Swanwick Airspace Improvement Programme
Airspace Development 4 (Dutch Interface Routes)

SAIP AD4
Documentation:
Stage 4 Update and Submit

Step 4B Airspace Change Proposal

NATS Uncontrolled

Action	Position	Date
Produced	Airspace Change Assurance, NATS Future Airspace & ATM	15/06/2018
Approved	ATC Lead – Airspace, NATS Swanwick ATM Development	15/06/2018
Approved	Project Manager SAIP	15/06/2018

Table 1 Production roles

NATS UNCLASSIFIED

Issue	Month/Year	Change Requests in this issue
Issue 1.0	Jun 2018	ACP submitted to CAA

Table 2 Publication history

1. Contents

2. Introduction

NATS' Swanwick Airspace Improvement Programme (SAIP) is proposing a number of modular airspace changes within the London Flight Information Region (FIR), managed by NATS Swanwick. It aims to modernise each region via airspace deployments (AD) in different regions of the FIR.

This module, SAIP AD4, concerns the development and systemisation of westbound air traffic service (ATS) routes in the Clacton Sector where there is significant demand forecast for the future. This region is known by LVNL (Dutch ANSP), MUAC (Maastricht Upper Airspace Control Centre) and NATS as the 'REFSO box' and is a volume of airspace in the Dutch FIR within which the air traffic service are delegated to NATS.

This proposal seeks to alter the westbound traffic flows from Maastricht Delta Sector (MUAC) which currently funnel via a single coordination waypoint (COP), GORLO, to more than one route via additional COPs. Some of the proposed routes will be designated as RNAV1 routes, providing a more systemised route structure aimed at reduced complexity and workload in this region of airspace. An enhanced cross border transfer of westbound traffic will reduce complexity and workload for NATS, LVNL and MUAC.

This proposed change has been designed in support of, and to complement, MUAC's free route airspace implementation (FRA-M) in the Netherlands, east of the UK FIR boundary and area of ATS delegation. This proposal also seeks to alter some eastbound flows, from NATS towards MUAC, in order to partially offset potential fuel disbenefit due to the westbound systemisation.

This is a Level 2A airspace change proposal (ACP). The proposed changes are all above 7,000ft and mostly over the sea. Priority has not been given to local environmental impacts such as noise, visual intrusion, tranquillity or local air quality.

If the proposal is approved by the CAA, the proposed design would be implemented on 6th December 2018.

3. Executive Summary

To facilitate the change summarised above, NATS developed design principles, evaluated some design concepts, analysed the leading concept, created a strategy to identify, engage and target specific stakeholders, launched & completed a focussed consultation, and analysed & categorised the responses submitted by fourteen stakeholders – see the table of references on page 27 for links to the relevant documents.

As covered in the Stage 3 Step 3D Collate and Review Responses document (Ref 12), three response elements were identified with the potential to impact the proposed design. Of those three, two were progressed into the final design (one specific improvement to westbound flows, one general improvement to eastbound flows) and one was rejected because it would be contrary to one of the design principles (would cause changes to traffic patterns below 7,000ft). This is detailed in Stage 4 Step 4A Update Design (Ref 13).

4. Current Airspace Description

4.1 Structures and Routes - UK-Dutch FIR Interface

The provision of ATS is delegated to LAC S13 at FL295 and above; and to LAC S14 between FL215 and FL295, in the area to the east of the London/Dutch FIR/UIR boundary. This area of ATS delegation is known as the 'REFSO Box'.

There are currently just two access waypoints from the MUAC Delta Sectors to LAC Clacton S13 and S14: GORLO and REFSO. These can be seen in Figure 1 below which shows the current route and sector structure in this region of airspace. MUAC airspace contains several flightplannable DCTs to GORLO from the east, which become ATS routes from GORLO westwards.

They are: GORLO – REFSO
GORLO – PEVAD
HSD – REFSO

The majority of traffic entering UK airspace from MUAC Delta sector flightplans via GORLO.

The transfer of communications and control from MUAC Delta Sector to NATS occurs in relation to these routes.

Currently, the volume of traffic that converges in the same area (GORLO) creates a high level of complexity and workload due to the manual tactical vectoring given by ATC. The complexity in this area of airspace is also often high due to traffic not being on flightplanned routes. With traffic forecast to increase, the complexity and workload will also continue to grow; alongside a rise in capacity pressure.

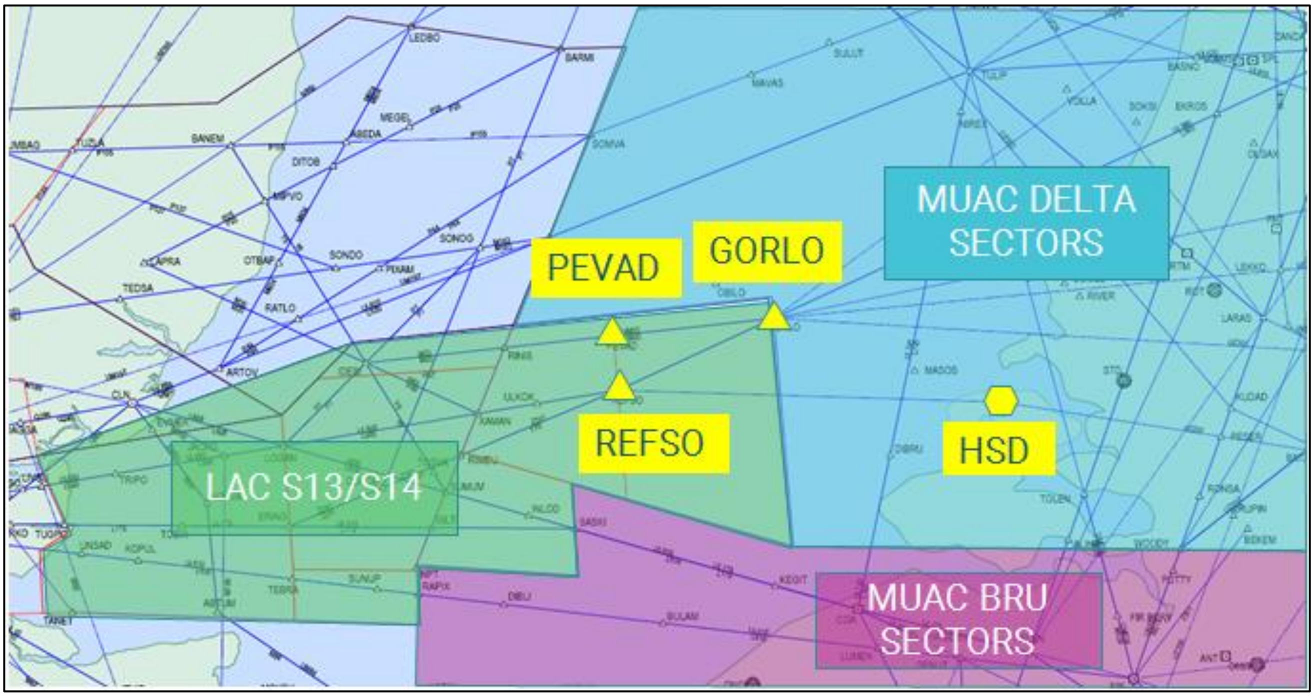

Figure 1: Existing Route and Sector Structure

The following figures illustrate the current usage via actual traffic density taken from radar data analysis. Westbound and eastbound traffic flow schematics are provided, separately, for ease of illustration.

4.2 Airspace usage and proposed effect

Figure 2 below shows a traffic density plot of all flights in the region. It was created using radar data from 1st to 12th June 2017; a period covering two summer weekends. The data was filtered to show traffic at FL100 or above. The flightplannable routes mentioned above can clearly be seen by a large number of aircraft (30+ a day) which flew these, with wide swathes either side of the flightplan routes within which ATC typically use tactical vectoring or direct routings.

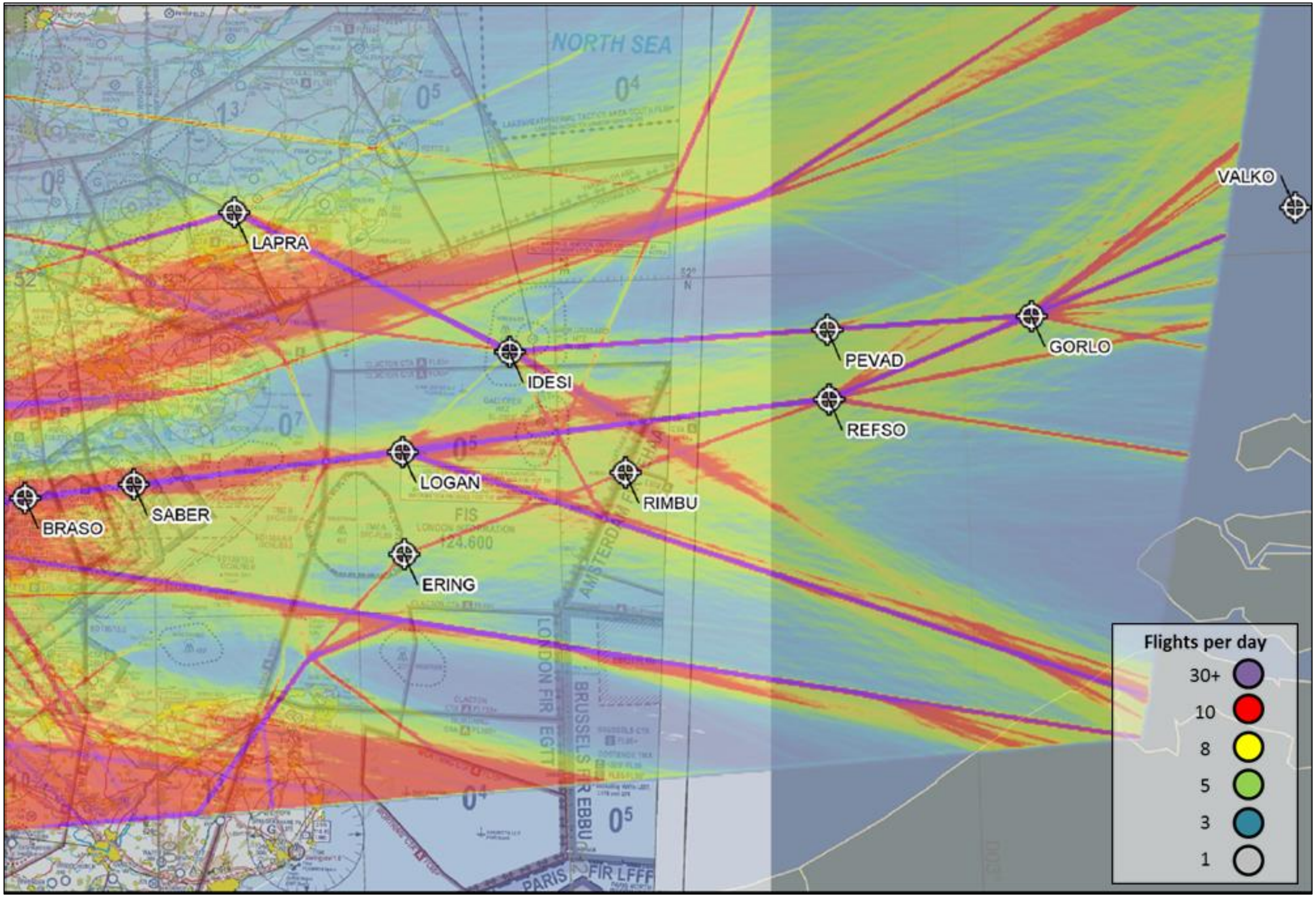

Figure 2 Current Traffic Density Plot, FL100+, showing 1-12 June 2017, a period of 13 days

