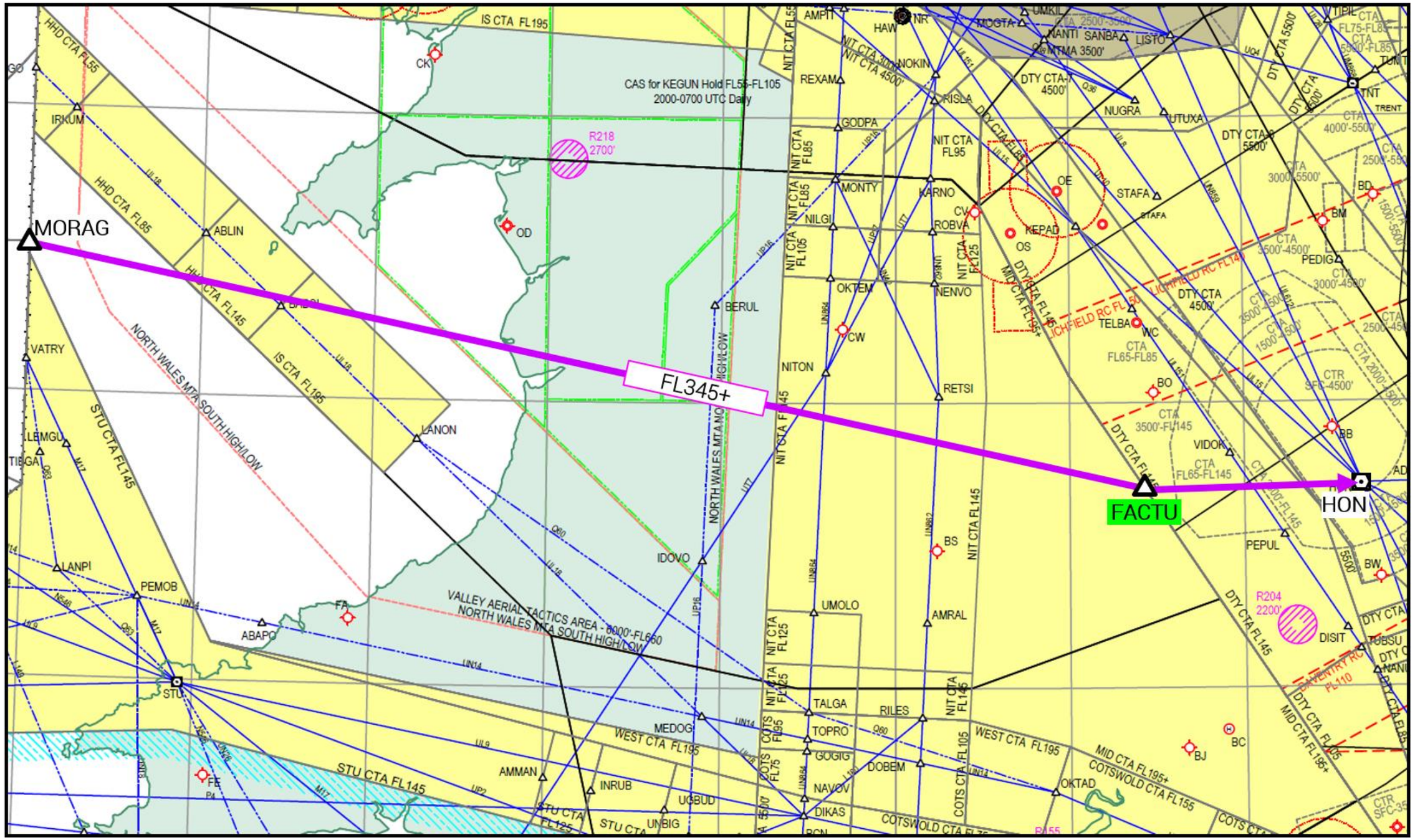

Figure 10 P155 eastbound MORAG HON final proposal – see para 3.7.3

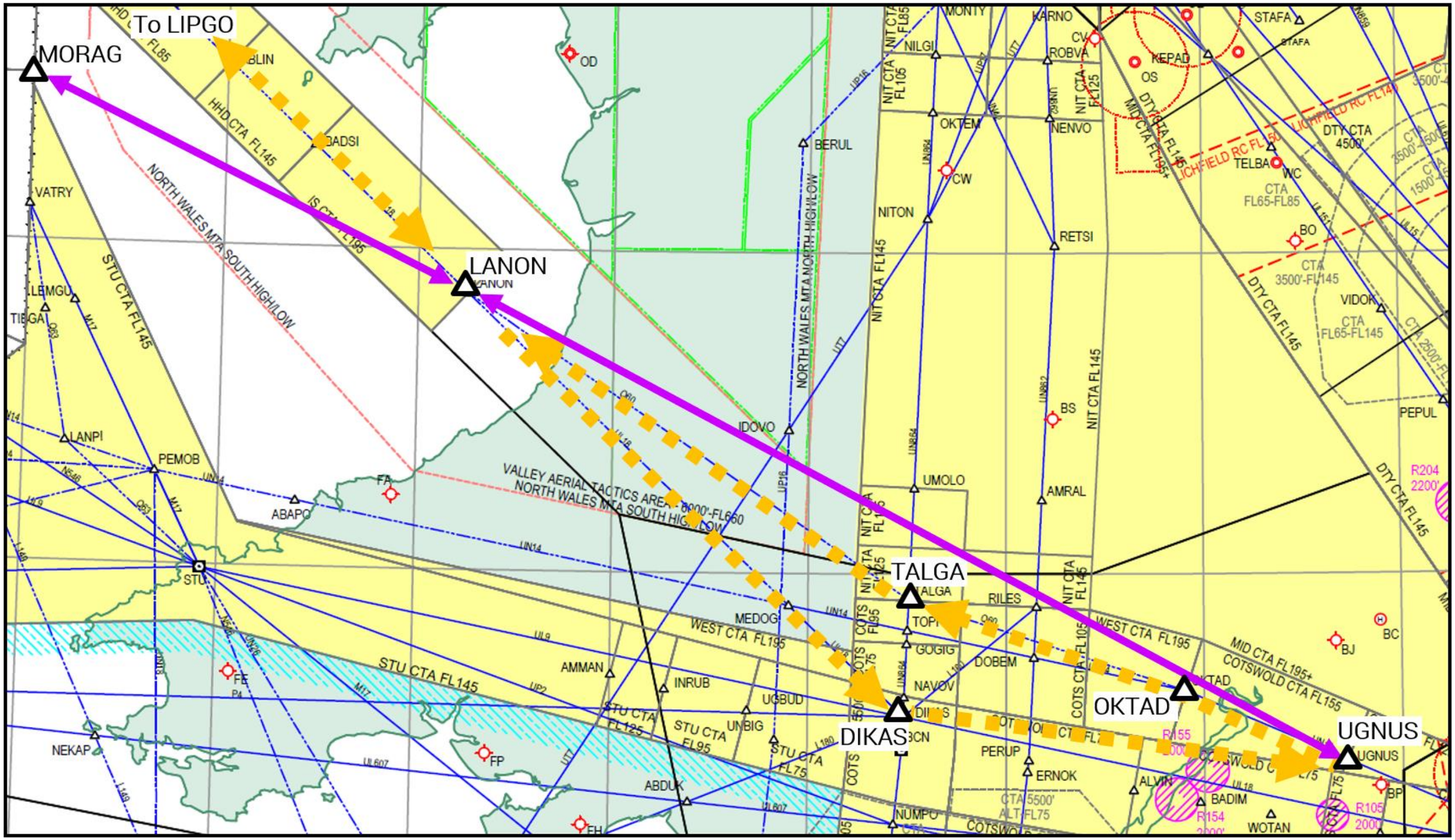

Figure 11 Q60 and L18 MORAG/LIPGO to DIKAS/UGNUS as consulted upon – see para 3.7.4

