Free Route Airspace Deployment 1

Consultation

Issue 1.2
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JB

Issue	Month/ Year	Changes in this issue
Issue 0.3	Aug 2019	Draft issued to CAA for comment
Issue 1.0	Sep 2019	Revised following comments from CAA
Issue 1.2	Sep 2019	First Issue

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1 Executive Summary

Free Route Airspace (FRA) is well established and NATS has been involved in developing the FRA concept over the last 5 years. FRA is a major initiative of the UK CAA's Airspace Modernisation Strategy (AMS) (CAP 1711). The implementation of FRA by European Union (EU) member states was mandated in European Law under the EU Implementing Regulation EU716/204 and has been recommended as a part of the Eurocontrol Single European Sky ATM Research (SESAR) programme.

Aligned to the UK AMS, NATS is proposing to introduce Free Route Airspace (FRA) across UK airspace in four deployments. The first (Deployment 1), across Scottish Sectors (blue shaded area in Figure 1 below) will allow aircraft in upper airspace to flight plan and fly between existing points and not be constrained to follow the current network of routes. The concept will also enable the opportunity to flight plan across the airspace managed by Borealis Alliance[1] member ANSPs unconstrained by the route network in each ANSP's airspace with free crossing at boundaries not limited to fixed entry/exit points.

The change from a network of routes to FRA represents a significant change for aircraft operators and Air Traffic Control (ATC); NATS welcomes your feedback to develop our proposed deployment. Future deployments will be consulted on through separate ACPs.

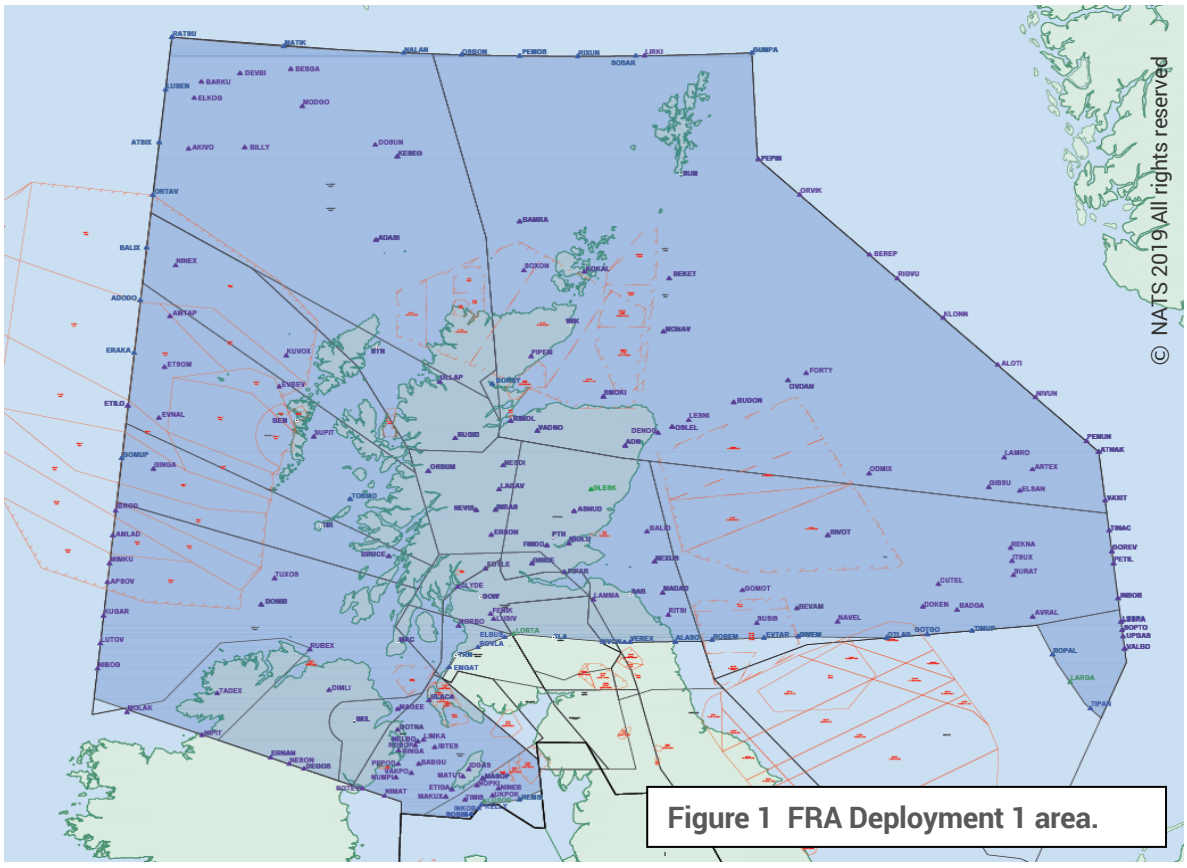


Figure 1 FRA Deployment 1 area.

[1] The Borealis Alliance includes the Air Navigation Service Providers (ANSPs) of Denmark, Estonia, Finland, Iceland, Ireland, Latvia, Norway, Sweden and the UK.

The level of change expected to support the implementation of FRA requires Airspace Changes to implement effectively and safely. Along with the European Mandate to implement FRA and CAA's AMS, developing the concept to support the needs of our Airspace Users and Aviation Stakeholders remains important to ensure changes are fit for purpose and comply with the required regulation and legislation.

We also want to share the potential benefits for implementation of FRA against the proposed options presented in the consultation document:

- FRA Option 1. In which all ATS routes are removed.
- FRA Option 2. In which the ATS route structure is partially maintained.
- FRA Option 3. In which the ATS route structure is maintained, but aircraft are not constrained to flight plan the routes within the FRA.

The changes proposed in this ACP will only affect flights above 25,500ft

The consultation begins on 17th September and ends on 10th December 2019, a period of 12 weeks.

This consultation document and response questionnaire are available via the CAA airspace change consultation portal at:

https://consultations.airspacechange.co.uk/nats/fra-d1

If the proposal is approved by the CAA, implementation of the airspace change will occur not before 3rd December 2020.

2 Introduction

2.1 About this consultation

This consultation relates to changes to airspace and the ATS route structure which will change aircraft flight profiles above 25,500ft. We are seeking feedback from any stakeholders who may be affected by the proposal. Primarily this is likely to be users of the airspace and other aviation stakeholders. Nonetheless we welcome feedback from any interested parties.

Your feedback at this stage will help us explore the potential impacts of the changes proposed to be made to the FRA Deployment 1 (D1) airspace. We invite considered responses supported by evidence where possible.

2.2 Scope of This Consultation

This consultation and ACP proposes the introduction of the first deployment of FRA (in the UK) across the majority of the Scottish Upper Information Region (UIR) (across the area depicted in Figure 1). This area of airspace was chosen due to its lower traffic complexity (compared to elsewhere in the UK), the lack of dependency on simultaneous airspace modernisation projects (e.g. LAMP), Borealis Alliance commitments and the requirements of neighbouring ANSPs.

While the legal mandate requires that FRA is implemented in all airspace above FL310, in the D1 area we have decided that the FRA concept of operations will extend down to FL255. This is because the established division between upper and lower airspace is at FL245; as a result, the ATC sectors are split at FL255, and the ATC of upper airspace starts at FL255. Hence it is logical to extend the FRA volume down to FL255 so that the upper airspace controllers are operating using a single concept of operations (i.e. FRA) within their sectors.

Currently lower ATS routes extend up to FL245. When FRA is introduced it is proposed that those routes established below the FRA D1 area will be raised to FL255 so that connectivity is maintained. Note this is the same solution as was introduced for the lower ATS routes below the Direct Route Airspace (implemented March 2015) (see Figure 3).

2.3 Proposed FRA Deployment Plan

FRA Deployment 1 is targeted to be introduced not before 3rd December 2020. Deployment across the whole UK is targeted to be complete not before 2024. This consultation is related to the proposed Deployment 1 airspace only.

Figure 2 below shows the proposed sequence of FRA deployment phases across the UK.

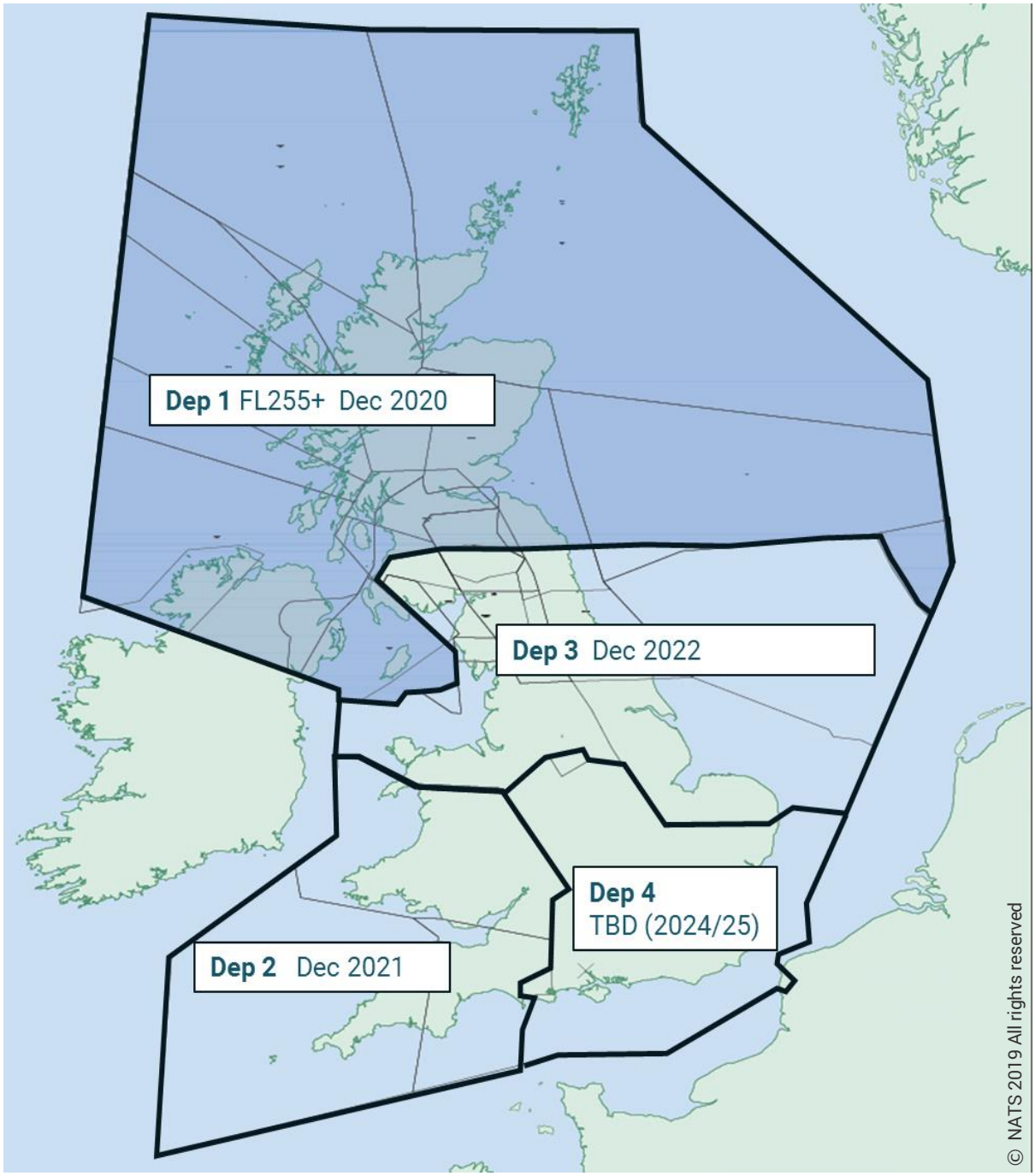


Figure 2 Planned FRA Deployment Phases.

