Future Airspace Strategy Implementation - North (FASI-N)

Revised hold and link routes in the Scottish TMA

Documentation: Stage 4 Update and Submit

Step 4B **Airspace Change Proposal**

NATS Unclassified

Action	Position	Date
Produced	Airspace Change Assurance, NATS Future Airspace & ATM	13/09/2018
Approved	ATC Lead – Airspace, NATS Prestwick Centre Terminal Operations Development	13/09/2018
Approved	Project Manager FASIN	13/09/2018

Table 1 Production roles

NATS UNCLASSIFIED

Issue	Month/Year	Change Requests in this issue
Issue 1.0	September 2018	ACP first issue, submitted to CAA

Table 2 Publication history

1. Executive Summary

This Airspace Change Proposal (ACP), sponsored by NATS, proposes to make changes to the ATS route structure in the Scottish Terminal Manoeuvring Area (ScTMA). These changes are necessary to support the changes proposed (in separate proposals) by Edinburgh and Prestwick Airports.

We propose to introduce the following changes:

- Move the position of the hold for flights inbound for Glasgow (currently the LANAK hold)
- Establish link routes to connect proposed Edinburgh SIDs to the enroute network
- Establish RNAV5 STARs realigned to the new Glasgow hold

The changes proposed herein will only affect flights above 7000ft.

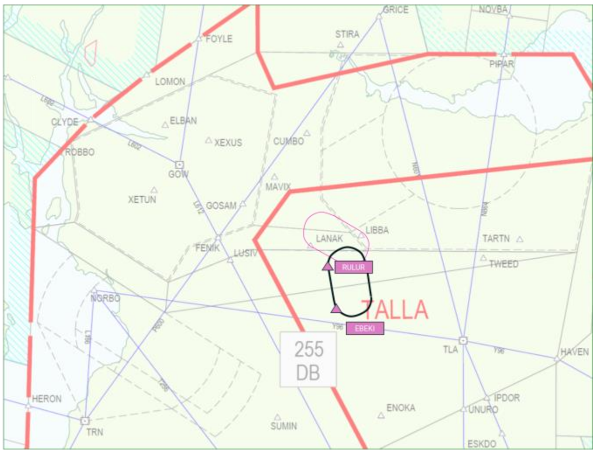

Figure 1 Proposal to move the LANAK hold

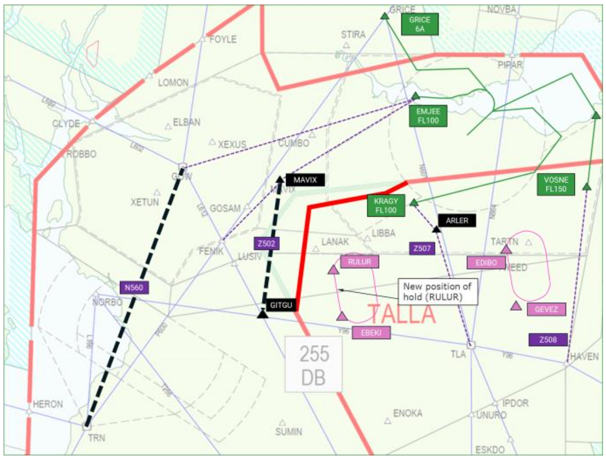

Figure 2 Proposed ATS link routes to EGPH SIDs

(Note a larger version of Figure 2 is provided on page 19)

These proposed changes are forecast to improve flight efficiency in the ScTMA. The combined airport and network changes, if approved, would result in a reduction in average fuel burn and CO_2 emissions per flight.

If the proposal is approved by the CAA, implementation of the airspace change will occur not before 28th February 2019.

.

2. Contents

3. Introduction

This Airspace Change Proposal (ACP) relates to changes to ATS routes which will change aircraft flight profiles above 7000ft.

Due to the altitude of the proposed changes (above 7000ft) this is a Level 2A ACP. As such, priority has been given to the environmental impacts of reduction CO_2. Local environmental impacts due to noise, visual intrusion, tranquillity and local air quality have not been prioritised. The primarily targeted group of stakeholders involved in consultation were aviation professionals (NATMAC, Airlines and Airports).

3.1 The Scottish Terminal Manoeuvring Area (ScTMA)

The ScTMA provides controlled airspace for managing all air traffic transitioning between Edinburgh, Glasgow and Prestwick airports ("the airports") and the enroute network. NATS Prestwick Centre (PC) manages the enroute air traffic in the region and interfaces with each airport's ATC unit. The controlled airspace of the ScTMA is depicted in Figure 3. The ScTMA is divided into four ATC sectors, TALLA North/South and GALLOWAY North/South, as shown in Figure 4.

In 2017 the ScTMA handled a total of 256,338 flights and 24 million passengers to/from Edinburgh, Glasgow and Prestwick airports (average of over 700 flights/65,700 passengers per day).

Each of the three major airports in the ScTMA are currently at different stages of the process of proposing new Performance Based Navigation (PBN) arrival and departure routes (SIDs & STARs). These changes are in accordance with the CAA Future Airspace Strategy (FAS) guidelines for the implementation of PBN (see link at footnote[1]), which is part of a UK-wide initiative to modernise our air navigation infrastructure.

Information on the individual airports' proposals is available at the links below:

Edinburgh Airport http://www.letsgofurther.com/

Glasgow Airport https://www.glasgowairport.com/airspace/ (Glasgow statement of Need linked here)

Glasgow Prestwick Airport http://www.glasgowprestwick.com/corporate/airspace-change-consultation/

(note this is the most up to date information available but may be subject to change)

Information on the current status of each proposal is available on the CAA website:

https://www.caa.co.uk/Commercial-industry/Airspace/Airspace-change/Decisions/FASI(N)/

Edinburgh Airport's proposals are mature. They have undergone extensive consultation and Edinburgh's ACP was submitted to the CAA for regulatory review in July 2018.

Glasgow Airport is in the early stages of developing proposals. None of the changes proposed herein are related to or dependent upon changes being proposed by Glasgow Airport.

Prestwick Airport's proposals are mature; Prestwick Airport's ACP was submitted to the CAA in October 2017 and is undergoing regulatory review.

If this ACP is approved by the CAA, the proposed design would be implemented not before the 28th February 2019.

[1] CAA Future Airspace Strategy for the United Kingdom 2011 to 2030

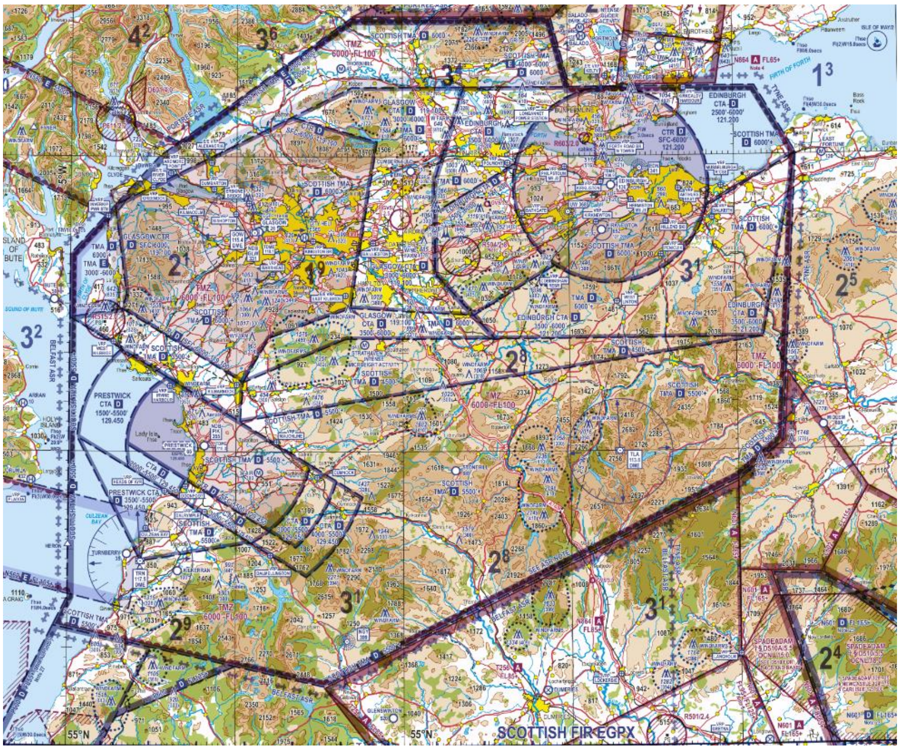

Figure 3 ScTMA Controlled Airspace (CAA VFR chart 500K)

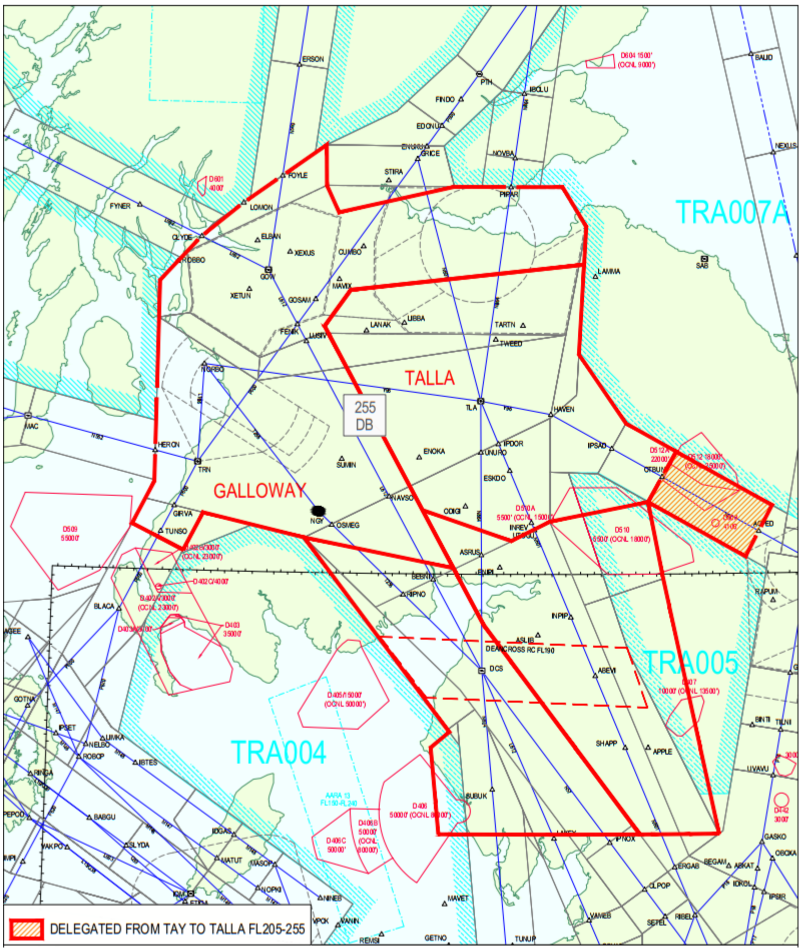

Figure 4 Prestwick Centre's TALLA and GALLOWAY sectors.