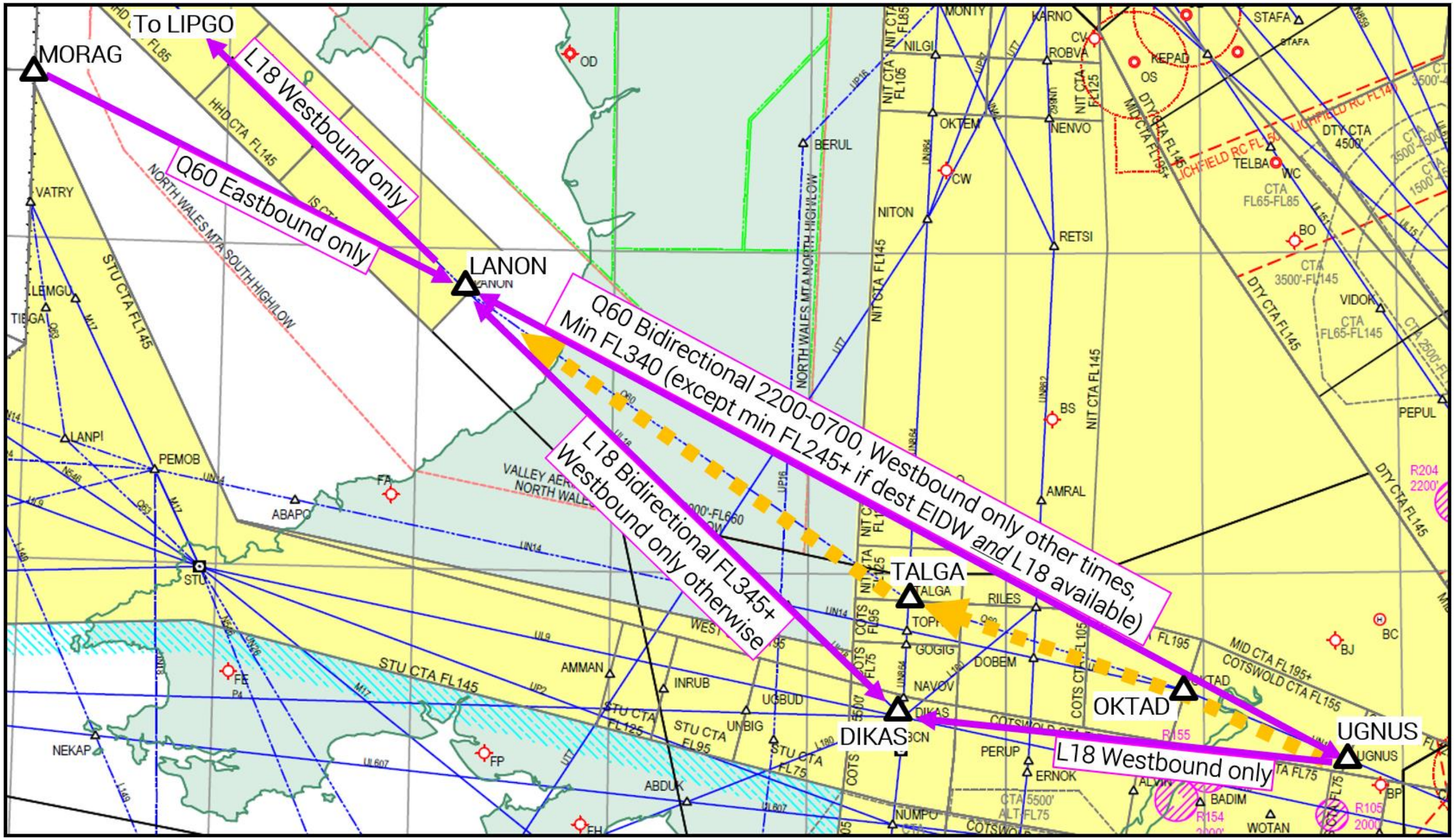

Figure 12 Q60 and L18 MORAG/LIPGO to DIKAS/UGNUS final proposal – see para 3.7.4

