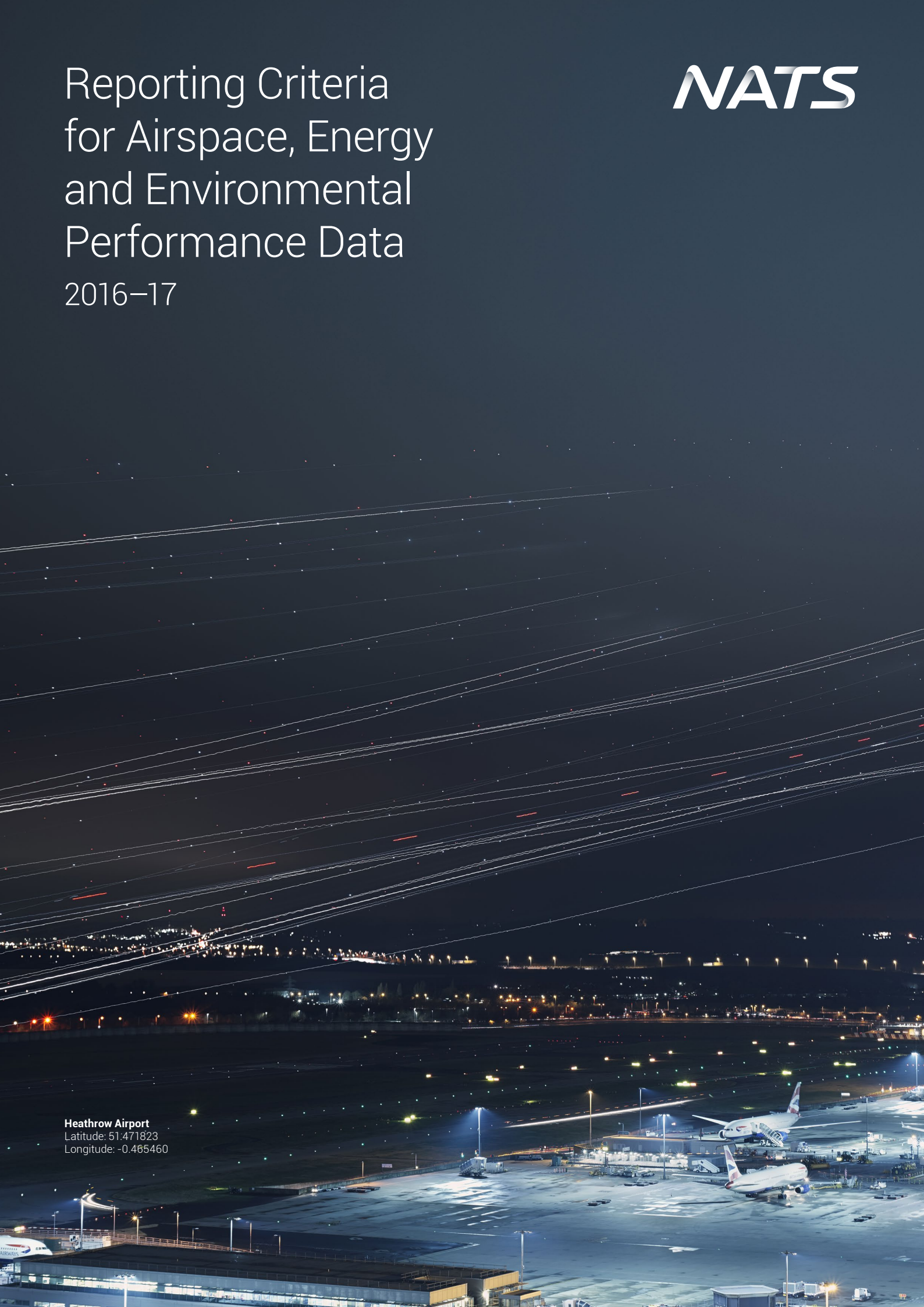
Reporting Criteria for Airspace, Energy and Environmental Performance Data

2016–17



Heathrow Airport
Latitude: 51.471823
Longitude: -0.465460

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1. Introduction

This document specifies NATS' methodology for the preparation of airspace, energy and environmental performance data in the Annual Report & Accounts (AR&A) for the reporting period 1st April 2016 – 31st March 2017.