3.2 Summary of changes included

This ACP includes the following changes.

- Introduction of ATS route N560 (GOW – TRN)
- Introduction of ATS route Z502 (MAVIX – GITGU)
- Realignment of existing ATS route T256 realigned NORBO-OSMEG
- Re positioning of the LANAK hold, to RULUR.
- Realignment and conversion to RNAV5, of EGPF STARs routing to the proposed RULUR hold

4. Justification and Objectives

4.1 Justification

Edinburgh and Prestwick Airports are at various stages of proposing changes to their SIDs, STARs and arrival transitions[2]. The proposed SIDs will be to RNAV1 specification, and the STARs and ATS routes will be to RNAV5 specification. This is being done in accordance with the CAA FAS which is a UK wide initiative to modernise the UK's air navigation infrastructure. It is further being precipitated by the withdrawal from service of several key conventional navigation beacons (VORs: GOW, PTH & TRN; NDBs: NGY) which are used for the conventional procedures. The deadline for the removal of procedures using these navigation aids is December 2019. Each airport is responsible for the SIDs from their airport, and they are engaged in proposing changes to them. NATS Prestwick Centre (PC) is responsible for the efficient operation of the ScTMA and wider enroute airspace network. As such it is responsible for integration of the airports' SIDs with the enroute network. NATS is also responsible for changes to STARs.

The aim of the proposals herein is to be integrated and aligned with the proposals of Edinburgh Airport.

It should be stressed that that changes to routes which impact flight paths below 7,000ft are the responsibility of Edinburgh and Prestwick Airports, and impacts related to these proposed changes are addressed in their respective consultations.

4.2 Objectives

Objectives for these proposals are to:

- Provide sufficient capacity in the ScTMA airspace;
- Minimise CO_2 emissions and fuel burn per flight;
- Enable smooth transition to a PBN environment for Edinburgh, Glasgow and Prestwick airports.

4.3 Alignment with the CAA's Future Airspace Strategy (FAS) Principles

The CAA's Future Airspace Strategy (FAS) is the UK's strategy for modernising the air navigation infrastructure. The FAS recommends that the ATS route network is improved, to take advantage of available PBN technology such as RNAV.

The changes proposed herein will provide an integrated RNAV PBN route structure as recommended by the FAS. The proposed contiguous integrated design of routes in the ScTMA will improve efficiency in the airspace.

[2] Detailed information relating to each of the airports proposals is available in the consultation documents listed in section 2.2 and on the CAAs airspace change portal (https://www.caa.co.uk/Commercial-industry/Airspace/Airspace-change/Decisions/FASI(N)/)

5. Current Airspace Description

5.1 Current Conventional Navigation

SIDs and STARs at the ScTMA airfields are currently defined with reference to the conventional VOR and NDB navigation beacons. These are now out-dated and many VORs & NDBs are being withdrawn from service (see Table 3).

5.2 Modernising the air route infrastructure

The UK enroute ATS route infrastructure is based on the RNAV5 navigation standard. This is safe, and more efficient than older 'conventional' navigation standards[3].

Most commercial aircraft already have the ability to conform to RNAV1. The equipage rate for aircraft which are RNAV1 capable in the ScTMA is currently 92%[4]. The CAA's Future Airspace Strategy (FAS)[5] also recommends that the ATS route network is improved, to take advantage of available technology such as RNAV.

This proposal is based on utilising RNAV5 for new ATS routes and STARs. This is in alignment with the RNAV5 mandate for flights above FL100, as a consequence of which the aircraft equipage for RNAV5 is close to 100%. As such it is assumed that all aircraft would be able to accept the RNAV5 STARs and alternative procedures for non-RNAV5-equipped aircraft are not required. (If STARs were promulgated as RNAV1 alternative procedures would be necessary and this would introduce additional complexity and workload for controllers).

Edinburgh, Glasgow and Prestwick Airports propose to replace the extant conventional SIDs with RNAV1 procedures. The STARs will be RNAV5.

The proposed change to RNAV PBN procedures is targeted to be complete before the withdrawal of the VORs. The conventional procedures which reference the VORs/NDB which are being decommissioned are listed in Table 3 below.

VOR/NDB being decommissioned	Used by current conventional procedures	Deadline for procedures to be removed	Proposed date of decommissioning
Glasgow – GOW	EGPH GOSAM 1D SID, EGPH STIRA STAR EGPF NORBO SID EGPF LUSIV SID EGPF TALLA SID EGPF TRN SID EGPF FOYLE SID EGPF LOMON SID EGPF ROBBO SID EGPF CLYDE SID EGPF PERTH SID EGPF GOW STAR EGPF STIRA STAR EGPF TRN STAR	Dec 2019	May 2020
Perth – PTH	EGPH STIRA STAR EGPF FOYLE SID EGPF ROBBO SID EGPF CLYDE SID EGPF PERTH SID EGPF STIRA STAR EGPF GLW NDB STAR	Dec 2019	May 2020

[3] RNAV5 requires that the aircraft can navigate within +/- 5nm of a route centreline for at least 95% of the time, whereas RNAV1 requires +/- 1nm accuracy for at least 95% of the time.
[4] NATS PBN equipage survey Jan-May 2017.
[5] Civil Aviation Authority, Future Airspace Strategy for the United Kingdom 2011 to 2030 (www.caa.co.uk/FAS)

VOR/NDB being decommissioned	Used by current conventional procedures	Deadline for procedures to be removed	Proposed date of decommissioning
Turnberry – TRN	EGPH GOSAM 1D SID, EGPH GOSAM 1C SID, EGPH TWEED STAR EGPF NORBO SID EGPF LUSIV SID EGPF TRN SID EGPF TRN STAR EGPK TRN SID EGPK NGY SID EGPK TRN STAR	Dec 2019	May 2020
New Galloway – NGY	EGPK NGY SID	Dec 2019	May 2020

Table 3 VOR rationalisation – conventional procedures affected.

The changes proposed in the airports' separate proposals are intended to remove the SID's dependency on conventional navigation beacons. The conventional procedures will be withdrawn when the new RNAV procedures are implemented. Omnidirectional Departures will be introduced to serve departing RNAV5 aircraft which will not be able to utilise the RNAV1 SIDs.

Figure 5 and Figure 6 below show the existing lower and upper route structure in the region.

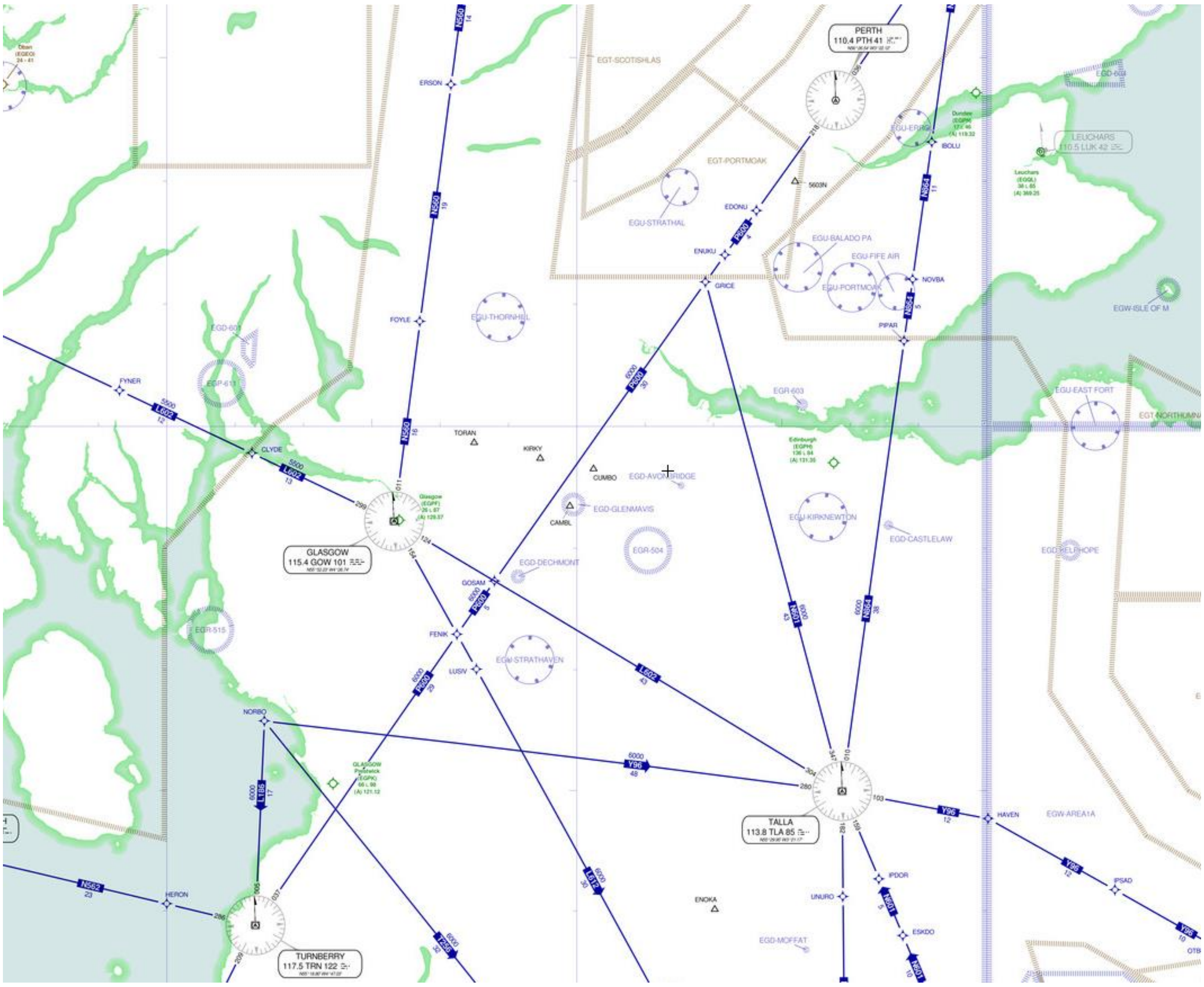

Figure 5 ScTMA Lower ATS Routes.