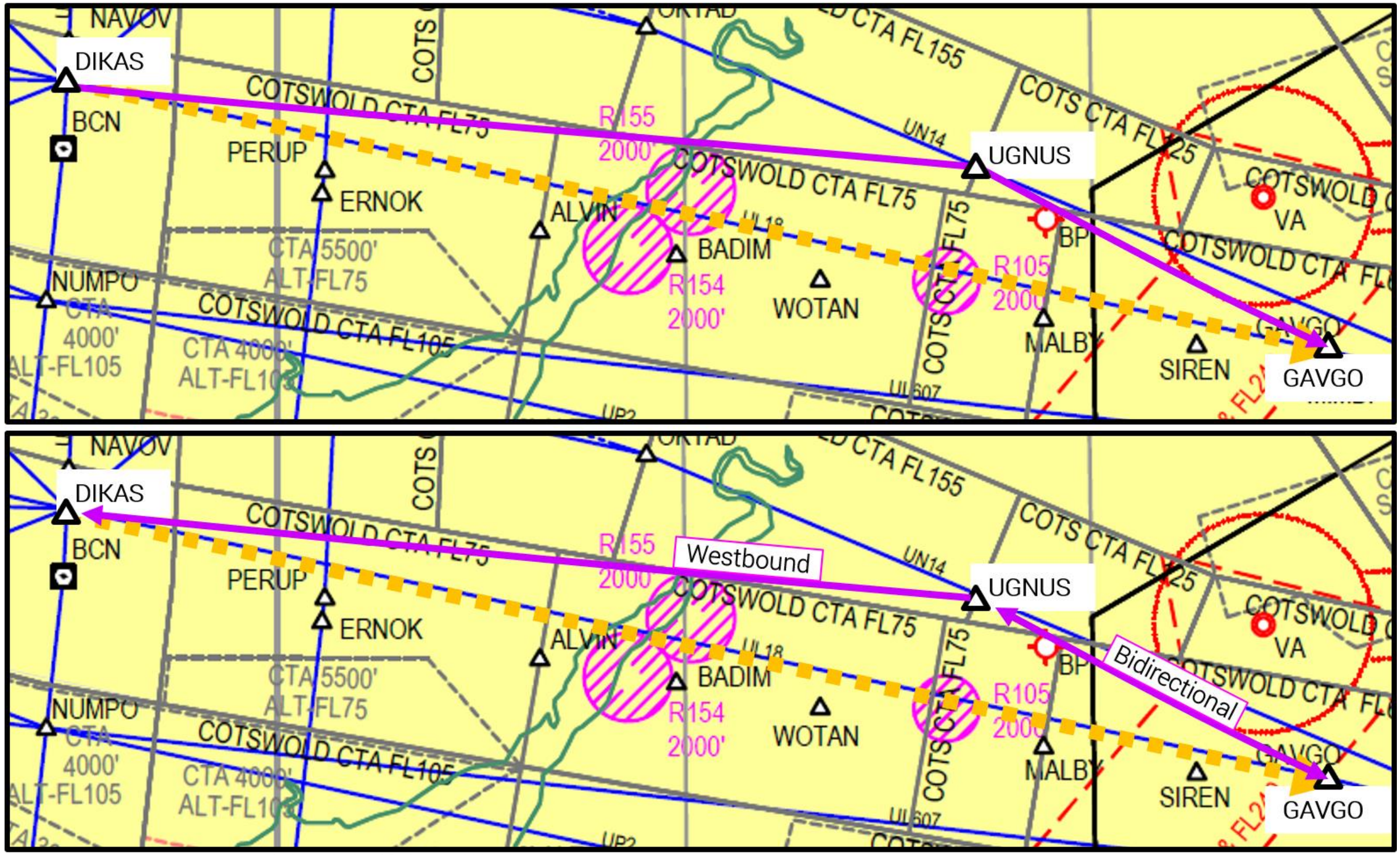

Figure 13 L18 GAVGO DIKAS as consulted upon (top) and final proposal (above) – see para 3.7.5