It is the responsibility of NATS' management to ensure that appropriate procedures are in place to prepare airspace, energy and environmental performance data in line with, in all material respects, the principles, criteria and methodologies set out in the following sections of this document.

Greenhouse gas (GHG) emissions data is prepared with reference to the World Resources Institute's (WRI) Greenhouse Gas Protocol (GHG Protocol) Corporate Standard and reported in accordance with the CDSB Framework for reporting environmental information and natural capital.

1.1 NATS statement on airspace, energy and environmental data

The principles of relevance, completeness, consistency, transparency and accuracy have been applied to our airspace, energy and environmental data as follows:

- **Relevance:** Ensure data appropriately reflects NATS' performance and serves the decision-making needs of users – both internal and external to the company. Relevant information is identified as potentially necessary for inclusion in the mainstream report, for the purposes of communicating the extent to which NATS contributes to and is affected (now or in the future) by environmental impacts. GHG emissions shall be treated as material in all cases as a contributor to climate change.
- **Completeness:** Account for and report on all data sources and activities within the chosen inventory boundary, with disclosure and justification for any specific exclusion. Disclosures are complete if it includes all information that is necessary for an understanding of the matter that it purports to represent and does not leave out details that could cause information to be false or misleading to users.
- **Consistency:** Use consistent methodologies to allow for meaningful comparisons of performance over time. Transparently document any changes to the data, inventory boundary, methods, or any other relevant factors in the time series. Consistency refers to the use of the same standards, policies and procedures over time. Comparability greatly enhances the value of information to users; consistency is the means to achieving that objective.

- **Transparency:** Address all relevant issues in a factual and coherent manner, based on a clear audit trail. Disclose any relevant assumptions and make appropriate references to the accounting and calculation methodologies and data sources used.
- **Accuracy:** Ensure accurate and up-to-date records through the development and introduction of procedures to form a reporting framework aligned to the GHG Protocol, CDSB Framework and the requirements of ISAE 3000/3410 assurance. The quantification of data shall systematically neither over nor under report actual performance, as far as can be judged, and uncertainties shall be reduced as far as practicable. Information shall be verifiable, i.e. characterised by supporting evidence that provides a clear and sufficient trail from monitored data to the presentation of airspace, energy and environmental information. The information shall be sufficiently accurate to enable users to make decisions with reasonable assurance as to the integrity of the reported information.

1.2 Assurance

Energy and environmental performance (financial year unless stated otherwise)	**2016–17**	**2015–16**
Modelled enabled Air Traffic Management (ATM) related CO_2 emission reduction (tonnes CO_2)	55,904^	157,156
Progress against 10% enabled ATM related CO_2 emissions reduction target	5.0%	4.7%*
3Di score (calendar year)	30.3	30.1
Scope 1 emissions (tonnes CO_2e)	3,502^	3,183*
Scope 2 emissions (tonnes CO_2e)	24,996^	27,934$^+$
Scope 1 + 2 intensity metric (tonnes CO_2e per £m of revenue)	31.0^	34.6$^+$
Energy consumption (MWh)	60,586	60,438$^+$
Water consumption (m^3)	48,630^	49,645$^+$

The data has been collected using the operational control approach and covers the UK sites of NATS Holdings Limited and its Aquila joint venture, which is based at NATS' head office. ATM CO_2 data for 2016 marked * has been restated to reflect improvements in the accuracy of modelling and in the quality and availability of industry data, updates to traffic forecasts, and changes to NATS' airport portfolio. For 2016 data marked $^+$, actuals have replaced some data estimates for the end of the reporting period and the figures have been restated where applicable. Certain environmental performance metrics in the table above as at 31 March 2017 have been subject to external assurance by PricewaterhouseCoopers LLP (PwC). PwC have carried out a limited assurance engagement on selected 2017 metrics marked ^. A copy of the assurance opinion is available at www.nats.aero/environment/cr.