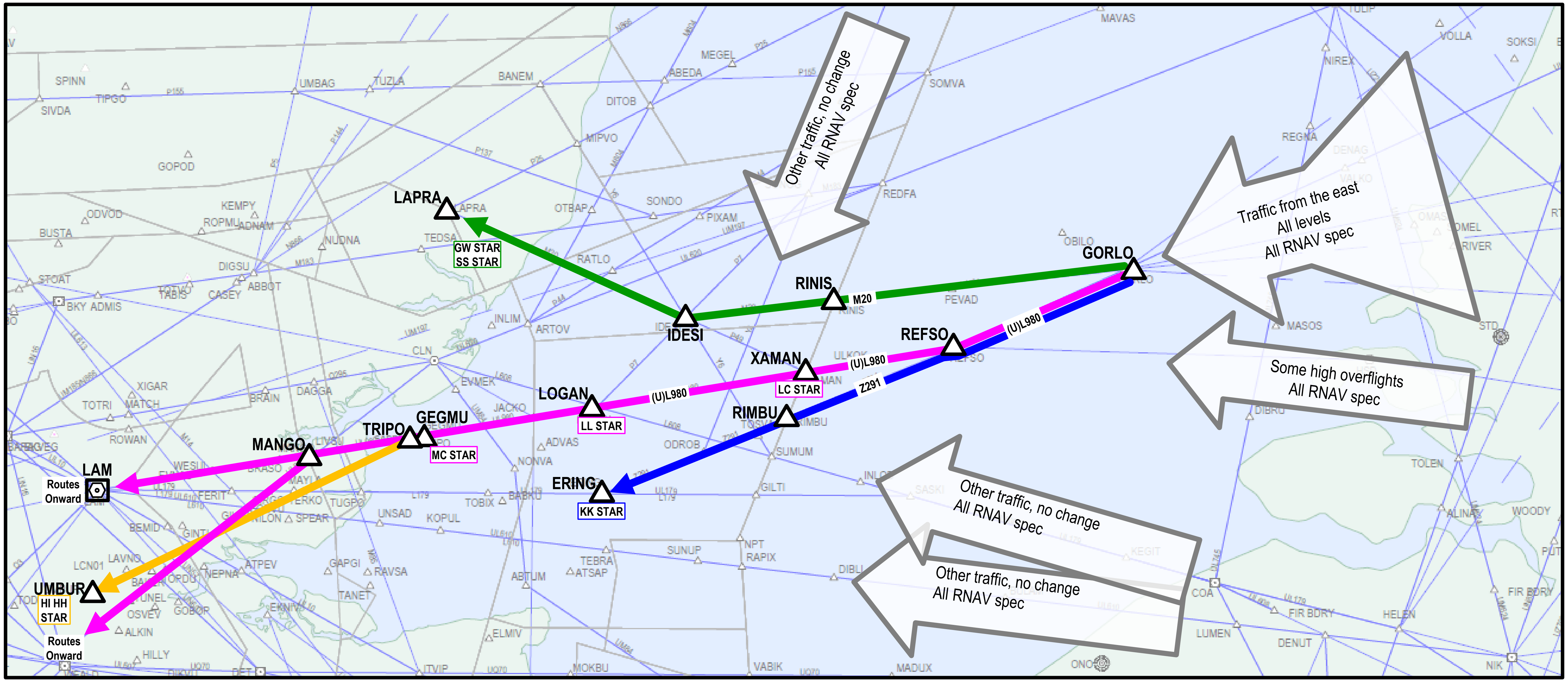

Figure 3: Current westbound routes, current flows of traffic relevant to this proposal

From GORLO To	Flight Level	Relevant Route Segment
EGGW EGSS	All	GORLO M20 LAPRA STAR connection point
EGLL EGWU EGLC EGMC EGKB EGLF LTMA overflights	All	GORLO L980 to STAR connection point GORLO L980 MANGO route onward via UL620 or LAM
EGKK	All	GORLO L980 REFSO Z291 ERING to STAR connection point
EGHI EGHH	All	GORLO L980 TRIPO UMBUR STAR connection point

Table 3: Westbound current route flow information

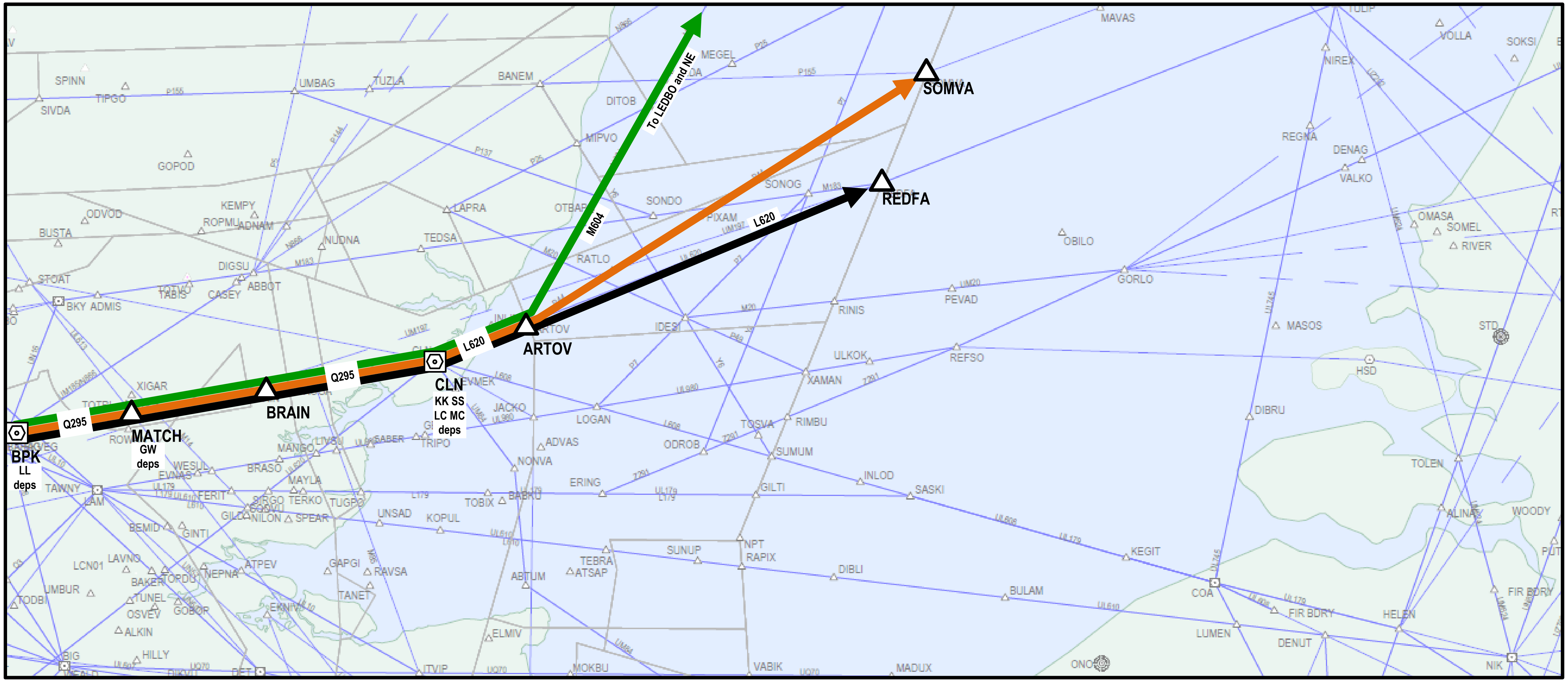

Figure 4 Most Relevant Current Eastbound Traffic Flows

Deps To REDFA	Flight Level	Relevant Route Segment	Deps to SOMVA	Flight Level	Relevant Route Segment	Deps to LEDBO and NE	Flight Level	Relevant Route Segment
EGLL	All	SID to BPK-Q295-CLN-L620	EGLL	All	SID to BPK-Q295-CLN-L620-ARTOV-P44-SOMVA	EGLL	All	SID to BPK-Q295-CLN-L620-ARTOV-M604
EGKK EGSS EGLC EGMC	All	SID or Dep to CLN L620 REDFA	EGKK EGSS EGLC EGMC	All	SID or Dep to CLN-L620-ARTOV-P44-SOMVA	EGKK EGSS EGLC EGMC	All	SID or Dep to CLN-L620-ARTOV-M604
EGGW	All	SID to MATCH-Q295-BRAIN-Q295-CLN-L620-REDFA	EGGW	All	SID to MATCH-Q295-BRAIN-Q295-CLN-L620-ARTOV-P44-SOMVA	EGGW	All	SID to MATCH-Q295-BRAIN-Q295-CLN-L620-ARTOV-M604

Table 4 Eastbound current route flow information

The proportions of airlines using the region has previously been described in the consultation strategy document (Ref 9). As per that document, airlines BAW, CFE, BEE, EZY, IBK, KLM, RYR, SAS and WZZ were our primary target because, combined, their flights account for c.70% of all flightplans using waypoint GORLO, and also are the operators whose proportion of flights each makes up 2% or more of flights using that same waypoint. These nine airlines are those most likely to be frequently impacted by the proposed changes, with the most frequent having an average of more than 50 flights per day, and the least frequent at least 7 flights per day.

A further 374 operators flew via GORLO in 2017, making up the remaining 30%.
339 of those operators flew on average less than once per day.
285 of those operators flew on average less than once per week.
199 of those operators flew on average less than once per month.

Proportionally, the remaining operators lower down the list fly far less frequently than the nine primary targets.

A further twelve operators CPA, AFL, EWG, GWI, FIN, LOT, DAL, BCY, UAE, VIR, VLG and NJE range from 1.4% (5.6 per day) to 0.5% (2.1 per day) of flights through GORLO.