2.4 Why not implement in one go, and progress the changes in one ACP?

The scope of the first FRA Statement of Need submitted to the CAA which initiated the ACP process was to introduce FRA throughout the UK. Following the assessment meeting and initial work on design principles and options development, it became apparent that the scale of the ACP (in particular the length of time required to implement FRA in phased geographical deployments) did not easily align with the engagement and consultation requirements of the ACP process. The implementation of FRA was assessed against influencing factors, such as system requirements, simultaneous airspace modernisation projects (LAMP, ScTMA, FASI-S etc.), traffic flow complexity, Borealis Alliance commitments and the requirements of neighbouring ANSPs. The results of which necessitated a geographically phased implementation to enable the introduction of FRA within the mandated

timescales. Therefore, in consultation with the CAA, the decision was taken to submit individual ACPs for each planned deployment of FRA.

2.5 Brexit

It should be noted that some of the legal requirements to implement FRA originate in EU law. It is NATS' position that due to wider commitments (e.g. Borealis Alliance and the CAA Airspace Modernisation Strategy) it is the intention to introduce FRA regardless of the status of the withdrawal of the United Kingdom from the European Union (EU).

2.6 Options for Consultation

Since this change is mandatory under EU law and is an agreed strategic aim of the European Commission Single European Sky initiative and the CAA's Airspace Modernisation Strategy (AMS), the options development has been limited to the following:

1. Baseline: FRA Option 0. Do nothing – maintain the current high level ATS route structure.
2. Implement FRA in accordance with Implementing Regulation EU716/2014.

   FRA Option 1. In which all ATS routes are removed.

   FRA Option 2. In which the ATS route structure is partially maintained.

   FRA Option 3. In which the ATS route structure is maintained, but aircraft are not constrained to flight plan the routes within the FRA.

   For each of Options 1-3 Route Availability Document (RAD) restrictions would be introduced in order to manage the flow of traffic transitioning into and out of FRA.

(more details of these options are given in section 6).

2.7 Stakeholders

The stakeholders targeted for involvement in this consultation are listed in Appendix A. However, any other stakeholders are at liberty to participate in this consultation.

The primary stakeholder groups are (in alphabetical order):

- Air Navigation Service Providers (ANSPs) who border the NATS Prestwick UIR;
- Airlines;
- Airports.
- Data Houses/ Flight-planning providers;
- National Air Traffic Management Advisory Committee (NATMAC) Members.
- Ministry of Defence

3 Justification and Objectives

This section outlines why FRA is being introduced, the legal mandate, and the objectives that will be achieved.

3.1 Justification

This ACP aims to introduce Free Route Airspace (FRA) across a large swathe of UK airspace. This will aid flight efficiency by enabling aircraft to flight-plan and fly user preferred routes, where possible. Free route airspace is being implemented internationally and is already in operation in several neighbouring states. The introduction of FRA in UK airspace will ensure that the UK upper airspace is harmonised with that of neighbouring states, enabling cross-border free routing.

The introduction of FRA will enable environmental benefit by enabling airline operators to reduce CO_2 emissions per flight, which in turn would produce economic benefit due to reduced operating costs.

The implementation of FRA by European Union (EU) member states was mandated in European Law under the EU Implementing Regulation EU716/2014 and is a major initiative of the CAA's Airspace Modernisation Strategy (AMS) (CAP 1711).

As a result, NATS is undertaking this ACP to both ensure the UK meets its legal obligations, as well as ensuring it conforms to the CAAs AMS requirements, whilst enabling airline operators to optimise their flight profiles.

3.2 Objectives

Objectives for these proposals are to:

- Fulfil SESAR PCP[2] Implementing Regulation EU716/2014.
- To conform to the CAA's AMS requirements (Ref 3).
- Fulfil Borealis Alliance commitment of introduction of FRA and harmonise our upper airspace with that of our neighbouring states, enabling cross-border FRA operations.
- Enable the reduction of CO_2 emissions and fuel burn per flight and conform to the DfT Air Navigation Guidance (Ref 11).

3.3 Alignment with the CAA's Airspace Modernisation Strategy (AMS) Principles

The CAA's Airspace Modernisation Strategy (AMS) (Ref 3) is the UK's strategy for modernising the air navigation infrastructure. Sections 4.5-4.11 refer specifically to FRA as a means to improving efficiency in the upper airspace.

[2] The Single European Sky ATM Research (SESAR) Pilot Common Project (PCP) has been formalised in EU law under the Implementing Regulation EU716/2014. For more detail see Eurocontrol SESAR website.

4 Current Airspace (Baseline)

The following pages describe the current airspace which forms the baseline (do nothing) scenario.

It should be noted that "Doing nothing" is useful as a baseline for comparison, but due to the legal mandate it is not considered as a viable option.

4.1 Current airspace diagrams

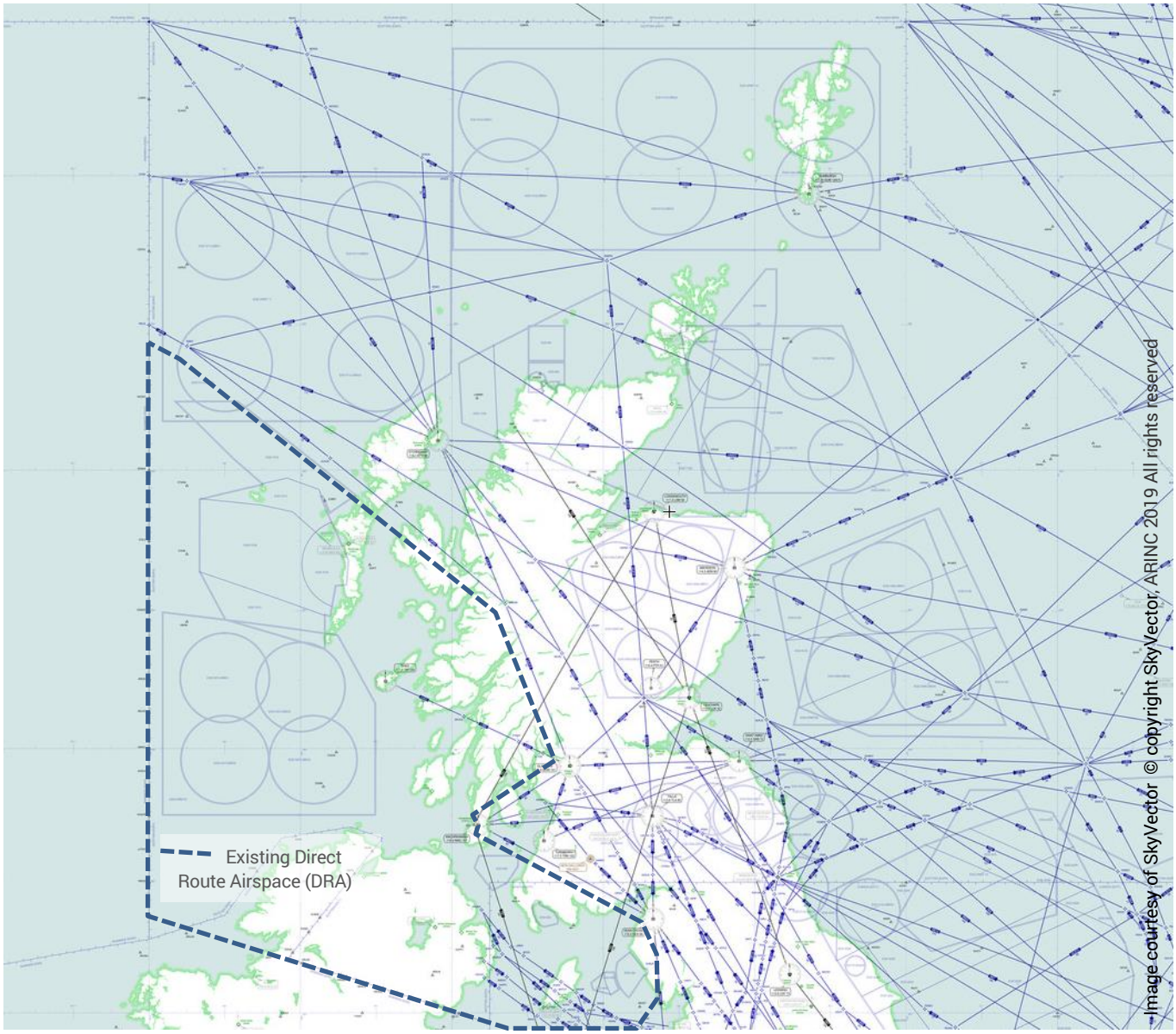


Figure 3 Current Scottish UIR airspace/routes including DRA

Figure 3 and Figure 4 show the current Scottish Upper information Region (UIR) airspace and Upper Air Traffic Service (ATS) route network. Note the Scottish Direct Route Airspace (DRA) to the west of the Scottish mainland is shown in Figure 3 (outlined by dashed lines). The DRA is an existing precursor to FRA where the ATS route structure has been removed and aircraft can fly published direct routes between designated entry/exit points.

