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NATS

Performance through Innovation

LAMP Phase1a: Stansted ACP Environmental Benefits Report

Fast Time Simulation Airspace Comparison

Version 1.1
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Prepared by
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Operational Analysis

LAMP Phase1a: Stansted ACP Environmental Benefits Report

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Acceptance

Action	Role	Name	Date
Author	Senior Research Analyst	name redacted	November 2014
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1.0	November 2014	First Issue	None
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Referenced Documents

List of documents referenced in this publication:

Ref	Title	Report Reference
(1)	Manual of Air Traffic Services, Part II. *NATS En-Route Plc, 2008.*	Operational Information, Swanwick
(2)	UK AIP AIRAC 05/2009	Aeronautical Information Service, NATS
(3)	NATS Fuel Burn and Related Emissions Model (KERMIT)	N/A

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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). All rights reserved.

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1. Executive Summary

A Fast Time Simulation study was requested to assess the environmental impact of the proposed LAMP Phase1a airspace on affected Stansted movements i.e. Stansted DVR departures.

The LAMP Phase1a airspace showed enabled benefits over the Baseline airspace for the sample dates modelled, with the average Stansted DVR departure calculated to have an enabled saving of 2Nm track distance and 205kg fuel burn.

There is a notable difference between the results for the easterly and westerly simulations with the easterly simulations showing much greater enabled benefits than their westerly counterparts.

2. Introduction

A Fast Time Simulation study was requested by the NATS LAMP project team to provide evidence of predicted enabled environmental benefits in support of the changes to Stansted procedures through the LAMP Phase 1a Airspace Change Proposal.

Fast Time modelling considers a Baseline airspace model against which a proposed change is compared in order to identify the effects of that change. This impact was determined using the KERMIT tool to assess the track mileage and fuel burn of the simulated trajectories.

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

3. Methodology

3.1. Modelling Assumptions

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

- The data included within the model is sufficient to ensure valid conclusions can be drawn. Where this may not be the case, it has been highlighted in the report.
- Airfield ground movement modelling was not implemented. All runway movements were free from taxiing: departing aircraft entered the simulation by appearing on the departure runway aligned and arriving aircraft were removed from the simulation once their speed on the runway had reduced to their normal taxiing speed.
- Standard inbound/outbound separations were modelled for all airfields. Details of these parameters were obtained from MATS Part 2(1) and the AIP(2) respectively.
- A "blue sky" weather picture with no wind was assumed for the Baseline and all comparative analysis between the Baseline scenarios and proposed designs.
- The airspace designs did not include flow restrictions or slot compliance such that unconstrained demand profiles were modelled. This ensured that problems inherent within the airspace were not masked by the utilisation of these tactical measures.
- The analysis used current day traffic samples grown on a city-pair basis to 2016 traffic levels for UK flights in line with the NATS November 2012 grid forecasts.
- When undertaking comparative analysis between the designs, the traffic samples used were common throughout the 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.
- Controller tasks were completed instantaneously with each controller able to control multiple aircraft simultaneously.

- Metric outputs were largely based on procedural and standing agreement altitudes and flight level restrictions on SIDs, STARs, Holds and transitions. Where the procedural levels were felt to be so different to what is actually flown, or to the profiles which are expected to be achieved, as to promote invalid conclusions, 'pessimistic typical' levels were used. These were based on expert controller validation and assumptions and any difference from procedural level restrictions are detailed in this report.
- All fuel burn and track mileage analysis is based on the output of the KERMIT environmental model(3).

3.2. Traffic Sample

For each sample day all flights which flight-planned to depart Stansted on a DVR SID were simulated.

The dates used to create the traffic samples for this analysis were selected to represent typically busy periods of LTMA traffic in 2013. CFMU data on the number of arrivals and departures from AIRAC 1307 (27/06/2013-24/07/2013) as a typical summer month was used to identify days of average, busy and unusually high traffic demand.

Dates with traffic delays and regulations were discarded from the initial sample to avoid any biased results. Traffic varies by the day of the week and therefore, it was decided that the sample days should be taken from different weekdays.

The chosen sample days were Friday 05/07/2013 and Monday 22/07/2013.

The last-filed flight-plans for these dates were then 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.

Changes in traffic patterns over time can affect the fleet mix and therefore, for the purpose of this analysis, it was necessary to adapt the 2013 traffc sample to reflect a 2016 fleet using Grid Forecasts.

The results for the Stansted changes are presented in this report as an average per flight rather than a total impact (growth and total CO2 will be covered in the ACP).

3.3. Simulation

Runway changes were not modelled. Two simulations were run for each day sample- once using easterly operations and once using westerly operations. Where environmental benefits are not quoted as being specifically easterly or westerly, they are calculated as an average of the two methods of operation.

A total of 8 scenarios were modelled as described in Table 1- Simulation scenarios

	Easterly		Westerly	
Design \ Sample	05/07	22/07	05/07	22/07
Baseline	Run 1	Run 2	Run 3	Run 4
Phase1a	Run 5	Run 6	Run 7	Run 8

Table 1- Simulation scenarios

Continued feedback from operational staff was obtained to validate the AirTOp modelling. This was to ensure the metrics were appropriate for assessing the viability of the project objectives.