The table below shows the aircraft types in the 75th percentile which flew via the fix GORLO in 2017. There were a total of 141,161 flights which matched these criteria.

Aircraft Type	Generic AC Type	Total	Proportion
A320	Medium Airbus	29,350	20.79%
B738	Medium Boeing	27,992	19.83%
A319	Medium Airbus	16,166	11.45%
A321	Medium Airbus	8,862	6.28%
B77W	2 Engine Boeing Heavy	6,561	4.65%
E190	2 Engine Small Jet	5,821	4.12%
DH8D	Heavy Turboprop	5,064	3.59%
E170	2 Engine Small Jet	3,049	2.16%
B772	2 Engine Boeing Heavy	2,824	2.00%

Specific Aircraft Types via GORLO (2017)

The table below shows the top 99% of these flights categorised by a generic aircraft type. Medium Airbus and Boeing aircraft made up 62% of these. The total and proportion of these aircraft types is not anticipated to change as a consequence of this proposal.

Generic Aircraft Type	Total	Proportion
Medium Airbus	55,358	39.22%
Medium Boeing	32,062	22.71%
2 Engine Small Jet	11,769	8.34%
2 Engine Boeing Heavy	10,347	7.33%
2 Engine Airbus Heavy	8,097	5.74%
Heavy Turboprop	5,592	3.96%
Small Jets	4,744	3.36%
Super Heavy	2,516	1.78%
Small Heavy	2,456	1.74%
Upper Medium	1,818	1.29%
4 Engine Medium	1,727	1.22%
4 Engine Boeing Heavy	1,649	1.17%
3 Engine Small	1,114	0.79%

Generic Aircraft Types via GORLO (2017)

4.3 Operational efficiency, complexity, delays and choke points – proposed effect

Currently, westbound traffic from adjacent ANSPs through the Clacton sectors converge on a single COP (known as GORLO). Traffic is manually split and separated into flows by air traffic control. This is a highly manual and workload intensive task; with traffic forecast to increase in the region, the complexity and associated controller workload will also increase, leading to inefficiencies and delay.

The proposed changes have been designed to reduce the complexity in this region of Dutch airspace through improvements made to the ATS route structure. It would mean that traffic is split into appropriate flows as it arrives in the Clacton sectors; leading to decreased controller workload and increased capacity.

NATS' proposed changes have been designed in order to minimise the scale of airspace change in the UK as well as supporting the implementation of MUAC's free route airspace (FRA-M). This is our justification.

The additional objective is to minimise fuel disbenefit which may be caused by the proposed westbound systemisation. To achieve this we are proposing changes to some of the eastbound flows, to reduce flightplan distance where possible. This fits with the Gatwick, Stansted and London City SID truncation work (separate from this proposal, but also enabling it – see para 6.3).

4.4 Safety issues

There are no specific safety issues within this area of airspace, in the current operation, to be solved by this proposal. Please see Section 10 for more details.

4.5 Environmental issues

There are no specific environmental issues within this area of airspace, in the current operation, to be solved by this proposal.

The current highly tactical westbound operation involves controllers manually changing aircraft headings and speeds in order to split them into appropriate flows. This controller tactical intervention is inefficient but cannot be easily captured as a measurable environmental issue. This proposal would formalise the westbound flow structure, reducing the need for tactical interventions, improving controller and pilot workload and reducing the likelihood of sector delays (which themselves are environmentally inefficient).

The cost of this more-predictable, lower-workload environment is a slight lengthening of flightplans for some route types, leading to an annual increase in fuel and CO_2 for some airline stakeholders. As outlined in the design principles (Ref 4 Design Principle 2), the primary environmental design principle for this proposal is to minimise fuel disbenefit. A detailed analysis of the environmental impact of the proposed changes is given in para 7.6 on page 18.

As the proposed changes are all above 7,000ft and mostly over the sea, priority has not been given to local environmental impacts such as noise, visual intrusion, tranquillity or local air quality.

5. Statement of Need

The following text is v2 of the DAP1916 form, as submitted in Jan 2018:

Issue: Most westbound traffic from adjacent ANSPs through the Clacton Sectors currently converge on a single coordination point (COP). They are tactically split and separated into appropriate flows by air traffic controllers. This is a highly controller-manual process and, with traffic increasing in the region, the complexity will increase leading to further controller workload, inefficiencies and delay.

Opportunity: NATS will work with our adjacent ANSP colleagues to reduce the complexity in the region by changing the ATS route structure in that area of Dutch airspace to better suit the UK Clacton controllers operating its ATS.

Desired Outcome: Traffic arrives in the Clacton sectors already split into appropriate flows, leading to decreased controller workload and increased capacity.

Specific challenges to overcome: The majority of this ATC complexity occurs in Dutch airspace, where the ATS is delegated to the UK Clacton Sectors. All changes must be agreed the by two adjacent ANSPs due to its cross-border nature.

6. Proposed Airspace Description

6.1 Objectives/Requirements for Proposed Design

The main requirement of this proposal is to complement MUAC's free route airspace implementation project and reduce UK controller workload by providing a systemised route structure for the westbound flow from the Netherlands FIR, with the collaboration of MUAC and LVNL.

The additional objective is to minimise fuel disbenefit which may be caused by the main objective.

For more details see para 4.3 on page 9.

6.2 Proposed New Airspace/ Route Definition and Usage

The proposed airspace arrangement splits the relevant westbound traffic into three main flows which can be radar monitored (reducing controller workload), and also modifies the eastbound traffic flows to partially offset any westbound fuel disbenefit. The following figures describe the proposed westbound and eastbound flow schematics, separately, for ease of illustration. They are equivalent to Figure 3 on page 6 (westbound) and Figure 4 on page 7 (eastbound). We are also proposing changes to two higher level ATS routes eastbound, and amending part of the area where air traffic services are delegated to the UK from the Netherlands via our ANSP collaborator LVNL. For full details of the changes made to the consulted-upon airspace arrangements please see Stage 4 Step 4A Update Design document (Ref 13).

We do not predict changes to the aircraft type mix using the region as a result of this proposal – we predict it will remain broadly comparable with the table describing Generic Aircraft Types via GORLO on page 8.

For full details of:

Info	See this ref document	Notes
Technical definition document	Ref 14	WGS84 data in excel format. Contains waypoint coordinates, ATS route segment true tracks, accurate distances between significant locations. To be approved by CAA mapping team. Closely associated with Ref 15.
Draft AIP changes	Ref 15	Lists AIP pages where changes need to occur and what those changes should be. Closely associated with Ref 14.
Airspace Design Definition (ADD)	Ref 16	The main repository of ATC design information relating to network connectivity, how it impacts specific sectors, and other items required to make changes to the ATC work environment. Associated with both Ref 14 and Ref 15.

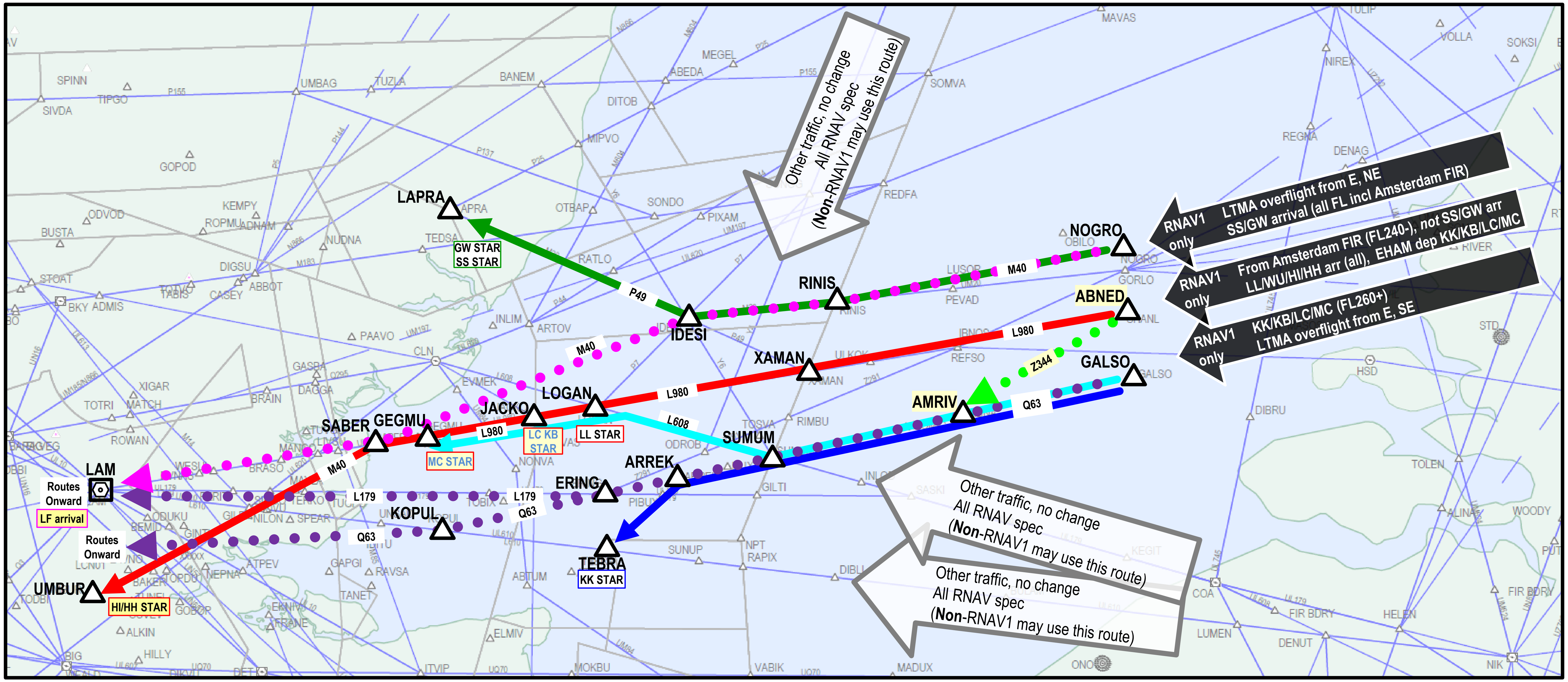

Figure 5 Final Design - Westbound proposal

To	Flight Level	Relevant Route Segment
EGGW EGSS	All FLs	NOGRO M40 IDESI P49 LAPRA STAR connection point
LTMA Overflights from E/NE	All FLs	NOGRO M40 SABER L980 LAM route onward
EGLL EGWU	All FLs	ABNED L980 to STAR connection point
EGHI EGHH	All FLs	ABNED L980 SABER M40 UMBUR STAR connection point
EGLC EGKB EGMC	FL200-	ABNED L980 to STAR connection point
All destinations, leaving the Amsterdam FIR (except arrivals to EGGW EGSS EGKK)	FL240-	ABNED L980 SABER L980 LAM route onward
EGLF	All FLs	ABNED L980 SABER L980 LAM connection to arrival route
EGKK (except deps from EHAM)	FL260+	GALSO Q63 ARREK TEBRA STAR connection point
EGKK (only deps from EHAM)	FL240-	ABNED Z344 AMRIV Q63 ARREK TEBRA STAR connection point
EGLC EGKB EGMC	FL260+	GALSO Q63 SUMUM L608 LOGAN to STAR connection point
LTMA Overflights from E/SE	All	GALSO Q63 ERING route onward via Q63 KOPUL or L179 LAM

