SAIP Airspace Deployment 1

ACP Benefits Report

Version 0.1

5250/RPT/14

A17043

March 2017

Prepared by:
[redacted]

NATS Private

Acceptance

Action	Role	Name	Date
Author	[redacted]	[redacted]	March 2017
Author	[redacted]	[redacted]	March 2017
Reviewer	[redacted]	[redacted]	March 2017
Approved	[redacted]	[redacted]	March 2017
Accepted	[redacted]	[redacted]	March 2017

Publication History

Issue	Month/Year	Change Requests and Summary	Safety Impact
V0.1	March 2017	First Draft	N/A

Referenced Documents

List of documents referenced in this publication:

Ref	Title	Report Reference
1	Environmental Toolsets and Algorithms	A1459
2	Manual of Air Traffic Services, Part II. LAC. NATS En-Route Plc, Valid until 4th May 17.	Operational Information, Swanwick
3	Manual of Air Traffic Services, Part II. LTC. NATS En-Route Plc, 9th December 2016.	Operational Information, Swanwick
4	UK AIP AIRAC 02/2017	Aeronautical Information Service, NATS
5	Swanwick Airspace Improvement Programme: Airpsace Deployment 1, ADD 1, Issue 1.	5250/ADD/01
6	Fuel Uplift – Metholdogy for Application – February 2013	NATS Analytics
7	Historical Analysis of Jet Fuel Prices	A16113
8	Apportionment of Benefit for LTIP Airspace Change Projects	A16105, 5250/RPT/02

Acknowledgements

Emissions figures in this document have been produced using BADA data. This product has been made available by the European Organisation for the Safety of Air Navigation (EUROCONTROL).

Table of Contents

1. Executive Summary

A Fast Time Simulation study has been undertaken to assess the environmental impact of the proposed Swanwick Airspace Improvement Programme (SAIP) Deployment 1.

The results of the Fast Time study conclude that the proposed airspace changes will result in an enabled fuel burn benefit of 7.11kT per year based on 2018 traffic levels. This grows to 8.37kT by 2023. This equates to 22.62kT and 26.63kT of CO_2 respectively.

Table 1 below summarises the impacts for NATS internal benefits management purposes.

Project Benefit: (fuel)	7.11kT
Traffic Assessment Year	2018
BADA Version	4.2
Recommendation	Project to accept benefit and incorporate into benefits tracking tool.
Benefit Lifecycle	Applicable from project delivery date onwards.
Analysis Location	[redacted]

Table 1: Summary of benefits for benefit management purposes.

2. Introduction

The L5250 Swanwick Airspace Improvement Programme (SAIP) is currently undertaking a number of modular airspace changes with the aim of reducing CO_2 emissions and increasing capacity within Swanwick's airspace.

Airspace Deployment 1 aims to improve systemisation and reduce fuel consumption for traffic entering and exiting the UK Flight Information Region (UKFIR) along the south coast. This is achieved by raising and removing standing agreements and creating a number of new Performance Based Navigation (PBN) routes.

To support the SAIP Airspace Deployment 1, Analytics has undertaken a benefits assessment to understand the environmental impact of the change. Enabled benefits consider the impact of the changes to the procedures that dictate fuel uplift requirements. These changes affect the economic efficiency of a route and are therefore most relevant to airline operators.

This Fast Time study (undertaken using specialist fast time simulation software called AirTOp) considered a baseline airspace model against which the proposed change was compared using the same traffic sample in order to identify the effects of the proposed route changes. The impact on fuel burn, CO_2 emissions and track distance was assessed using the NATS Environment MOdel (NEMO)[ref1].

This document provides a summary of the Fast Time Simulation study.