2. Organisational boundary for NATS' energy and environmental reporting

2.1 Operational control

NATS applies the operational control method in order to consolidate its organisational boundary in each reporting year. This approach best reflects the company's influence over its environmental impact and goes beyond the minimum compliance requirements outlined above. At the legal structure level, it is considered that the company has operational control over an operating entity if NATS or one of its subsidiaries has the full authority to introduce and implement its Environment Policy at the operating entity.

NATS is split into two main business units which provide two distinct services:

- NATS (En Route) plc (NERL) — the regulated part of the business which provides air traffic management services to aircraft within the UK and part of the North Atlantic.
- NATS (Services) Ltd (NSL) — the unregulated part of the business which provides air traffic control services at 15 of the UK's major airports. NSL Ltd also includes a number of subsidiary companies.

NATS Holdings Ltd has authority to implement its Environment Policy within NERL and NSL.

NATS also has joint ventures:

- ***AQUIL***A Air Traffic Management Services where there is 50% ownership. Aquila is a joint venture between NATS and Thales to deliver Project Marshall, a programme initiated by the Ministry of Defence.
- FerroNATS where there is 50% ownership. FerroNATS is a joint venture between NATS and Ferrovila Servicios to deliver air traffic navigation services to 10 airports across Spain.

NATS Holdings Ltd does not have authority to implement its Environment Policy within AQUILA and FerroNATS. However, AQUILA's office is co-located at NATS head office and is included in energy and environmental performance reporting.

The same operational control approach at the legal structure level shall be applied at the facility level in order to define responsibility for energy and environmental performance within facilities. NATS is therefore responsible for reporting energy and environmental performance that occur within facilities over which NATS or one of its operations has the full authority to introduce and implement its Environment Policy.

NATS Holdings Limited's estate portfolio includes freehold title, rental, lease, service agreements or licences, which includes the provision of a contract service at a number of locations. All freehold sites are included in scope, unless they are sub-let, as well as leasehold sites where NATS has operational control. The estate portfolio includes control centres, airports, offices and warehouses, as well various types of remote communication, navigation and surveillance sites — some of which are co-located.

Under the operational control approach, fuel combustion, process and fugitive emissions from all sites under our control should be categorised as Scope 1 and GHG emissions from consumption of purchased electricity are categorised as Scope 2. Exclusions are listed in the next section.

NATS owns vehicles (mainly for transport, logistics or engineering purposes) and leases vehicles (allocated and pool vehicles mainly for engineering purposes) using providers such as Arval, Inchcape and Volkswagen. Under the operational control approach, fuel combustion for these vehicles are categorised as Scope 1. Additional benefit cars and those from the Zenith salary sacrifice car scheme are considered not under NATS control and are therefore not included in Scope 1.

2.2 Operational Boundary for NATS' GHG Reporting

Category	GHG Source	
Scope 1 (Direct)	— On site natural gas combustion *(where NATS or one of the operating entities it is responsible for contracts directly with the energy supplier)*	
	— Gas oil (including red and white diesel and heating oil) combustion *(where NATS or one of the operating entities it is responsible for contracts directly with the energy supplier)*	
	— Road fuel combustion *(where NATS or one of the operating entities it is responsible for contracts directly with the vehicle supplier)*	
	— Fugitive emissions *(where NATS or one of the operating entities it is responsible for contracts directly with the refrigerant supplier)*	
Scope 2 (Energy indirect)	— Electricity consumption *(where NATS or one of the operating entities it is responsible for contracts directly with the energy supplier)*	

2.3 Materiality threshold

NATS has adopted a 5% materiality threshold at the gross organisational level. This means that energy and environmental performance data reasonably estimated to not cumulatively equal more than 5% of the category figure (i.e. individual categories of scope 1 emissions, scope 2 emissions and water consumption) for NATS Holdings Ltd can be regarded as immaterial to intended users and excluded.

3. Methodology for calculating scope 1 and 2 emissions and water consumption (Estate)

3.1 GHG Protocol

NATS follows the most common approach to calculating GHG emissions from emission sources, which is to take activity data (e.g. units of electricity consumed or distance travelled) and multiply it by an emission factor which gives an estimate of the GHG emissions figure.