Table 5: Final Design - Westbound proposed route flow information

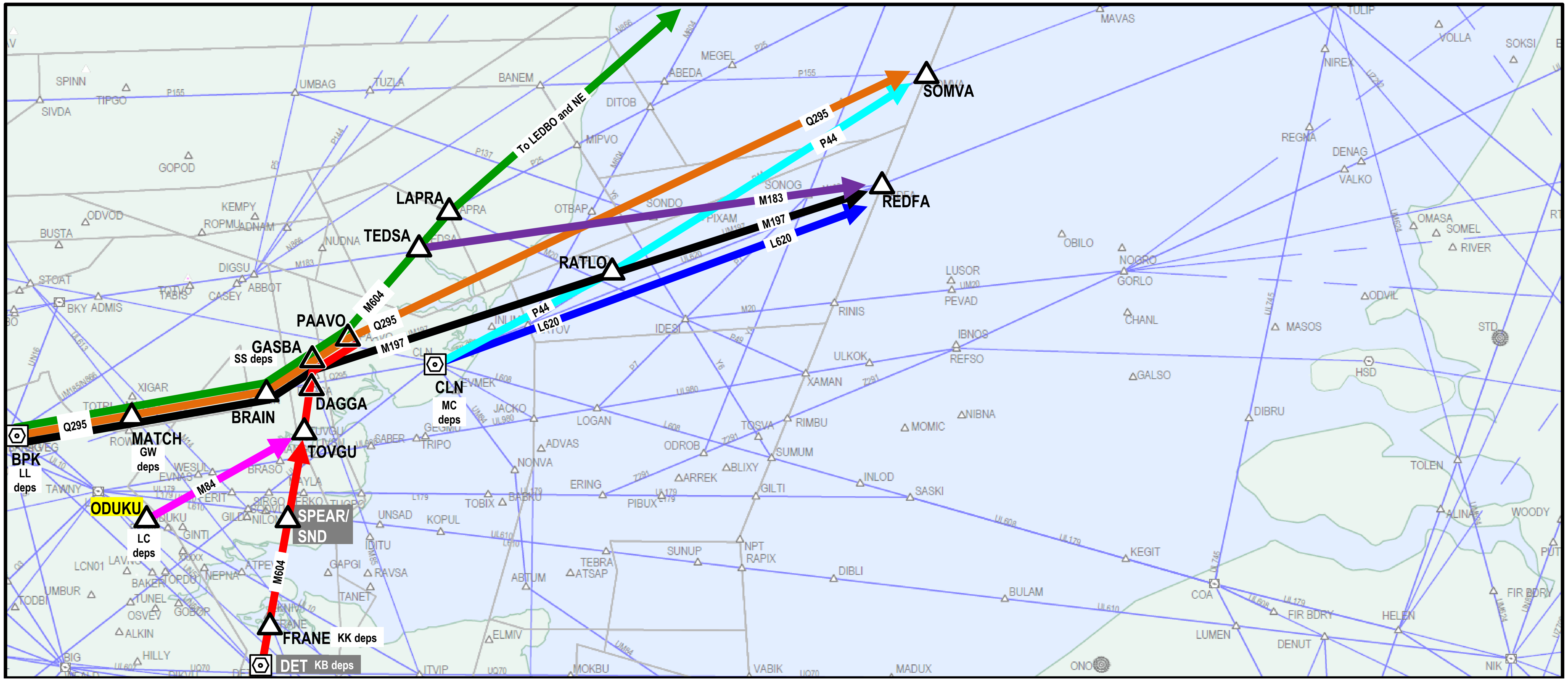

Figure 6 Final Design – Eastbound proposal

Deps To REDFA	Flight Level	Relevant Route Segment	Deps to SOMVA	Flight Level	Relevant Route Segment	Deps to LEDBO & NE	Flight Level	Relevant Route Segment
EGLL	All	SID to BPK-Q295-BRAIN-M197-GASBA-M197-REDFA	EGLL	All	SID to BPK-Q295-PAAVO–Q295–SOMVA	EGLL	All	SID to BPK-Q295-PAAVO-M604-LAPRA-M604-LEDBO-M604…
EGKK	All	SID truncated to FRANE-M604-DAGGA-GASBA–M197-REDFA	EGKK	All	SID truncated to FRANE-M604- PAAVO–Q295–SOMVA	EGKK	All	SID truncated to FRANE-M604-PAAVO-M604-LAPRA-M604-LEDBO-M604…
EGSS	All	SID truncated to GASBA–M197–REDFA	EGSS	All	SID truncated to GASBA–M197–RATLO–P44–SOMVA	EGSS	All	SID truncated to GASBA–M604-PAAVO-M604-LAPRA-M604-LEDBO-M604…
EGGW	All	SID to MATCH–Q295–PAAVO–M604–TEDSA–M183–REDFA	EGGW	All	SID to MATCH–Q295–SOMVA	EGGW	All	SID to MATCH -Q295–PAAVO- M604-LAPRA-M604-LEDBO-M604…
EGLC	All	SID truncated to ODUKU–M84–TOVGU–M604–GASBA–M197–REDFA	EGLC	All	SID truncated to ODUKU–M84–TOVGU–M604-PAAVO–Q295–SOMVA	EGLC	All	SID truncated to ODUKU–M84–TOVGU–M604-PAAVO-M604-LAPRA-M604-LEDBO-M604…
EGMC	All	Dep to CLN–L620–REDFA	EGMC	All	Dep to CLN–P44–SOMVA	EGMC	All	(As per SOMVA then NE when east of the FIR boundary)
EGKB	All	Dep to DET M604-DAGGA-GASBA–M197-REDFA	EGKB	All	Dep to DET M604- PAAVO–Q295–SOMVA	EGKB	All	Dep to DET M604- PAAVO-M604-LAPRA-M604-LEDBO-M604…

Table 6 Final Design - Eastbound proposed route flow information

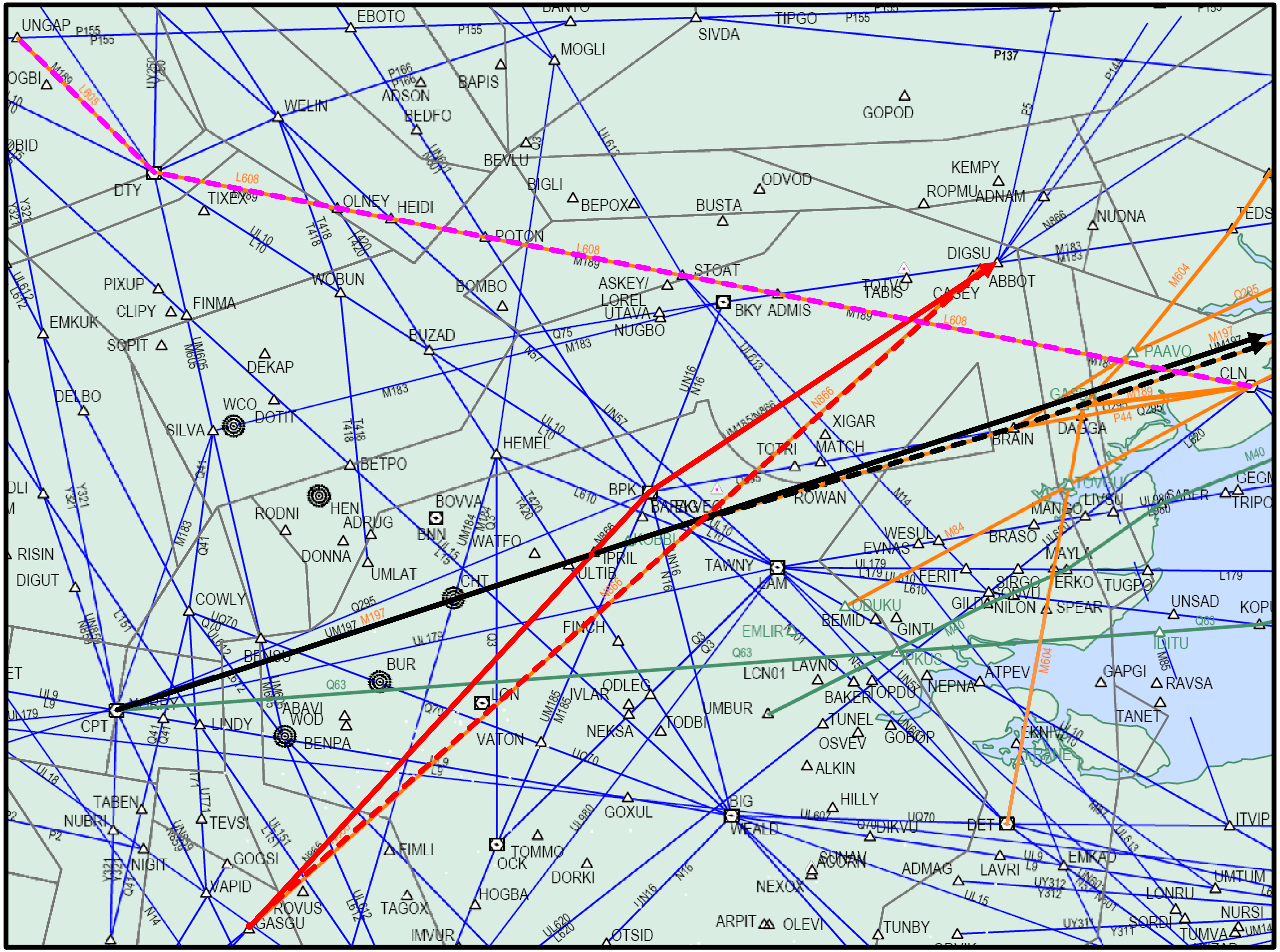

Figure 7 Additional eastbound improvements M197, N866

N866 dogleg via BPK removed, shorter eastbound flightplan mileage
Removes unwanted M185 dual-designation

M197 lateral amendment allows better LTMA departure connectivity to the new eastbound flows.
The current M197 base is too high in this region for EHAM arrivals via Sector 12, meaning such flights must avoid the more-direct (yet unavailable) M197 and plan a dogleg via L620/M185/Q295 – affecting heavy transatlantics into Schiphol.
Lowering M197's base in the region allows operators to access this more direct route, with shorter overall eastbound flightplan mileage.
Conversion from CDR1/3 to permanent ATS route east of CPT removes night time/ weekend restrictions in this region, allowing the route segment to be used H24, maximising benefits.

