Swanwick Airspace Improvement Programme
Airspace Development 5
LAC West – ATS Route Connectivity Improvements

SAIP AD5 LAC West Connectivity

Compliance Paper
CAP1616 Stage 1 and Stage 2, Level 1 and Level 2 ACP

NATS Uncontrolled
© 2018 NATS (En-route) plc, ('NERL') all rights reserved

Roles

Action	Role	Date
Produced	**Airspace Change Specialist** NATS Future Airspace and ATM	07/12/2018
Reviewed Approved	**ATC Lead** NATS Swanwick Development	07/12/2018
Reviewed Approved	**Development ATCO** NATS Swanwick Development	07/12/2018
Reviewed Approved	**SAIP AD5 Project Manager L5250** Operations & Airspace Programme Delivery	07/12/2018

Drafting and Publication History

Issue	Month/Year	Changes this issue
1.0	Dec/2018	Initial version published to the CAA online portal

Contents

© 2018 NATS (En-route) plc

1. Introduction

This document is an additional paper provided to demonstrate compliance with CAP1616 under the unusual circumstances of a provisional Level 2 proposal becoming a Level 1 proposal at Stage 2 of CAP1616. This document aims to provide adequate evidence to satisfy compliance with Stage 1 requirements in respect of stakeholder engagement on Design Principles (DPs).

Altitude is used in this document for consistency and clarity to the layman[1].

2. Summary of CAA argument

i. At Stage 1 of this proposal, NATS stated that there would be no alteration of traffic patterns below 7,000ft, the meaning being the alteration of commercial air traffic patterns.

ii. Based on this information, the CAA provisionally awarded this ACP Level 2 status.

iii. GA traffic was neither mentioned nor considered in the context of local noise impacts or CO_2 emissions, only in the context of aviation impacts such as airspace access etc.

iv. NATS asked the CAA about the establishment of controlled airspace (CAS) with a base of Flight Level (FL)65, similar to 6,500ft altitude. After a period of consideration, the CAA stated that this has the potential to alter flightpaths of General Aviation (GA) traffic patterns below 7,000ft over an inhabited area, leading to potential noise and other impacts.

v. By definition this is a Level 1 Airspace Change Proposal (ACP). NATS accepted and stated this in its Stage 2 Step 2B submission paperwork. NATS also provided a page of evidence and arguments with regard to the lack of impact this would have on ground based observers.

vi. This did not fully address CAA process concerns, contributing to this proposal's failure to advance to Stage 3 Consult. The other items contributing to this proposal's failure to advance are of a different nature and are being resubmitted separately under Step 2B.

3. Summary of NATS' counterargument

i. Inclusion of local community (ground based) stakeholders in the engagement for this proposal is not appropriate. This is because there would be no discernible change in impact for such stakeholders. There would be no discernible change in noise impacts, visual intrusion or CO_2 emissions associated with the affected GA flights. Robust evidence is provided below to demonstrate this, in accordance with CAP1616 Appx B paras B35 and B38.
This evidence is provided in four parts – firstly the small number of potentially affected GA flights, secondly the imperceptible noise impact an affected GA flight might have on ground based observers, thirdly the imperceptible difference in visual intrusion impact, finally the no-change in fuel use hence no change to CO_2 emissions due to the proposal.

ii. Aviation stakeholders are those most appropriate for this proposal.

iii. The overall list of stakeholders identified and engaged under Stage 1 remains fit for purpose.

iv. The DP stakeholder workshops and subsequent airspace design stakeholder workshops therefore remain fit for purpose.

v. NATS contends that the work done for Stage 1 "Define" and the result of its Gateway Assessment should stand.

[1] It is acknowledged that there are technical differences between altitudes and flight-levels however this document discusses the *difference* in impact of flights at different altitudes/levels. Provided a common reference is used, there is no difference between comparing altitudes or flight levels.

4. Supporting evidence: The number of GA flights potentially affected

4.1 This section expands on, and adapts, the evidence previously submitted by NATS under Step 2B. It demonstrates the very small number of potentially affected GA flights due to this proposal.

4.2 We analysed radar data for June 2018 in the vicinity of the lowest proposed CAS volume.

4.3 See Section 9, Data Appendix: Number of GA Flights in the region, for source data.

4.4 In the region of interest, 94% (4,904) of relevant transponding aircraft indicated they were operating at 6,499ft or lower. This means only 6% (284) of such flights would be affected by this proposed change, c.9-10 flights per day on average.