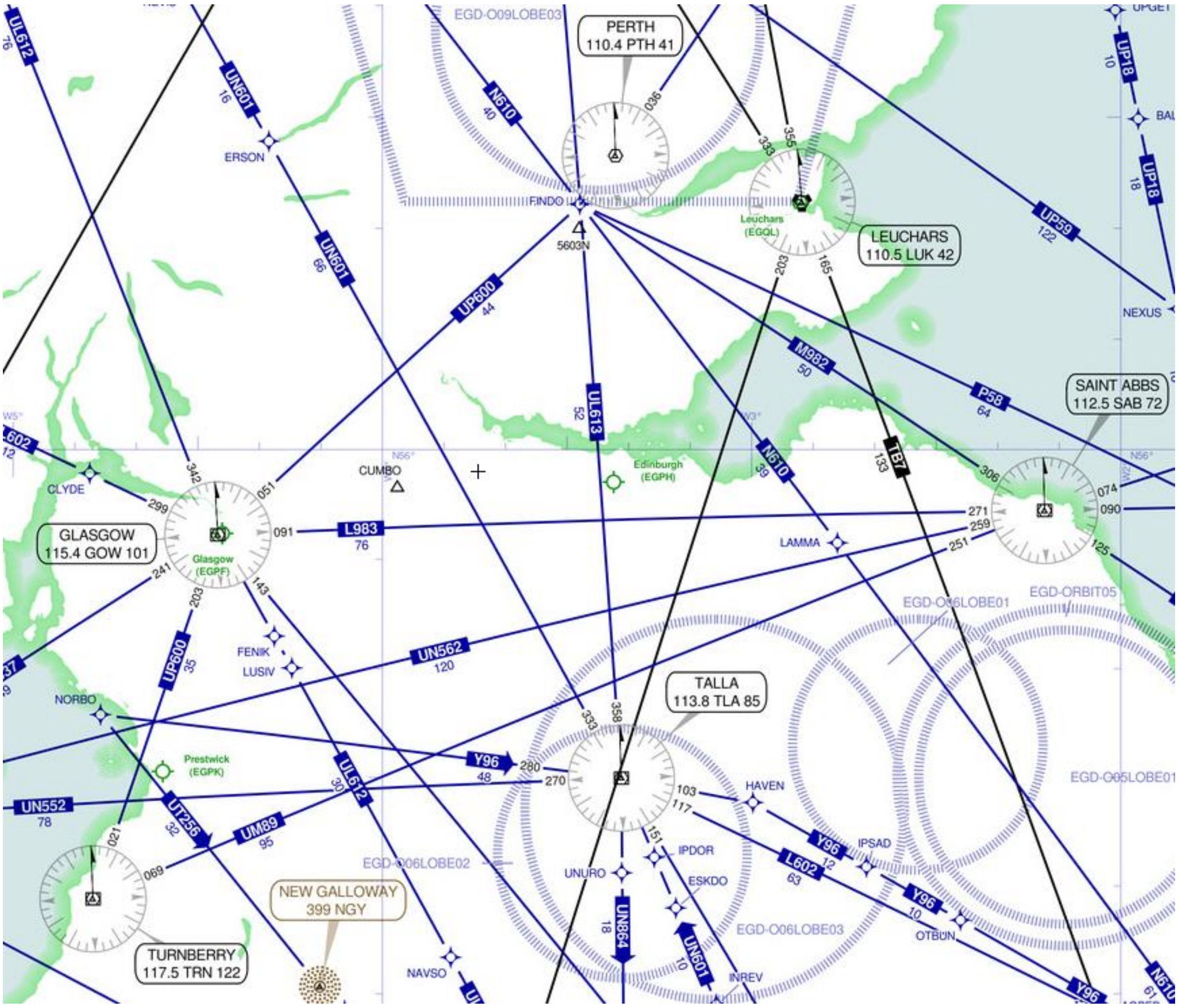

Figure 6 ScTMA Upper ATS Routes.

5.3 Existing track concentrations

Figure 7 (over) shows the current day distribution of flight paths in the ScTMA.

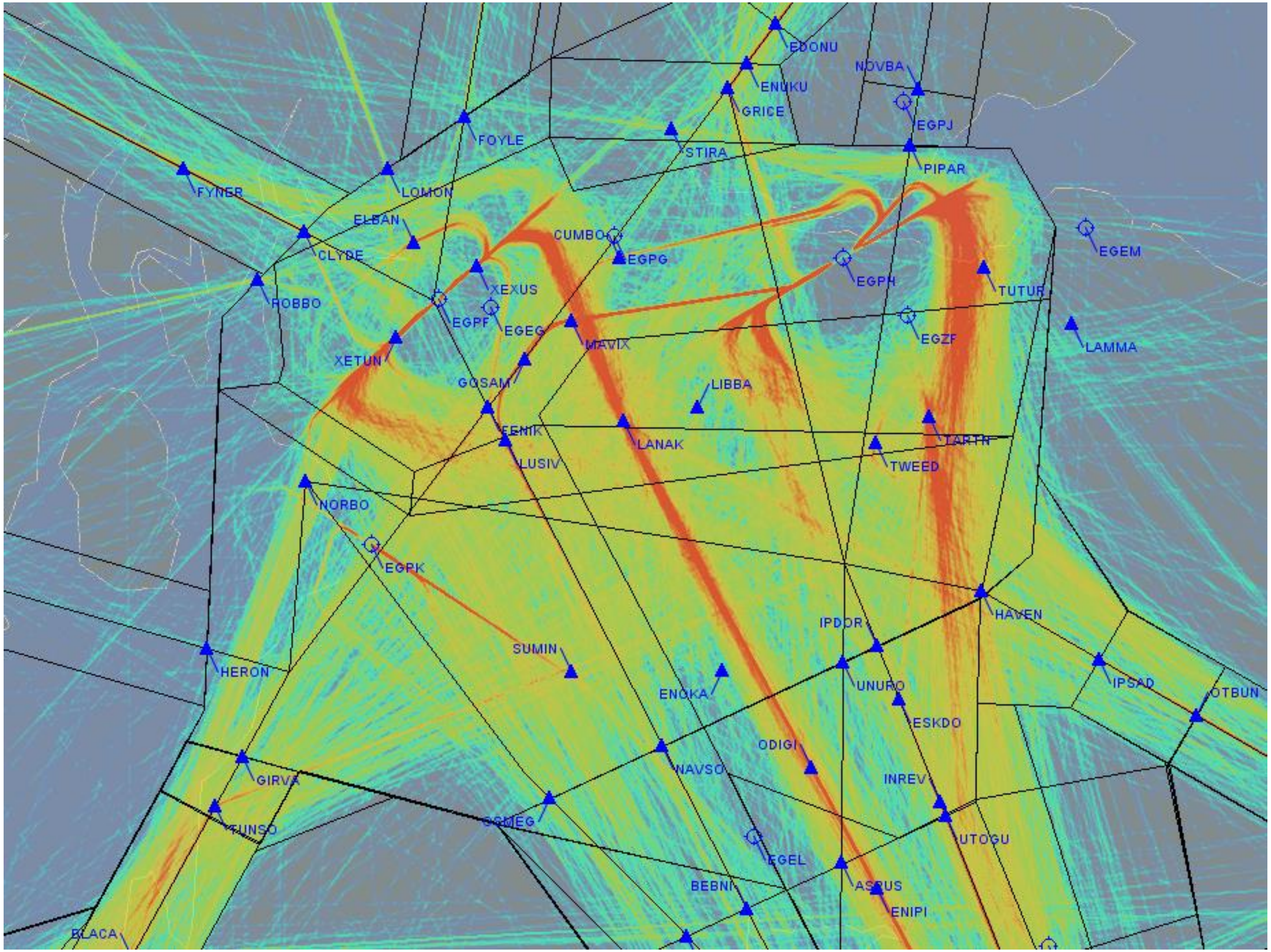

Figure 7: Current-day flight paths in the Scottish TMA below FL180 (1 week period, July 2017, including easterly & westerly operations)

These figures show the density of flight paths[6] so that the current number of flights over any given location in a typical day can be gauged. These give a good indication of where the main concentrations of flights currently occur.

Where there is a spread of flight paths, this is a result of many factors including:

- the different speeds and performance of the various aircraft types. (In general, slower aircraft [e.g. turbo props and smaller aircraft] will turn with tighter radii, while larger jet aircraft fly faster and turn with wider radii);
- vectoring by Air Traffic Control (note for departures, aircraft are not vectored off the defined routes until they are above Noise Preferential Route maximum altitude which is 3000ft);
- variation due to wind and different runway operation.

For reference the current conventional Standard Instrument Departure (SID) route definitions and Standard Terminal Arrivals (STARs) routes are available here.
(http://www.nats-uk.ead-it.com/public/index.php%3Foption=com_content&task=blogcategory&id=62&Itemid=111.html)

Once above 4,000ft aircraft are often tactically vectored by ATC and are instructed by ATC to leave a SID. Hence above 4,000ft the departure flight paths may be more dispersed.

This can be seen in Figure 7 by the dispersed nature of the departures which fan-out as they get further from the airport.

The colour coding on the flight path density diagram (Figure 7) show the number of flights that typically overfly areas.

5.4 Operational Efficiency, Complexity, Delays and Choke Points

The airspace in the vicinity of the LANAK hold is currently an area where interactions between Edinburgh departures, Glasgow arrivals, and Glasgow departures create complexity and significant workload for ATC.

The proposed changes have been designed to reduce the complexity in this region of airspace through improvements made to the ATS route structure, leading to decreased controller workload. In combination with the Edinburgh ACP moving the LANAK hold to RULUR will enable Edinburgh departures to climb above the level of the Glasgow inbound aircraft, thus reducing ATC workload.

The additional operational objective is to reduce fuel burn where possible and this is achieved by the implementation of the route from MAVIX to GITGU, which saves 4nm for each Edinburgh departure on that SID. Additionally it also creates benefit by creating a natural split between Glasgow 05 Departures and Edinburgh Departures, which currently both route via FENIK.

5.5 Environmental Issues

The predominant environmental issue for flights above 7000ft is the impact of CO_2 emissions, and hence the objective of these changes is to introduce efficiencies which minimise CO_2 emissions on a per flight basis.

Detailed analysis of the environmental impact of the proposed new routes is given in section 6. This includes analysis of the current vs proposed routes for the impact on CO_2 emissions, fuel burn and track mileages.

The proposed change to RULUR hold enables a realignment of the TALLA/GALLOWAY ATC sector boundary and also the introduction of the new ATS route Z502 from MAVIX –GITGU. This reduces track mileage and CO_2 emissions of EGPH departures to the south.