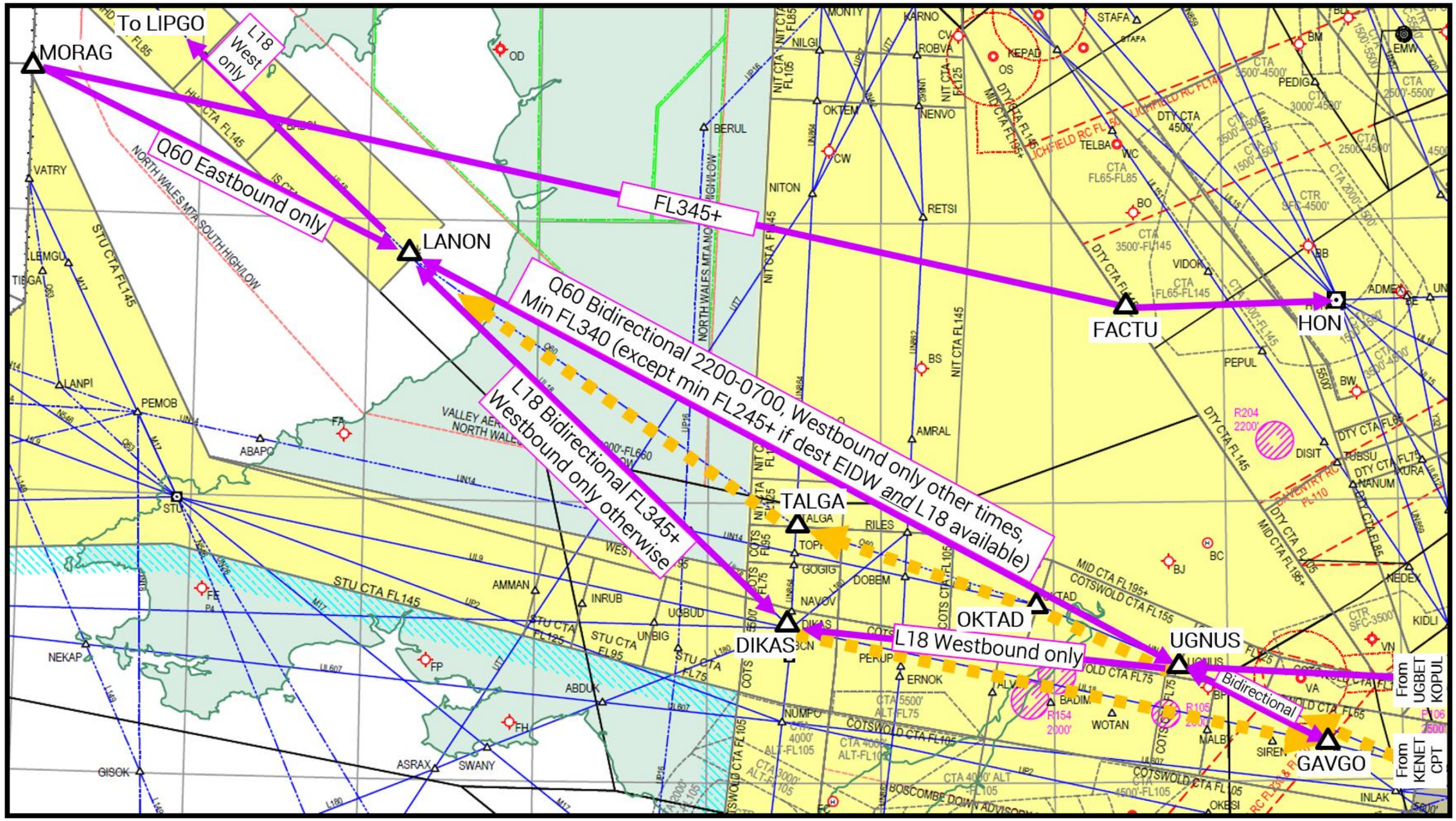

Figure 14 Wider view of P155, Q60 and L18 final proposal, combining Figure 7, Figure 10, Figure 12 and Figure 13 to illustrate connectivity and flow direction in an overview chart

5. Final Options Appraisal

The following table is based on key analyses described in CAP1616 Table E2 on pages 160-162:

Group	Impact	Level of Analysis	Evidence
Communities	Noise impact on health and quality of life	N/A	Changes to commercial air traffic patterns are all above 7,000ft. The potential noise impacts caused by a small number of non-commercial GA-type flights, descending to FL65 at certain times under certain conditions, is neither measurable nor describable.
Communities	Air quality	N/A	No changes below 1,000ft .
Wider society	Greenhouse gas impact	Monetise and quantify	The proposed changes would result in a beneficial net saving in fuel burn of -1,806T in 2020, for the associated regions. In 2030 there would be an increased forecast fuel burn saving of -2,238T for the year. The impact assessment indicates that c.124,000 flights would be impacted by the change by 2020, rising to c.148,000 by 2030. The forecast used was NATS 2017 Annual Base Forecast to produce the annualised numbers. WebTAG was used to assess the greenhouse gas impact over time from the proposed changes, for the traded sector. This design option would yield a positive Net Present Value which reflects a benefit i.e. a CO_2 emissions reduction. There would be a reduction of CO_2 in the opening year (2020) of -4,353T which would further decrease to 55,146T over a 60 year appraisal period. WebTAG was also used to show the overall Net Present Value of CO_2 emissions reduction for the traded sector was calculated at £601,249. Traded and non-traded flights were categorised as intra-EU for traded (72.1%) and all other flights as non-traded (27.9%). These figures were calculated by looking at the origin and destination for UK arrivals, departures and overflights, in 2017. These benefits have arisen from the proposed shorter routes for Birmingham arrivals/ departures and the new high-level ATS routes which offer more direct routings and therefore less track mileage. The proposed Heathrow offload route will result in a small increase of fuel usage and CO_2; however there is still an overall benefit and large reduction in fuel/ CO_2. The worksheet outputs are shown in Section 9.
Wider society	Capacity/ resilience	Qualitative	Increased flightplanning options can allow aircraft operators to avoid capacity-constrained areas. As forecast traffic levels grow, the ability to avoid restrictions by utilising alternative flightplan routes would reduce the likelihood of delay, thus improving the resilience of the wider route network.