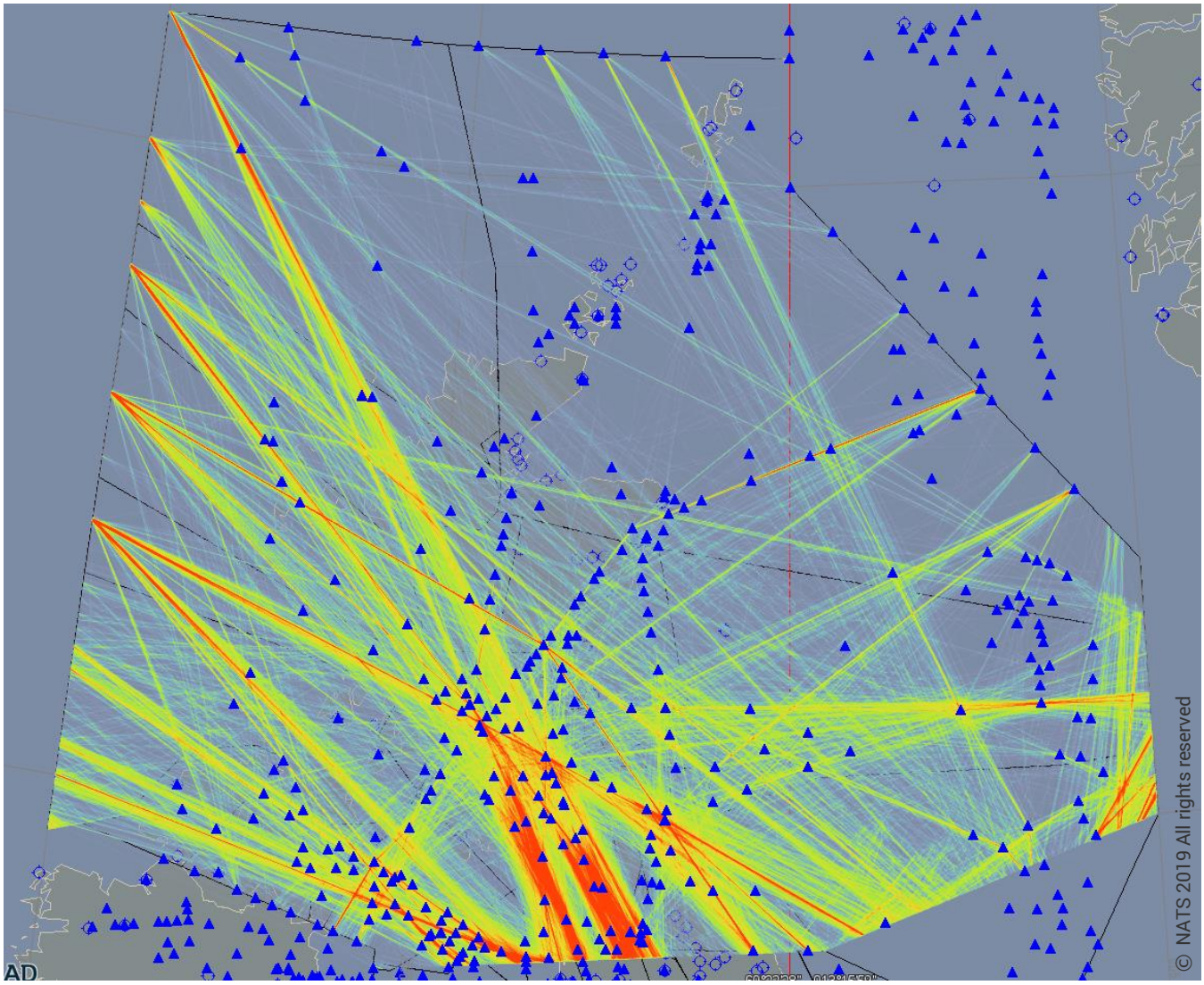


Figure 4 Current Scottish UIR traffic flows

Figure 4 shows current flight-path density plots (from radar data, using a one week representative sample from Q3 2018). This shows the typical flows of traffic in the upper airspace.

Currently all aircraft flight plan to fly along the published ATS route structure (or in the DRA, on published Directs (DCTs), which are trajectories between specified waypoints). The ATS route structure is based on ground-based navigation beacons, many of which are being withdrawn from service, due to age. Modern satellite navigation now makes navigation between any points possible and there is much less reliance on ground-based navigation beacons. As such it is now common-place for air traffic control (ATC) to allow aircraft to route direct to a point (termed a tactical direct), to improve efficiency as aircraft transit through UK airspace. The use of the designated entry/exit points (termed coordination points (COPs)) at the UIR boundary, and the influence on flight-paths of some navigation beacons and the ATS route structure can be seen clearly in Figure 4. However, the regular use of tactical direct shortcuts to/from the COPs can also be discerned. The points where traffic converges on the western boundary are oceanic entry and exit points, where transatlantic flights join the oceanic airspace.

For reference, the extant UK route structure is defined in detail in the following sections of the UK Aeronautical Information Publication (AIP) (Ref 9):

ENR 3.2 UPPER ATS ROUTES
ENR 3.3 AREA NAVIGATION ROUTES
ENR 6.71 UPPER AIRSPACE CONTROL AREA AND UPPER ATS ROUTES (North Sheet)

5 FRA Concept Overview

FRA is defined as "A specified airspace within which users may freely plan a route between a defined entry point and a defined exit point, with the possibility to route via intermediate (published or unpublished) waypoints, without reference to the ATS route network, subject to airspace availability." Within this airspace, flights remain subject to air traffic control.

Deployment of FRA is an EU legal requirement[3].

Within FRA air traffic will be able to flight plan user preferred trajectories without reference to a route structure, therefore flows of traffic are able to change hour by hour, month by month and year by year in a manner which is not constrained by airspace design and is therefore less predictable. Short and long term factors which can have an influence on the routings chosen by aircraft operators include:

Short Term Factors

- weather/winds (jet stream position),
- industrial action,
- events such as large sporting events (e.g. football matches, Olympics etc),
- military activity,
- ATC traffic regulations (used to manage flows).

Long Term Factors

- relative route charges between neighbouring countries,
- fuel prices,
- company business models/ fleet mix,
- seasonal route preferences,
- changing destinations and emerging markets,
- political factors,
- tourism preferences/marketing/fashion.

FRA is also expected to facilitate flight planning and fuel benefits which will contribute to the UK Ireland Functional Airspace Block (FAB) Performance Plan & UK Airspace Modernisation Strategy (AMS).

In addition, NATS has committed to introducing FRA in UK upper airspace to facilitate the harmonised Borealis Alliance volume of FRA. Borealis member ANSPs have committed to put in place a seamless and integrated FRA (Cross-Border) extending across national airspace boundaries, from the eastern boundary of the North Atlantic to the western boundary of Russian airspace in the North of Europe; without the need for crossing boundaries at mandated points (COPs).

[3] Legislative requirement of the SESAR Pilot Common Project (PCP) ATM Functionality 3 (AF3) Implementing Rule. The SESAR PCP AF3 requires ANSPs to implement FRA, at FL305+, by 1st January 2022.

5.1 Overflights.

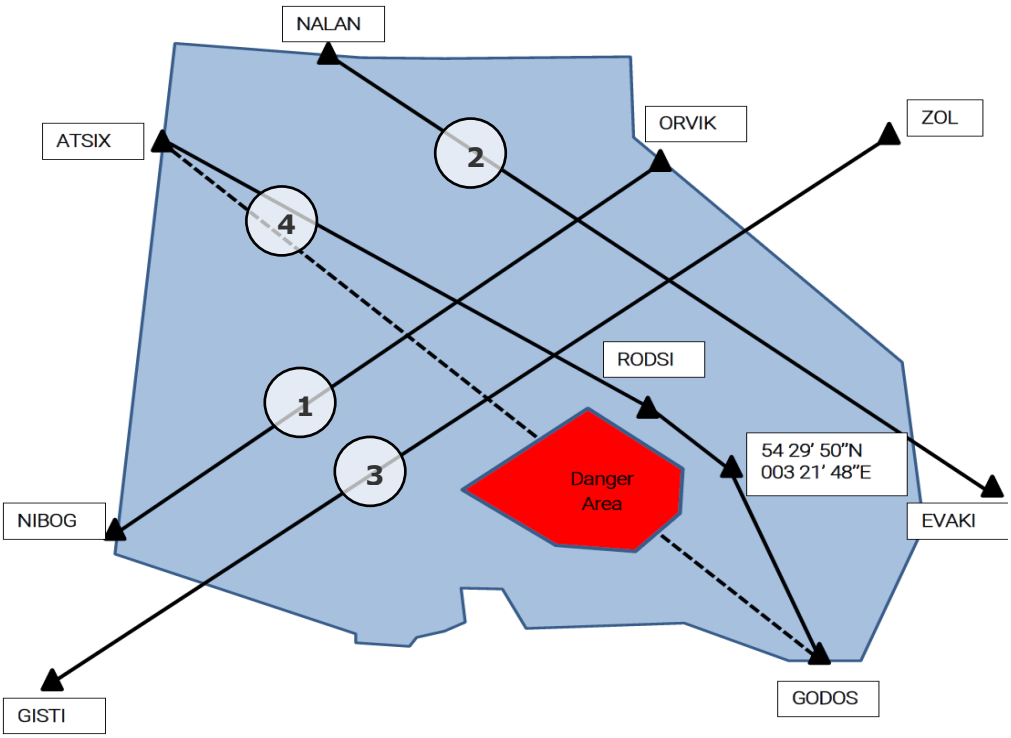


Figure 5 Examples of transiting flight plans.

Figure 5 shows examples of flight plans transiting the blue FRA area. These range from:

1. Transit between two existing points on the UIR boundary (e.g. NIBOG-ORVIK) with no intermediate points in between.
2. Transit between an existing oceanic exit point (or FRA entry point) on the UIR boundary (NALAN) to a point outside UK airspace (EVAKI). (Cross border FRA)
3. Transit between start and end points both outside UK airspace (e.g. GISTI – ZOL), with no intermediate points defined within UK airspace. (Cross border FRA).
4. Example of a flight plan which would not be permitted would be ASTIX –GODOS since it would transit a volume of active segregated Special Use Airspace (SUA). For this to be accepted it would have to route via intermediate points to take it around the SUA (e.g. an existing waypoint RODSI and/or latitude/longitude: 54° 29' 50"N, 003° 21' 48"E).

Note that in FRA any point can be included in a flight plan, these can be defined by an existing waypoint, range and bearing from an existing point or any point in space as defined by latitude/longitude coordinates.

5.2 Arrivals

Figure 6 and Figure 7 show examples of the proposed arrival structure using Aberdeen and Edinburgh as examples. Each airport will have a defined set of arrival points for descending out of FRA to join the lower ATS route structure. As in today's operation, these routes may then link to Standard Terminal Arrival Routes (STARs) (where available) for the destination airport. The transition from the lower ATS routes to the STAR would be unchanged from today. The inclusion of Arrival points simply defines the point at which aircraft transition from FRA to the route structure below. (note: Edinburgh, Glasgow, Prestwick and Newcastle are the only airports within the FRA D1 footprint which have STARs.)

The arrival points for all airports under the FRA D1 area are detailed in the Standard Route Document (SRD, Ref 8). When FRA is deployed these will be published in the RAD Appendix 5.