Was segment of M189
Now redesignated L608
(administrative, more logical name)

Background chart:
Blue routes are current
Orange and **Green** routes are the main focus of this proposal (see other figures)

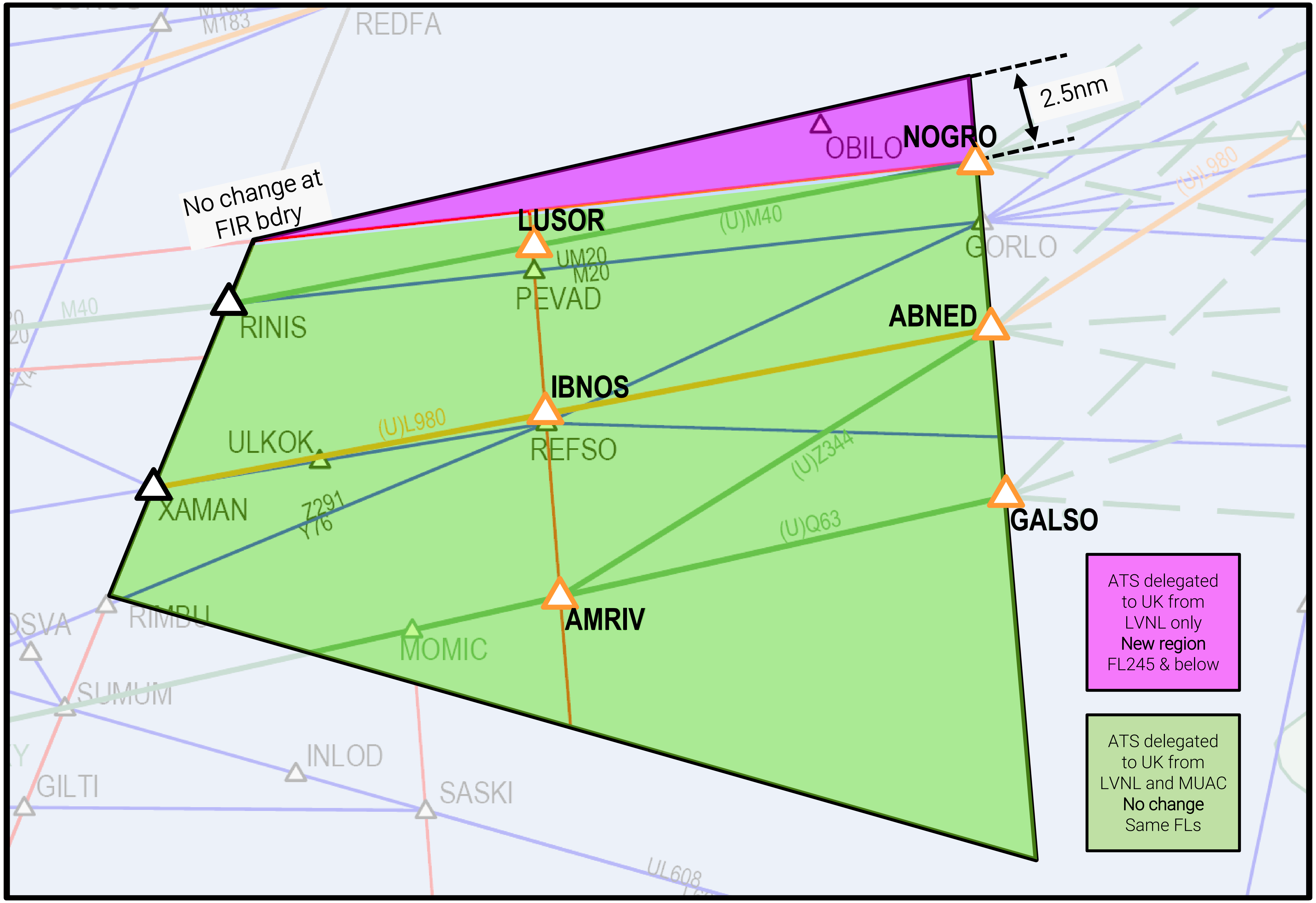

Figure 8 ATS delegation arrangements

LVNL has requested that NATS takes on ATS responsibility for the magenta area up to FL245, width 2.5nm in the vicinity of NOGRO tapering to none at the FIR boundary.
NATS is already responsible for the green area (no change to volume or levels).

SID Truncations and this proposal

6.3 For full details see Stage 4 Step 4a Update Design, Section 7 (Ref 13).

6.4 London City, Gatwick and Stansted current SIDs via CLN are planned to be truncated – either before, or at the same time as, this proposal is implemented. The CLN SID truncations for these airports are enabling items for SAIP AD4 and may provide a fuel benefit.

6.5 The fuel analyses elsewhere in this document are standalone, based on the SAIP AD4 final design in this document. The potential CLN SID truncation benefits are not being claimed under this SAIP AD4 proposal.

Standard Terminal Arrival Route (STAR) naming convention, DVOR Rationalisation and this proposal

6.6 There will be changes to some Standard Terminal Arrival Routes (STARs) in the region, at the same time as this proposal.

6.7 This is for three reasons:

6.7.1 Firstly, some STARs are being truncated or removed as part of this proposal. This is where ATS routes and STAR routes have common route segments. Examples include Luton EGGW and Stansted EGSS STARs via ABBOT/CASEY which can be truncated at common waypoint LAPRA, and Gatwick EGKK STARs via TIMBA which can be truncated at common waypoint ABTUM under this proposal, meaning an unnecessary duplicate STAR can be withdrawn. Reducing the number of STARs reduces the burden on flightplanning infrastructure and also reduces chart maintenance.

6.7.2 Secondly, because international standards mean the STAR's name (designation) should be the *first* waypoint in its definition. Currently, the UK names its STARs after the *last* waypoint in its definition, but the UK is gradually transitioning to the international standard first-waypoint method.

6.7.3 Thirdly, DVOR rationalisation causes STAR changes – see below.

DVOR Rationalisation and this proposal

6.8 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.

6.9 The DVOR rationalisation work will also change some STAR names at the same time.

6.10 This is worth noting because the Airspace Design Definition (known as ADD) and the draft AIS data, supplied for this proposal under Step 4B, will refer to the *finalised* names – either due to truncation / change of naming convention as part of this SAIP AD4 proposal, or due to the (separate) DVOR rationalisation proposal. This is to avoid accidentally progressing two names for the same STAR where changes are in the same overlapping region, and more than one AIS data package is supplied.

6.11 Changing the name of a STAR causes no impact and makes no difference to the actual route flown by the aircraft, except as already illustrated in this proposal (all above 7,000ft). There are no impacts on, or benefits for, this proposal due to changing the name of a STAR.

Comprehensive detailed route information

6.12 The ADD (Ref 16) provides more detailed route, sector, STAR and SID information relevant to this proposal.

7. Impacts and Consultation

NATS completed engagement activities with stakeholders identified as those being most likely to be affected by the proposed design. These targeted airline stakeholders are listed in para 4.2 and detailed in Section 15. NATS briefed all of the stakeholders individually on the planned changes alongside briefing wider groups and forums such as the Flight Efficiency Partnership (FEP) meeting. The Consultation Strategy Document (Ref 9) details all of the engagement activities completed prior to the consultation going live.

NATS commenced a focussed consultation on the proposed airspace changes on Wednesday 2nd May 2018. The consultation was conducted via an online portal where users could submit a formal response alongside viewing the consultation document (Ref 11). The consultation document provides an overview into how the consultation was administered; an overview into the current airspace; the proposed changes and impacts of the proposed changes.

The consultation was open for four weeks; closing on Wednesday 30th May 2018. A total of fourteen responses were received during this period; which are covered in the following sections. A full summary of how the consultation was run and a theming of all responses can be found in the Collate and Review Responses document (Ref 12).

The consultation feedback summarised in Stage 3 Collate and Review Responses (Ref 12 Section 3) is:

- The westbound fuel disbenefit was an acceptable cost, given the systemisation benefit.
- The eastbound improvements did not fully offset the westbound disbenefit.

7.1 Net impacts summary for proposed route

Category	Impact	Evidence
Safety/Complexity	Increased predictability of traffic flows from and to the Netherlands, reduction in complexity of ATC task due to systemisation	Para 4.4, para 6.2 and subsequent associated diagrams, Section 10
Capacity/Delay	Clacton West Monitoring Value (MV, a measure of capacity) planned to increase c.7% (indicative figure, post-deployment by the unit if considered appropriate). Estimated total UK delay reduction per flight: Up to 1.7s (2019) Up to 2.4s (2029)	See Paras 7.5 and 7.6
Fuel Efficiency/CO_2	Predicted net fuel burn decrease 4,084T in 2019 (12,897T CO_2) and, in 2029, 4,769T fuel burn decrease (15,165T CO_2).	See Paras 7.5 and 7.6
Noise – Leq/SEL	Not a priority – all changes 7,000ft or above	See Para 7.7
Tranquillity, visual intrusion (AONBs & National Parks)	Not a priority – all changes 7,000ft or above	See Para 7.7
Local Air Quality	Not a priority – all changes 7,000ft or above	See Para 7.7
Other Airspace Users	Minimal impact, no changes to volume or classification of CAS.	See Paras 7.3-7.4

7.2 Units affected by the proposal

NATS is sponsoring this proposal, on behalf of Swanwick Centre (comprising London Area Control LAC and London Terminal Control LTC).

The ANSPs LVNL and MUAC are both collaborative partners, each making their own changes separate from, associated with and simultaneous with, this proposal. NATS has worked with both, ensuring agreements as per Design Principle 1, and their respective Amsterdam Centre and Maastricht Centre are both relevant units.

There were no other units or airport operators identified as being significantly impacted by the proposed changes as this is an en-route proposal with no proposed changes in impact to airport operations.

7.3 Military impact and consultation

During Stage 1 of this process, ten Design Principles were agreed with CAA. These can be found in the Step 1B Design Principles document (Ref 4). Design Principle Six (DP6) stated that the proposed changes should have no adverse impact on UK military operations where the UK provides ATS.

The MoD was consulted as a mandatory stakeholder via DAATM, as per standard airspace consultations. The MoD responded to the consultation stating that they have no objections to the proposal and specifically welcomed the inclusion of DP6.