General Aviation	Access	N/A	The main change in impact to GA users would be from the volume of new proposed CAS base FL65, near to Birmingham. It would increase the area Birmingham radar can use for tactical vectoring, for their arrivals and departures. The FUA CAS volume is proposed as Class D at lower levels and Class C at higher levels which allows for VFR GA transit, partially mitigating the potential impact. The GA use of this airspace is dependent on weather conditions and seasonality, but can be assumed to exist generally throughout the year. This proposal is expected to cause a low impact on GA users with 94% of GA currently flying at FL65 or lower, in this region (as described in the Compliance Paper previously published).
General Aviation/ commercial airlines	Economic impact from increased effective capacity	Quantify	N/A – there is no forecast increase in air transport movements, passenger numbers or cargo carried as an outcome of this proposal. The flightplan options this proposal would introduce could allow airlines to avoid capacity constrained areas and avoid consequential delay and cost. However this is not quantifiable, and no specific capacity increase is assumed by this proposal.
General Aviation/ commercial airlines	Fuel burn	Monetise	Analysis predicts a decrease in fuel usage and burn, at a saving of £706,225 in 2020, increasing to become a saving of £920,311 in 2030 (both Net Present Value). This was based on the IATA jet fuel price of 10th May 2019, at 669.96USD/tonne converted to GBP at 0.77$/£ and presumes a constant fuel price and exchange rate. The forecast used was NATS 2017 Annual Base Forecast.
Commercial airlines	Training cost	N/A	N/A – it is not proportionate to attempt to quantify airline training costs.
Commercial airlines	Other costs	N/A	N/A – there are no other known costs which would be imposed on commercial aviation.
Airport/ Air navigation service provider	Infrastructure costs	N/A	N/A – there would be no costs attributable to infrastructure.
Airport/ Air navigation service provider	Operational costs	N/A	N/A – this proposal would not lead to changes in operational costs.
Airport/ Air navigation service provider	Deployment costs	Qualitative and quantitative	Approximately 140 LAC/ LTC controllers would require full training. They would require the NATS simulator facility. Support staff are required to run the simulator – data preparation, testing, simulator setup, pseudo pilots, feed sector controllers, training staff, safety analysts, output to be collated into a sim report. Some operational support staff may require briefings. The reduced availability of operational controllers during their conversion training means that operational rostering becomes a factor when considering continuous service delivery. NB NATS cannot quantify training costs for other ANSPs; however their acceptance of this proposal is a high-priority design principle. This proposal cannot be introduced without their agreement and it is assumed that any such training costs are acceptable to these agencies.