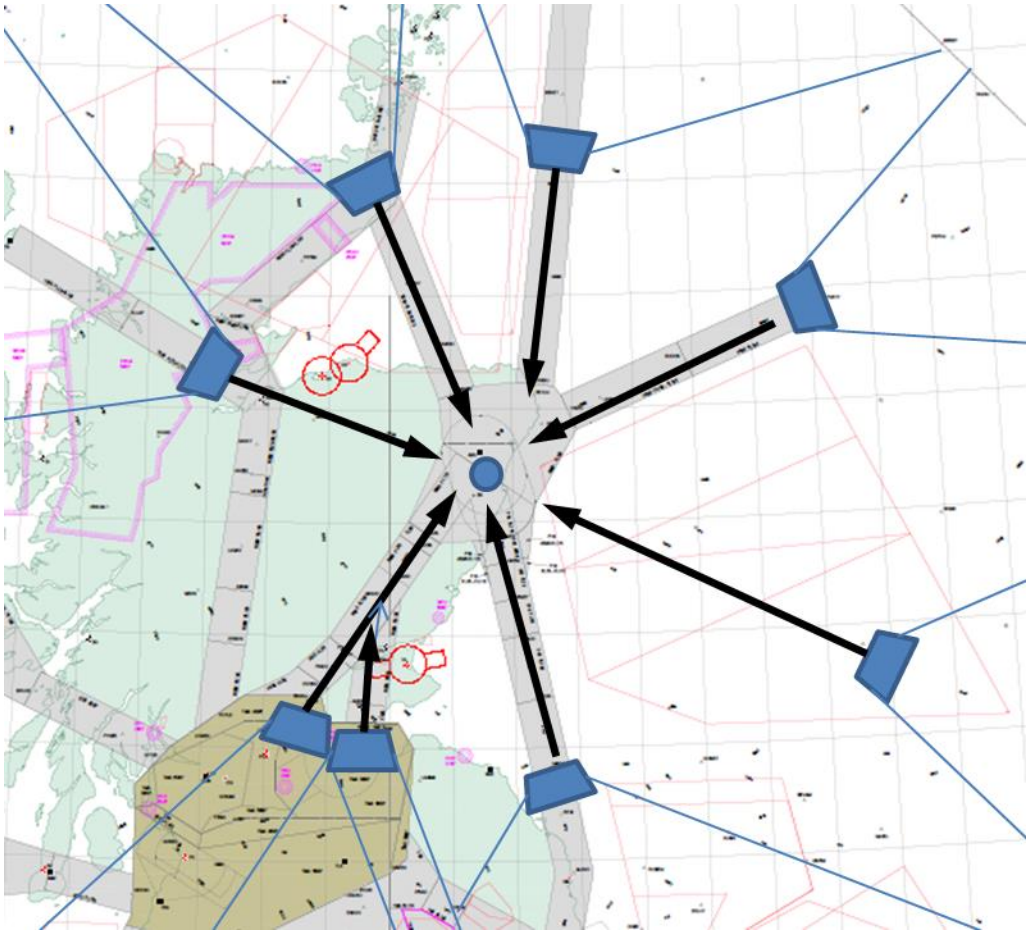


Figure 6 Indicative Examples of Arrivals to Aberdeen

Airport	Route below	ARR Points
EGPD	North Y905	MONAV
	N-East P600	OVDAN
	S-East	RIVOT
	South P18	MADAD
	South N864	PIPAR
	S-West P600	GRICE
	West	RIMOL
	N-West Y904	WIK

Table 1 Indicative examples of arrival points (Aberdeen)

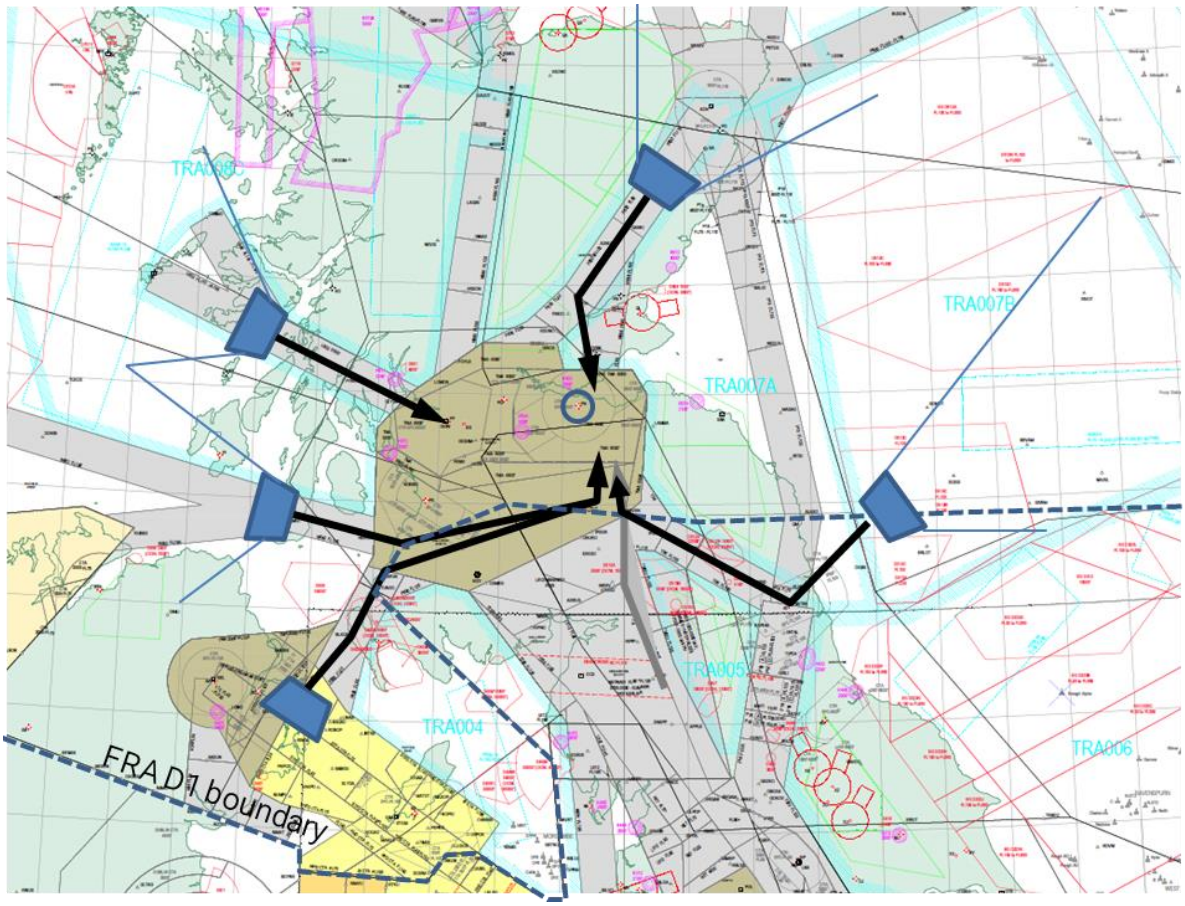


Figure 7 Indicative Examples of Arrivals to Edinburgh

Airport	Route below	ARR Points
EGPH	North P600	GLESK
	East	ROBEM
	S-West P600	GOTNA
	S-West	MAC
	West	BRUCE
	N-West	LAGAV

Table 2 Indicative Examples of arrival points (Edinburgh)

5.3 Departures

Figure 8 and Figure 9 show examples of the proposed departure structure using Aberdeen and Edinburgh as examples. Each airport will have a defined set of points for departures to transition (climb) from the lower ATS route structure into FRA. If Standard Instrument Departures (SIDs) are available at the departure airport the transition from the SID to the lower ATS routes network will be unchanged from today.

The departure points for all airports under the FRA D1 area are detailed in the Standard Routing Document (SRD, Ref 8). When FRA is deployed these will be published in the RAD Appendix 5.

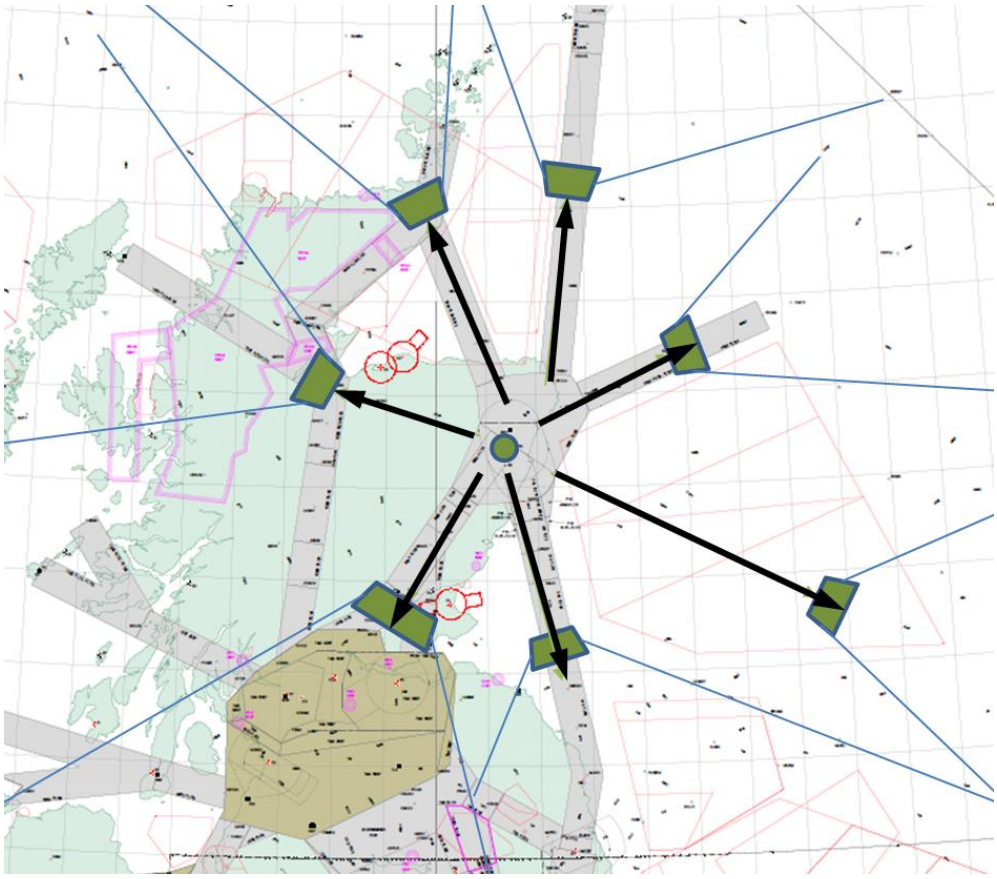


Figure 8 Indicative Examples of Departures from Aberdeen

Airport	Route below	DEP Point
EGPD	North Y905	MONAV
	N-East P600	BUDON
	S-East	RIVOT
	South P18	NEXUS
	South N864	IBOLU
	S-West P600	PTH
	West	RIMOL
	N-West Y904	WIK

Table 3 Indicative Examples of departure points (Aberdeen)