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

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

[6] These are derived from radar data taken from July 2017.

5.6 Safety

Ensuring the safety of proposed changes is a priority for NATS. Safety representatives from SARG have had oversight of the safety assurance process.

All proposed procedures have been designed in accordance with ICAO PANS-OPS RNAV procedure design criteria.

6. Statement of Need

The Statement of need for this ACP, from the DAP1916 form (DAP1916 ref. no. 1860) is shown below.

5. Statement of Need

Please provide a brief 'Statement of Need' expressing explicitly what airspace issue or opportunity you are seeking to address. Your Statement of Need should clearly articulate the current situation, the issue (and the cause of it) to be resolved or the opportunity to be addressed along with any other factors or requirements. *

This airspace change proposal will make changes to the Scottish TMA airspace and ATS route network. The proposed changes will interface with SIDs and STARs serving Edinburgh, Glasgow and Prestwick airports. Each of these airports is currently in the process of making changes to their SIDs/STARs/Arrival transtions; the changes proposed to the Scottish TMA by this ACP have been coordinated with the airports' proposals and will complement the airports' proposals.
Changes proposed may include (but may not be limited to):

- Introduction ATS route N562 (GOW – TRN)
- Introduction ATS route Z502 (MAVIX – GITGU)
- Realignment of existing ATS route T256 (realigned NORBO-OSMEG)
- Re positioning of the LANAK hold, to RULUR.
- Realignment and conversion to RNAV5 of EGPF STARs to route to the proposed RULUR hold

Current Situation
Conventional SIDs/STARs at the ScTMA airports are not PBN and will soon be made obsolete by the decomissioning of conventional navigation beacons (GOW, PTH, TRN, NGY).

Issue to be addressed
Conflicting traffic flows between Edinburgh and Glasgow (particularly in the vicinity of the LANAK hold). Introduction of the new hold position and ATS routes will reduce conflicts by systemising the traffic, also reducing fuel burn & CO_2 emissions for flights using these routes.

Cause
Legacy ATS structure requires modernisation in accordance with the FAS.

7. Proposed Airspace Description

7.1 Objectives/Requirements for Proposed Design

In line with the objectives listed in section 4.2 the following requirements have particular relevance for the proposed route designs

- Maintain or improve the level of safety for flights in the ScTMA;
- Reduce per-flight CO_2 emissions
- Reduce per-flight fuel burn
- Facilitate efficient integration of the SIDs proposed by Edinburgh Airport into the UK enroute ATS route structure;
- Facilitate efficient integration of the SIDs proposed by Prestwick Airport into the UK enroute ATS route structure;
- Cater for all levels of aircraft PBN equipage;
- Maintain or reduce ATC workload (per flight);
- Maintain or Increase sector capacity (measured by sector monitor value);
- Minimise additional controlled airspace required for changes;
- Have negligible/no impact on military operations.

7.2 Design Principles

The proposed routes have been designed in accordance with the design principles as detailed in Ref 4 "FASI (North) Scottish Terminal Manoeuvring Area - Design Principle & Engagement Process".

7.3 New Routes Required

The ATS routes proposed in this ACP are listed below in Table 4 highlighted in yellow. The routes proposed in the Edinburgh and Prestwick proposals are also listed (no colour). The ACP which they are proposed in is listed in the 5th column.

ATS Route	Routing	RAD Restrictions			Notes
		Upper /Lower Cruise Limit	Direction	Airspace Change Proposal (ACP)	
Z507	KRAGY – ARLER – TLA	FL250/ FL110	EASTBOUND ONLY	Edinburgh ACP	EGPH Connectivity from KRAGY and ARLER SID to Y96, N864 and TRN
N537	EMJEE – BEMAS - LIKLA – GOW – MAC	FL240/ FL100	WESTBOUND ONLY	Edinburgh ACP	EGPH Connectivity from EMJEE SID to L602 and N560
Z500	EMJEE – MAVIX – FENIK	FL240/ FL100	WESTBOUND ONLY	Edinburgh ACP	EGPH Connectivity from EMJEE SID to L612, P600
Z502	MAVIX – GITGU	FL240/ FL100	WESTBOUND ONLY	This ACP	EGPH Connectivity from EMJEE & MAVIX SID to L612
Z506	VOSNE – HAVEN	FL240/ FL160	WESTBOUND ONLY	Edinburgh ACP	EGPH Connectivity from VOSNE SID to Y96
Z509	EVTOL – TLA	FL250/ FL70	EASTBOUND ONLY	Edinburgh ACP	EGPH Connectivity from EVTOL SID to Y96, N864 and TRN
Z250	LUCCO – SUMIN – BULLY - ODLIP –- HAVEN	FL250/ FL70	EASTBOUND ONLY	Prestwick ACP	EGPK Connectivity from LUCCO SID to Y96
Z248	LUCCO – OSMEG	FL250/ FL70	EASTBOUND ONLY	Prestwick ACP	EGPK Connectivity from LUCCO SID to T256
Z249	SUDBY –- OSMEG	FL250/ FL70	EASTBOUND ONLY	Prestwick ACP	EGPK Connectivity from SUDBY SID to T256
Z246	DAUNT –- HERON	FL240/ FL80	WESTBOUND ONLY	Prestwick ACP	EGPK Connectivity from DAUNT SID to N560
Z247	OKNOB –- HERON	FL240/ FL80	WESTBOUND ONLY	Prestwick ACP	EGPK Connectivity from OKNOB SID to N560
N560	TRN – GOW – PTH	FL450/ FL70	BI-DIRECTIONAL	This ACP	EGPH Connectivity from LIKLA SID to TRN
T256	NORBO - OSMEG	FL450/ FL70	EASTBOUND ONLY	This ACP	EGPK Connectivity (T256 Realigned)

Table 4 ATS Routes being proposed

7.4 Change to the Glasgow hold

The extant LANAK hold for inbounds to Glasgow is proposed to be moved to RULUR (see Figure 1). The position of RULUR was selected in order to place it further upstream along the extant arrival traffic flow, such that the usual vectoring patterns for arrivals remain unchanged. This option was tested during real-time simulations and was proved to be a safe and effective ATC solution (see Ref 18). Note the proposed new position of the hold has been agreed with Glasgow and Edinburgh; and is deconflicted from the Edinburgh departure routes (as proposed in their separate ACP).

Inbounds to Glasgow are routed via EBEKI which improves the management of inbound and outbound traffic. This also ensures that aircraft enter the RULUR hold using a direct entry procedure which results in improved containment and hence a smaller protected area. The proposed distribution of flight paths of the arrivals in the vicinity of RULUR will be unchanged from extant patterns from LANAK. Figure 8 shows flight path densities for current day arrivals via LANAK.

Arrivals to runway 23 from RULUR will generally continue to pass over LANAK in a swathe as they are vectored to final approach (as per today).

Arrivals to runway 05 will be routed as per today by being turned on a ~290° heading between EBEKI and RULUR as they are vectored to final approach. The proposed future vectoring pattern will be as per today and the position of arrivals below 7000ft will be unchanged.

See Ref 10 - Consultation Appendix B for more levels.

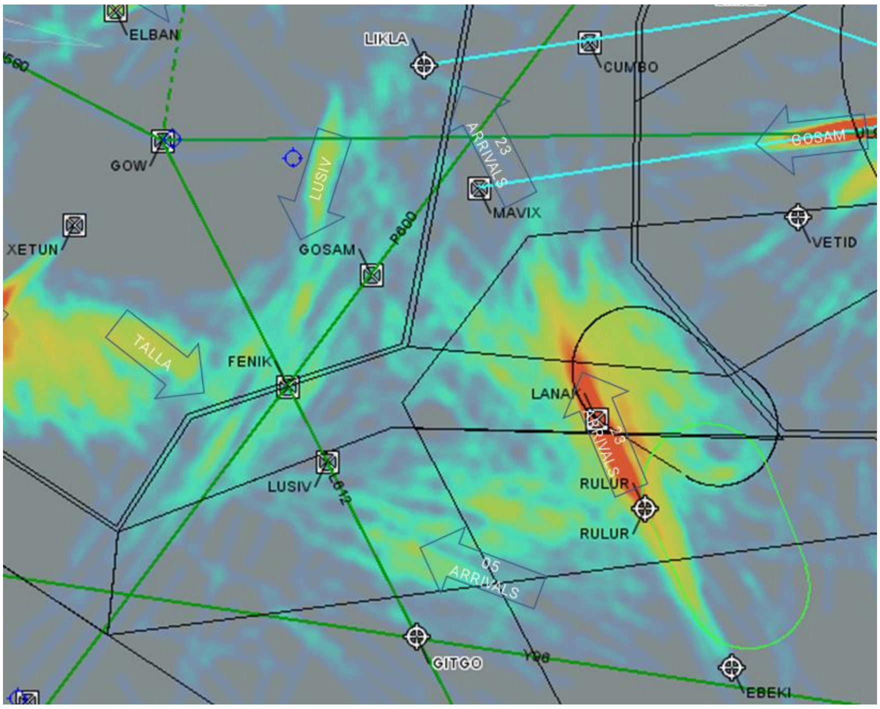

Figure 8 Vectoring patterns from the LANAK vs RULUR holds (7000-8000ft) (excerpt from Consultation Appendix B)

Note: the preference is for the RULUR hold to be defined as distance based subject to CAA approval. Since this gives more predictable containment.

7.5 Changes related to Edinburgh's (EGPH) proposed SIDs

Edinburgh is proposing several link routes within its own ACP which link the ends of their proposed SIDs with the enroute network.

The following additional link routes are required (proposed in this ACP) in order to assure adequate systemisation of the Edinburgh SIDs in the ScTMA.

These are:

N560 GOW, TRN

Z502 MAVIX, GITGU

These are shown in bold in Figure 9.