3. Methodology

3.1. Modelling Assumptions

During modelling and the analysis of results, the following assumptions were made:

- Results were required for 2018 as the first full year of implementation and 2023 as a future case.
- The baseline model assumes procedures from MATS Part II(ref 2 and 3) and UK AIP(ref4). The scenario model uses the same procedures, with changes specified in SAIP Airspace Definition Document (ADD) issue(ref 5).
- The number of flights modelled is sufficient to enable valid conclusions to be drawn. Where this may not be the case, it has been highlighted in the report.
- Aircraft linking (the linkage between inbound and outbound flights made by the same aircraft) was not modelled.
- Airfield ground movement was not modelled. All runway movements were free from taxiing: departing aircraft entered the simulation by appearing on the departure runway aligned ready for take-off, and arriving aircraft were removed from the simulation once their speed on the runway had reduced to their normal taxiing speed.
- A “blue sky” weather picture with no wind was assumed for the Baseline and proposed designs.
- The airspace designs did not include flow restrictions or slot compliance such that unconstrained demand profiles were modelled. This ensured that inefficiencies inherent within the airspace were not masked by the utilisation of these tactical measures.
- The traffic growth was based on NATS 2015 Grid Forecasts and grown on a city-pair basis (2015 is the latest grid forecast available).
- Traffic growth at Heathrow and Gatwick was not modelled as these airfields are currently close to their maximum capacity.
- When undertaking comparative analysis between the designs, the traffic samples used were common to the analysis of both baseline and the proposed designs. This was to ensure any observed differences were due to the airspace design, not due to changes in the traffic samples.
- Conflict resolution was not used in the enroute phase, i.e. aircraft flew their flight planned route.
- The simulation did not make use of holds or consider separation on approach.
- Simulated controller tasks were completed instantaneously with each controller able to control multiple aircraft simultaneously.
- Metric outputs were based on procedural and standing agreement altitudes and flight level restrictions on SIDs, STARs, Holds and transitions.
- Runway changes were not modelled.
- All fuel burn analysis is based on the output of the NATS Environmental MOdel (NEMO). The BADA versions used by NEMO were BADA4.2 and BADA3.13. BADA3.13 was used for aircraft types where a suitable BADA4.2 aircraft type match is not available.
- A fuel uplift calculation was also applied to the fuel burn results. Fuel uplift is fuel which is burned merely to carry other fuel. Fuel Uplift was calculated using the equation detailed in Fuel Uplift: Methodology for Application, 2013(ref 6).
- Danger Area activation was not modelled.

- The price of fuel is assumed to be £510 per tonne(ref 7).

3.2. Traffic Samples

The traffic samples contain all the traffic affected by SAIP AD1. A full breakdown of the traffic sample is given in Appendix A.

A number of routes included in the ADD did not have any traffic on them in the sample days chosen. Analysis of these routes for the whole of 2016 has illustrated that the traffic on these routes is less than 1% of the whole sample. These routes are given in Appendix B.

A number of routes within the ADD are included for route connectivity purposes only. Therefore, there is no change to the flight plannable route due to the implementation of SAIP AD 1. These routes are given in Appendix C.

One route was not included as it is only required during times of danger area activation. This is also given in Appendix C.

3.2.1. Base-Year Traffic Samples

The dates used to create the traffic samples for this analysis were selected to represent typically busy periods of traffic in 2016.

The chosen sample days were the 6th and 8th of July 2016.

The last-filed flight-plans for these dates were obtained from CFMU, via EUROCONTROL's Network Strategic Tool (NEST). This captures what the traffic requested to fly in adherence to the procedures and avoids the inclusion of any tactical or capacity management effects upon the traffic routings.

The sample days were used for the comparative analysis of the baseline airspace versus the proposed design. This analysis was limited to two day-long traffic samples because the time and resource involved with running additional samples was considered disproportionate to the additional value they would bring (the two sample days were deemed to be representative of normal busy operation days).

3.2.2. Grown Traffic Samples

Traffic has been grown in the simulation to 2019 and 2024 traffic levels using the NATS 2015 Base Case Grid Forecast. 2019 and 2024 were chosen as these dates represent the full SAIP implementation year and five years after implementation. Traffic was grown using EUROCONTROL's Flight Increase Process Simulator (FIPS) algorithm. FIPS randomly selects a number of flights to "clone" using a pre-determined growth percentage which is defined by the user. A "cloned" flight has the exact same characteristics as the flight it is cloned, from however its departure time is varied by ± 15 minutes. In this case, the percentages are defined by key city-pair/region which is defined by the NATS 2015 Base Case Forecast.