6. Safety Assessment

6.1 NATS has a dedicated safety manager for the SAIP project. Their role is to assess the scale of each airspace change, to ensure the CAA-compliant NATS Safety Management System is followed. Also their role is to submit safety arguments with supporting evidence to the CAA's en-route safety regulator, to clearly demonstrate each airspace change is acceptably safe for implementation and the right assurances are in place.

6.2 The NATS safety manager has assessed the SAIP AD5 proposed change. Due to the impacted sectors being of high complexity, and the high capacity of traffic throughput of the combined sector group, along with the changes to ATC routes and procedures, the assessment resulted in a High Impact Change that require full Safety Assurance in accordance with the NATS Safety Management Manual (SMM).

6.3 Any change assessed as 'high impact' triggers a greater depth of safety analysis and mitigation work, it does *not* mean there is any particular safety risk in the region caused by the proposal. As part of the ongoing safety work for SAIP AD5, a full safety analysis occurred which will result in the production of a Project Safety Assurance Report (PSAR). These documents are technical in nature and are designed to be read by experts in the field of aviation safety with full contextual awareness of the contents. These documents are confidential and would not be published as part of the airspace change process. A high level summary of the hazards will be submitted to the CAA as part of the ACP Step 4B, this fulfils the ACP requirement in advance of the wider safety evidence work directly coordinated between SARG and NATS.

6.4 The post-consultation design changes (described in this document) would have no impact on this subject. The following text is the same as that submitted for Stage 3:

Birmingham Arrivals and Departures

6.5 The flows proposed would provide a modernisation and partial systemisation of the region, whereby the handling of flights would be much more predictable.

6.6 The proposal aims to provide more systemised, predictable flightplanning options for Birmingham arrivals and departures which would be fully contained within the proposed CAS volumes thus reducing overall controller and cockpit workload.

6.7 The proposed volumes of CAS would contain Birmingham arrivals and departures within CAS. This is a more predictable air traffic environment during the hours of operation, and logically flights within CAS are safer than those outside CAS.

6.8 This would cause a reduction in the complexity of the region's airspace for the same amount of traffic, for both ATC and pilots. There would be less coordination and fewer tactical actions required, thus reducing the number of controller interactions. This would also result in a lower RT loading.

6.9 NATS' first priority is safety (and transparently demonstrating its commitment to safety). NATS will construct an appropriate safety case to show that an appropriate containment buffer for ATS Routes is applied to the proposed volumes of CAS.

Heathrow Offload Routes

6.10 The flows proposed would provide a more predictable method for the tactical balancing of flows by reducing the need for late tactical stack swaps. This would lead to a more modernised and partially systemised environment.

6.11 This would consequently reduce the operational complexity currently experienced within this region, and potential associated safety risks linked to this.

6.12 The proposed offload route and CAS could be used by pre-selected flights. This would increase the overall environmental efficiency.

6.13 A decrease in coordination and controller interactions would reduce ATC complexity. A reduction in late-notice stack-swaps would reduce cockpit workload.

6.14 NATS' first priority is safety (and transparently demonstrating its commitment to safety). NATS will construct an appropriate safety case in accordance with standard practice.

ATS routes and TRA 002

6.15 There is no particular safety consideration to be addressed by the implementation of new/revised high level ATS routes. However, some items are commonly used tactical-directs which would become formal ATS routes, logically these have better aeronautical data definitions (e.g. AIP publication, defined RNAV status etc).
Addendum post-consultation: The changes to the ATS routes described in this document do not change the safety concepts evaluated under the formal safety assessment.

6.16 There is no particular safety consideration to be addressed by the implementation of a revised TRA 002 boundary. The MoD are content that this would not cause a safety issue for their operation.
NATS is similarly content, and appreciates the MoD's acceptance of this item.