The proposed final design meets DP6.

7.4 General Aviation airspace users impact and consultation

One of the ten Design Principles created in Step 1B stated that there should be no change to the volume or classification of CAS (DP4). Another design principle, DP5, stated that the proposed changes should have no impact on GA operations. Together these DPs illustrate that this proposal, by design, would not impact GA or other airspace users.

As there was no identified impact on GA operations, NATS did not target GA airspace users for consultation.

The proposed final design meets DP4 and DP5.

7.5 Commercial air transport impact and consultation

NATS has engaged and consulted directly with airline operators who were identified as being relevant carriers within the associated area of airspace. These are listed in Section 15 and for full details of the consultation strategy, document, consultation responses and their collation please see Stage 3 documents (Refs 9-12).

There were three consultation response elements which had the potential to impact the final design; ultimately only two, Elements 1 (easyJet) and 3 (KLM Royal Dutch Airlines), were progressed (Stage 4 Step 4a Update Design, Ref 13).

Element 1 caused a modification to the design affecting some flights arriving at airports Biggin Hill EGKB, London City EGLC and Southend EGMC provided their maximum requested flight level was FL200. It could not apply to such traffic FL220 or FL240 due to conflictions with LVNL's EHAM departure traffic. Traffic destined for EGKB EGLC EGMC requesting FL220 or FL240 would need to choose either FL200 (central flow) or FL260 (southern flow), these would be route restrictions. For example, Amsterdam Schiphol EHAM departures to those three London airports would fit this modification.

Element 3 caused a modification to the design, affecting some eastbound flights via REDFA, due to an improved ATS route M197, and other eastbound flights using the improved N866. For example, some transatlantic flights from the southwest arriving at Amsterdam Schiphol EHAM would fit the M197 modification, and some flights transiting the sector from southwest to northeast would fit the N866 modification.

Due to this, Clacton West sector's monitoring value (MV) is planned to increase c.7% (indicative figure). This would occur post-deployment by the unit if considered appropriate and is a measure of capacity/delay.

The estimated total UK delay reduction per flight due to this proposal is up to 1.7s (2019), and up to 2.4s (2029). As previously noted, some city pair routes may be longer under this proposal, potentially changing the travel times for those routes.

7.6 CO_2 environmental analysis impact and consultation

Post-consultation, the NATS Analytics Team made improvements to the accuracy of the fuel modelling system. The increased accuracy is due to the doubling of the source traffic sample and the expansion of the scope of eligible traffic flows, from waypoint-specific to sector-wide.

This led to a better modelling "capture" of the most appropriate traffic flows from a larger sample pool, when compared with Stage 3 Full Options Appraisal (Ref 10) and the consultation material (Ref 11).

These tables reflect that improved modelling accuracy. For full details please see para 15.4 on page 29.

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

Traffic Flow (SAIP AD4)	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)
EGGW Arr	N/A	-£144,222	2,714	259
EGKK Arr	N/A	-£46,731	878	89
EGLC Arr	N/A	-£693,909	13,050	1,266
EGLL Arr	N/A	-£2,151,870	40,410	4,095
EGSS Arr	N/A	-£21,826	412	36
EHAM Dep (Excluding arrivals to Airports listed above)	N/A	£339	-6	-1
Other Westbound flights	N/A	£793,042	-14,945	-1,361
Flights Via REDFA	N/A	£4,838,916	-91,005	-8,827
Flights Via GIVPO	N/A	£3,053,967	-57,528	-5,311
Flights Via SOMVA	N/A	£1,788,725	-33,651	-3,232
All flows	**N/A**	**£7,416,474**	**-139,674**	**-12,987**

The following table estimates the annual fuel burn and CO_2 change per traffic flow for 2019 and 2029:

Traffic Flow (SAIP AD4)	Annual Fuel Burn Change 2019 (T)	No. Flights 2019	Annual CO_2 Change 2019 (T)	No. Flights 2029	Annual Fuel Burn Change 2029 (T)	Annual CO_2 Change 2029 (T)
EGGW Arr	81.6	34,490	259	38,004	89.9	286
EGKK Arr	28.0	28,646	89.0	27,756	27.1	86
EGLC Arr	398.1	24,017	1,266	25,664	425.4	1,353
EGLL Arr	1288	109,747	4,095	106,521	1,250	3,975
EGSS Arr	11.2	47,044	36.0	63,392	15.1	48
EHAM Dep (Excluding arrivals to Airports listed above)	-0.2	19,430	-0.6	22,811	-0.2	-0.6
Other Westbound flights	-427.9	156,687	-1,361	19,0929	-521.4	-1,658
Flights Via REDFA	-2,776	130,601	-8,827	139,593	-2,967	-9,435
Flights Via GIVPO	-1,670	20,239	-5,311	23,982	-1,979	-6,293
Flights Via SOMVA	-1,017	19,405	-3,232	21,174	-1,109	-3,527
All flows	**-4,084**	**590,306**	**-12,987**	**659,826**	**-4,769**	**-15,165**

Notes on these tables:

The consultation feedback summarised in Stage 3 Collate and Review Responses (Ref 12 Section 3) is:

- The westbound fuel disbenefit was an acceptable cost, given the systemisation benefit.
- The eastbound improvements did not fully offset the westbound disbenefit.

The design was changed due to these consultation results, specifically Elements 1 and 3. We improved the westbound structure by allowing some EGLC EGKB EGMC arrivals to use the central flow. We improved the eastbound structure by modifying two ATS routes. These changes were due to consultation feedback and would cause improvements to the results.

As discussed above, there was also an improvement to the accuracy of the fuel modelling system, illustrated by the different balances between the data in these tables and the equivalent data published in Stage 3 Full Options Appraisal (Ref 10) and consultation material (Ref 11). Due to the improved analysis accuracy, the individual flow results have different balances, with an overall reduction in fuel burn and CO_2 emissions.

Overall there were improvements to the final airspace design due to consultation feedback.

7.7 Local environmental impacts and consultation

This is a Level 2A airspace change proposal (ACP). The proposed changes are all above 7,000ft and mostly over the sea. Priority has not been given to local environmental impacts such as noise, visual intrusion, tranquillity or local air quality.

7.8 Economic impacts

The likely economic impacts are detailed in Stage 4 Step 4a Update Design (Ref 13) Section 5, based on the improved fuel analysis modelling accuracy discussed above. Those impacts are copied below for ease of reference.

Group	Impact	Level of Analysis	Evidence
Communities	Noise impact on health and quality of life	N/A	N/A – airspace changes are above 7,000ft and mainly over the sea
Communities	Air quality	N/A	N/A – airspace changes are above 7,000ft and mainly over the sea.
Wider society	Greenhouse gas impact	Monetise and quantify	We predict the proposed change would cause a net decrease in fuel burn for the region by 4,084T in 2019. In 2029 we predict a forecast net decrease in overall fuel burn of 4,769T. Forecast flows between particular city pairs may change to a greater or lesser extent. The forecast used is NATS December 2017 Base Forecast. WebTAG was used to assess the greenhouse gas impact over time from the proposed changes, for the traded sector. This concept would yield a neutral Net Present Value. However there would be a decrease of CO_2 in the opening year (2019) of 12,987T which would rise to 139,674T over a 60 year appraisal period. WebTAG has also been used to show the Net Present Value of CO_2 for the non-traded sector; this was calculated at £7.4m. The worksheet outputs for both of these are shown in Appendix A. For WebTAG tables see para 15.5 on page 30 (traded) and para 15.6 on page 31 (non-traded). See para 7.6 upper table for the WebTAG greenhouse gas analysis for each of the relevant traffic flows.
Wider society	Capacity/ resilience	Qualitative	The resulting systemisation of this region would improve predictability and capacity as a result. This systemisation would yield an overall benefit in terms of conflict/complexity reduction; thus improving the airspace resilience.

Group	Impact	Level of Analysis	Evidence
General Aviation	Access	N/A	N/A – there would be no change in impact to General Aviation airspace users.
General Aviation/ commercial airlines	Economic impact from increased effective capacity	Quantify: Sector monitoring values (planned) Delay reduction per flight (predicted)	Clacton West MV planned to increase c.7% (indicative figure). This would occur post-deployment by the unit if considered appropriate Estimated total UK delay reduction per flight Up to 1.7s (2019) Up to 2.4s (2029). As previously noted, some city pair routes may be longer under this proposal, potentially changing the travel times for those routes.
General Aviation/ commercial airlines	Fuel burn	Monetise	Analysis predicts a decrease in fuel usage and burn, at a benefit of £1.9m in 2019, increasing to £2.2m in 2029 (both Net Present Value). This was based on the IATA jet fuel price of 30 Mar 18, at 658.50USD per tonne converted to GBP at 0.71$/£ and presumes a constant fuel price and exchange rate. Forecast flows between particular city pairs may change to a greater or lesser extent. The forecast used is NATS December 2017 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 80 LAC controllers and c.50 TC 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.

8. Analysis of Options

In order to maximise the UK's benefit from the simultaneous planned changes in Dutch airspace, NATS developed three separate option concepts (not including baseline Option Zero do-nothing) in conjunction with our colleague ANSPs LVNL and MUAC.

All three options were similar in concept – systemising the westbound flows through the CLN sectors in the region of the Netherlands FIR where ATS is delegated to the UK (Design Options, Ref 6).

Each of those options placed the systemised flows in different positions, from a macro point of view.

We then evaluated those three macro Options against the Design Principles from Stage 1 (Ref 4 and Ref 7):

> Option Zero (baseline, no change) was rejected because it did not fit with the planned changes in Netherlands airspace and was not agreed by the three ANSPs.
>
> Option 1 (too far south) and Option 2 (too far north) were rejected.
> Neither was agreed by all three ANSPs.
>
> Option 3 was agreed by all three ANSPs.

Our highest ranking Design Principle, DP1 (Ref 4) stated that agreement between the three ANSPs was required, thus we selected our preferred Option 3 as the only design concept meeting that principle. Option 3 is a relatively central three-flow westbound system using RNAV1 routes. Each route flow is allocated to the different destinations of the flights using the region. Eastbound improvements were also identified and progressed.

We then undertook a full Options Appraisal (Stage 3 Ref 10) which quantified as far as possible the analyses required by CAP1616. Subsequently we consulted on a more detailed design of Option 3, where we provided coordinates of the planned waypoints, route flow details and level restrictions where relevant.

The consultation resulted in three response elements, of which two (Element 1 and Element 3) were progressed, along with some administrative technical changes. For full details of the consultation, its feedback and what we did due to the feedback, see para 7.5 on page 17, Stage 3 Ref 12 and Stage 4 Ref 13.