4.5 Further, since the proposal would only affect GA flights during FUA hours of activation (non-H24 options described in Step 2A(i)), excluding all flights operating in core weekday daytime hours, we contend that the actual impact is likely to be even lower.

4.6 We reiterate that this data sample was for June 2018, a peak summer month for GA activity. There would be fewer GA flights per month outside the peak of summer.

4.7 Typically the GA types of aircraft operating at the levels in question, outside CAS, would be small, private, piston-engined aircraft.

4.8 The impacts of implementing CAS at FL65 could be one of three possibilities:

- Such flights descend to cross the base just below FL65/6,500ft;
- They route around the new CAS at their previous level (no change in noise impact below 7,000ft); or
- They request a clearance from ATC to enter the proposed CAS at their current level (no change in noise impact below 7,000ft).

4.9 It is impossible to predict what proportion of the potential maximum 6% (284) would choose which of these three courses of action.

4.10 We therefore assess that a very small proportion of GA flights could potentially be impacted by this proposal.

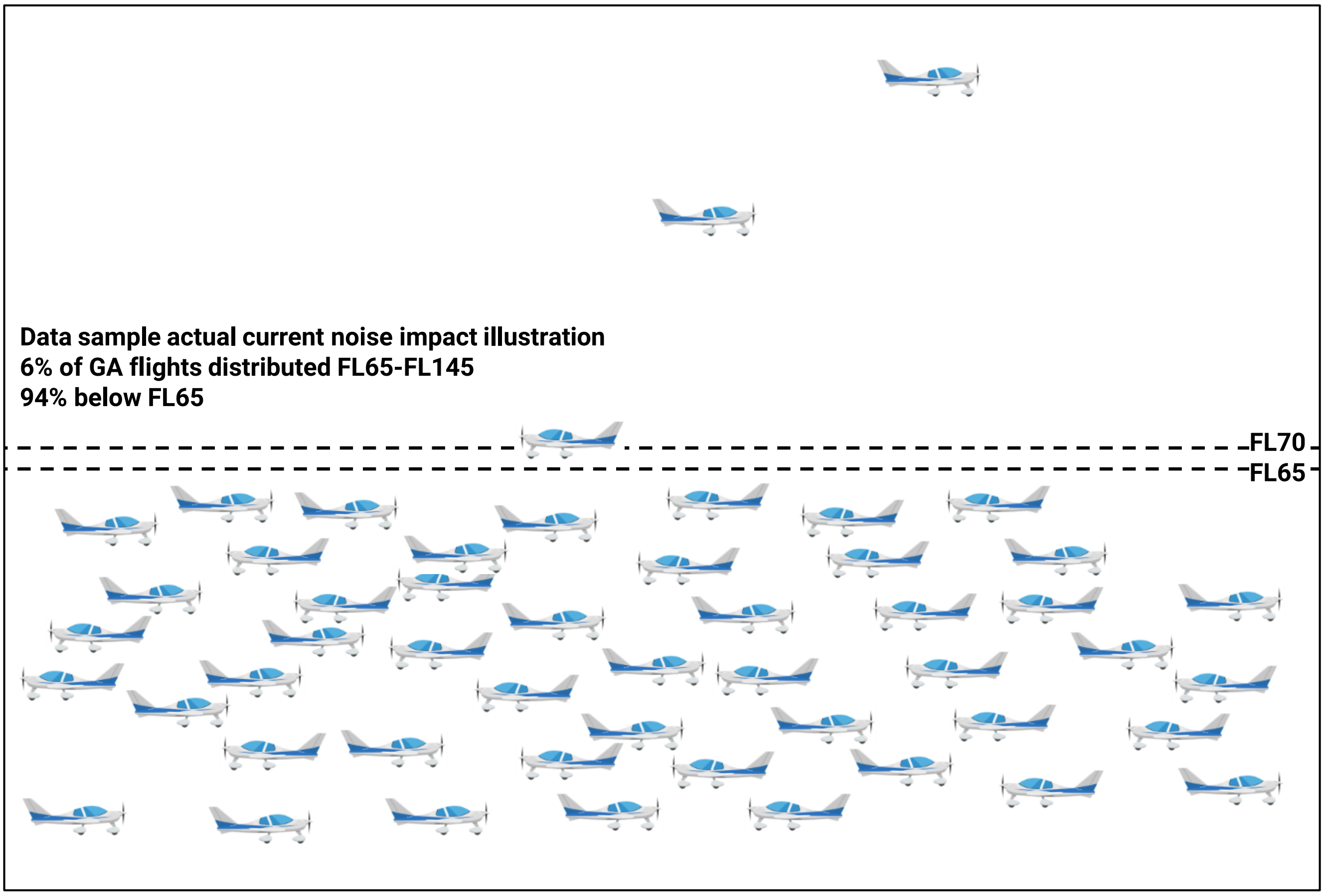
5. Supporting evidence: Noise impacts of a GA flight descending to 6,400ft