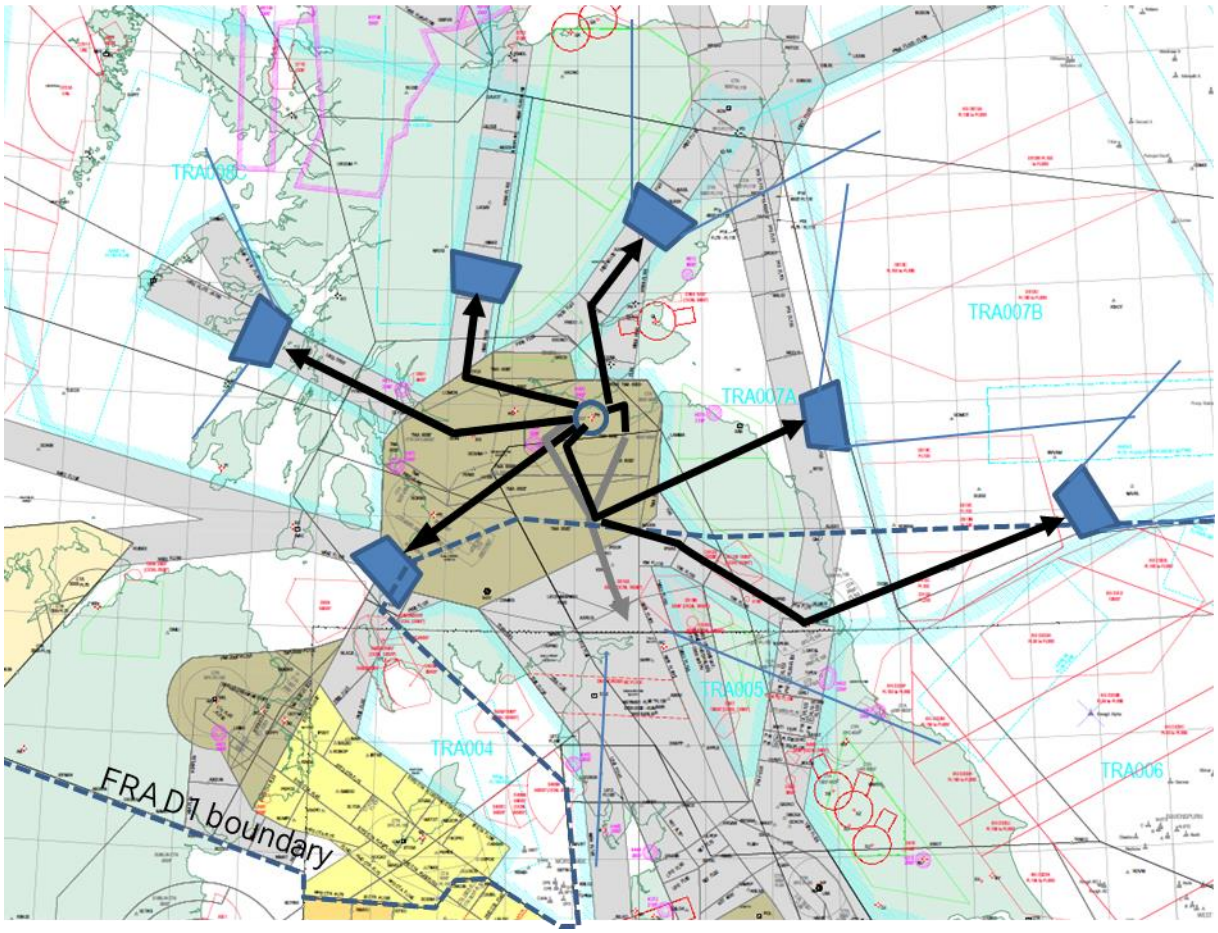


Figure 9 Indicative Examples of Departures from Edinburgh

Airport	Route below	ARR Points
EGPH	North P600	ASNUD
	East	MADAD
	East -FRA ENTRY	GIVEM
	S-West P600	TRN
	S-West	TRN
	West	BRUCE
	N-West Y904	ERSON

Table 4 Indicative Examples of departure points (Edinburgh)

5.4 Cross Border FRA & Borealis Alliance

In addition to the introduction of Arrival and Departure Points for airfields, FRA also allows for the introduction of Cross Border operations i.e. the ability to flight plan to cross existing international airspace boundaries without the need to do so via a published Co-ordination Point (COP).

The Borealis Alliance membership have worked cooperatively since 2012 to develop a common FRA concept of operations as outlined in the Borealis Free Route Airspace Concept of Operations v1.0 (Ref 1). Many of the design options discussed in the Stage 2 document set (refs 5 & 6) are related to, and have been influenced by the engagement between Borealis Alliance members as well as other Stakeholders and Air Navigation Service Providers (ANSPs).

The intention of the cross-border FRA concept is to secure unconstrained cross-border FRA operations at the ANSP interfaces, in accordance with the Eurocontrol European Route Network Implementation Plan (ERNIP Part 1) (ref 2) and North Atlantic Documents e.g. ICAO Doc 7030 (ref 4). This concept will provide the possibility for airspace users to flight plan a preferred trajectory, regardless of national FIR boundaries, and portions of airspace within which ATS is delegated to the participating states. This will allow flight plannable free routing from the North Atlantic to the Russian Border.

Figures 10-12, show the development of the Borealis FRA Airspace (source Borealis Alliance 2019).

Figure 10 Current State of Borealis FRA (2019)

Figure 11 Borealis FRA, Post UK FRA D1 (Dec 2020)

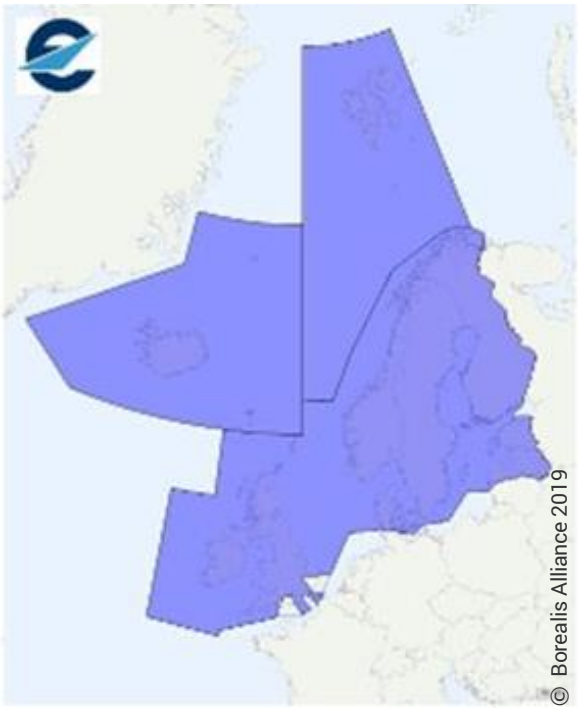


Figure 12 Borealis FRA Post 2024

In Figure 13 the sections of the border where cross-border transit is proposed to be unconstrained are indicated by the red lines. For the other parts of the border, crossing will have to be flight planned via one of the established coordination points.

5.5 FRA- Concept Options

Figure 13 shows the FRA area which is under consideration for Deployment 1.

The following options are proposed for consultation.

FRA Option 1. In which all ATS routes are removed.

FRA Option 2. In which the ATS route structure is partially maintained.

FRA Option 3. In which the ATS route structure is maintained, but aircraft are not constrained to flight plan the routes within the FRA.

These design options proposed are discussed in Section 6 in detail.

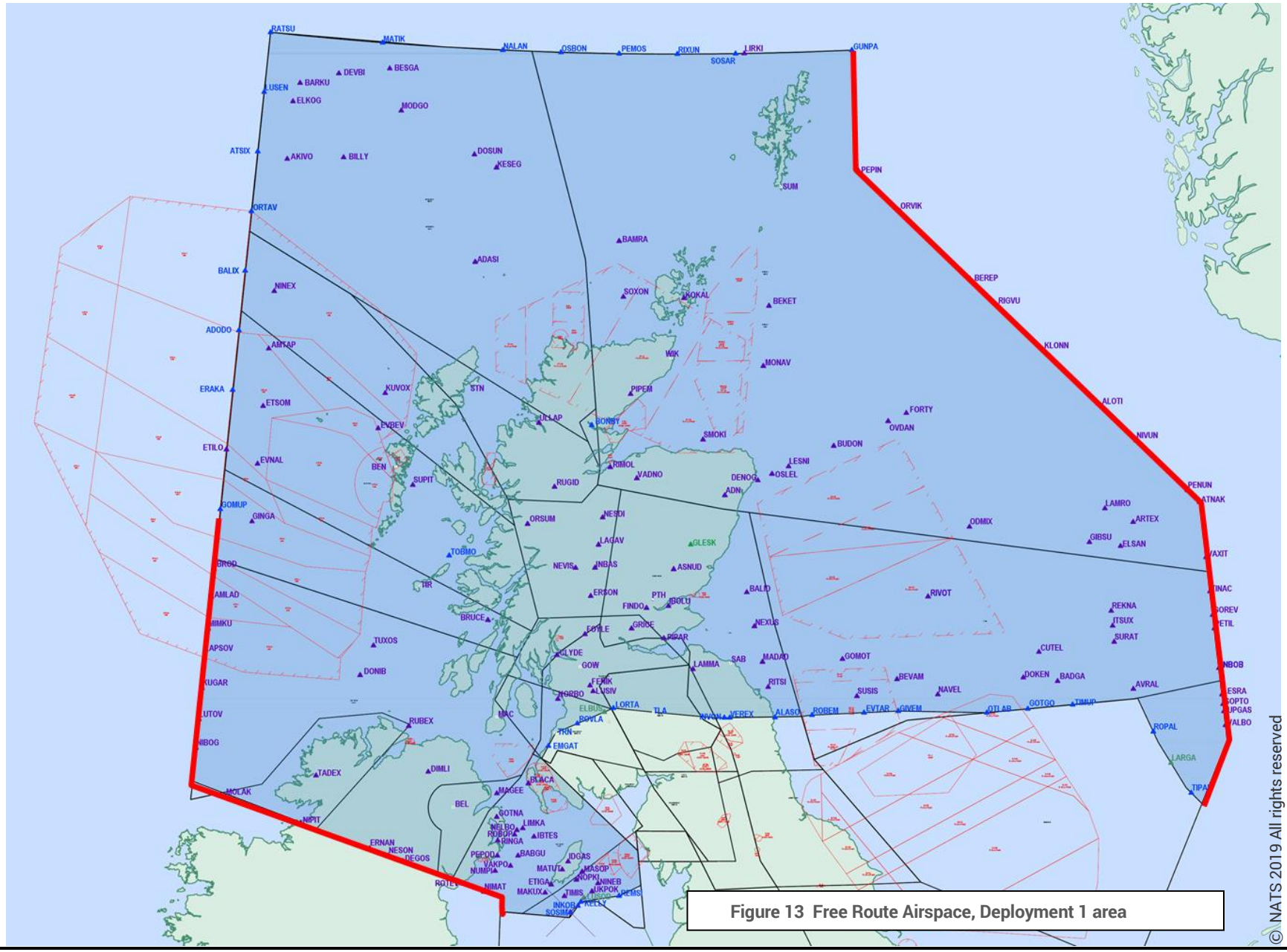


Figure 13 Free Route Airspace, Deployment 1 area

5.6 Flight plan Buffer Zones

To support the safe introduction of proposed FRA changes, NATS has reviewed the application of Flight-Plan Buffer Zones (FBZs) as part of the introduction of FRA to ensure flight plans remain compliant and consistent with policy across the Deployment 1 Area.