Post-consultation, the NATS Analytics Team made improvements to the accuracy of the fuel modelling system for the final options appraisal (Stage 4 Ref 13 Section 5). The increased accuracy is due to the doubling of the source traffic sample and the expansion of the scope of eligible traffic flows, from waypoint-specific to sector-wide. This led to a better modelling "capture" of the most appropriate traffic flows from a larger sample pool, when compared with Stage 3 Full Options Appraisal (Ref 10) and the consultation material (Ref 11).
See also para 15.4 Analysis modelling assumptions on page 29.

The final design is hereby submitted because it best meets the design principles and takes account of consultation feedback.

9. Airspace Description Requirements

	The proposal should provide a full description of the proposed change including the following:	Description for this proposal
a	The type of route or structure; for example, airway, UAR, Conditional Route, Advisory Route, CTR, SIDs/STARs, holding patterns, etc	See para 6.2 for ATS route schematics
b	The hours of operation of the airspace and any seasonal variations	H24
c	Interaction with domestic and international en-route structures, TMAs or CTAs with an explanation of how connectivity is to be achieved. Connectivity to aerodromes not connected to CAS should be covered	See para 6.2 for ATS route schematics See ADD Ref 16
d	Airspace buffer requirements (if any). Where applicable describe how the CAA policy statement on 'Special Use Airspace – Safety Buffer Policy for Airspace Design Purposes' has been applied.	N/A
e	Supporting information on traffic data including statistics and forecasts for the various categories of aircraft movements (passenger, freight, test and training, aero club, other) and terminal passenger numbers	See page 8
f	Analysis of the impact of the traffic mix on complexity and workload of operations	The design concept is to flow the traffic as per para 6.2 (see ATS route schematics) to reduce complexity and workload.
g	Evidence of relevant draft Letters of Agreement, including any arising out of consultation and/or airspace management requirements	See Draft LoAs Ref 17
h	Evidence that the airspace design is compliant with ICAO Standards and Recommended Practices (SARPs) and any other UK policy or filed differences, and UK policy on the Flexible Use of Airspace (or evidence of mitigation where it is not)	See para 6.2 for ATS route schematics. See RSAD Ref 18 for evidence of CAP1385 compliance.
i	The proposed airspace classification with justification for that classification	No changes to airspace volumes/classification. Remains Class A/Class C as currently defined
j	Demonstration of commitment to provide airspace users equitable access to the airspace as per the classification and where necessary indicate resources to be applied or a commitment to provide them in line with forecast traffic growth. 'Management by exclusion' would not be acceptable	NATS commits to provide the same level of access post-implementation in line with forecast growth.
k	Details of and justification for any delegation of ATS	See para 6.2 and Figure 8 for summary of ATS delegation changes (from Dutch to UK)

10. Safety Assessment

Ensuring the safety of proposed changes is a priority for NATS. 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-accepted, CAP670-compliant NATS Safety Management System is followed. Also their role is to submit safety arguments with supporting evidence directly 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.

The NATS safety manager has assessed the SAIP AD4 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 required full Safety Assurance in accordance with the NATS Safety Management Manual (SMM). 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 AD4, a full safety analysis occurred which will result in the production of a Project Safety Assurance Report (PSAR). These documents will be 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.

NATS Analytics estimates a reduction in conflictions between 6%-24% in Sector 13/14 as a result of the change, indicating a benefit for complexity and capacity.

Regarding the relevant traffic flows for this proposed change, today's arrangement sends all the major flows westbound through the single waypoint GORLO.

This proposal would change the balance for traffic received from MAAS/LVNL regions, so that the flows would become systemised into three main tracks as they reach the airspace where air traffic services are delegated to the UK. This would be managed and adjusted as needed within S13/S14, where the reduction in complexity means fewer controller instructions to pilots, reducing the overall potential for safety errors.

The flows would, by design, be simpler to manage in the vicinity of GORLO and REFSO due to the proposal.

Qualitatively there would be a positive impact on safety whilst also increasing the capacity of the sector group, because the rebalancing of the flows means more traffic could be safely handled with fewer controller interactions, and without changing CAS size or type.

NATS Safety Manager for SAIP AD4 has produced a formal HAZID report in accordance with the CAA-approved NATS safety management protocols (Ref 19 not for publication).

NATS ATC lead and Safety Manager for SAIP AD4 have produced a Route Spacing Analysis Document (RSAD, Ref 18 not for publication). This report demonstrates how routes have been spaced, when flights can use them on their own navigation under radar monitoring conditions, and when flights will be tactically managed.

The NATS Safety Manager will liaise directly with the CAA's Safety and Airspace Regulation Group (SARG) for this proposal.

11. Operational Impact

	An analysis of the impact of the change on all airspace users, airfields and traffic levels must be provided, and include an outline concept of operations describing how operations within the new airspace will be managed. Specifically, consideration should be given to:	Evidence of compliance/ proposed mitigation
a	Impact on IFR general air traffic and operational air traffic or on VFR General Aviation (GA) traffic flow in or through the area	IFR GAT as per para 6.2 flow schematics. No specific impact on OAT or VFR GA in the region.
b	Impact on VFR operations (including VFR routes where applicable);	No specific impact on VFR GA in the region as per para 7.4.
c	Consequential effects on procedures and capacity, i.e. on SIDs, STARs, and/or holding patterns. Details of existing or planned routes and holds	See para 6.2 flow schematics. See para 7.5 for forecast improvements in CLN Sector MV and total UK flight delay reduction (a measure of capacity)
d	Impact on aerodromes and other specific activities within or adjacent to the proposed airspace	N/A
e	Any flight planning restrictions and/or route requirements	See para 6.2 flow schematics. See ADD (Ref 16) for flightplanning restrictions and route requirements.

12. Supporting Infrastructure/ Resources

	General requirements	Evidence of compliance/ proposed mitigation
a	Evidence to support RNAV and conventional navigation as appropriate with details of planned availability and contingency procedures	See RNAV Coverage Ref 20
b	Evidence to support primary and secondary surveillance radar (SSR) with details of planned availability and contingency procedures	Traffic uses the same regions as today in a similar manner from a surveillance point of view. Demonstrably adequate for the region.
c	Evidence of communications infrastructure including R/T coverage, with availability and contingency procedures	Traffic uses the same regions as today in a similar manner from a comms infrastructure point of view. Demonstrably adequate for the region.
d	The effects of failure of equipment, procedures and/or personnel with respect to the overall management of the airspace must be considered	Existing contingency procedures would continue to apply.
e	Effective responses to the failure modes that will enable the functions associated with airspace to be carried out including details of navigation aid coverage, unit personnel levels, separation standards and the design of the airspace in respect of existing international standards or guidance material	Existing contingency procedures would continue to apply.
f	A clear statement on SSR code assignment requirements	No change
g	Evidence of sufficient numbers of suitably qualified staff required to provide air traffic services following the implementation of a change	See Stage 4 Step 4a Update Design (Ref 13) where we described the need to train c.130 NATS controllers, presuming the approval and implementation of this proposal. This training will be complete in good time for the planned implementation date.

13. Airspace and Infrastructure

	General requirements	Evidence of compliance/ proposed mitigation
a	The airspace structure must be of sufficient dimensions with regard to expected aircraft navigation performance and manoeuvrability to fully contain horizontal and vertical flight activity in both radar and non-radar environments	See para 6.2 flow schematics.
b	Where an additional airspace structure is required for radar control purposes, the dimensions shall be such that radar control manoeuvres can be contained within the structure, allowing a safety buffer. This safety buffer shall be in accordance with agreed parameters as set down in CAA policy statement 'Safety Buffer Policy for Airspace Design Purposes Segregated Airspace'. Describe how the safety buffer is applied, show how the safety buffer is portrayed to the relevant parties, and provide the required agreements between the relevant ANSPs/ airspace users detailing procedures on how the airspace will be used. This may be in the form of Letters of Agreement with the appropriate level of diagrammatic explanatory detail.	See para 6.2 and Figure 8 for details of additional region of ATS delegation to the UK This will occur in the Dutch FIR as agreed between NATS and LVNL such that both parties are satisfied. The CAA buffer policy does not apply because there is no distinction between CAS or other segregated airspace along this boundary, it is purely regarding controlling authorities. There would be a minimum of 2.5nm buffer between the two controlling authorities.
c	The Air Traffic Management system must be adequate to ensure that prescribed separation can be maintained between aircraft within the airspace structure and safe management of interfaces with other airspace structures	See para 6.2 for ATS route schematics. See RSAD Ref 18 for evidence of CAP1385 compliance.
d	Air traffic control procedures are to ensure required separation between traffic inside a new airspace structure and traffic within existing adjacent or other new airspace structures	See para 6.2 for ATS route schematics. See RSAD Ref 18 for evidence of CAP1385 compliance. See item b above.
e	Within the constraints of safety and efficiency, the airspace classification should permit access to as many classes of user as practicable	No changes to CAS classification
f	There must be assurance, as far as practicable, against unauthorised incursions. This is usually done through the classification and promulgation	No change to CAS volume or classification – no change to these arrangements
g	Pilots shall be notified of any failure of navigational facilities and of any suitable alternative facilities available and the method of identifying failure and notification should be specified	Existing contingency procedures would continue to apply.
h	The notification of the implementation of new airspace structures or withdrawal of redundant airspace structures shall be adequate to allow interested parties sufficient time to comply with user requirements. This is normally done through the AIRAC cycle	This change will be promulgated by AIRAC as per typical cycle schedule
i	There must be sufficient R/T coverage to support the Air Traffic Management system within the totality of proposed controlled airspace	Traffic uses the same regions as today in a similar manner from a comms infrastructure point of view. Demonstrably adequate for the region. See item 12 c.
j	If the new structure lies close to another airspace structure or overlaps an associated airspace structure, the need for operating agreements shall be considered	See Draft LoAs Ref 17 for agreements between ANSPs. Other procedures and operating agreements will be implemented as per CAA-approved MATS Part 2.
k	Should there be any other aviation activity (low flying, gliding, parachuting, microlight site, etc) in the vicinity of the new airspace structure and no suitable operating agreements or air traffic control procedures can be devised, the change sponsor shall act to resolve any conflicting interests	Should this occur, we would act appropriately.
	ATS route requirements	Evidence
a	There must be sufficient accurate navigational guidance based on in-line VOR/DME or NDB or by approved RNAV derived sources, to contain the aircraft within the route to the published RNP value in accordance with ICAO/ Eurocontrol standards	See RNAV Coverage Document (Ref 20) Primarily we would expect flights to use GNSS navigation.
b	Where ATS routes adjoin terminal airspace there shall be suitable link routes as necessary for the ATM task	See para 6.2 for ATS route schematic. See ADD (Ref 16) for more details
c	All new routes should be designed to accommodate P-RNAV navigational requirements	Some new routes require RNAV1, other amendments are compatible with RNAV1 but do not require it
	Terminal airspace requirements	Evidence
	Changes to link with proposed terminal structures are illustrated in para 6.2 ATS route schematics & described in the associated text from para 6.3-0. For full details see ADD Ref 16.	
	Off-route airspace requirements	Evidence
	There are no proposed changes to off-route airspace structures	