5.1 It is assumed that an aircraft wishing to fly below CAS in uncontrolled airspace would fly at a maximum altitude of 100ft below the base of CAS.

5.2 The following illustrates the potential impacts of GA flights given this scenario:

5.2.1 The lower a flight operates, the greater the noise impact would be, as observed from the ground.

5.2.2 6% (284) of GA flights in this data sample are currently distributed between 6,499ft-14,499ft:



5.2.3 The remaining 94% of GA flights already operating below 7,000ft would produce the greatest noise of this data sample. Those operating above 7,000ft would produce far less, and they are only a very small proportion of flights as demonstrated in the previous section.

5.3 The CAA's reference noise model known as ANCON does not contain noise metric data for GA aircraft types – it is used for commercial aircraft types, all of which are far larger, heavier with more powerful engines than GA types.

5.4 The quietest commercial aircraft type in the CAA's data tables is for a 50-seat regional jet. An example is an Embraer ERJ145 or Bombardier Canadair CRJ100, both commercial twin jets 90-100ft in length with 70ft wingspans weighing more than 20 tonnes.

5.5 Even using departure (i.e. climb power) engine settings, the noise level L_{max} for these types falls below the CAA noise model's reliability limit[2] on passing 5,500-6,000ft.

5.6 See Section 10, Data appendix: Noise L_{max} metrics for commercial aircraft, for source data.

[2] Below 55dBA L_{max}, ANCON model output cannot be relied upon due to variability & lack of supporting measurement data.

© 2018 NATS (En-route) plc

5.7 A typical GA aircraft is a fraction of the size, has one or two small piston engines, and weighs about one tenth of these 50-seat regional jets.

5.8 Our worst case noise argument runs as follows:

5.8.1 The proposed FL65 CAS operates H24, affecting all GA flights in the region all the time

5.8.2 Peak summer GA activity occurs all year round

5.8.3 All 6% of potentially affected GA flights descend to 6,400ft instead of maintaining altitude and flying round the proposed CAS, or maintaining altitude and acquiring a clearance to transit CAS

5.8.4 A 50-seat regional jet's noise metric, at departure settings, is below the limit of reliability for the CAA's noise model when climbing from 6,000-6,500ft

5.8.5 A typical GA aircraft is far smaller and less powerful, so would produce far less noise than a 50-seat regional jet at the same altitude

5.8.6 Therefore a typical GA aircraft would be below the limit of reliability for the CAA's noise model when at 6,000-6,500ft, and is actually likely to be far lower on any qualitative noise scale given its relative size and engine power

5.8.7 The remaining 94% of GA flights in the region are already lower than 6,499ft and therefore higher on any qualitative noise scale, likely masking the altitude changes of the 6% of higher flights (which would already be below the noise model reliability limit as per previous para)

5.9 In the Government's (DfT) 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) section 2.10 states:

> *2.10 Consultation with environmental stakeholders will usually only be necessary where the proposed changes concern controlled airspace below an altitude of 7,000 feet or could have considerable knock-on effects on how air traffic uses adjoining uncontrolled airspace below the same altitude..*

The noise impacts associated with changes to the flight paths of large commercial airliners at ~7,500ft are considered by the DfT & CAA to be below the threshold necessary for engagement with local community stakeholders on the ground. The noise footprint of typical commercial airliners at ~7,500ft is many times greater than a light aircraft at 6,400ft. Hence it is unreasonable to require engagement with local community stakeholders on the ground, in respect of the almost imperceptible changes in noise impacts due to the changes to a small number of light aircraft at relatively high altitude.

5.10 We therefore assess that the noise impact of a GA flight at 6,400ft would be well below the thresholds usually prescribed for noise impact studies (~55dBA L_{max}).