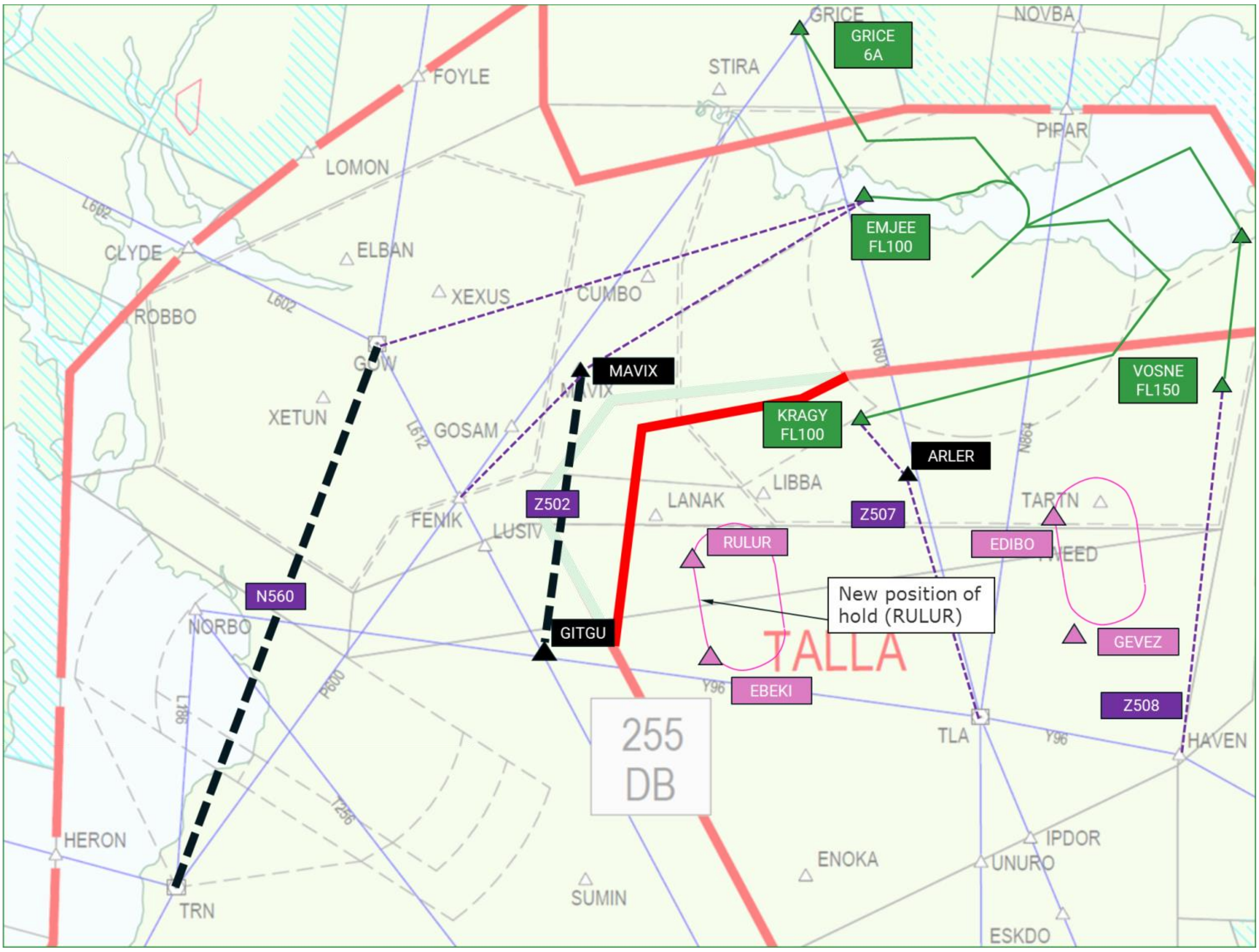

Figure 9 Link routes proposed in this ACP related to the proposed EGPH SIDs.

Note: changes related to the EGPH STARs are incorporated in the Edinburgh Airport ACP.

7.6 Glasgow proposed STARs

Due to the proposed move of the hold for arrivals to Glasgow from LANAK to RULUR, STARs which currently terminate at LANAK will be replaced with equivalent RNAV5 STARs to RULUR. The introduction of these new STARs is part of this ACP. Note that in accordance with revised CAA policy, the proposed STARs will be named according to the ICAO convention using the start point.

New STAR Name	Old STAR Name	ATS Route Connectivity	Route	Expected Level Restriction	Usage
RIBEL1G	LANAK2A	P16, N601	RIBEL- NISKA-ASLIB-ENIPI-ODIGI-PFS35-EBEKI-RULUR	FL70 level RULUR, actual level to be determined by ATC	
APPLE1G	LANAK1B	APPLE	APPLE- ASLIB-ENIPI-ODIGI-PFS35-EBEKI-RULUR	FL70 level RULUR, actual level to be determined by ATC	FL285+
TUNSO1G	TRN1A	P600	TUNSO – NIBTA – EBEKI – RULUR	FL70 level RULUR, actual level to be determined by ATC	FL150L BAVRO
TRN1G		P600	TRN – EBEKI – RULUR	FL70 level RULUR, actual level to be determined by ATC	
HAVEN1G	LANAK2D	Y96	HAVEN-TLA-PFE01-EBEKI-RULUR	FL70 level RULUR, actual level to be determined by ATC	

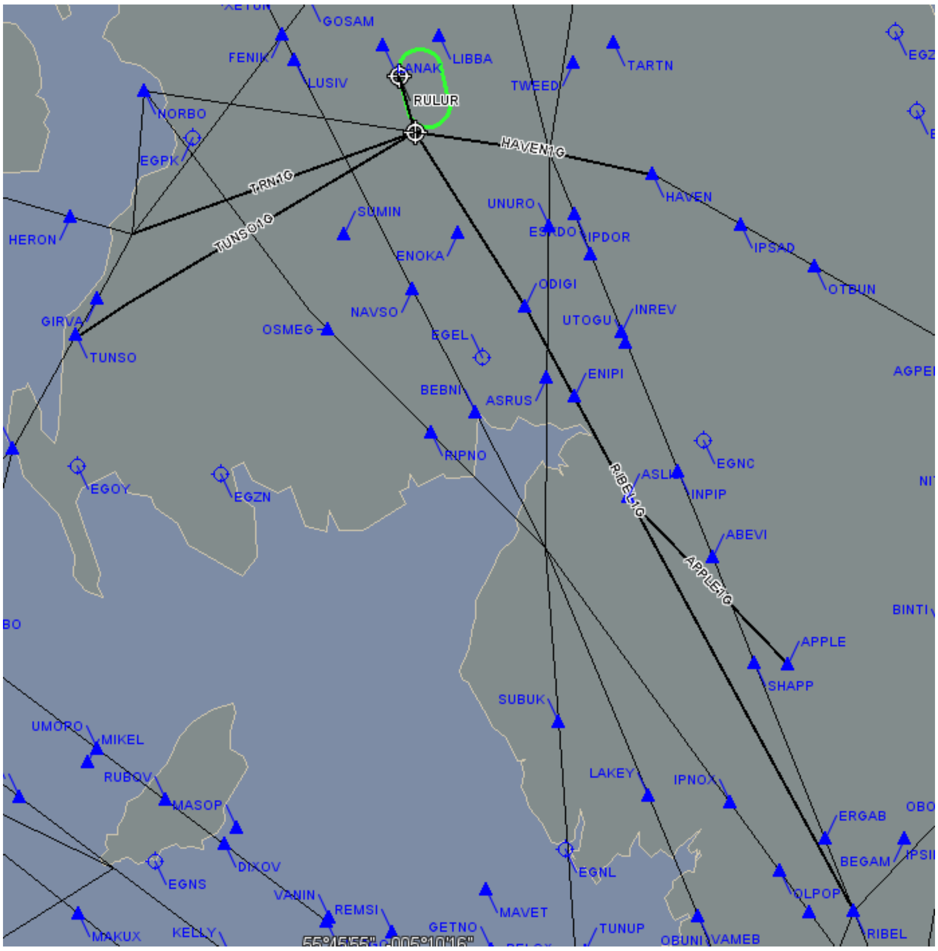

Figure 10 Proposed EGPF RNAV5 STARs to RULUR.

7.7 RNAV equipage

The equipage rate for aircraft which are RNAV1 capable in the Talla and Galloway sectors is currently 92%[7]. The routes proposed in this ACP are RNAV5. RNAV5 is mandated for flight above FL100, hence the equipage rate for RNAV5 is close to 100%.

Non-RNAV5 arrivals would be vectored by ATC from the hold to the appropriate instrument approach IAF. All non-RNAV5 aircraft will be radar monitored by ATC to ensure separation is maintained from all other traffic.

7.8 Route allocation

The allocation of traffic to each SID is dependent on the airports' use of each SID.

The route allocation system and traffic volumes are described in the individual airports' ACPs. This would not preclude controllers from vectoring flights if they perceive an advantage in flexibility or efficiency.

7.9 Systemisation and route separation

The proposed ATS routes and holds will be tactically managed by NATS Prestwick Centre ATC. Flights will be monitored by ATC and do not rely on PBN reduced route separations (as described in CAP1385 PBN Enhanced Route Spacing Guidance).

7.10 Other Design Options Considered (but not progressed)

Full assessment of design options which were considered but not progressed is given in Ref 6 (Design Principle Evaluation and Options Appraisal).

7.11 Full options assessment

The "Options Appraisal (Phase II – Full) including safety assessment" (Ref 9) as required by CAP1616, is published on the CAA portal.

7.12 Implementation Timetable

The earliest implementation of the changes proposed herein would be 28th Feb 2019.

7.13 Reversion Statement

Should the proposal be approved and implemented, a post implementation review will be undertaken after the airspace has been in operation for 12 months. At this point whether the airspace change has achieved its design objectives will be evaluated. Due to the interdependencies between these changes and those proposed by Edinburgh (which are planned to come into operation during this time frame); if the proposed changes do not meet the objectives, reversion to the pre-implementation state would have to take account of the related airports' changes.

7.14 IFP Flight Validation (Flyability)

The proposed RNAV STARs are within PANS-OPS tolerances for MSD, and they are equivalent to the extant EGPF STARs to LANAK which have been in use for many years. Hence it has been deemed by the project that no benefit will be gained by undertaking simulator flight validation.

[7] NATS PBN equipage survey Jan-May 2017.

7.15 Supporting Information

For full details of:

Info	See this ref document	Notes
Technical definition document	Ref 13	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.
Draft AIP changes	Ref 14	Lists AIP pages where changes need to occur and what those changes should be.

The fuel analyses in this document are standalone, based on the FASIN ScTMA final design in this document.

7.16 DVOR Rationalisation and this proposal

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

7.17 Comprehensive detailed route information

Ref 13 the WGS84 spreadsheet provides detailed route STAR information relevant to this proposal.

8. Impacts of this proposal

8.1 Noise, visual intrusion, the general public, stakeholders on the ground

The changes proposed herein impact flights above 7000ft. Some of the EGPH SIDs have published end altitudes of 6000ft. However flights would only level at 6000ft in rare situations such as a radio failure. Appendix B shows radar trajectories which illustrate the typical levels flown. Table 4 below summarises the altitudes at which aircraft will typically pass the end points of the SIDs.