A Flight-Plan Buffer Zone (FBZ) is an area (always associated with Special Use Airspace (SUA)) promulgated to ensure adequate flight plan trajectory separation from active Danger Areas or other SUA.

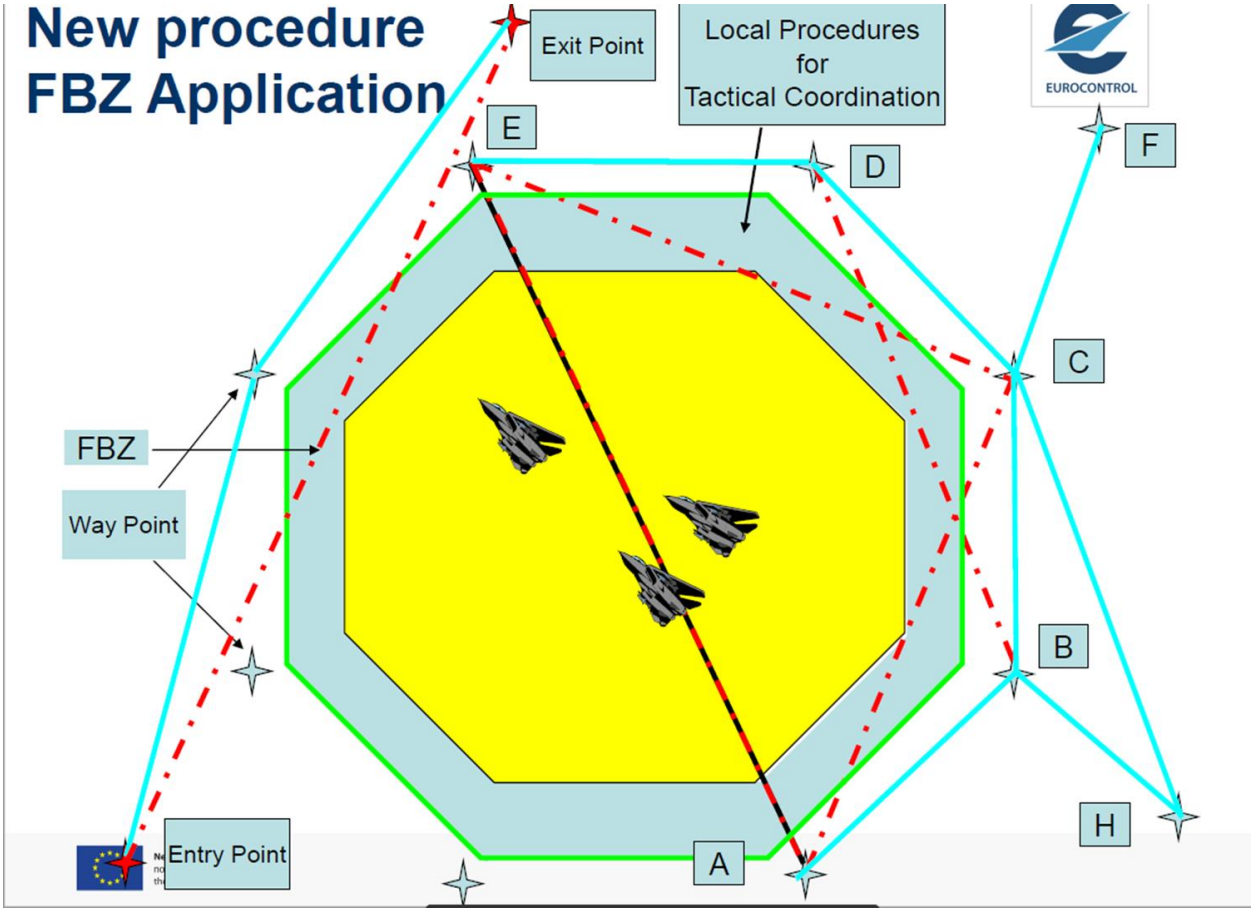


Figure 14 Flight plan Buffer Zone

In the example shown in Figure 14 the yellow area is the Special use airspace/Danger area, the blue zone surrounding it is the FBZ. This extends 5nm around the boundary of the SUA[4]. Flight plans will be rejected[5] by the IFPS if the projected trajectory of the flight would enter the FBZ. In Figure 14 any of the red dotted flight plans would be rejected. The blue flight plans would be accepted.

5.7 No Planning Zones

A No Planning Zone (NPZ) is a defined airspace volume which may be used to restrict flight plans and thus prevent undesirable traffic flows in a particular area. They can also be used where gaps in ATM capability exist i.e. Geographical Radio Communication or Radar Surveillance Coverage Gaps.

[4] 5nm is contingent on the current CAA buffer policy. This is under review and a change to the buffer policy could result in a change to this distance.
[5] FBZ would be applicable to General Air Traffic (GAT) Flight Plans submitted to the European Network Manager. They would not affect Military Operational Air Traffic (OAT) flight plans. Equally, FBZ would only be established in FRA and would therefore not affect recreational users filing VFR / IFR flight Plans

The proposed deployment of FRA will comply with guidelines for NPZs as set out within Para 4.5.5 of the Eurocontrol Network Management Flight Planning Requirements - Guidelines issued Dec 2018 (Ref 10):

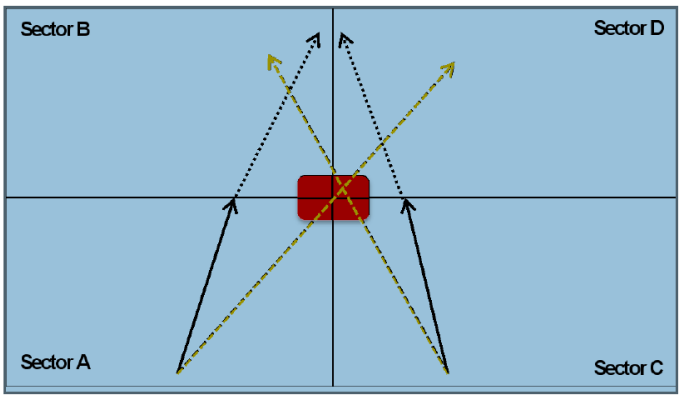
- *When and where required to prevent inappropriate flight trajectory airspace crossings or to properly manage ATC operationally, sensitive areas inside or across relevant FRA area/s establishment of No Planning Zone/s (NPZ) might be considered in accordance with provisions in ERNIP Part 1, 6.9.1.*
- *Within the airspace volume representing such zone the planning of flight trajectory is either not permitted or allowed under certain specified conditions. In order to assist the airspace users in the presentation of the intended flight operation, the flight planning limitation/s shall be defined in the Route Availability Document (RAD).*
- *Airspace users can avoid such zone by flight planning via appropriate significant points around it or in accordance with allowed conditions.*
- *Such a zone is named "No Planning Zone" (NPZ) and shall be published in accordance with provisions in ERNIP Part 1, Annex 4.*

A number of use cases are provided below where NATS may introduce NPZs to support safe and efficient use of FRA.

Case 1: Separation provision during transfer of control (within Free Route Airspace)

Occasions where two flights are transferred by two different upstream control sectors to two different downstream control sectors are difficult to manage. As such, alignment of sector boundaries has to be avoided by coordinated airspace design.

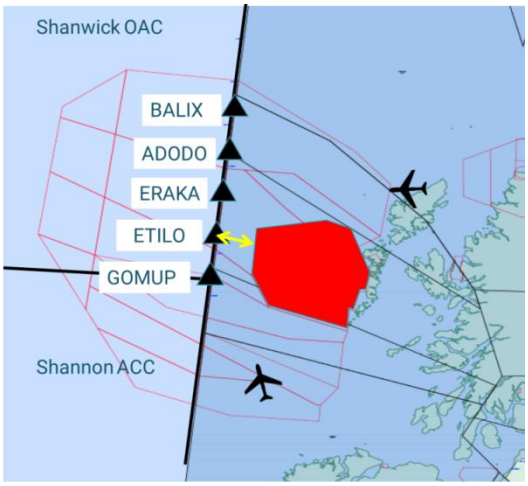
If a coordinated airspace design approach is difficult or not practical and in order to manage such ATC operationally sensitive areas, limiting flight planning through a small critical part of the airspace around the sector boundaries (red shaded zone) has to be considered.



A No Planning Zone (NPZ) is the airspace of defined dimensions within which the planning of flight trajectory is either not permitted or only allowed under certain specified conditions.

Airspace users can avoid such zone/s by planning via appropriate significant points around the zone/s or in accordance with allowed conditions.

Case 2: NPZ used to prevent undesirable interaction around Oceanic interfaces



NPZs can be used to prevent undesirable interaction around Oceanic interfaces. The example to the left illustrates how an NPZ to the West of existing SUA - D701 may be used to prevent aircraft routing too close to the Oceanic boundary whilst D701 is active (which could create crossing interactions with limited airspace to resolve conflictions).

Case 3: NPZ used to prevent flight through areas of insufficient communications or surveillance coverage. Similar to Cases 2 & 3 but where an area is known to have insufficient communications or surveillance coverage.

5.8 5LNC waypoints at NAVAID locations

The introduction of FRA represents a major change in flight planning. Historically navigation aids such as VORs and NDBs have been identified by three letter coded identifiers (e.g. BEL for the Belfast VOR). However these codes are not unique internationally and as a result there are many instances of two navigation beacons having the same identifiers. For example the BELLA NDB in neighbouring Norway also has the identifier BEL. Hence it is possible for a flight plan to include two navaids which have the same identifier. Currently this can be managed since the navaid would be on a route and hence it would be obvious from the flight plan which navaid was being referenced. However with the introduction of FRA internationally this could become an issue (a free route flight plan including two BCNs could cause problems for flight planning systems, and possibly be rejected).

Examples of identifiers which are of concern are:

- BEL (Belfast VOR), confusion with BEL (Bella NDB in Denmark)
- TRN (Turnberry VOR), there are 8 TRNs worldwide with including 2 capital cities Tirana Albania, Tehran Iran.
- BNN (Bovingdon VOR), confusion with BNN (Bronnoy VOR Norway).
- BCN (Brecon VOR) confusion with BCN (Barcelona VOR Spain).

To address this issue the EuroControl FRA Design Guidelines (Ref 2), recommend that five letter name code (5LNC) waypoints are created, co-located at NAVAID position.

2.10 NAVAIDs as FRA Significant Points

2.10.1. In accordance with ICAO Annex 11, the two-letter or three-letter coded designators for significant points marked by the site of a radio navigation aid are not "unique" worldwide.

2.10.2. Any NAVAID position can be used as a FRA significant point.

2.10.3. Following the implementations of cross-border FRAs and their stepped expansions relevant ATC systems might encounter problems with flight plan processing due to duplicated NAVAIDs as FRA significant points.

2.10.4. In order to avoid such potential problems and based on a network agreement:

a) States should not define relevant NAVAID as FRA significant point; or

b) States should co-locate the NAVAID position with "unique" 5LNC.