SAIP Airspace Deployment 1 will have its first full year of implementation in 2018 and five years after is 2023. A constant set of traffic samples for 2019 and 2024 will be used for all deployments of the SAIP project. Total fuel burn values are prorated using fuel burn average from the 2019 and 2024 models and 2018 and 2023 traffic movements. The 2018 and 2023 movement numbers were grown from 2015 using the same method as the 2019 and 2024 traffic samples.

3.3. Simulation

Two simulations were run for each day sample; one assuming easterly operations and one assuming westerly operations. The simulations were run for both a 2019 and a 2024 traffic sample.

All results are weighted 70%/30% in favour of westerly operations(ref 8).

4. Results

Table 2 shows simulated distance, fuel burn, CO_2 and cost results based on 2018 forecast traffic. The study shows that procedural fuel burn will decrease by 7.11kT with an associated reduction in CO_2 emissions of 22.62kT. Based on assumed fuel price of £510 per tonne(ref 7), this would result in a cost saving of £3.6m.

[redacted]

Table 2: Fuel Burn and CO_2 change based on 2018 forecast traffic.

Table 3 shows that, based on forecasts for 2023 traffic, procedural fuel burn will decrease by 8.37kT with an associated reduction in CO_2 emissions of 26.63kT.

[redacted]

Table 3: Fuel Burn and CO_2 change based on 2023 forecast traffic.

It should be noted that two routes showed a small distance benefit and a small fuel burn disbenefit. This is caused by a change in flight levels due to changes to standing agreements.

5. Summary and Conclusions

A Fast Time Simulation study was undertaken to assess the environmental impact of changes proposed in SAIP Deployment 1.

The results of the simulation show an enabled fuel burn benefit of 7.11kT based on the 2018 traffic forecast and 8.37kT for the 2023 traffic forecast. The associated CO_2 benefit for 2018 is 22.62kT and for 2023 is 26.63kT.

Appendix A – Route Definitions

The table below details the routes which were included in the analysis.

Route	Baseline Definition
LTMA Departures via L22 & N514	LTMA Deps via MERLY and MOPAT
LTMA Arrivals via L982	LTMA Arrs via ORTAC
LTMA Departures via M17	LTMA deps via EXMOR
LTMA Departures via M195	LTMA Deps via LORKU
LTMA Arrivals via N17	LTMA Arrs via GAPLI
LTMA Departures via N19	LTMA Deps via SAM and GAPLI
LTMA Arrivals via N513	LTMA Arrs via DIDEL
LTMA Departures via N63	LTMA Deps via LELNA
LTMA Arrivals/ Departures via P86	LTMA Deps/Arrs via SUPAP or PEMAK
EGKK Arrivals via UP88	KK Arrs via REVTU
EGLL/WU Arrivals via UP87	LL/WU inbounds via REVTU
EGBB/NX Arrivals via UM184	EGBB/NX Arrs via DIKRO
EGSS/GW/SC Arrivals via UM185	SS/GW/SC Arrs via DIKRO
EGSS Departures via Q41	SS Deps via SAM or GWC and NOT via LORKU or LELNA or ORTAC
Overflights via M17	SAM – EXMOR not LTMA
Overflights via M195	Via LORKU not LTMA
Overflights via N19	SAM – GAPLI not LTMA arr/dep
Overflights via N63	Via LELNA not LTMA
All Traffic via UN867	Anything via GARMI

Appendix B – Routes with no traffic

The following flows have been excluded as there was no traffic on these routes on the sample days chosen.

Route	Reason Not To Include
Overflights via N514	No traffic in the sample.
Y321	No traffic on this route in the sample met the criterion of flight planning above FL245.
N17	No traffic in the sample.
P86	No traffic in the sample.

Appendix C – Routes not included in the analysis.

The following routes have not been modelled as the changes to them did not affect the distance or fuel burn metrics.

Route	Reason Not To Include
Y110	Change did not affect metrics
P620	Change did not affect metrics
Q3	Change did not affect metrics
Y113	Not considered because DA activation was not modelled
UL980	Change did not affect metrics
L980	Change did not affect metrics
N621	Change did not affect metrics
UN862	Change did not affect metrics
Y110	Change did not affect metrics