Free Route Airspace Deployment 2

Gateway documentation:
Stage 2 Develop and Assess

Step 2B Options Appraisal
(Phase 1 Initial)
including Safety Assessment

Roles

Action	Role	Date
Produced	**Airspace Change Specialist** Airspace & Future Operations	07/09/2020
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Issue	Month/Year	Changes this issue
1.0	Sep 2020	First published to CAA Portal
1.1	Sep 2020	Changes to address CAA Gateway 2 comments

Contents

1. Introduction

1.1 This document forms part of the document set in accordance with the requirements of the CAP1616 airspace change process.

1.2 This document aims to provide adequate evidence to satisfy Stage 2 Develop and Assess Gateway, Step 2B Options Appraisal (Phase 1 Initial), including Safety Assessment.

1.3 The implementation of Free Route Airspace (FRA) is mandated in EU law via the SESAR PCP[1] Implementing Regulation EU716/2014, and as such is not benefits driven.

2. Change Level

2.1 The changes proposed in this ACP impact flights above FL245. Hence in accordance with the Levels as defined in CAP1616, it is expected that this proposal would be categorised as a Level 2C change.

2.2 In line with the requirements for a Level 2B change the environmental impact assessment has been conducted on the basis of CO_2 emissions. There would be no perceptible change to noise impacts to stakeholders on the ground so no noise analysis has been conducted.

[1] 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. It should be noted that the SEAR Deployment Manager is currently updating the PCP requirements. This update will be considered within the FRA deployment project when it is published.

3. Options Appraisal (Phase 1 Initial)

3.1 The baseline (do nothing) option would not deliver any benefit or meet the mandated legal requirement to introduce FRA in the UK UIR.

3.2 This ACP proposes three alternative options, any of which could be used to implement FRA in accordance with the mandated requirements.

- FRA Option 1 (preferred). In which all ATS routes are removed, and RAD restrictions are introduced in order to manage the flow of traffic transitioning into and out of FRA.
- FRA Option 2. In which the ATS route structure is partially maintained, for instance in areas of high complexity where systemisation of the flows is required such as the London TMA.
- FRA Option 3. In which the entire ATS route structure is maintained, but aircraft are not constrained to flight plan the ATS routes within the FRA.

3.3 The detailed makeup of the above three options is described in Doc 2a(ii) Table 2.

3.4 FRA Option 1 – ATS Routes Removed (preferred option)

FRA Option 1 would implement FRA across the Deployment 2 area with all ATS routes removed and RAD restrictions introduced in order to manage the flow of traffic in complex areas and transitioning into and out of FRA.

The CAP1616 Initial Options Appraisal analysis is given below.

Group	Impact	Level of Analysis	Description
Communities	Noise impact on health and quality of life	Qualitative	The proposed changes to air traffic patterns are all above FL245 (circa 24,500ft). This is well above the 7,000ft threshold below which noise impacts are considered significant and analysis is required. The potential noise impacts are neither measurable nor describable.
Communities	Air quality	N/A	No changes below 1,000ft
Wider society	Greenhouse gas impact	Quantitative and Qualitative	The introduction of FRA would enable flights to plan the most direct route through the airspace (subject to structural and limitations where required to maintain capacity) without the need to plan the existing routes. This enables individual flights to adapt their trajectories to consider not only distance and direction, but meteorological conditions and other factors which could improve efficiency. The analysis indicates that the introduction of FRA would enable a reduction in CO_2 emissions of 10,041T based on EUROCONTROL flight plan data for the year 2019. The airspace change was modelled using the fast-time simulation software AirTOp. Modelled traffic was drawn from 21st June 2019. Fuel burn was annualised based on traffic count in 2019 based on count of flight planned city pairs obtained from Eurocontrol's Network Simulation Tool (NEST) v1.6.6. The fuel burn and resultant CO_2 emissions for the baseline and scenario was calculated using Base of Aircraft Data (BADA) v4.2 where available, and BADA 3.14 for all other trajectories. The additional benefit of reduced fuel uplift and reduced CO_2 emissions due to the corresponding weight reduction would influence the impact and has been considered in the analysis. It must be noted that FRA will only enable this benefit. Actual trajectories planned within FRA will be determined by airspace users. The Full Options Appraisal will provide more granularity and a 10 year forecast in accordance with the requirements CAP1616.
Wider society	Capacity/ resilience	Qualitative	Increased flight planning flexibility would allow aircraft operators to flight plan more efficiently and would give them the option of avoiding capacity constrained areas. The ability to avoid restrictions by utilising alternative flight plan trajectories would reduce the likelihood of delay, thus improving the resilience of the wider network.
General Aviation	Access	Qualitative	GA access to the higher-level airspace above FL245 would be unchanged.
General Aviation/ commercial airlines	Economic impact from increased effective capacity	Qualitative	The introduction of FRA would not increase air transport movements, passenger numbers or cargo carried as an outcome of this proposal. The flight plan options this proposal would introduce could allow airlines to avoid capacity constrained areas and avoid consequential delay and cost. However, this is not quantifiable, and no specific capacity increase is assumed or claimed by this proposal.
General Aviation/ commercial airlines	Fuel burn	Qualitative and quantitative	The introduction of FRA would enable flights to plan the most direct route through the airspace (subject to structural and limitations where required to maintain capacity) without the need to plan the existing routes. This enables individual flights to adapt their trajectories to consider not only distance and direction, but meteorological conditions and other factors which could improve efficiency. The analysis indicates that the introduction of FRA would enable a reduction in fuel burn of 3,157T for the modelled year 2019.