$tC0_2e$ = Activity Data x Emission Factor

NATS uses the UK Government GHG Conversion Factors in order to convert activity data into tCO_2e.

These are updated annually by Defra/DECC and are available online here:
www.ukconversionfactorscarbonsmart.co.uk

For the current reporting year (1st April 2016–31st March 2017) the 2016 Defra/DECC emission factors have been used.

3.2 Exclusions

NATS has chosen to adopt a complete and transparent approach that appropriately reflects the, energy and environmental performance of the company, and serves the decision-making needs of users, both internal and external to NATS, and therefore a list and justification of specific exclusions are outlined below:

Scope 1 GHG emissions:

- Natural gas supplied at the Corporate & Technical Centre is also used by the Joint Venture AQUILA ATMS, as it is co-located at this site. However it is not sub-metered. Therefore while Joint Ventures are out of scope, the proportion associated with AQUILA ATMS usage has not been removed from NATS Holdings Ltd scope 1 GHG emissions.
- NATS operate two biomass boilers, the scope 1 emissions for these have been excluded from reporting.

Scope 2 GHG emissions:

- Electricity supplied at the Corporate & Technical Centre is also used by the Joint Venture AQUILA ATMS, as it is co-located at this site. However it is not sub-metered. Therefore while Joint Ventures are out of scope, the proportion associated with AQUILA ATMS usage has not been removed from NATS Holdings Ltd scope 2 GHG emissions.
- It shall be assumed that electricity generated at four sets of on-site Photo Voltaic panels is used to supplement NATS' energy usage and not exported to the grid.

Water consumption:

- Limited sites are billed on rateable value (RV) rather than metered consumption and are not included in scope but are considered de minimus.

3.3 Estimations & Assumptions

NATS seeks to use primary data to calculate emissions wherever possible, however, in some cases data may not be available or of sufficient quality (e.g. due to lack of measurement capability, equipment replacements, equipment failures or billing issues) in which case secondary data, such as proxy data and extrapolation, will be used.

Estimation techniques are prioritised based on primary data and proxy data. For example, the vast majority of energy and environmental data is based on primary evidence, e.g. monthly invoices from utility providers. Depending on the utility provider's invoice scheduling and our third party verifier's checking, there may be periods towards the end of the financial year where accruals have to be estimated, for example if a water utility provider estimates usage and bills quarterly.

Where there is a full month gap in primary evidence, the equivalent period in the year previous will be used to estimate the accrual, or if not available, the equivalent period of the most recent actual data is used to estimate the accrual.

Where there is a partial month gap in primary evidence, an average of the previous 6 months actual data is used to replace that partial month data in its entirety. Where the previous 6 months includes unrepresentative data, e.g. due to missing data, a rebate, or some other identifiable material change above/below expected consumption, the months containing that unrepresentative consumption are excluded from the average used to fill the substantive partial month gap.

For new acquisitions, accruals are estimated based on a comparable site, where supplier estimates from previous tenants are unavailable.

3.4 Detailed methodology for assured environmental performance metrics

The table below indicates the methodology for the calculation of environmental performance metrics subject to external assurance. For each metric we have provided an overview of the following:

Source	Methodology
SCOPE 1: Natural Gas	Data measurement and recording Natural gas combustion is measured through the natural gas meters included within NATS' operational boundary. NATS receives invoices from the suppliers based on actual meter reads or estimate reads. The invoice data is collected by TEAM (Energy Auditing Agency) Ltd on behalf of NATS using their proprietary billing validation system (TEAM Sigma). The kilowatt hours of natural gas used on site, as recorded on the invoices, are captured on the TEAM Sigma system. Manual meter readings are taken for some manned sites and are submitted to NATS FM Systems team via email. Manual meter reads are not used for greenhouse gas reporting but are used to query anomalous billing. GHG emissions quantification NATS uses the UK Government GHG Conversion Factors for the relevant reporting period (2016 emission factor) in order to convert activity data in KWH into tCO_2e. Emissions from on-site natural gas combustion where NATS has operational control are classified as Scope 1 emissions.