The CAA has expressed concern that the co-location of a unique 5LNC at an existing navaid position may cause problems such as label obscuring/garbling on aircraft cockpit FMS displays. Hence we seek feedback (particularly from aircraft operators and Flight planning service providers) on whether this would cause any issues. Note examples where this situation currently exists in the UK include:

- SND (Southend VOR) & SPEAR
- WHI (Whitegate NDB) & UMKIL
- NEW (Newcastle VOR) & NATEB
- INS (Inverness VOR) & RIMOL
- BIG (Biggin Hill VOR) & WEALD
- BNN (Bovingdon VOR) & BOVVA
- LAM (Lambourne VOR) & TAWNY

5.9 Simulations

Two real time simulations of FRA concepts and design options have been undertaken by NATS over a total of eight days.

- 16-20 April 2018 (Prestwick Centre)
- 24-26 April 2019 (Prestwick Centre) Attended by RAF(U) Swanwick

These simulations have served to inform opinions of the different options and provide hands-on experience for air traffic controllers such that different options can be evaluated. This experience has been fed-back into the qualitative assessments as recorded in the options matrices in the accompanying Stage 2aii options evaluation document.

6 Proposed FRA Options

The purpose of this consultation is to allow you to give your feedback on our proposals for FRA. This section presents the options for possible implementations of FRA, upon which we request your feedback.

6.1 Options

Given the EU mandate and the CAA AMS requirement to introduce FRA, NATS' options on how to implement delivery are limited. Equally, the methodologies required by the European Network Manager to ensure consistency across all States, as well as agreements reached as part of the Borealis Alliance, in respect of Cross Border Operations, further constrain viable options. The following 3 options on which we are seeking your feedback, are provided in order of descending preference:

- FRA Option 1. In which all ATS routes are removed.
- FRA Option 2. In which the ATS route structure is partially maintained.
- FRA Option 3. In which the ATS route structure is maintained, but aircraft are not constrained to flight plan the routes within the FRA.

For each of Options 1-3, RAD restrictions would be introduced in order to manage the flow of traffic transitioning into and out of FRA.

6.2 FRA Option 1

Option 1 represents the purest implementation of FRA where all routes are removed, this option is NATS' preferred solution (it is also the EuroControl preference). By removing the route structure, it encourages more efficient flight planning behaviour, thus increasing the likelihood of benefit realisation. It creates a consistent environment for air traffic controllers, whereby all confliction points are determined by aircraft trajectory.

6.3 FRA Option 2

Option 2 represents a compromised implementation of FRA where some routes are retained primarily to manage flows and transitions into and out of FRA. For example, rather than using mandated waypoints for aircraft leaving FRA inbound to an airport, routes would be extended into FRA to connect to STARs or lower Route Structures. Also where flow management is regularly required in a specific volume of airspace (for example between Danger Areas), then routes may be retained and mandated to provide a systemised ATS route structure, to facilitate improvement in capacity. It is stressed that this option would only be used in a limited way for Deployment 1 given the relatively low complexity of the airspace. If FRA Option 2 were implemented it would allow certain flows to be systemised in much the same way as today, and for ATC to utilise the RNAV1 route structure where necessary to maintain predictable capacity. This concept could add complexity to the air traffic operation by introducing a mixed mode of operation. It will also constrain the ability for airlines to file the most efficient flight plans.

The retention or partial retention of routes would require controllers to react to different systems of conflict generation; adding complexity to the operation by introducing a mixed mode of controller procedures and system requirements. Furthermore, the retention of routes would require the use of parallel but not necessarily complimentary RADs along with the associated administration of such documents.

6.4 FRA Option 3

Option 3 represents a compromise implementation of FRA where **all** ATS routes are retained, but aircraft operators are not required to flight plan along the routes. This represents a significant compromise to the implementation of FRA and is not NATS' preferred solution.

Conceptually Option 3 has the potential to minimize the initial impact on airline operators. By retaining all upper routes as today, airlines and flight planning service providers could choose to what degree they wish to embrace FRA and either route direct, or continue to flight plan and fly the existing ATS route structure. This option could be used as a transitional arrangement to minimize the initial impact on airline operations, with routes being withdrawn at a later date (e.g. one of the subsequent FRA implementations). However, this option may not encourage the most efficient flight plans to be filed and therefore may not realise the full benefits that FRA facilitates. In addition, it exacerbates the mixed mode of operation issue explained in option 2. It should be noted that the removal of upper routes within Direct Route Airspace (DRA) (implemented in 2015) and the successful introduction FRA within other States airspace has produced no discernible disruption.

6.5 Requirements

The requirements for FRA as mandated by the EU Implementing Regulation EU716/2014 are listed in the Stage 2 documentation (Refs 5 & 6).

How each of these requirements could be best met was evaluated in Stage 2. This resulted in the use of combinations of the tools available to construct the options which are now being progressed for consultation (as outlined in this section).

6.6 Design Principles

The proposed FRA options have been designed in accordance with the design principles as detailed in the Stage 1B Design Principles document.

6.7 PBN equipage

The FRA airspace will not be designated as having an associated RNAV equipage specification (as is required for ATS routes). However, RNAV5 equipage is mandated above FL100 (with exclusions for some State and Military aircraft) and hence the vast majority of aircraft are RNAV5 equipped as a minimum.

6.8 Systemisation and separation

The proposed FRA will be managed by NATS Prestwick Centre ATC. Flights will be monitored by ATC with the assistance of automated track-keeping conformance monitoring and conflict detection tools. These will alert ATC if a flight deviates from its expected trajectory, or if aircraft trajectories are in conflict and hence ATC intervention is required. Optimisation of traffic flows will be achieved in areas of high traffic density and complexity through the use of RAD restrictions which will require that flight plans pass through designated waypoints depending on origin/destination e.g. requirements for entering or exiting designated FRA Airspace

6.9 Other Design Options Considered (but not progressed)

Full assessment of design options which were considered but not progressed is given in Ref 5 (Design Principle Evaluation and Options Appraisal).

The requirements for FRA as mandated by the EU Implementing Regulation EU716/2014 are listed in Ref 5. The design options that were considered in Stage 2 in order to meet each of these mandated requirements are detailed in Ref 5. Combinations of these were then used to construct the options progressed for consultation (i.e. the Options as outlined in Section 6).

6.10 Full options assessment

The "Options Appraisal (Phase II – Full) including safety assessment" (Ref 6) as required by CAP1616 (Ref 7), accompanies this document and is published on the CAA portal for this airspace change.

6.11 Implementation Timetable

The *earliest* implementation of any of the changes proposed herein would be 3rd December 2020 (AIRAC 13/2020). Implementation is subject to CAA approval.

7 Impacts of this proposal

This section describes the impacts and/or benefits of the proposed FRA options.

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

The changes proposed herein impact flights above 25,500ft. This is well above the 7,000ft threshold stipulated by the DfT, below which overflights are deemed to have significant impact on stakeholders on the ground. As such, we assess that there would be no significant change to noise or visual intrusion and no change in impact to stakeholders on the ground due to any of the proposed FRA change options.

7.2 CO_2 emissions & fuel burn

CO_2 emissions & fuel burn analysis has been performed using computer simulations which modelled the operation of the FRA D1 airspace. The results of this modelling indicate that the proposed changes will result in a reduction in average fuel burn and CO_2e emissions per flight. The best-case forecast average reduction in fuel burn (which corresponds to Option 1) is 24kg per flight, this gives a total reduction of 7682 tonnes of fuel p.a. (2019 traffic level), and a forecast reduction in CO_2e emissions of 24,429 tonnes p.a.

The summed overall impacts for each option are summarised in Table 5 below.

Overall figures	2021 CO_2e (T)	2031 CO_2e (T)	CO_2e (£) (traded)	CO_2e (£) (non-traded)	2021 Fuel (£)	2031 Fuel (£)
Option 1: 100%	12,214	14,189	2,601,273	1,578,970	2,007,187	2,331,676
Option 2: 75%	9,161	10,642	1,950,954	1,184,228	1,505,390	1,748,757
Option 3: 40%	4,886	5,676	780,382	631,588	802,875	932,670

Table 5 CO_2e emissions & fuel burn impacts for each FRA Option

Column 2 & 3 in Table 5 give the annual CO_2e emissions savings estimated for each option in 2021 and 2031. Columns 4 & 5 give the figures for monetised value of traded and non-traded CO_2e emissions savings, totalled across the years 2021-31. Columns 6 & 7 give the annual saving in fuel cost, estimated for each option for 2021 and 2031.

Results from WebTAG are given in Appendix A of the Full Options Analysis (ref 6). Note that the Option 1 results in Table 5 summarise the computer simulation results which are given in full in Table 2, Appendix A of the Full Options Analysis (ref 6).

7.3 Airspace capacity

The flight-plan options this proposal would enable, will allow airlines to avoid capacity constrained areas and avoid consequential delay and cost. However, this is not quantifiable and no specific change in capacity is assumed or claimed by this proposal.

FRA implemented with no restrictions could result in a reduction in the airspace capacity. Hence RAD restrictions are proposed to be used to manage the flow of traffic transitioning into and out of FRA, and to provide some optimisation in areas of high traffic complexity.

7.4 MoD

The proposed FRA is not expected to have any impact on MoD operations. Operational Air Traffic (OAT) flight plans will not be affected by NPZ & FBZ, which form part of the (International Flight Plan System) IFPS.

Where large scale military exercises occur, flight plan restrictions would be managed by the CAA, Airspace Regulation (Utilisation) (notified by NOTAM).

As part of this change it is proposed to extend the North Sea Reduced Coordination Area (NSRCA) so that the entire FRA D1 area is designated as reduced co-ordination area (RCA). An RCA simply sets out who is responsible for the initiation of coordination between 'on-Route' and off-Route' traffic. (Note that the Hebrides Upper Transition Area (HUTA) has been established as an RCA for circa 40 years)

This will assist MoD ATS providers by enlarging and simplifying the RCA.

The introduction of FRA D1 will require that the definition of the NSRCA is amended in the Letter of Agreement (LOA) with the MoD. NATS seek feedback from the MoD as to whether it would be appropriate also to combine the NSRCA and HUTA to form a single RCA across the FRA D1 area.

7.5 General Aviation (GA) airspace users

There is not expected to be any impact on general aviation or sport aviation airspace users. Arrangements for the activation of Upper Gliding Areas within the Scottish region will be unaffected by the introduction of FRA.

7.6 Commercial Airlines

There is expected to be a positive impact on the operations of commercial airlines. FRA will enable increased flexibility in flight planning. Flight plans will more closely reflect the trajectories flown. As such there may be benefits in reduced distances flown and reduced fuel uplift requirement. Because of the flexibility of flight planning which FRA will facilitate, and how the airlines will choose to use this flexibility, it is difficult to predict and quantify the benefits to airlines with certainty.

7.7 Impact on Aviation Safety

The proposed FRA takes advantage of the precise navigation technology available on modern aircraft.