			This would result in a fuel saving of c.£1,288,056 based on the 2020 Historical Analysis of Jet Fuel Prices for the period April 2015 – March 2020. That analysis puts cost of fuel at £408 per Tonne for 2020. The airspace change was modelled using the fast-time simulation software AirTOp. Modelled traffic was drawn from 21st June 2019. Fuel burn was annualised based on traffic count in 2019. . The fuel burn for the baseline and scenario was calculated using Base of Aircraft Data (BADA) v4.2 where available, and BADA 3.14 for all other trajectories. The additional benefit of reduced fuel uplift due to the corresponding weight reduction would influence the impact and has been considered in the analysis. It must be noted that FRA will only enable this benefit. Actual trajectories planned within FRA will be determined by airspace users.
Commercial airlines	Training cost	Qualitative	There is not expected to be any airline training cost associated with FRA implementation.
Commercial airlines	Other costs	Qualitative	Updates to FMS and flight planning systems will be by the routine AIRAC updates. There are no other known costs which would be imposed on commercial aviation.
Airport/ Air navigation service provider	Infrastructure costs	Qualitative and quantitative	The cost of implementation of the change, adaptation of systems is estimated to be between £3-4 million.
Airport/ Air navigation service provider	Operational costs	Qualitative	This proposal would not lead to changes in operational costs.
Airport/ Air navigation service provider	Deployment costs	Qualitative and quantitative	Approximately 100 AC controllers would require training using the NATS simulator facility. Support staff are required to run the simulator – data preparation, testing, simulator setup, pseudo pilots, feed sector controllers, training staff, safety analysts, output to be collated into a sim report. Some operational support staff may require briefings. The reduced availability of operational controllers during their conversion training means that operational rostering becomes a factor when considering continuous service delivery. NB NATS cannot quantify training costs for other ANSPs; however, their acceptance of this proposal is a high-priority design principle. It is assumed that any such training costs are acceptable to these agencies.

3.5 FRA Option 2 – ATS Routes Structure is Partially Maintained

FRA Option 2 comprises an FRA implementation across the Deployment 2 area where ATS routes are partially maintained in order to systemise traffic flows in complex areas. For this implementation option the majority of the impacts are the same as for option 1.