Source	Methodology
SCOPE 1: On-site fuel combustion	Data measurement and recording Other fuel usage data such as gas oil or diesel used in machinery or in buildings is captured through invoices. This data is reported based upon the quantities and types of fuel delivered during the reporting period and it is assumed that all fuel that is delivered is combusted. It is assumed that electricity generated from oil usage is only used by NATS and not exported to the grid. GHG emissions quantification NATS uses the UK Government GHG Conversion Factors for the relevant reporting period (2016) in order to convert activity volume data into tCO_2e. Emissions from fuel combustion on sites where NATS has operational control are classified as Scope 1 emissions.

Source	Methodology
SCOPE 1: Road vehicle fuel combustion	Data measurement and recording Liquid fuel combustion (diesel and petrol) within owned and leased company cars (both deemed to be 'controlled' by NATS) is measured and recorded using both the company expenses system and a fuel card system provided by Arval, as well as through Europcar. Some data is recorded in miles and some data is recorded in litres of fuel. GHG emissions quantification NATS uses the UK Government GHG Conversion Factors for the relevant reporting period in order to convert activity data (miles or litres) into tCO2e. Where the car type and fuel type is known, a specific emission factor relating to these will be used. Where the car type and fuel type is unknown, an average car unknown fuel emission factor is used. Emissions from road vehicle fuel combustion in both owned and leased vehicles are classified as Scope 1 emissions.

Source	Methodology
SCOPE 1: Fugitive emissions	Data measurement and recording Fugitive emissions data is collected for all sites where we have operational control. Refrigerant gas losses are recorded in f-gas logs for each refrigerated assets as required by the F-Gas regulations. GHG emissions quantification NATS uses the UK Government GHG Conversion Factors for the relevant reporting period (2016) in order to convert activity data (litres) into tCO2e. Specific emission factors are used for specific refrigerant gases. Fugitive emissions are categorised as Scope 1.

Source	Methodology
SCOPE 2: Electricity consumption – Location based method	Data measurement and recording Electricity consumption is measured through the electricity meters included within NATS' operational boundary. NATS has partnered with Siemens Metering Services and now has automatic meter reader (AMR) technology installed across the majority of sites. Manual electricity meter reads for non-AMR sites are obtained when required and passed onto the supply company as required for billing. NATS receives invoices from the suppliers based on actual meter reads or estimate reads. The invoice data is collected by TEAM (Energy Auditing Agency) Ltd on behalf of NATS using their proprietary billing validation system (TEAM Sigma). The kilowatt hours of electricity used on site, as recorded on the invoices, are captured on the TEAM Sigma system. Manual meter readings are taken for some manned sites and are submitted to NATS FM Systems team via email. Manual meter reads are not used for greenhouse gas reporting but are used to query anomalous billing. GHG emissions quantification NATS uses the UK Government GHG Conversion Factors for the relevant reporting period (2016) in order to convert KWH activity data into tCO_2e under the location based method.

Source	Methodology
Water Consumption	Data measurement and recording Water data is collected through water meters included within NATS' operational boundary. NATS receives invoices from the suppliers based on actual meter reads or estimate reads. The invoice data is collected by TEAM (Energy Auditing Agency) Ltd on behalf of NATS using their proprietary billing validation system (TEAM Sigma). The volume of water used on site, as recorded on the invoices, are captured on the TEAM Sigma system. Limited sites are billed on rateable value (RV) rather than metered consumption and are not included in scope but are considered de minimus. Water consumption quantification NATS records water consumption in cubic metres (m^3) as recorded on invoices from third party providers.

3.5 Errors & restatements

At the end of the financial year, accruals are estimated where invoices have not been received for each category of energy and environmental data. The accrual estimates are replaced by actuals as those invoices are received and processed after the year-end figures have been verified and assured. If there is a material difference in activity data, the figures will be restated in the following year's mainstream report, still using the appropriate emission factors for the year which the restated data relates to. Similarly, if errors are discovered and are material, the data will be restated in the mainstream report.