7. Hold Replication, DVOR Rationalisation, future STAR Replication, and this proposal

7.1 For full details of what DVOR rationalisation is, please search the CAA website for ACP-2017-62 which provides an introduction to the concept along with some examples in progress at time of writing.

7.2 This SAIP AD5 proposal includes RNAV1 replications of the existing conventional-navigation WCO, BNN and GROVE holding patterns, as part of the standard instrument arrival (STAR) flight procedures required to service this airspace change.

7.3 At a future date TBC, other conventional-navigation STARs using these same holding patterns will be adapted (replicated) to become RNAV1 STARs – this is generally a technical exercise with no stakeholder impact. Those future replicated STARs will be managed as a separate airspace change outwith this proposal.

7.4 No action is required – this is for completeness of information only.

8. Environmental Assessment – Summary

8.1 Feedback Elements 2 and 11 slightly reduced the annual fuel benefit for Birmingham Airport arrivals and departures because the FUA availability was shortened by one hour from 1000L to 0900L. This reduction in benefit is forecast to be from 489t to 465t in 2020 (loss of 24t fuel benefit), and for 2030 from 549t to 523t (loss of 26t benefit). This is still a benefit, and the loss is acceptable in order for the wider proposal to progress.

8.2 As detailed in para 3.7, some of the other high-level ATS routes were modified slightly in order to improve the connectivity and flow directions within the wider network, leading to increases and losses depending on the situation:

8.2.1 Q60 westbound KOPUL UGNUS – Fuel benefit increases from 312t as consulted upon, to 594t due to the additional westbound traffic captured by connectivity with L179. This is an additional 282t (2020 total annual prediction).

8.2.2 N24 eastbound PEMOB NIGIT – The previously highlighted consultation data error caused this ATS route, predicted to provide 659t of annual fuel burn benefit rising to 743t in 2030, to be removed entirely from the proposal, losing that expected benefit – we apologise for this error.

8.2.3 P155 eastbound MORAG HON – No change.

8.2.4 Q60 and L18 MORAG/LIPGO to DIKAS/UGNUS – Fuel benefit change from 118t as consulted upon, to 82t, a loss of 26t (2020 total annual prediction). For 2030 the figures are 158t and 116t respectively, a loss of 42t compared with the consultation. This is still a benefit, and the loss is acceptable in order to improve the connectivity and flows within the wider network.

8.2.5 L18 GAVGO DIKAS – None was claimed as it was an enabler for other benefits, no change.

8.3 The following table illustrates the differences between the annual fuel burn prediction in the consulted upon design and that of the final design.

Traffic Flow	Annual Fuel Burn Change 2020 (T)		Final CO_2 Change 2020	Annual Fuel Burn Change 2030 (T)		Final CO_2 Change 2030
	Consulted	Final Proposal	CO_2 (T)	Consulted	Final Proposal	CO_2 (T)
Birmingham Arrivals and Departures	-489	-465 (loss 24t)	-1,479	-549	-523 (loss 26t)	-1,663
Heathrow Offload Route	+71	+71	+226	+80	+80	+254
Q60 KOPUL - UGNUS	-312	-594 (gain 282t)	-1,889	-443	-800 (gain 357t)	-2,544
Q60 MORAG – LANON - UGNUS	-118	-82 (loss 36t)	-261	-158	-116 (loss 42t)	-369
N24 PEMOB - NIGIT	-659	0 (error)	0	-743	0 (error)	0
P155 MORAG – FACTU - HON	-299	-299	-951	-425	-425	-1,352
All flows	-1,806	-1,369 (loss 447t)	-4,353	-2,238	-1,784 (loss 454t)	-5,673

Table 2 Comparison of consulted upon fuel burn change vs final proposal fuel burn change

9. Appendix A – 10 year greenhouse gas WebTAG summary

Greenhouse Gases Workbook - Worksheet 1

Scheme Name: NATS SAIP AD5 Stage 4 ACP

Present Value Base Year	2010
Current Year	2018
Proposal Opening year:	2020
Project (Road/Rail or Road and Rail):	road

Overall Assessment Score:

Net Present Value of carbon dioxide equivalent emissions of proposal (£): £601,249

*positive value reflects a **net benefit** (i.e. CO2E emissions reduction)

Quantitative Assessment:

Change in carbon dioxide equivalent emissions over 60 year appraisal period (tonnes): -55,146
(between 'with scheme' and 'without scheme' scenarios)

Of which Traded -39760.24437

Change in carbon dioxide equivalent emissions in opening year (tonnes): -4,353
(between 'with scheme' and 'without scheme' scenarios)