Group	Impact	Level of Analysis	Evidence
Communities	Noise impact on health and quality of life	Qualitative	(Same as FRA Option 1) The proposed changes to air traffic patterns are all above FL245 (circa 24,500ft). This is well above the 7,000ft threshold below which noise impacts are considered significant and analysis is required. The potential noise impacts are neither measurable nor describable.
Communities	Air quality	N/A	(Same as FRA Option 1) No changes below 1,000ft
Wider society	Greenhouse gas impact	Qualitative and quantitative	The same evidence statement as Option 1 applies. However, Option 2 is likely to provide slightly less enabled CO_2 emissions benefit than Option 1 because it is likely that some flights will flight plan the partially retained ATS route structure.
Wider society	Capacity/ resilience	Qualitative	The same evidence statement as Option 1 applies. The retention of some of the ATS route structure would assist in network resilience.
General Aviation	Access	Qualitative	(Same as FRA Option 1) GA access to the higher level airspace above FL245 would be unchanged.
General Aviation/ commercial airlines	Economic impact from increased effective capacity	Quantitative	(Same as FRA Option 1) The introduction of FRA would not increase air transport movements, passenger numbers or cargo carried as an outcome of this proposal. The flight plan options this proposal would introduce could allow airlines to avoid capacity constrained areas and avoid consequential delay and cost. However, this is not quantifiable, and no specific capacity increase is assumed or claimed by this proposal.
General Aviation/ commercial airlines	Fuel burn	Qualitative and quantitative	The same evidence statement as Option 1 applies. However, Option 2 is likely to provide slightly less enabled fuel saving benefit than Option 1 because it is likely that some flights will flight plan the partially retained ATS route structure.
Commercial airlines	Training cost	Qualitative	(Same as FRA Option 1) There is not expected to be any airline training cost associated with FRA implementation.
Commercial airlines	Other costs	Qualitative	(Same as FRA Option 1) Updates to FMS and flight planning systems will be by the routine AIRAC updates. There are no other known costs which would be imposed on commercial aviation.
Airport/ Air navigation service provider	Infrastructure costs	Qualitative and quantitative	(Same as FRA Option 1) The cost of implementation of the change, adaptation of systems is estimated to be £3.5 million.
Airport/ Air navigation service provider	Operational costs	Qualitative	(Same as FRA Option 1) This proposal would not lead to changes in operational costs.
Airport/ Air navigation service provider	Deployment costs	Qualitative and quantitative	(Same as FRA Option 1) Approximately 100 AC controllers would require training using the NATS simulator facility. Support staff are required to run the simulator – data preparation, testing, simulator setup, pseudo pilots, feed sector controllers, training staff, safety analysts, output to be collated into a sim report. Some operational support staff may require briefings. The reduced availability of operational controllers during their conversion training means that operational rostering becomes a factor when considering continuous service delivery. NB NATS cannot quantify training costs for other ANSPs; however, their acceptance of this proposal is a high-priority design principle. It is assumed that any such training costs are acceptable to these agencies.

3.6 FRA Option 3 – ATS Routes Structure is Wholly Retained

FRA Option 3 comprises an FRA implementation across the Deployment 2 area where ATS routes are wholly retained. This gives aircraft operators the option of flying the routes if desired (or not). It also gives ATC the option of using the systemisation afforded by the ATS routes in areas where high traffic densities could impact capacity without systemisation of flows.

Group	Impact	Level of Analysis	Evidence
Communities	Noise impact on health and quality of life	Qualitative	(Same as FRA Option 1) The proposed changes to air traffic patterns are all above FL245 (circa 24,500ft). This is well above the 7,000ft threshold below which noise impacts are considered significant and analysis is required. The potential noise impacts are neither measurable nor describable.
Communities	Air quality	N/A	(Same as FRA Option 1) No changes below 1,000ft
Wider society	Greenhouse gas impact	Qualitative and quantitative	The same evidence statement as Option 1 applies. However, Option 3 is likely to provide slightly less enabled CO_2 emissions benefit than Options 1 and 2 because it is likely that some flights will flight plan the retained ATS route structure.
Wider society	Capacity/ resilience	Qualitative	The same evidence statement as Option 1 applies. The retention of the structure would assist in network resilience.
General Aviation	Access	Qualitative	(Same as FRA Option 1) GA access to the higher level airspace above FL245 would be unchanged.
General Aviation/ commercial airlines	Economic impact from increased effective capacity	Qualitative	(Same as FRA Option 1) The introduction of FRA would not increase air transport movements, passenger numbers or cargo carried as an outcome of this proposal. The flight-plan options this proposal would introduce could allow airlines to avoid capacity constrained areas and avoid consequential delay and cost. However, this is not quantifiable, and no specific capacity increase is assumed or claimed by this proposal.
General Aviation/ commercial airlines	Fuel burn	Qualitative and quantitative	The same evidence statement as Option 1 applies. However, Option 3 is likely to provide slightly less enabled fuel saving benefit than Options 1 and 2 because it is likely that some flights will flight plan the retained ATS route structure.
Commercial airlines	Training cost	N/A	(Same as FRA Option 1) There is not expected to be any airline training cost associated with FRA implementation.
Commercial airlines	Other costs	N/A	(Same as FRA Option 1) Updates to FMS and flight planning systems will by the routine AIRAC updates. There are no other known costs which would be imposed on commercial aviation.
Airport/ Air navigation service provider	Infrastructure costs	Qualitative and quantitative	(Same as FRA Option 1) The cost of implementation of the change, adaptation of systems is estimated to be £3.5 million.
Airport/ Air navigation service provider	Operational costs	N/A	(Same as FRA Option 1) This proposal would not lead to changes in operational costs.
Airport/ Air navigation service provider	Deployment costs	Qualitative and quantitative	(Same as FRA Option 1) Approximately 100 AC controllers would require training using the NATS simulator facility. Support staff are required to run the simulator – data preparation, testing, simulator setup, pseudo pilots, feed sector controllers, training staff, safety analysts, output to be collated into a sim report. Some operational support staff may require briefings. The reduced availability of operational controllers during their conversion training means that operational rostering becomes a factor when considering continuous service delivery. NB NATS cannot quantify training costs for other ANSPs; however, their acceptance of this proposal is a high-priority design principle. It is assumed that any such training costs are acceptable to these agencies.