Airport/ Runway	SID	End Point	Published end altitude	Altitude Expected at SID end point/ start of link route
EGPH/24	EVTOL 1C	EVTOL	6000ft	FL90
EGPH/24	ARLER 1C	ARLER	6000ft	FL90
EGPH/24	LIKLA 1C	LIKLA	FL100	FL100
EGPH/24	MAVIX 1C	MAVIX	FL100	FL100
EGPH/24	GRICE 4C	GRICE	6000ft	FL100
EGPH/24	VOSNE 1C	VOSNE	FL150	FL150
EGPH/06	EMJEE 1D	EMJEE	FL100	FL100
EGPH/06	GRICE 5D	GRICE	6000ft	FL100
EGPH/06	VOSNE 1D	VOSNE	FL150	FL150
EGPH/06	KRAGY 1D	KRAGY	FL100	FL100

Table 5 Typical altitudes at the start of link routes (based on current day performance radar data)

Impacts due to noise of aircraft overflights occur at the specific locations associated with routes/flights and are considered significant (according to the DfT guidance) when the aircraft in question are below 7000ft. Since flights flying on the portions of the routes proposed in this ACP will be above 7000ft, we assess that there would be no significant noise or visual intrusion impact to stakeholders on the ground due to the proposed routes. For information regarding the noise impact related to flight paths below 7,000ft please refer to the airports' individual ACPs/consultation material.

8.2 CO_2 emissions & fuel burn

CO_2 emissions & fuel burn analysis has been performed, modelling the entire ScTMA airspace including the changes proposed by Edinburgh and Prestwick airports. When performing CO_2 emissions & fuel burn analysis common start/finish points must be used so that comparison can be made between extant and proposed scenarios. Many of the link routes connect to SIDs proposed by the airports (in separate proposals). It is not possible to analyse the link routes in isolation. The results have been broken down by individual route and by airport so that the impact of each route proposed can be assessed. The results of this modelling indicate that the proposed changes will result in a reduction in average fuel burn and CO_2 emissions per flight. The total annual reduction in fuel burn (2019 traffic level) is forecast to be 5,550 tonnes, and the reduction in CO_2 emissions forecast is 17,651 tonnes.

The overall impacts are summarised Tables 4 to 6 below.

				2019			2029		
ATS Route	Routing	Departure Airport	Average Fuel Change Per Flight (kg)	Yearly Flights	Yearly CO2 Change (T)	Yearly Fuel Burn Change (T)	Yearly Flights	Yearly CO2 Change (T)	Yearly Fuel Burn Change (T)
Z507	KRAGY-ARLER-TLA	EGPH	-23	18,297	-1,339	-421	20,735	-1,518	-477
N537	EMJEE-BEMAS-LIKLA-GOW-MAC	EGPH	-49	6,297	-981	-308	7,137	-1,111	-350
Z502	EMJEE-MAVIX-GITGO	EGPH	-103	26,413	-8,615	-2709	29,934	-9,763	-3070
Z506	VOSNE-HAVEN	EGPH	-67	5,823	-1,241	-390	6,600	-1,407	-442
Z509	EVTOL-TLA	EGPH	-19	3,210	-198	-62	3,638	-224	-71
T256	NORBO-OSMEG	EGPH	-19	320	-20	-6	363	-22	-7
N562	TRN-GOW-PTH	EGPH	-13	7,993	-337	-106	9,058	-382	-120
Z250	LUCCO-SUMIN-BULLY-ODLIP-HAVEN	EGPK	-167	73	-39	-12	83	-44	-14
Z248	LUCCO-OSMEG	EGPK	-59	2,456	-459	-144	2,783	-521	-164
Z249	SUDBY-OSMEG	EGPK	-33	819	-86	-27	928	-97	-31
Z246	DAUNT-HERON	EGPK	-77	491	-120	-38	557	-136	-43
Z247	OKNOB-HERON	EGPK	-16	164	-8	-3	186	-9	-3
ATS link routes Total			**-58**	**72,356**	**-13,443**	**-4227**	**82,002**	**-15,236**	**-4791**

Table 6 Departures CO_2 emissions & fuel burn impacts (by link route usage)

				2019			2029		
Airport	Runway	SID	Average Fuel Change Per Flight (kg)	Yearly Flights	Yearly CO2 Change (T)	Yearly Fuel Change (T)	Yearly Flights	Yearly CO2 Change (T)	Yearly Fuel Change (T)
EGPH	06	EMJEE	-112	7,994	-3,012	-947	9,060	-3,414	-1074
EGPH	06	GRICE	6	1,376	20	6	1,559	22	7
EGPH	06	KRAGY	-19	3,944	-222	-70	4,469	-252	-79
EGPH	06	VOSNE	-133	3,072	-1,287	-405	3,482	-1,458	-459
EGPH	24	EVTOL	-20	3,210	-198	-62	3,638	-224	-71
EGPH	24	ARLER	-25	14,353	-1,117	-351	16,266	-1,266	-398
EGPH	24	GRICE	-26	4,127	-330	-104	4,677	-375	-118
EGPH	24	LIKLA	2	4,723	-529	-166	5,353	-600	-189
EGPH	24	MAVIX	-56	19,993	-6,054	-1904	22,658	-6,861	-2158
EGPH	24	VOSNE	2	2,751	45	14	3,118	52	16
EGPH total			**-46**	**65,544**	**-12,685**	**-3989**	**74,279**	**-14,376**	**-4521**
EGPK	12	OKNOB	-16	164	27	8	186	30	10
EGPK	12	SUDBY	-33	819	-244	-77	928	-277	-87
EGPK	12	SUMIN	-159	18	-1,298	-408	21	-1,471	-463
EGPK	12	TRN	-46	127	-200	-63	144	-227	-71
EGPK	30	LUCCO	-61	2,511	-1,127	-354	2,845	-1,277	-402
EGPK	30	DAUNT	-77	491	-337	-106	557	-382	-120
EGPK	30	TRN	-64	382	36	11	433	41	13
EGPK total			**-56**	**4,512**	**-3,549**	**-1116**	**5,113**	**-4,023**	**-1265**
SIDs Total			**-73**	**70,056**	**-16,235**	**-5105**	**79,392**	**-18,399**	**-5786**

Table 7 Departures CO_2 emissions & fuel burn impacts (by SID usage)

Note that the difference between the totals in Table 6 and Table 7 are due to those flights which depart on a SID but do not then use one of the proposed new ATS routes. For example flights departing on GRICE SIDs from Edinburgh do not use any of the new ATS link routes.

Impacts due to CO_2 emissions can only be assessed by analysing the existing route vs the proposed route between common start/end points, hence where the SIDs are part of the route these must be part of the analysis. Please see Consultation (Ref 10) Appendix C for examples.

Category		Average Fuel Change per Flight (kg)	2019			2029		
			Yearly Flights	Yearly CO2 Change (T)	Yearly Fuel Change (T)	Yearly Flights	Yearly CO2 Change (T)	Yearly Fuel Change (T)
Departures	EGPH	-46	65,544	-12,685	-3,989	74,279	-14,377	-4,521
	EGPK	-56	4,512	-808	-254	5,113	-916	-288
All Departures		-51	70,056	-13,493	-4,243	79,392	-15,293	-4,809
Arrivals	EGPH	1	65,544	248	78	74,279	280	88
	EGPK	5	4,512	76	24	5,113	86	27
All Arrivals		-1	70,056	324	102	79,392	366	115
Overflights		0	24,030	-10	-3	27,198	-10	-3
All ScTMA flights		**-23**	**164,142**	**-13,178**	**-4,144**	**185,982**	**-14,936**	**-4,697**

Table 8 All ScTMA flights fuel burn impacts (by Airport arrival/departure/overflights)

Note only the emissions benefits due to route Y96 and N560 (outlined in table 5 above) can be considered to be exclusively due to the changes herein. Hence as directed by the CAA the WebTAG analysis for this ACP only considers the benefit due to these two routes.

Results from WebTAG are given in Appendix B. The reduction in CO_2 emissions due changes solely incorporated in this ACP equates to a WebTAG calculated Net Present Value CO_2 benefit of £59,408.

The proposals as outlined herein serve as an enabler for some enhanced benefits when coupled with the proposed airports' routes. An example of this is given in the consultation document (Ref 10 Appendix C), which explains how efficiencies are enabled by the combined SID + link route which cannot accrue without both sets of changes being approved.

8.3 Delays to air traffic and airspace capacity

The objective of this proposal is to integrate the routes proposed by the airports efficiently into the enroute network. The ScTMA enroute airspace network is not capacity constrained currently and delays are not an issue in the ScTMA at current-day traffic levels. Analysis has indicated that the network as proposed herein could operate without the necessity of introducing delays, with forecast future traffic levels at least to 2024 (traffic levels beyond that were not tested).

Further route enhancements in the ScTMA were considered, however these have not been progressed since at current and forecast traffic levels up to 2024 they are not required.

Hence no change in delays is claimed in relation to this ACP.

8.4 MoD

The proposed routes are not expected to have any impact on MoD operations.

8.5 General Aviation (GA) airspace users

The proposed routes are all contained within existing controlled airspace. There is no requirement for new controlled airspace as part of this ACP. Hence there is not expected to be any impact on general aviation or sport aviation airspace users.

8.6 Impact on Aviation Safety

The proposed new routes take advantage of the precise navigation technology available on modern aircraft. By promulgating the routes using the RNAV navigation standard, aircraft will be flying according to a systemised route structure with less reliance on air traffic control for tactical intervention.

ATC monitors the track keeping of all aircraft and where an unauthorised deviation from centreline occurs it is Air Traffic Control's responsibility to monitor, and if necessary intervene and prevent a loss of separation from occurring. Implementation of RNAV routes typically results in improved track-keeping; this has an associated safety benefit.

The proposed position of the RULUR hold represents a safety benefit (compared to LANAK) since it gives improved separation of traffic flows with less requirement for ATC tactical intervention.