3.6 Market based emissions calculations

We have been unable to obtain comprehensive evidence from our utility suppliers to meet the GHG Protocol Scope 2 Quality Criteria for market based emissions reporting. As a result, the location based residual conversion factors have been applied to our Scope 2 emissions data to calculate market based emissions. This provides an identical market and location based Scope 2 emissions total. For this reason, only a single scope 2 total has been reported.

4. Methodology for calculating modelled enabled ATM related CO_2 emissions reduction (Airspace)

4.1 Acknowledgements

Aviation CO_2 emissions data is prepared using the Base of Aircraft Data (BADA) models and data. This product has been made available by the European Organisation for the Safety of Air Navigation (EUROCONTROL). All rights reserved.

4.2 Principles of NATS' CO_2 impact assessments

NATS' focus for environmental benefit analysis is to identify 'enabled benefits'[1]. Enabled benefits are those attributable to changes in NATS' procedures of operation (for example the introduction of more efficient routes). The majority of enabled savings are calculated by comparing the new flight procedures/plans versus the old procedure/plans and are based on flight plans rather than the actual track flown. In doing so the metric aims to reflect the improvements NATS is able to implement in its provision of airspace structure and operating procedures to airlines.

A portion of enabled savings take into account 'tactical' changes such as controllers facilitating more direct routes through the current structure of controlled airspace, and actual aircraft movement data (e.g. in the assessment of changes in taxi-time performance).

NATS uses a number of data sources to undertake these assessments. The primary sources are:

- Central Flow Management Unit (CFMU) flight plan data, sourced from Eurocontrol and stored in NATS' data warehouse
- Radar data, sourced from NATS' radar network and stored in the NATS data warehouse
- Airspace data, covering routes and navigation points, sourced from the CFMU and stored in the NATS data warehouse.

Aviation CO_2 emissions data is prepared using the Eurocontrol Base of Aircraft Data (BADA) models and data. This is the international standard for aircraft performance and fuel burn modeling. NATS uses a fuel:CO_2 ratio of 1:3.18, this is the ratio specified by NATS' regulator (the Civil Aviation Authority)[2].

Fuel uplift is fuel which is burned merely to carry other fuel. For example, an airspace change may save 50kg of fuel per flight, but extra fuel would have been uploaded and burned merely transporting that 50kg until it was burned. NATS has analysed the relationship between distance flown and the percentage of fuel uplift using flight planning software and found it to be linear. NATS uses this linear relationship to calculate the percentage of fuel uplift which should be applied to fuel savings based on the distance flown from the origin airport to the end of the procedural change that is being quantified.

4.3 ATM CO_2 emissions baseline

Estimates of the CO_2 emissions that resulted from the operation of aircraft handled by NATS in 2006 were generated so that NATS can track its progress towards a March 2020 target of reducing ATM related CO_2 emissions by 10% on average per flight[3]. This information demonstrated the performance towards this target through the separate assessment of the three forms of NATS operations, namely:

- Ground movements at UK airports where NATS provides a tower service
- UK domestic airspace (London and Scottish Flight Information Regions)
- NATS' North-Atlantic operations (Shanwick sector)

1 CO_2 emissions WG Steering Group meeting output

2 CAP 725 Airspace Change Process Guidance Document

3 OA1010: CO_2 Performance: Comparison of CO_2 Emissions from 2006 to 2009

4.4 NATS Environmental Toolset

NATS has implemented the BADA aircraft performance and fuel models in an in-house toolset called NEMO (NATS Environmental Model). NEMO is used to calculate fuel burn for all aircraft trajectories held within the NATS data warehouse.

To make comparisons between a current procedural profile and a proposed procedural profile (for example for Airspace Efficiency Database), NATS has also created a Profile Generating Tool that uses the BADA aircraft performance data to generate 4D flight profiles. NEMO is also used to calculate the fuel burn for these simulated procedural profiles.

NEMO calculates the fuel using: altitude; speed; aircraft type; phase of flight (i.e. cruise, climb or descent); and aircraft mass. NEMO uses these inputs combined with the BADA performance models to calculate the mean fuel flow for each radar point.