Net Present Value of traded sector carbon dioxide equivalent emissions of proposal (£): £871,126
(N.B. this is not additional to the appraisal value in cell I17, as the cost of traded sector emissions is assumed to be internalised into market prices. See TAG Unit A3 for further details)

*positive value reflects a **net benefit** (i.e. CO2E emissions reduction)

Change in carbon dioxide equivalent emissions by carbon budget period:

	Carbon Budget 1	Carbon Budget 2	Carbon Budget 3	Carbon Budget 4
Traded sector	0	0	-9701.89857	-18072.83835
Non-traded sector	0	0	-3754.27143	-6993.51165

Qualitative Comments:

Sensitivity Analysis:

Upper Estimate Net Present Value of Carbon dioxide Emissions of Proposal (£): £901,874

Lower Estimate Net Present Value of Carbon dioxide Emissions of Proposal (£): £300,625

Data Sources:

Note that, for consistency with Stages 2 and 3, the "current year" in this workbook was left as 2018 as that is when the work was started on the proposal.
Changing the year to 2019 has no effect on the output calculations.

The table below illustrates the distribution of the NPV and CO_2 by traffic flow.

(The total values may not be identical to the sum of the individual traffic flows due to rounding within the analysis)

There is no row for the deleted route N24 PEMOB NIGIT.

Traffic Flow	Net Present Value of CO_2 equivalent emissions of proposal (£) Traded Sector	Net Present Value of CO_2 equivalent emissions of proposal (£) Non-Traded Sector	Change in CO_2 equivalent emissions over 60 year appraisal period (T)	Change in CO_2 equivalent emissions in opening year (T)
Birmingham Arrivals and Departures	N/A	£188,926	-17,280	-1,479
Heathrow Offload Route	N/A	*-£28,873*	*2,641*	*226*
Q60 KOPUL - UGNUS	N/A	£265,660	-24,381	-1,889
Q60 MORAG – LANON - UGNUS	N/A	£37,699	-3,463	-261
P155 MORAG – FACTU - HON	N/A	£137,837	-12,663	-951
Total	**N/A**	**£601,249**	**-55,146**	**-4,353**

10. Appendix C – Analysis modelling methodology and assumptions

Three fuel burn modelling methodologies were used for the calculations in this document:

10.1 Birmingham arrivals and departures

This airspace change has been modelled using the fast-time simulation software AirTOp.
The traffic sample days used were the 6th & 8th July 2016 grown to 2019 traffic.
Annualised traffic figures are based on the 2017 NATS base case forecast.
The traffic sample contained all aircraft which arrived or departed at EGBB.
The AirTOp Model was run once each for easterly and westerly operations and then weighted 30%/70% in accordance with typical runway use.
Fuel burn modelling has been undertaken using the KERMIT emissions model. The KERMIT model uses Base of Aircraft Data (BADA) data which has been made available by the European Organisation for the Safety of Air Navigation (EUROCONTROL) all rights reserved. The AirTOp simulation model also uses BADA aircraft performance data.
Fuel uplift is included in the assessment.
AirTOp version 2.3.112 was used.
The Baseline traffic data was based on flight plan data and not actual flown data. This ensured that network constraints associated with excessive demand did not mask underlying demand requirements on the airspace.
When undertaking comparative analysis between the scenarios, the traffic samples remained the same as that in the Baseline (do-nothing) scenario. This was to ensure any observed differences were due to the airspace design, not due to changes in the traffic sample.
No conflict resolution was applied Controller tasks were completed instantaneously with each controller able to control multiple aircraft simultaneously (no workload constraints or response limitations applied). For the fuel burn analysis, the models were run once only, using the scheduled aircraft departure times as per the flight plan. Holding and arrival separation was not turned on within the baseline and scenario. The average fuel burn benefit per aircraft is calculated using only the traffic and aircraft types observed on the particular traffic flows relevant to the scenario

10.2 Heathrow Offload Route

Flights were modelled using the NATS Analytics profile generator.
Comparisons were made to show the difference in total fuel burn and total CO_2 emissions for the route change. The fuel burn and CO_2 emissions were calculated using the NATS Analytics tool KERMIT (Kerosene Emissions Research Model in the TMA), using Eurocontrol BADA data.
For each aircraft type the average fuel uplift percentage was calculated using the equation detailed in Fuel Uplift: Methodology for Application, 2013.
The traffic sample used was from 2017 NEST data grown to 2020/2030 traffic levels using the 2017 NATS traffic base forecast.

10.3 High-level ATS routes

As there is no level change for traffic using the ATS routes, the fuel saving was calculated for each flight by multiplying the distance saving (NM) by the fuel burn (per NM) for that aircraft type at their RFL (using Eurocontrol's BADA data).
Fuel uplift was then applied using the Fuel Uplift: Methodology for Application, 2013 to give the overall change in fuel used.

End of document