4. Safety Assessment

4.1 Options Appraisal Safety Assessment - Baseline

The current operation uses a published route structure and airline operators flight-plan to follow available ATS routes or flight plannable Directs (DCT) as published in the Route Availability Document (RAD). The published routes are supportive of strategic de-confliction between flights against active Special Use Airspace volumes (such as Danger Areas) and airspace with constrained radiotelephony or surveillance coverage. The routes also provide an operational framework that is conducive to Air Traffic Controllers' familiarity with traffic patterns, potential conflict points and practices for conflict avoidance/resolution. Flights into and out of the airspace volume (i.e. across boundaries with other Sectors and Air Traffic Control Units) are nominally managed via published waypoints.

In addition to flights following routes, some may be instructed to take a more direct path through the airspace. This is done in a tactical manner by Air Traffic Controllers based on their judgement that a different path can be followed safely.

Air Traffic Controllers are supported in their task by equipment functionality (tools) that includes prediction of the trajectories that aircraft will follow. Predicted trajectories can be viewed by Controllers, and the tools use the former to identify potential areas of conflict between aircraft for Controllers' attention. The tools also monitor the conformance of aircraft to their expected trajectories and highlight deviations. The tools support the Controllers in ensuring that the aircraft pass through the airspace safely separated from other aircraft, Danger Areas etc.

4.2 Options Appraisal Safety Assessment – Current Position

Project activities so far have included a Real Time Development Simulation and associated Safety and Human Factors workshops.

The initial work[2] that has been done has indicated that the Air Traffic Controllers regard the FRA mode of operation as being similar to that experienced today. Key factors underlying this are that direct routings that are (tactically) provided today are expected to be reflected in flight plans and that the tools will continue to support Controllers in foreseeing and resolving potential conflicts. Although reduced familiarity as to where conflicts may occur is a possibility (due to the ability to flight plan user-preferred trajectories) the tools are designed to provide adequate support in discerning and managing changes in this aspect.

A qualitative high-level safety appraisal for the three proposed options for FRA indicates that the existing level of safety performance undertaken within the current operation would be maintained.

[2] It has not yet been possible to fully involve all ATC parties (such as the Military) or to exercise the final form of equipment functionality.

5. Conclusion and Next Steps

5.1 This proposal has been developed following the submission of the following Statement of Need to the CAA Airspace Regulation:

> In response to SESAR PCP Implementing Regulation EU716/2014, NATS intends to implement Free Route Airspace (FRA) in a phased manner across UK airspace. The SESAR PCP ATM Functionality 3 (AF3) states that Free Route shall be provided and operated in the airspace for which the Member States are responsible at and above flight level 310 in the ICAO EUR region by 1st January 2022. This ACP proposes the introduction of the second deployment of FRA across the Swanwick West Sector Group (which covers most of Wales and southwest England) in order to comply with this Implementing Regulation within the required timescale.

(Note the timeline for this second deployment is aiming to implement by 1st Jan 2023).

5.2 This document describes options which address the Statement of Need by the proposed introduction of Free Route Airspace across the southwest London UIR. This will meet PCP mandated requirements and Borealis Alliance commitments regarding the implementation of FRA.

5.3 Additionally, the options have been developed thus far with assistance, input, feedback and effort from senior MoD staff, senior representatives of all bordering ANSPs, representatives from airlines and flight planning service providers. NATS thanks all these stakeholders and looks forward to continuing the development of this proposal.

5.4 Three options have been appraised and will be carried forward for further development and consultation. FRA Option 1 is preferred because it reduces flight planning complexity and aligns with EUROCONTROL guidance. Furthermore, it aligns with the UK FRA deployment 1 preferred option and is therefore more likely to result in a consistent FRA system throughout the UK UIR.

5.5 Subject to CAA approval at the Stage 2 Gateway Assessment, this proposal will then move on to Stage 3 - Consult.

End of document