Simulated trajectories, from the Profile Generating Tool, are defined by a series of 'flight legs' — sections of the flight profile for which the height, speed and phase of flight of the aircraft is constant. NEMO uses the same inputs (altitude, speed, aircraft type, phase of flight, aircraft mass) and BADA performance models and calculates the fuel flow for each flight leg.

4.5 Governance

As part of NATS' Environmental Management System (certified to ISO14001), a suite of policies, standards and controls are in place to manage its environmental impacts. This includes an Environmental Performance Moderation Panel (EPMP) which provides oversight for the basis of reporting aviation fuel/CO_2 savings.

4.6 Operational changes assessed

On an ongoing basis NATS operates a number of different project types which contribute to the enabled savings through planned and tactical changes.

Airspace Efficiency Database (AED) changes are small-scale proposed changes that relate to routings or level restrictions, usually developed by controllers at NATS' units. For example, a minor re-definition of a high-level route to remove a dog-leg, or raising a standing agreement level for traffic to improve fuel efficiency. The methodology for calculating the change in fuel burn is to compare the current planned route to the proposed planned route. NATS enables fuel benefits through AEDs by making changes to the airspace structure, within controlled airspace. As such the enabled savings performance reported is based on changes to planned routes. The metric is not designed to validate emission reductions based on actual flight routes taken.

Arrivals and departures to and from airfields are most fuel efficient if aircraft can perform continuous climbs and descents (termed CCOs and CDOs). NATS enables improvements in this performance through engagement at a strategic level with airlines and airports providing data on achievement levels to target improved performance. NATS' controllers also enable improved performance in their day-to-day control and through provision of distance-to-run information to pilots.

Fuel burnt whilst taxiing between stands and the runway at airports (taxi-time) can be reduced by initiatives to reduce ground holding times. NATS seeks to minimise taxi-times at the airfields it operates a service at and so includes any changes in this ground fuel use in the annual assessments.

At Heathrow Airport, the Department for Transport recognises that arrival demand may exceed capacity and NATS is permitted to employ Tactically Enhanced Arrival Measures (TEAM) which allow aircraft to land on the designated departure runway to reduce stack-holding delay. NATS optimises TEAM operations to reduce this delay and its associated fuel burn.

4.7 CO_2 assessment methodologies

The initiatives which contribute to the CO_2 enabled benefit claim for the financial year 2016–17 are from small-scale projects and tactical improvements including: Airspace Efficiency Database (AEDs), Flexible Use of Airspace (FUA), changes to continuous climb and descent (CCO/CDO), taxi-time changes, and TEAM.

For all changes that can affect airline flight planning, the benefit to fuel uplift is also calculated and claimed.

4.8 Airspace Efficiency Database

Description of change

The changes assessed during the 2016/17 financial year were:

- Route changes
- Level restriction changes
- SID truncations.

Methodology

The methodology is to compare the current) flight procedures/ plan to the proposed (or scenario) flight procedures/plan. The NATS data warehouse is used to identify the total number of aircraft per year that would be affected by the change.

A summary of the methodology is:

- Extract traffic that would be affected by the route/level change for the most recent complete calendar year from the BI Data Warehouse
- Obtain the current flight procedures and create 'scenario' procedures for each aircraft type
- Calculate the fuel of the current procedures and scenario procedures for each aircraft type
- Calculate the total enabled benefit by summing the (benefit) × (annual number of aircraft) over all aircraft types
- Calculate the additional fuel uplift benefit.

A Standard Instrument Departure (SID) truncation is a special case of AED change where the length of the SID is reduced to a point commensurate with final SID level restriction. SID truncation analysis is a specific variant of AEG analysis because there is variation in the method by which airlines flight plan for SIDs. NATS engaged with the airlines and sought agreement on what fuel benefits should be claimed by NATS through the SID truncation programme. It was agreed that, since ~50% of carriers historically fuel plan for the entire SID, then 50% of the benefit (which is calculated across all airlines) should be claimed. Therefore, the full procedure versus procedure benefit is calculated in line with the standard AED methodology, but only half of this is claimed as the enabled saving.