6. Supporting evidence: Visual impacts of a GA flight descending to 6,400ft

6.1 This section describes the change in visual impact between GA aircraft flying at 6,900ft and the same aircraft flying at 6,400ft. (This assumes the plot flies at 100ft below the CAS base in order to remain clear of CAS).

6.2 A typical GA aircraft is a PA27 Piper Aztec, a light twin piston engined aircraft, 31ft long with a wingspan of 38ft and weighing about 2 tonnes.

6.3 At just below 7,000ft, the viewing angle wingtip-to-wingtip is less than $^1/_3$ of one degree.

6.4 This small angle makes seeing the aircraft itself extremely difficult in the first place – trained air traffic controllers would have difficulty spotting such an aircraft visually from the ground given a clear sky, the naked eye, and no radar assistance to identify the specific flight. Aircraft at this altitude do not produce any condensation trails therefore this would not be a source of visual impact.

6.5 Should a PA27 fly at 6,499ft, the equivalent visual impact would be similar to that of a herring gull flying a few feet lower than the top of Canary Wharf.

6.6 We assess that the differences between the visual impact of a GA aircraft descending from a higher altitude to 6,400ft is imperceptible, and the absolute visual impact of a GA aircraft at 6,400ft is also virtually nil.

7. Supporting evidence: CO_2 impacts of a GA flight descending to 6,400ft

7.1 This section describes the change in CO_2 emissions between GA aircraft flying at the highest possible scenario altitude, 14,400ft, and the same aircraft flying at 6,400ft.

7.2 As previously noted, a typical GA aircraft is a PA27 Piper Aztec, a light twin piston engine aircraft.

7.3 At 14,400ft, this aircraft burns 1.8kg fuel per minute of flight, leading to CO_2 emissions of 5.7kg/min.

7.4 At 6,400ft, this aircraft also burns 1.8kg fuel per minute of flight, leading to CO_2 emissions of 5.7kg/min.

7.5 There is no difference in the fuel burn rate between the two altitudes, thus no change in CO_2 emissions due to GA aircraft descending from the upper to lower altitude.

7.6 Based on Eurocontrol BADA 3.13.1 data - see Section 11, Data appendix: Fuel and CO_2, for calculations.

7.7 We therefore assess that the CO_2 difference is zero between the two scenarios.

© 2018 NATS (En-route) plc

8. Conclusion, Effect on Stakeholder Identification, and CAP1616 Compliance

8.1 Section 4 demonstrated that in the worst case, only a very small proportion (6%) of GA flights in the region have the potential to be impacted.

8.2 Section 5 demonstrated that, worst case, comparing GA noise scenarios with 50-seat regional jet scenarios, the changed noise impact of each GA flight would be below the threshold for noise impact studies.

8.3 Section 6 demonstrated that the difference in GA visual impacts between the two scenarios is practically imperceptible.

8.4 Section 7 demonstrated that the difference in GA CO_2 emissions between the two scenarios is zero.

8.5 We conclude there are either no perceptible, measurable differences, or no differences at all, between the two GA scenarios from the point of view of ground based observers/stakeholders.

8.6 It would not be possible to attempt to describe this lack of perceptible difference to any ground based local community stakeholder group. The affected GA flights would not be put in a position whereby their actions would impact a local community.

8.7 Therefore, local community stakeholder groups are not an appropriate type of stakeholder for this proposal. Aviation stakeholders are appropriate.

8.8 No stakeholder groups have been left out of the engagement on, nor the continued design development of, this proposal.

8.9 The stakeholder groups, already identified and well-engaged, are suitably representative for this proposal at both Stages 1 and 2.