8.7 Stakeholder pre-engagement

The proposed changes are inter-related to the airports' proposals. There has been significant pre-engagement with key stakeholders to ensure that there is minimal impact on their operations and that they are content with the proposals. The engagement has been via the following fora:

Stakeholder Group	Forum	Engagement
Airlines	Lead Carrier Forum, Operational Partnership Agreement (OPA), Flight Efficiency partnership (FEP)	- Periodic updates to canvass feedback and design input - Via airports and base captains for local input - Airline Economic/Flight Planning Teams to ensure considerations of airspace design vs economic benefits are aligned. - Involvement in flight simulations of proposed procedures
Scottish Airports	Scottish TMA Working Group	- Regular meetings (at least quarterly) to review design developments, agree participation in simulation and design activities and gain feedback from consultation/ regulatory decision making
FASI-N Steering Group (formerly SDDG – Scottish Design Development Group)	FASI-N Steering Group	- Regular meetings (at least quarterly) to update progress against deliverables and raise issues for strategic intervention and resolution.
Military	FASI-N Steering Group	- Some involvement in FASI-N Steering Group - ScTMA Working Group - Direct contact with airports via their consultations
Coding Houses	RNDSG	- Periodic updates to provide oversight of planned changes, timescales and lessons learnt from across the industry
General Aviation	FASVIG	- Updated via FASVIG

NATS completed engagement activities with stakeholders identified as those being most likely to be affected by the proposed design. The airline stakeholders targeted are listed in Appendix A. NATS briefed stakeholders on the planned changes via the fora listed above. The Consultation Strategy Document (Ref 8) details all of the engagement activities completed prior to the consultation going live.

NATS commenced consultation on the proposed airspace changes from 30th May – 26th July 2018. The consultation was conducted via the CAA Citizen Space online portal where users could view and download the consultation document (Ref 10), and submit a formal response. The consultation document provided an overview of the current airspace; the proposed changes and outlined any impacts that the proposed changes may have.

The consultation was open for eight weeks; closing on 26th July 2018. A total of fifteen responses were received during this period. A full summary of the consultation and a theming of all responses can be found in the Collate and Review Responses document (Ref 11).

The consultation feedback is summarised in Stage 3 Collate and Review Responses (Ref 11 Section 3). The majority of respondents supported the proposals or were neutral. There was one objection which was from Glasgow Airport; however the basis of this objection was mostly related to matters outside the scope of this ACP (e.g. the timetable for VOR decommissioning). The detailed response to the issues raised by Glasgow Airport is included in Ref 11.

8.8 Net impacts summary for proposed routes

Category	Impact	Evidence
Safety/Complexity	Increased predictability and deconfliction of traffic flows from and to Edinburgh and Glasgow Airports. Reduction in complexity of ATC task due to systemisation	Para 5.6 Para 8.6, Section 11
Capacity/Delay	No claims are made for changes to capacity or delays.	See Para 8.3
Fuel Efficiency/CO_2	The total annual reduction in fuel burn (2019 traffic level) is forecast to be 5,550 tonnes. The reduction in CO_2 emissions forecast is 17,651 tonnes.	See Para 8.2
Noise – Leq/SEL	Not a priority – all changes 7,000ft or above	See Para 8.14
Tranquillity, visual intrusion (AONBs & National Parks)	Not a priority – all changes 7,000ft or above	See Para 8.14
Local Air Quality	Not a priority – all changes 7,000ft or above	See Para 8.14
Other Airspace Users	Minimal impact, no changes to volume or classification of CAS.	See Paras 8.10-8.12

8.9 Units affected by the proposal

NATS Prestwick Centre is sponsoring this proposal.

The main airports in the ScTMA: Prestwick, Glasgow and Edinburgh Airport are interested parties.

There are interfaces with the routes proposed by Edinburgh in their separate ACP. The routes proposed herein create synergies as described in Appendix C of the Consultation Document (Ref 10).

The proposed STARs to Glasgow Airport / RULUR hold affect arrivals to Glasgow Airport.

There were no other units or airport operators identified as being significantly impacted by the proposed changes.

8.10 Consultation overview

This consultation received fifteen responses. The numbers of responses were as follows:

- Airports – 4
- NATMAC representatives & aviation industry representatives – 4
- Airlines – 4
- MoD – 1
- Individuals – 1
- District Community Councils – 1

The overall response categories were as follows.

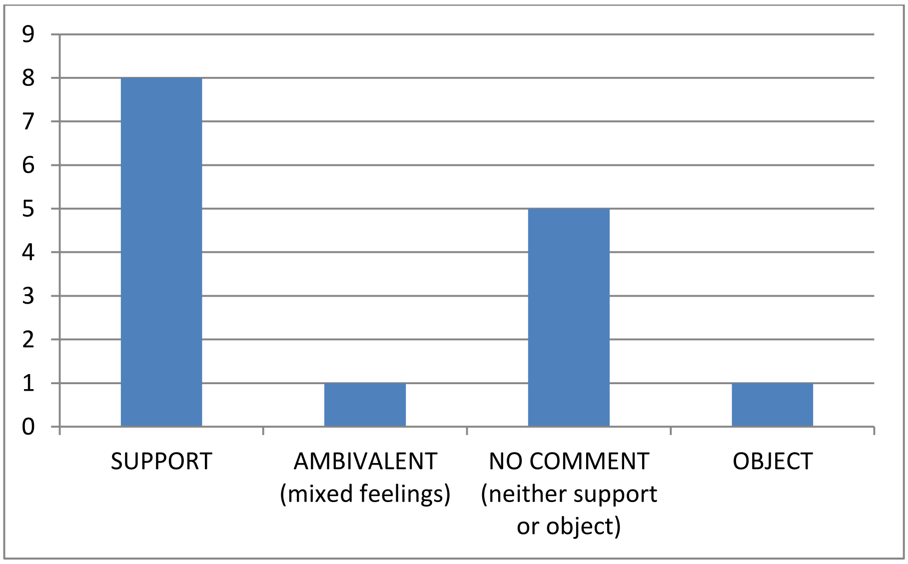

Figure 11 Overall response categories

For full analysis of the consultation responses please see Ref 11.

8.11 Military impact and consultation

Design Principle 3.3 Airspace Use (see Step 1B Design Principles document (Ref 4)) stated that the proposed changes should have no adverse impact on UK military operations where the UK provides ATS. The proposed final design meets this Design Principle.

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.

8.12 General Aviation airspace users impact and consultation

Design Principle 3.3 Airspace Use (see Step 1B Design Principles document (Ref 4)) stated that there should be no impact on GA operations. It also stated that the volume of CAS should be kept to a minimum.

The proposed final design meets these Design Principles.

Five GA stakeholders responded to the consultation. Of these 2 supported and 3 were neutral.

8.13 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 17 and for full details of the consultation strategy document, consultation responses and their collation please see Stage 3 documents (Refs 8-11).

8.14 Local environmental impacts and consultation

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

8.15 Design Changes Arising from Consultation

There were five consultation response elements which had the potential to impact the final design. Ultimately only two:

- Element 1 (Rockwell Collins) - ensuring continuity of altitudes between all procedures, and
- Element 5 (Glasgow Airport Ltd) – LIBBA hold and STAR removal,

were progressed (see Stage 4 Step 4a Update Design, Ref 13).

These elements do not represent change to the underlying designs.

8.16 Economic impacts

The likely economic impacts are detailed in Stage 4 Step 4a Update Design (Ref 12) Section 5, based on the fuel analysis. 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
Communities	Air quality	N/A	N/A – airspace changes are above 7,000ft.
Wider society	Greenhouse gas impact	Monetise and quantify	The proposed changes (solely contained in this ACP) are forecast to result in a total annual reduction in CO_2 emissions (2019 traffic level) of 454 tonnes p.a. rising to 515 tonnes by 2029. WebTAG was used to monetise the impact of the change in CO_2 emissions due to these proposed changes. The proportion of traffic intra-EU is 72.1% with 27.9% originating/destined for non-EU countries. Hence these proportions are used for the traded/non-traded split. This yields an overall emissions net benefit for carbon dioxide of £59,408 NPV. Sensitivity analysis states a possible range of the benefit from £89,112 - £29,704. This benefit is due to routes being shorter and having more efficient climb profiles (which yield significant savings in CO_2 emissions). Appendix A includes the above greenhouse gas WebTAG analysis output.
Wider society	Capacity/ resilience	Qualitative	The proposals in this ACP seek to integrate the airports' changes into the enroute network. As such the overall airspace infrastructure will be enhanced; however no claims of increased capacity to the network or greater resilience of the network are made.
General Aviation	Access	N/A	Not applicable – there would be no change in impact to General Aviation airspace users. There are no changes in classification or extent of controlled airspace proposed.
General Aviation/ commercial airlines	Economic impact from increased effective capacity	Quantify: Sector monitoring values (planned) Delay reduction per flight (predicted)	Not applicable – this concept was not designed with the intention of increasing the capacity of this region of airspace.
General Aviation/ commercial airlines	Fuel burn	Monetise	The projected annual fuel burn saving are: Year — Amount — Value (NPV) 2019 — 143 tonnes — £66,756 2029 — 161 tonnes — £75,752 10 year Total — 1,677 tonnes — £783,360 This was based on the IATA jet fuel price (April 2018). Additionally the Net Present Value of traded sector carbon dioxide equivalent emissions of the proposal is £71,083. This represents the saving that airlines would make due to a reduction in the amount of carbon off-set credits required to be purchased.
Commercial airlines	Training cost	N/A	Beyond familiarisation there are no training costs to the airlines associated with the proposed changes.
Commercial airlines	Other costs	N/A	Not applicable – there are no other costs known which would be incurred by commercial aviation.
Airport/ Air navigation service provider	Infrastructure costs	N/A	Not applicable – there will be no costs attributable to infrastructure such as equipment or construction costs.

Group	Impact	Level of Analysis	Evidence
Airport/ Air navigation service provider	Operational costs	N/A	Not applicable – this proposal would not lead to a change in operational costs.
Airport/ Air navigation service provider	Deployment costs	Qualitative and quantitative	Training Costs: £100 - £250k NPV Delivery of change under AIRAC process: £100k NPV

9. Analysis of Options

9.1 Initial Proposals

Seven proposals were initially considered and analysed at the Stage 2 options assessment.

Proposal 1:

Proposal 1 to move the LANAK hold was evaluated as beneficial bringing benefits in safety, capacity and workload. These benefits justify the cost associated with progressing this change, and hence it was progressed.

Proposal 2 -6:

Proposals 2 to 6 and the baseline (extant) enroute airspace structure were tested during real time simulations with traffic levels grown to forecast 2025 levels. For these proposals it was demonstrated that the extant enroute structure was able to cope with grown traffic levels. As such it was determined that the extant airspace would continue to be fit for purpose up to at least 2025. At current and forecast traffic levels in the ScTMA, the benefit of introducing proposals 2-6 did not justify the cost of introducing these changes. Hence proposals 2-6 were not progressed.

(Note: Based on HAZID output Proposal 3, Option 2 may need to be revisited at a later time (in a separate ACP).)