Data and Models used

- Data source: Flights in NATS data warehouse
- Data sample: All flights that used the route in the most recent calendar year
- Tools: NEMO and NATS Profile Generator
- Models: BADA aircraft performance and fuel models as contained in NEMO; NATS fuel uplift equation.

4.9 Continuous Climb and Descent

Description of change

NATS has a number of initiatives targeted at improving the number of arrivals and departures to and from airfields which achieve continuous climbs and descents (CCOs and CDOs). These include provision of CDO performance data to industry partners through the UK Sustainable Aviation coalition and on-going operational emphasis on delivery of efficient profiles. Changes in performance, and the resulting impact on fuel burn, are captured in NATS' annual assessment.

Methodology

A summary of the methodology is:

- The radar data within NATS data warehouse is queried to identify whether climbs and descents out of and into airfields are continuous or whether a level-off occurs.
- Continuous climbs are generally measured up to 10,000 ft and continuous descents are measured from variable altitudes which take into account the configuration of airspace around the airfield.
- The fuel benefit based on the fuel difference between a typical CCO/CDO versus a non-CCO/CDO with a 5 nautical mile level-off for the most frequent aircraft type at the airfield in question.
- Year on year comparisons can be either positive i.e. fuel saving benefit, or negative i.e. fuel saving dis-benefit and are recorded accordingly.

Data and Models used

- Data source: Flights in NATS data warehouse.
- Data sample: All flights in the financial year at each of the NATS-controlled airfields.
- Tools: NEMO and NATS Profile Generator.
- Models: BADA aircraft performance and fuel models as contained in NEMO.

4.10 Taxi-time

Description of change

NATS seeks to improve taxi-time performance (incorporating ground holding) at each of the airfields where it provides control through day-to-day emphasis on performance. Changes in performance year-to-year are monitored and captured in annual assessments.

Methodology

A summary of the methodology is:

NATS data warehouse contains records from the airports' electronic flight strips (EFPS) which record the instructions which controllers give to aircraft. The average arrival taxi-time is calculated as the difference between the touch down and arrival at the stands. The average departure taxi-time is calculated as the time between push-back from the stand and the line-up at the runway.

The yearly fuel burn change at each airport is calculated by multiplying:

- Average ground fuel burn
- The change in taxi time from the previous year
- The number of movements.

Year on year comparisons can be either positive i.e. fuel saving benefit, or negative i.e. fuel saving dis-benefit and are recorded accordingly.

Data and Models used

- Data source: Flights in NATS data warehouse.
- Data sample: All flights in the financial year at each of the NATS-controlled airfields with EFPS.
- Tools: No bespoke tools.
- Models: BADA aircraft performance tables.

4.11 Tactically Enhanced Arrival Measures (TEAM)

Description of change

NATS seeks to optimise the use of TEAM operations when permitted at Heathrow. Changes in performance year-to-year are monitored and captured in annual assessments.

Methodology

A summary of the methodology is:

- NATS data warehouse is used to identify the number of TEAM arrivals per hour i.e. flights that landed on the designated departure runway.
- The average stack holding time in these hours is also calculated from records in the data warehouse.
- The total number of minutes of stack holding saved as a result of TEAM is then estimated by multiplying the average holding time by the number of TEAM arrivals.
- The total number of minutes saved is multiplied by the average stack fuel burn to give to total amount of fuel saved in the year.
- Year on year comparisons can be either positive i.e. fuel saving benefit, or negative i.e. fuel saving dis-benefit and are recorded accordingly.

Data and Models used

- Data source: Flights in NATS data warehouse.
- Data sample: All Heathrow arrivals in the financial year.
- Tools: No bespoke tools.
- Models: BADA fuel models as calculated by in NEMO and stored in the data warehouse.

4.12 Exclusions

Flexible Use of Airspace operations in 2016-17 and the PC Upper Airspace project is excluded from this analysis and assurance due to incomplete data at the time of preparation.

Find out more on: www.nats.aero/environment