The versions of the airspace modelling used to obtain the results quoted in this report are LAMP Baseline v6.4 and LAMP Phase1a v1.83.

3.4. Software Versions

Fast Time Simulation was undertaken using AirTOp version 2.3.11.

Fuel burn and emissions analysis of the trajectories was conducted using KERMIT version 6.3.

Both of the above tools used BADA 3.11 data to model aircraft performance characteristics.

4. Design Overview

The following airspace designs have been modelled for this analysis;

4.1. Baseline Airspace

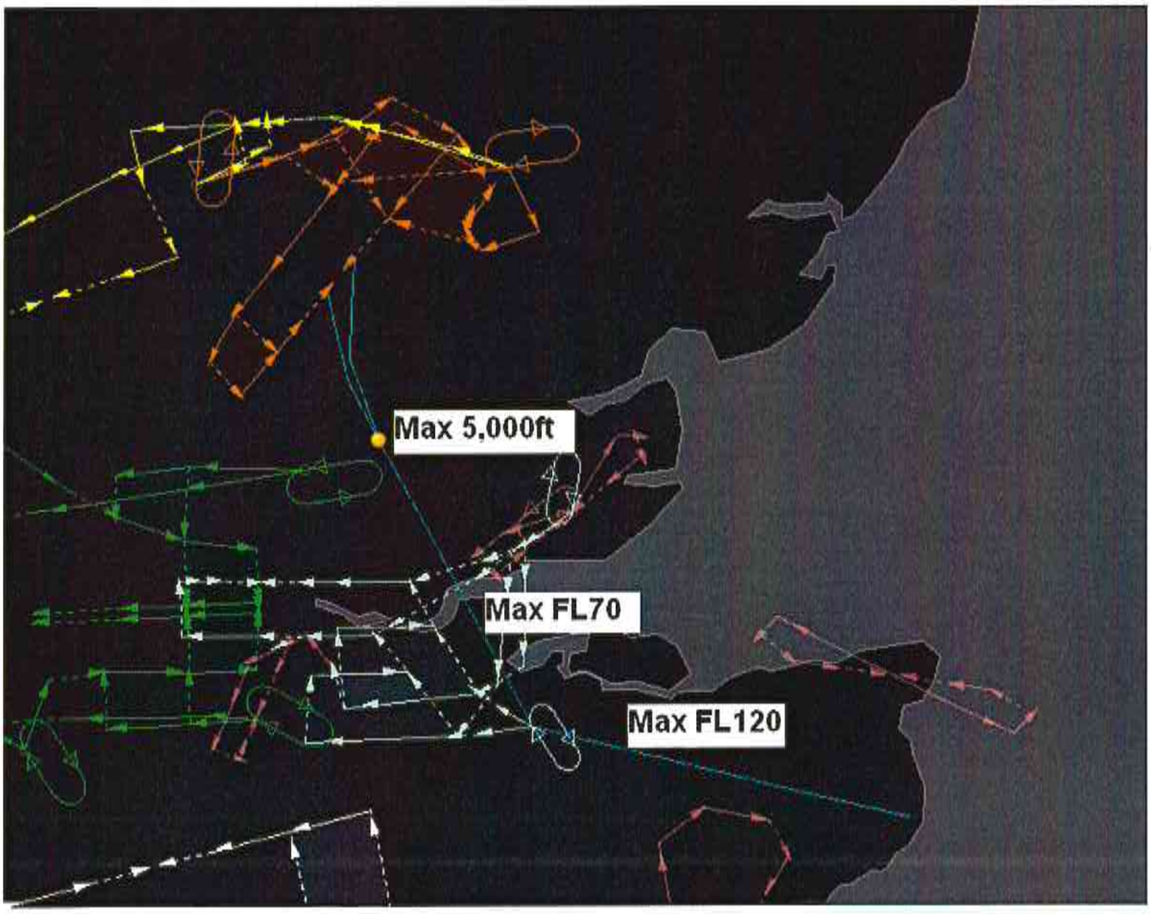

Figure 1- Baseline airspace modelled in AirTOp with Stansted DVR easterly and westerly SIDs highlighted

The baseline model was based on the information contained in AIRAC [3] cycle April 2009 as validated by operational controllers, with the modification that level restrictions followed a 'pessimistic-typical' profile rather than the procedural levels on the SID plate primarily intended for radio-fail situations. These level modifications are denoted in Figure 1- Baseline airspace modelled in AirTOp with Stansted DVR easterly and westerly SIDs highlighted above and were arrived at using expert controller validation.