14. Environmental Assessment

	Theme	Content	Evidence of compliance/ proposed mitigation
a	WebTAG analysis	Output and conclusions of the analysis (if not already provided elsewhere in the proposal)	See para 15.5-15.6 and Stage 4 Step 4A Ref 13
b	Assessment of noise impacts (Level 1/M1 proposals only)	Consideration of noise impacts, and where appropriate the related qualitative and/or quantitative analysis If the change sponsor expects that there will be no noise impacts, the rationale must be explained	Level 2 (N/A)
c	Assessment of CO_2 emissions	Consideration of the impacts on CO_2 emissions, and where appropriate the related qualitative and/or quantitative analysis If the change sponsor expects that there will be no impact on CO_2 emissions impacts, the rationale must be explained	See para 7.6 and Stage 4 Step 4A Ref 13
d	Assessment of local air quality (Level 1/M1 proposals only)	Consideration of the impacts on local air quality, and where appropriate the related qualitative and/or quantitative analysis If the change sponsor expects that there will be no impact on local air quality, the rationale must be explained	Level 2 (N/A)
e	Assessment of impacts upon tranquillity (Level 1/M1 proposals only)	Consideration of any impact upon tranquillity, notably on Areas of Outstanding Natural Beauty or National Parks, and where appropriate the related qualitative and/or quantitative analysis If the change sponsor expects that there will be no tranquillity impacts, the rationale must be explained	Level 2 (N/A)
f	Operational diagrams	Any operational diagrams that have been used in the consultation to illustrate and aid understanding of environmental impacts must be provided	N/A
g	Traffic forecasts	10-year traffic forecasts, from the anticipated date of implementation, must be provided (if not already provided elsewhere in the proposal)	See para 7.6 and Stage 4 Step 4A Ref 13
h	Summary of environmental impacts and conclusions	A summary of all of the environmental impacts detailed above plus the change sponsor's conclusions on those impacts	See para 7.1

15. Annexe

15.1 References – supplied as separate documents from Ref 13-Ref 21.

Ref No	Description	Notes
1	SAIP AD4 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 1 Stakeholder Engagement Evidence	(link)
6	Stage 2 Design Options	(link)
7	Stage 2 Design Principle Evaluation	(link)
8	Stage 2 Initial Options Safety Appraisal	(link)
9	Stage 3 Consultation Strategy	(link)
10	Stage 3 Full Options Appraisal	(link)
11	Stage 3 Consultation Website and Document	(link)
12	Stage 3 Collate and Review Responses	(link)
13	Stage 4 Update Design	Supplied separately
14	Technical definition document WGS84	Supplied separately
15	Draft AIP changes	Supplied separately
16	Airspace Design Definition (ADD)	Supplied separately
17a/b/c	Draft Letters of Agreement (LoAs)	Supplied separately
18	Route Spacing Analysis Document (RSAD)	Supplied separately
19	Safety Management Hazard Identification (HAZID)	Supplied separately
20	RNAV Coverage via DEMETER	Supplied separately
21	Draft overview chart of the region	Supplied separately
22	WebTAG greenhouse gas workbook – traded sector	Supplied separately
23	WebTAG greenhouse gas workbook – non-traded sector	Supplied separately

15.2 List of Consultation Stakeholders

Links to the consultation were placed on the NATS Customer Website and also on the NATS public website. One member of the public responded.

The consultation was most relevant to the stakeholders listed below, but not exclusively.

Mandatory Stakeholder:
MoD Ministry of Defence via Defence Airspace & Air Traffic Management (DAATM)

Primary Target Stakeholders:
These nine air operators were engaged during the consultation and their response actively sought, each was emailed several times with reminders of the closing date.

BAW British Airways
RYR Ryanair
WZZ Wizz Air
EZY easyJet
KLM KLM Royal Dutch Airlines
BEE Flybe
IBK Norwegian Air Shuttle
CFE BA CityFlyer, a subsidiary of British Airways
SAS Scandinavian Airlines

Additional Stakeholders:
These twelve air operators were informed of the consultation and were encouraged to respond, reminder emails were also sent.

CPA Cathay Pacific
AFL Aeroflot
EWG EuroWings
GWI GermanWings
FIN Finnair
LOT LOT Polish Airlines
DAL Delta Airlines
BCY CityJet
UAE Emirates Airline
VIR Virgin Atlantic
VLG Vueling Airlines
NJE NetJets

15.3 Airline Glossary

Abbreviation	Airline	Abbreviation	Name	Abbreviation	Name
AFL	Aeroflot	EWG	Eurowings	NJE	Netjets
BAW	British Airways	EZY	EasyJet	RYR	Ryanair
BCY	Cityjet	FIN	Finnair	SAS	Scandinavian Airlines
BEE	Flybe	GWI	Germanwings	UAE	Emirates
CFE	BA CityFlyer, a subsidiary of BAW	IBK	Norwegian Air Shuttle	VIR	Virgin Atlantic Airways
CPA	Cathay Pacific Airways	KLM	KLM Royal Dutch Airlines	VLG	Vueling Airlines
DAL	Delta Airlines	LOT	LOT Polish Airlines	WZZ	Wizz Air

15.4 Analysis modelling assumptions

The fuel analysis methodology was improved between consultation and final design. The following table describes those assumptions.

Common assumptions span the table row.

The increased accuracy is mainly due to the doubling of the source traffic sample and the expansion of the scope of eligible traffic flows, from waypoint-specific to sector-wide.

<table>
<tr><th>Stage 3 Full
Options Appraisal fuel analysis</th><th>Stage 4 Final
Options Appraisal fuel analysis</th></tr>
<tr><td colspan="2">This airspace change has been modelled using the fast-time simulation software AirTOp.</td></tr>
<tr><td>The traffic sample used was the 6th July 2016
grown to 2019 traffic.</td><td>The traffic sample used were the 6th & 8th July 2016
grown to 2019 traffic.</td></tr>
<tr><td colspan="2">Annualised traffic figures are based on the 2017 NATS base case forecast.</td></tr>
<tr><td>The traffic sample contained all aircraft which routed via at least one of the following waypoints:
ERING, IDESI, XAMAN, SUMUM, GORLO, RAPIX, REDFA</td><td>The traffic sample contained all aircraft which routed via at least one of the following sectors:
TC EAST, S12, S13, S14</td></tr>
<tr><td colspan="2">The AirTOp Model was run once for easterly and westerly operations</td></tr>
<tr><td colspan="2">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.</td></tr>
<tr><td colspan="2">As the routing change was en-route only, the fuel benefit is not split into Easterly/Westerly operations (weighted 30%/70%).
Fuel uplift is included in the assessment</td></tr>
<tr><td>AirTOp version 2.3.28 was used</td><td>AirTOp version 2.3.80 was used</td></tr>
<tr><td colspan="2">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</td></tr>
<tr><td colspan="2">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. Note that a traffic sample twice the size was used for the Stage 4 Baseline and Stage 4 Final analysis.</td></tr>
<tr><td colspan="2">No conflict resolution was applied. In each conflict run, if the same pair of aircraft had more than one conflict, only one conflict was counted. 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</td></tr>
<tr><td colspan="2">For the interaction analysis, the model was run 50 times for the Easterly and Westerly variants. Within each run, the departure times of flights were varied between -5 and +10 minutes, and added to the reference time of each flight plan to allow for random variation in the departure times.
In this instance, the number of interactions generated by each run is being used as a proxy for the change in complexity in S13/14 due to the proposal. An interaction is defined as an instance where two aircraft within the simulation are within a separation criteria of 5NM horizontally and 1,000ft vertically and is being used a proxy for a situation where the controller would be required to intervene in order to maintain the safe separation of aircraft.
In order to estimate the change in capacity of the affected sectors, the percentage change in the average number of interactions was halved and then declared as the capacity change i.e. if the percentage change in interaction was a 10% reduction, a 5% capacity increase was assumed. This is purely an approximation for delay benefits estimation only.
The capacity changes were then applied to the NATS Reporting Period 3 (RP3) forecast delay model to determine the change in UK delay (A18013).</td></tr>
</table>

15.5 WebTAG - 10 year greenhouse gas results, all traffic flows, Traded Sector

Greenhouse Gases Workbook - Worksheet 1

Scheme Name: NATS SAIP AD4

Present Value Base Year 2018

Current Year 2018

Proposal Opening year: 2019

Project (Road/Rail or Road and Rail): road/rail

Overall Assessment Score:

Net Present Value of carbon dioxide equivalent emissions of proposal (£): £0

*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): -139,674
(between 'with scheme' and 'without scheme' scenarios)

Of which Traded -139673.55

Change in carbon dioxide equivalent emissions in opening year (tonnes): -12,987
(between 'with scheme' and 'without scheme' scenarios)

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	-53255.46	-71470.5
Non-traded sector	0	0	0	0

Qualitative Comments:

Sensitivity Analysis:

Upper Estimate Net Present Value of Carbon dioxide Emissions of Proposal (£): £0

Lower Estimate Net Present Value of Carbon dioxide Emissions of Proposal (£): £0

Data Sources:

See Ref 22 for Excel workbook (traded sector).

15.6 WebTAG - 10 year greenhouse gas results, all traffic flows, Non-Traded Sector

Greenhouse Gases Workbook - Worksheet 1

Scheme Name: NATS SAIP AD4

Present Value Base Year 2018

Current Year 2018

Proposal Opening year: 2019

Project (Road/Rail or Road and Rail): road/rail

Overall Assessment Score:

Net Present Value of carbon dioxide equivalent emissions of proposal (£): £7,416,474

*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): -139,674
(between 'with scheme' and 'without scheme' scenarios)

Of which Traded 0

Change in carbon dioxide equivalent emissions in opening year (tonnes): -12,987
(between 'with scheme' and 'without scheme' scenarios)

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	0	0
Non-traded sector	0	0	-53255.46	-71470.5

Qualitative Comments:

Sensitivity Analysis:

Upper Estimate Net Present Value of Carbon dioxide Emissions of Proposal (£): £11,124,711

Lower Estimate Net Present Value of Carbon dioxide Emissions of Proposal (£): £3,708,237

Data Sources:

See Ref 23 for Excel workbook (non-traded sector).

End of document