Proposal 7:

Proposal 7 is designed to increase network flexibility and resilience for traffic using the SIDs as proposed by EGPH and EGPK in their separate ACPs. Proposal 7 could provide valuable network resilience and hence the two proposed link routes suggested were progressed.

Proposals 1 to 6 were simulated using Real Time Simulation (RTS), which was held at NATS Prestwick Centre on the 15/16/17th November and 20/21st December 2017. EGPH, EGPF, EGPK attended as participants and the CAA attended as observers. The objective of the RTS was to determine the suitability of the proposed airspace concepts. The link routes suggested by Proposal 7 were introduced as a result of feedback from the simulations.

The changes that have been evaluated for this ACP were categorised according to the following option categories:

9.2 Options Progressed

The options progressed through consultation and as proposed herein are summarised below. The option being progressed is described in detail in section 7, referred to below as “Option 2”

Option 1: Do nothing (no change), keep the airspace as extant. (REJECTED)

Option 2: Implement the minimum changes necessary to support the airports’ proposals and provide the necessary connectivity to the enroute network. (PROGRESSED)

Option 3: Implement innovative new routes to further systemise the ScTMA. (REJECTED)

These proposals were each evaluated against the Design Principles from Stage 1 (Ref 5 and Ref 9):

Proposals that constituted innovation (option 3) were discounted after extensive testing in real time simulations (see Stage 2 Design options evaluation (ref 6)). Potential impact of changes being proposed by the MOD to North Sea Danger Areas was also unknown at this time. The proposals that are being progressed herein fall into the category of Option 2 since only changes that are necessary to support the airports’ proposals and provide the necessary connectivity to the enroute network are being progressed.

The Stage 3 Options Appraisal (Ref 10) quantifies the analyses required by CAP1616. Consultation was undertaken based upon the Option 2 changes.

The consultation resulted in five response elements, of which two (Element 1 and Element 5) 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, Stage 3 Ref 11 and Stage 4 Ref 12.

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

10. 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 section 7, Figure 9 and Figure 10 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 section 7 for ATS route schematics See Ref 13 for detailed route definition.
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 para 3.1 and Ref 21
f	Analysis of the impact of the traffic mix on complexity and workload of operations	See Ref 18. Systemisation proposed in order to reduce complexity and workload.
g	Evidence of relevant draft Letters of Agreement, including any arising out of consultation and/or airspace management requirements	Ref 16 gives the current LoA between NATC PC and Edinburgh Airport ATC. Changes to Annex A of this document (procedures) are being negotiated and will be agreed prior to ACP approval.
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 IFP report (Ref 23) for ICAO PANS-OPS compliance and RDAR (Ref 17) 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	No changes to ATS delegation proposed.

11. Safety Assessment

Ensuring the safety of the proposed changes is a priority for NATS. NATS has a dedicated safety manager for the FASIN 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 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.

NATS Analytics estimates a net reduction in interactions as a result of the proposed changes as shown below. This indicates a net reduction in complexity, which is likely to yield an improvement in safety.

Sector	Baseline Model			Proposed Model			Change between baseline & proposed	
	Min	Max	Avg	Min	Max	Avg	Abs	Daily
Galloway North	42	85	57	30	69	51	-6	-1
Galloway South	45	79	56	28	56	40	-16	-3
Talla North	171	279	226	175	242	205	-21	-4
Talla South	28	58	41	27	85	60	+19	+4

Table 9 Traffic interations by sector (five days)

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

NATS Safety Manager for FASIN SCTMA will produce a formal HAZID report in accordance with the CAA-approved NATS safety management protocols. HAZID analysis will be completed and shared with TM Ops inspectors before training commences.

NATS ATC lead and Safety Manager for FASIN SCTMA have produced a Route Design Analysis Report (RDAR, Ref 17 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.

12. 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 sections 7 and 8. No 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 8.12.
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 section 8 See para 8.13 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	See section 8.9
e	Any flight planning restrictions and/or route requirements	See Ref 13 for route requirements.

13. 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 19
b	Evidence to support primary and secondary surveillance radar (SSR) with details of planned availability and contingency procedures	No change to airspace volume/coverage required. 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	No change to airspace volume/coverage required. 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	Introduction of RNAV procedures gives improved redundancy (reduced reliance on single point of failure conventional navaids). Hence contingency procedures such as the LIBBA hold/STAR no longer required.
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	RNAV Coverage see Ref 19. 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.	Training by briefing and CBT is planned. This training will be complete in good time for the target implementation date.

14. 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 RDAR ref 17 for route separation and airspace containment assurance.
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.	CAS volumes will be unchanged. See RDAR ref 17 for route separation and airspace containment assurance.
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 RDAR Ref 17 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 RDAR Ref 17 for evidence of CAP1385 compliance.
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 13 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 LoA Ref 16 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 DME/DME Coverage (Ref 19). 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 section 7.
c	All new routes should be designed to accommodate P-RNAV navigational requirements	See section 7. ATS routes and STARs are RNAV5.
	Terminal airspace requirements	Evidence
	Changes to link with proposed terminal structures are illustrated in section 7.	For full details see section 7 .
	Off-route airspace requirements	Evidence
	There are no proposed changes to off-route airspace structures.	

15. 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 Appendix B section 18- and Stage 4 Step 4A (Ref 12)
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 8.2 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 ref 21 and section 8.
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 8.8

16. References – (Refs 1-10 linked, Refs 12-23 supplied as separate documents)

Ref No	Description	Notes
1	FASIN ScTMA CAA web page – progress through CAP1616	Link
2	Stage 1 Assessment Meeting Presentation	See ref 1 link
3	Stage 1 Assessment Meeting Minutes	See ref 1 link
4	Stage 1 Design Principles	See ref 1 link
5	Stage 2 Design Options	See ref 1 link
6	Stage 2 Design Principle Evaluation	See ref 1 link
7	Stage 2 Initial Options Safety Appraisal	See ref 1 link
8	Stage 3 Consultation Strategy	See ref 1 link
9	Stage 3 Options Appraisal	See ref 1 link
10	Stage 3 Consultation Website and Document	Link
11	Stage 3 Collate and Review Responses	See ref 1 link
12	Stage 4 Update Design	Supplied separately
13	Technical definition document WGS84	Supplied separately
14	Draft AIP changes	Supplied separately
~~15~~	~~(Removed)~~	~~Supplied separately~~
16	Draft Letter of Agreement (LoA) between NATS PC & EGPH	Supplied separately
17	Route Design Analysis Report (RDAR)	Supplied separately
18	Simulation Quick Look Test report (QLTR)	Supplied separately
19	DME/DME Coverage via DEMETER	Supplied separately
20	Draft overview chart of the region	Supplied separately
21	Fuel/CO_2 emissions analysis	Supplied separately
22	WebTAG greenhouse gas workbook	Supplied separately
23	IFP Report, Draft Charts and coding tables	Supplied separately

17. Appendix A - Consultation Stakeholders

The consultation was most relevant to the stakeholders listed below who were invited to participate. Any other stakeholders were also welcome to contribute.

Airlines	
Aer Lingus	FlyBe
Air Berlin	Gamma Aviation
Air Canada	German Wings
Air France	Gulf Air
Air New Zealand	Iberia
UK Air Tanker	Jet2
American Airlines	KLM
Austrian Airlines	Logan Air
BA Cityflyer	Lufthansa
BAR	Novair
BMI	Qatar Airways
Bristow Helicopters	RyanAir
British Airways	Sabre
Cityjet	SAS
CargoLux	Saudia
Delta Airways	Stobart Air
DHL	Tag Aviation
Eastern Airways	Thomas Cook
EasyJet	Thomson/TUI
Emirates	Turkish Airlines
Etihad	United Airlines
FedEx	Virgin Airlines
FinnAir	WizzAir
VLM	

National Air Traffic Management Advisory Committee (NATMAC) Members	
Aviation Environment Federation (AEF)	British Parachute Association (BPA)
Airport Operators Association (AOA)	British Helicopter Association (BHA)
Aircraft Owners & Pilots Association (AOPA UK)	European UAV Systems Centre Ltd
Association of Remotely Piloted Aircraft Systems (ARPAS UK)	General Aviation Safety Council (GASCo)
	General Aviation Alliance (GAA)
British Airways (BA)	Guild of Air Traffic Control Officers (GATCO)
British Aerospace Systems (BAE Systems)	Helicopter Club of Great Britain (HCGB)
British Airline Pilots Association (BALPA)	Heathrow Airport Ltd
British Air Transport Association (BATA)	Heavy Airlines
British Balloon & Airship Club (BBAC)	Honourable Company of Air Pilots
British Business & General Aviation Assoc (BBGA)	Light Aircraft Association (LAA)
British Gliding Association (BGA)	Light Airlines
British Hang Gliding & Paragliding Assoc (BHPA)	Low Fares Airlines (LFA)
British Microlight Aircraft Association (BMAA)	Ministry of Defence (MoD) (mandatory)
British Model Flying Association (BMFA)	PPL/IR

Airports	
Edinburgh Airport Ltd	Cumbernauld Airport
Glasgow Airport Ltd	Strathaven Airfield
Glasgow Prestwick Airport	

18. Appendix B: WebTAG - 10 year greenhouse gas results

Greenhouse Gases Workbook - Worksheet 1

Scheme Name: NATS FASIN PLAS ScTMA

Present Value Base Year 2010

Current Year 2018

Proposal Opening year: 2019

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

Overall Assessment Score:

Net Present Value of carbon dioxide equivalent emissions of proposal (£): £59,408

*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): -5,332
(between 'with scheme' and 'without scheme' scenarios)

Of which Traded -3845

Change in carbon dioxide equivalent emissions in opening year (tonnes): -454
(between 'with scheme' and 'without scheme' scenarios)

Net Present Value of traded sector carbon dioxide equivalent emissions of proposal (£): £71,083
(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	-1336.88	-1769.40
Non-traded sector	0	0	-517.32	-684.69

Qualitative Comments:
The results in this sheet relate only to the routes which are contained 100% within the NATS ACP.
Proportion Traded: 72.1% (intra-EU)
Proportion Non-traded: 27.9% (outside EU)

Sensitivity Analysis:

Upper Estimate Net Present Value of Carbon dioxide Emissions of Proposal (£): £89,112

Lower Estimate Net Present Value of Carbon dioxide Emissions of Proposal (£): £29,704

Data Sources:
Computer simulation using AirTOP modelling tool, with BADA performance data.
Traffic data extracted using Eurocontrol's Network Strategic Tool (NEST).
Traffic growth rates as per NATS base case traffic forecasting

See Ref 22 for Excel workbook

End of document