4.2. Phase 1a Airspace

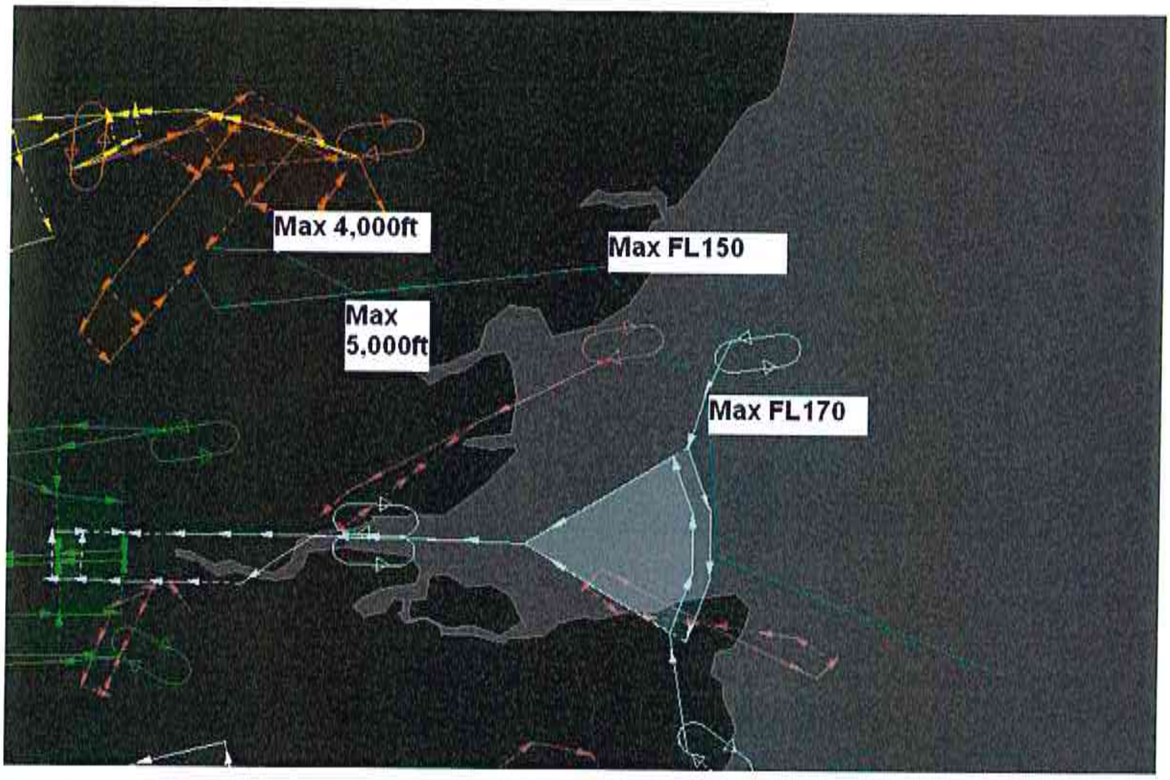

Figure 2- LAMP Phase1a airspace modelled in AirTOp with Stansted CLN easterly and westerly SIDs as well as connecting airway (U)L12 highlighted

The following differences from the baseline procedures have been modelled for Stansted;

Stansted DVR departures depart on the CLN SID and follow new airway (U)M84. Again, the level restrictions followed a 'pessimistic-typical' profile rather than procedural levels intended for radio-fail situations. These level modifications can be are denoted in above and were arrived at using expert controller validation.

5. Enabled Environmental Benefits Analysis

The simulation results are notably different for easterly and westerly operations. Hence, they are given separately in addition to the overall averages quoted in the tables below.

5.1. Track Distance

Table 2 shows the average track distance comparison to the nearest Nm. A positive figure denotes a lower average track mileage in the Phase1a airspace simulations than in the baseline, and vice versa for negative values.

	Baseline minus Phase1a		
	Easterly Sims	Westerly Sims	Overall
Average track mileage per flight (Nm)	6	-2	2

Table 2

5.2. Enabled fuel burn

Table 3 shows the average enabled fuel burn saving to the nearest 5kg.

	Baseline minus Phase1a		
	Easterly Sims	Westerly Sims	Overall
Average enabled fuel burn saving per flight (kg)	290	120	205

Table 3

5.2.1. Fuel burn by aircraft type

Table 4 shows a breakdown of the above metrics by aircraft type. Where this reduces the sample size to less than 10 aircraft the results are not reported. The number of aircraft is taken from all 4 simulations combined and the 'Baseline minus Phase1a' results are reported as an average of the aircraft in that group.

		Number of aircraft	Baseline minus Phase1a
2016	All aircraft types	286	205kg
	Medium Airbus	68	190kg
	Medium Boeing	178	175kg
	Small Heavy	16	485kg

Table 4

6. Summary of Results

The LAMP Phase1a airspace showed enabled benefits over the Baseline airspace for the sample dates modelled, with the average Stansted DVR departure calculated to have an enabled saving of 2Nm track distance and 205kg fuel burn.

There is also a notable difference between the results for the easterly and westerly simulations with the easterly simulations showing much greater enabled benefits than their westerly counterparts. As the prevailing wind in the UK is south-westerly, this methodology may mean that the overall enabled benefits quoted in this report are overestimated. If this is considered to be the case, a more conservative estimate may be obtained by considering the range between the westerly results and the overall results as illustrated in Table 5 below.

	Baseline minus Phase1a
Enabled fuel burn saving (kg)	120-205

Table 5