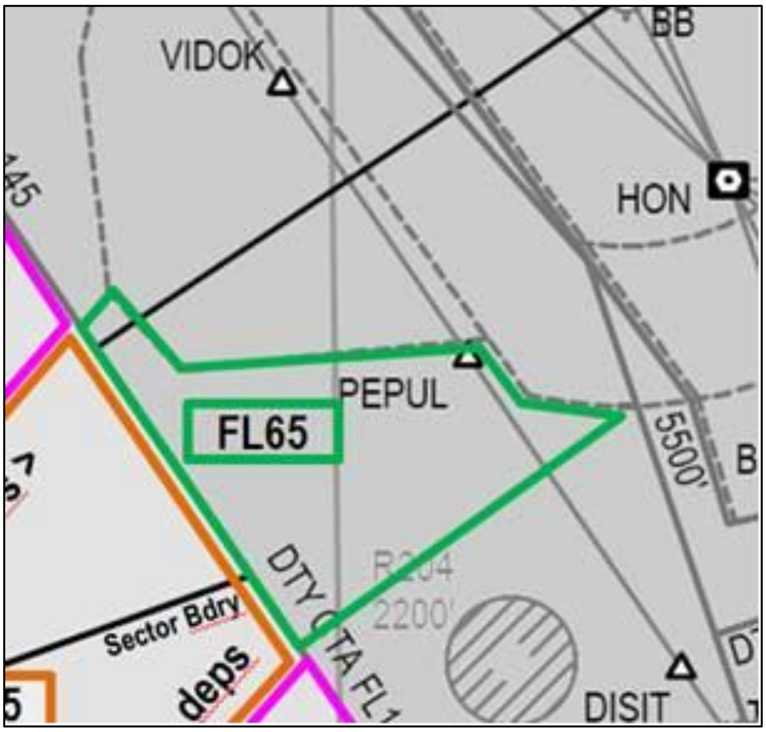
8.10 This proposal's Stage 1 Define Gateway complies with CAP1616 as it stands and does not need to be repeated.

8.11 For Stage 2 Develop and Assess, the same stakeholders as Stage 1 have been well-engaged and provided two-way input into the airspace design process. This complies with CAP1616.

© 2018 NATS (En-route) plc

9. Data Appendix: Number of GA Flights in the region

9.1 The green area in the chart below is representative of the proposed CAS options in the vicinity of Birmingham Airport as described in Step 2A(i) of this proposal.



9.2 The longest dimension of the largest green area CAS option in this proposal is c.25nm diagonally, thus the maximum impact on any given GA flight operating in a straight line would be for 25nm.

9.3 The analysis focused on aircraft radar returns with unverified transponder, flying outside CAS and not participating in an air traffic control service. Hence since the aircraft type is not recorded it is not possible to accurately analyse what aircraft types are involved. Likewise, the altitude of primary radar plots of non-transponding aircraft cannot be analysed.

9.4 For June 2018, all transponding aircraft within the volume were identified.
All transponder codes corresponding with aircraft under the control of an air traffic control unit were removed.
The remainder is shown below, with Mode C unverified and no aircraft type information available:

Mode C raw indication	Count	Mode C raw indication	Count
0-5,999ft	4,833	6,500-6,999ft	35
6,000-6,499ft	71	7,000-14,499ft	249
Total below 6,499ft	4,904	Total above 6,499ft	284
[284/(4,904+284)] x 100 = 5.5%, rounded up to 6% for this document			

© 2018 NATS (En-route) plc

10. Data appendix: Noise L_{max} metrics for commercial aircraft

10.1 The following table is an extract from the CAA's representative aircraft noise metrics, L_{max}dBA as supplied to NATS by the CAA's Environmental Research Consultancy Department, by their Manager Aircraft Noise Modelling, in February 2012.

Height (ft)	dBA of a 50-seat regional jet under departure conditions
500	86
1000	78
1500	74
2000	70
2500	67
3000	65
3500	62
4000	60
4500	58
5000	57
5500	56
6000	Below 55
6500	Below 55
7000	Below 55

10.2 As per footnote 2 on page 5, the CAA states that, below 55dBA $_{Lmax}$, ANCON model output cannot be relied upon due to variability & lack of supporting measurement data.

© 2018 NATS (En-route) plc

11. Data appendix: Fuel and CO_2

11.1 As previously noted in our examples, a typical GA aircraft is a PA27 Piper Aztec, with twin piston engines.

11.2 The BADA v3.13.1 performance file for this aircraft states that fuel use per minute at 3,000ft is the same when flying at 16,000ft. This is 1.8kg/min.

11.3 The fuel use at 14,400ft is thus the same as at 6,499ft, i.e. 1.8kg/min.

11.4 1.8kg of fuel, when burnt, emits 5.7kg CO_2. However, the same amount of fuel would be burnt per minute at both altitudes in question.

11.5 Therefore neither CO_2 nor other greenhouse gas emissions would change due to the proposed descent scenario.

11.6 Later BADA datasets do not contain this aircraft type, indeed few GA types, hence the use of 3.13.1.

© 2018 NATS (En-route) plc

End of document

© 2018 NATS (En-route) plc