ATC can monitor the track keeping of all aircraft and in FRA the trajectory flown *should* be the same or very close to the flight-planned trajectory (unless controller intervention is required). Hence in FRA it should be easier for ATC to identify where an unauthorised deviation from the flight planned trajectory occurs. This can be automatically notified/alerted to the air traffic controller by conformance monitoring tools.

With an increase in the proportion of aircraft conforming to the flight plan route (compared to the current day operation), the operation of medium term conflict detection (MTCD) tools becomes more effective and accurate. This assists the ATC operation and could result in an improvement in safety.

7.8 Reversion Statement

Should the proposal be approved and implemented, depending on the Option implemented, reversion to the pre-implementation state would be:

- FRA Option 1. (In which all ATS routes are removed) – Complex and very difficult
- FRA Option 2. (In which the ATS route structure is partially maintained) – Complex and very difficult
- FRA Option 3. (In which the entire ATS route structure is maintained) – more easily achieved

Due to the removal of ATS Routes the changes proposed by option 1 and 2 would permanently and significantly change the airspace structure, hence making reversion complex and extremely difficult. For Option 3, due to the retention of the route structure, reversion could be more easily achieved.

In the unlikely event that there are unexpected issues caused by this proposal, then short notice changes could be made via NOTAM or by adding Route Availability Document (RAD) restrictions. For a permanent reversion, the changes would have to be reversed by incorporating this into an appropriate future AIRAC date. Due to the limitations of NATS Area System (NAS - flight and radar data processing) large scale airspace changes are only implemented four times a year.

8 How to respond to this consultation

The consultation begins on 17th September and ends on 10th December 2019, a period of 12 weeks..

Consultation material is available on the CAA's airspace change consultation portal at:

https://consultations.airspacechange.co.uk/nats/fra-d1

The list of stakeholders targeted for this consultation is given in Appendix A. These stakeholders have been directly informed of this consultation.

The consultation is not limited to these stakeholders - anyone may respond.

A feedback questionnaire is provided on the consultation portal.

It is recommended (and preferred by the CAA) that responses are made via the portal.

Submissions via the portal are sent direct to the CAA. Supporting documents may also be submitted via the portal.

Please note that when submitting feedback you will be asked to provide the following information:

- Your name, and your role if you are responding on behalf of an organisation.
- Your contact details (email)
- One of the following: SUPPORT OBJECT NO COMMENT AMBIVALENT
- Your reasons for supporting or objecting to the proposal.

(For example: the impacts and benefits it may have on your flights or organisation, and how often you would be affected.)

If this proposal does not affect your operation, please respond as that fact itself is useful data.

Note that all responses go direct to the CAA who will moderate submissions. Responses will be publicly visible by being published on the CAA airspace change portal subsequent to submission.

Respondents can also submit a postal response to the consultation. We will not commit to respond to postal responses directly. Postal responses can be sent to the following address:

NATS Airspace Consultation (Ref FRA D1),
Mailbox 11, 4000 Parkway,
Whiteley,
Fareham,
Hampshire, PO15 7FL

9 Compliance with process, and what happens next

9.1 Compliance

If you have questions or comments regarding the conduct of the airspace change process (e.g. adherence to CAP1616 (Ref 7)), please contact the CAA:

Airspace Regulation
Ref: NATS FRA-D1 ACP 2018 – 11
Safety and Airspace Regulation Group
Aviation House
Beehive Ring Road
Crawley
West Sussex
RH6 0YR

Form FCS 1521 can be used for this purpose

Note: These contact details **must not** be used for your response to this consultation. If you do so, your response may be delayed or missed out.

9.2 What happens next?

When the consultation period closes, we will publish a report summarising the feedback received.

We will then submit an Airspace Change Proposal to the CAA based on this consultation document and the feedback report.

The CAA will then study the proposal to decide if it has merit, and will publish a decision on its website.

If the CAA approves this proposal, we plan to implement the changes not before December 2020.

10 References

1. Borealis Free Route Airspace Concept of Operations v1.0
2. EUROCONTROL European Route Network Improvement Plan (ERNIP) – Part 1: European Airspace Design Methodology - Guidelines - Edition December 2018 (Relevant sections: Section 6 Enroute Design Methodology, Sub-section 6.5: Free Route Airspace (FRA) Design)
3. CAA Airspace Modernisation Strategy (CAP 1711) (Relevant Sections: Upper Airspace Section 4)
4. ICAO Doc 7030, North Atlantic (NAT) Regional Supplementary Procedures
5. FRA Deployment 1 - Design Principle Evaluation and Options Appraisal
6. FRA Deployment 1 - Options Appraisal (Phase II – Full) including safety assessment
7. CAP1616 Airspace Design: CAA Guidance on regulatory process for changing airspace design.
8. Route Availability Document:
    a. RAD Appendix 3 – Flight Level Capping Limits
    b. RAD Appendix 4 – En-Route DCT's / Limits
    c. RAD Appendix 5 – Airport Connectivity
    d. RAD Appendix 7 – FUA Restrictions
    e. Pan European Annex – Route Restrictions Within ECAC Airspace
9. Aeronautical Information Publication (AIP)
10. Eurocontrol Network Management Flight Planning Requirements - Guidelines issued Dec 2018
11. Department for Transport Air Navigation Guidance 2017. (Guidance to the CAA on its environmental objectives when carrying out its air navigation functions, and to the CAA and wider industry on airspace and noise management.)

11 Glossary of Terms

ACC	Area Control Centre (there are two ACCs in the UK, Swanwick and Prestwick)
ACP	Airspace Change Proposal
AIP	Aeronautical Information Publication (where airspace and route definitions are published)
ANSP	Airspace Navigation Service Provider
AOR	Area of responsibility
ATC	Air Traffic Control
ATS	Air Traffic Services
Baseline	'As is' situation against which proposed changes are measured
Borealis Alliance	Alliance amongst north-west European Air Navigation Service Providers to drive better performance for stakeholders through business collaboration. The Alliance includes the ANSPs of Denmark, Estonia, Finland, Iceland, Ireland, Latvia, Norway, Sweden and the UK.
CAA	the UK Civil Aviation Authority
CAP	Civil Aviation Publication (publications produced by the CAA)
CONOPS	Concept of operations
D1	deployment one, the first deployment of FRA across the area shown in Figure 1.
DCT	(Direct) Waypoint to waypoint routing, which does not use an airway.
Eurocontrol	European Organisation for the Safety of Air Navigation; with 41 members it seeks to achieve safe and seamless air traffic management across Europe.
FAB	Functional Airspace Block. (e.g. the UK + Ireland airspace is agreed as a FAB)
FBZ	Flight Plan Buffer Zones – areas for flight planners to avoid to provide separation from Special Use Airspace.
FIR	Flight Information Region (Airspace below FL255)
FL:	Flight level, the altitude reference which aircraft use at higher altitudes using standard pressure setting, essentially units of 100ft, i.e. FL255 equates approximately to 25,500ft
FMC/FMS	Flight Management Computer/Flight Management System
FRA	Free Route Airspace
ICAO	International Civil Aviation Organisation – an agency of the United Nations.
IFPS	Integrated Flight-plan Processing System
LAMP	London Airspace Modernisation Programme; established to redesign the airspace in and around the London TMA region, providing a more efficient airspace design, modernising the route structure and making better use of aircraft and ATC technologies.
MTCD	medium term conflict detection. Generic term for any ATC tool which looks ahead and predicts when aircraft are likely to be in conflict
NATMAC	National Air Traffic Management Advisory Committee
NDB	Non-Directional Beacon (radio navigation beacon)
NM	Network Management
NPZ	No Planning Zone – area where a flight plan is not permitted to enter at all or only when meeting prescribed criteria.
PCP	SESAR Pilot Common Project.
PBN	Performance Based Navigation – international requirements which standardise accuracy, safety and integrity for satellite navigation systems.
RAD	Route Availability Document: contains the policies, procedures and descriptions for route and traffic orientation. Includes route network and free route airspace utilisation rules and availability.
SESAR	Single European Sky ATM Research A collaborative project to completely overhaul European airspace and its air traffic management
SID	Standard Instrument Departure.
SRD	Standard Routing Document
STAR	Standard Terminal Arrival Route
SUA	Special Use Airspace – areas designated for operations of a nature that limitations may be imposed on aircraft not participating in those operations (i.e. military training areas)
TMA	Terminal Manoeuvring Area
UIR	Upper Information Region (Airspace above FL255)
VOR	VHF Omnidirectional Range (radio navigation beacon)
WebTAG	Department of Transport's web-based Transport Analysis Guidance; provides information on the role of transport modelling and appraisal, and templates for analysis (e.g. for Greenhouse gas emissions, and noise).

Appendix A List of Stakeholders

Airlines

Aer Lingus
Air Canada
Air France
Air New Zealand
American Airlines
Austrian Airlines
BA Cityflyer
BAR
British Airways
Cityjet
Cargolux
Delta Airways
DHL
Eastern Airways
EasyJet
Emirates
Etihad
FedEx
FinnAir
FlyBe
Gamma Aviation
Gulf Air
Iberia
Jet2
KLM
Logan Air
Lufthansa
Qatar Airways
Ryanair
SAS
Saudia
Stobart Air
Tag Aviation
Thomas Cook
Thomson/ TUI
Turkish Airlines
UK Air Tanker
United Airlines
Virgin Airlines
WizzAir

Air Navigation Service Providers (ANSPs)

ANS Finland (Finland)
Avinor (Norway)
Direction des Services de la Navigation Aérienne (DSNA) (France)
DSNA ACC Brest (France)
DSNA ACC Reims (France)
EANS (Estonia)
Eurocontrol Maastricht Upper Area Control Centre (MUAC)
Eurocontrol Central Flow Management Unit (CFMU)
Irish Aviation Authority (IAA) (Ireland)
Isavia (Iceland)
Latvijas Gaisa Satiksme (LGS) (Latvia)
LFV (Sweden)
NAVIAIR (Denmark)
RAF(U) Swanwick (UK Royal Air Force)

Data Houses/ Flight-planning providers

Lido,
Jeppesen,
Lufthansa Systems,
NavBlue,
Sabre

National Air Traffic Management Advisory Committee (NATMAC) Members

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

Airports[6]

EGAA Belfast Aldergrove
EGAC Belfast City
EGAE Londonderry/Eglinton
EGEC Campbeltown
EGPE Inverness
EGPF Glasgow
EGPG Cumbernauld
EGPH Edinburgh

[6] MoD Airfields are not included since consideration of these is incorporated in the DAATM joint response.

EGEO Oban	EGPI Islay
EGNO Warton	EGPK Prestwick
EGNS Isle of Man	EGPL Benbecula
EGNT Newcastle	EGPM Scatsa
EGNV Durham Tees Valley	EGPN Dundee
EGPA Kirkwal	EGPO Stornoway
EGPB Sumburgh	EGPT Perth/Scone
EGPC Wick	EGPU Tiree
EGPD Aberdeen	Highlands & Islands Airports Ltd (HIAL)
Other	
QinetiQ	UK Space Agency