# GHG report

## Basis of reporting for NATS' airspace, energy and environmental performance data 2019-20

NATS

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# 1. Introduction

## 1.1. Purpose

This document details the greenhouse gas (GHG) collection, conversion and reporting process used to report our annual GHG emissions. The scope of this report includes both conventional estate related environmental and energy metrics, as well as modelled enabled Air Traffic Management (ATM) related $CO_2$ emission performance. GHG emission data is prepared and reported with reference to the World Resources Institute's (WRI) Greenhouse Gas Protocol (GHG Protocol) Corporate Standard and ISO 14064:2018.

## 1.2. Scope of verification

The extent of verification is set out in Table 1 below. NATS considers all sources of emissions to be significant unless stated in the table below.

| Scope and category | Verified to reasonable level of assurance | Verified to limited level of assurance | Not verified | Not reported | Risk assessment based justification of why not reported |
|---|---|---|---|---|---|
| Scope 1: direct | | | X | | |
| Scope 2: location based | | | X | | |
| Scope 2: market based | | | X | | |
| Scope 3 | | | | | |
| 1: Purchased goods & services | | | X | X | Not reported at this time |
| 2: Capital goods | | | X | X | Not relevant to NATS operations |
| 3: Fuel and energy related activities | | | X | X | Not reported at this time |
| 4: Upstream transportation & distribution | | | X | X | Not reported at this time |
| 5: Waste generated in operations | | | X | X | Complete data unavailable (insignificant emission source below 1% of total) |
| 6: Business travel | | | X | X | Not reported at this time |
| 7: Employee commuting | | | X | X | Not reported at this time |
| 8: Upstream leased assets | | | X | X | Complete data unavailable. This is an area undergoing work. |
| 9: Downstream transportation and distribution | | | X | X | Not relevant to NATS operations as a service provider. |
| 10: Processing of sold products | | | X | X | Not relevant to NATS, as a service provider, we do not have physical products that require end of life treatment. |
| 11: Use of sold products and services | | | X | | |
| 12: End-of-life treatment of sold products | | | X | X | Not relevant to NATS operations |
| 13: Downstream leased assets | | | X | X | Not relevant to NATS operations |
| 14: Franchises | | | X | X | Not relevant to NATS operations |
| 15: Investments | | | X | X | Outside of operational control |
| Scope 4: avoided | | | X | | |

**Table 1 - Scope of verification of GHG emissions in 2019-20**

## 1.3. GHG disclosure policy statement

To guarantee that the GHG assertion held within the annual GHG disclosure is a true and fair account, the principles of relevance, completeness, consistency, transparency and accuracy shall be applied.

- Relevance: Ensure the GHG inventory appropriately reflects our GHG emissions 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 we contribute to and are 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 GHG emission 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 emissions 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. The quantification of GHG emissions shall systematically neither over nor under actual GHG emissions, 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 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.

We therefore are committed to:

- Subjecting the chosen inventory boundary to regular internal review;
- Continual improvement and update of our policies and procedures to ensure they meet and comply with changes to the GHG Protocol and best practice GHG reporting;
- Regular re-assessment of GHG emission sources or development of action plans to identify and address gaps in data;
- Management of systematic processes to ensure that it meets all relevant provisions within the GHG Protocol standards;
- Inclusion of all relevant GHG emissions, as appropriate, and enable meaningful comparisons in GHG information;
- Disclosure of sufficient and appropriate GHG information to allow intended users to make decisions with reasonable confidence;
- Recording, management and reporting of reliable and timely GHG information;
- The reduction of bias and uncertainties as far as is practical;
- Appropriate levels of independent verification and/or assurance.

# 2. Reporting requirements

## 2.1. Description of NATS

NATS is the main air navigation service provider in the United Kingdom (UK). NATS provides en-route air traffic control services to flights within the UK Flight Information Regions and the Shanwick Oceanic Control Area in the North Atlantic, and provides air traffic control services to airports in the UK and Gibraltar.

## 2.2. Person responsible for GHG reporting

The Head of Sustainable Operations is responsible for reporting GHG emissions resulting from our operations. Management, governance and oversight of scope 1, 2, 3 and 4 emissions are provided by a technical Environmental Performance Moderation Panel and a Benefits Delivery Panel, with additional oversight provided by the Board audit committee and an Executive sub-committee (Environmental Strategy Steering Group).

## 2.3. Competency & training

GHG emissions inventory management is led by the Sustainable Operations team, with close support from Facilities Management, Analytics, Finance, Supply Chain, Internal Audit and other teams, who have relevant experience in GHG emissions calculations, reporting and assurance. Subject matter experts are responsible for individual areas of activity and coordination is managed by a single person reporting to the Head of Sustainable Operations.

Training requirements are kept under regular review as part of annual appraisals and internal management review. The implementation of the GHG Protocol was supported by external training.

## 2.4. Report period covered

This document specifies our methodology for the preparation of airspace, energy and environmental performance data in the Annual Report & Accounts (AR&A) for the reporting period 1st April 2019 – 31st March 2020. Due to the impacts of Covid-19 on our business, we delayed publication of this report until November 2020.

## 2.5. Base year (and recalculations)

Although we have been actively collecting and monitoring performance data since 2006, for the purposes of the ISO14064 verification, 1st April 2017 – 31st March 2018 was the first year that we undertook full data verification and is therefore the base year, generated in accordance with ISO14064-1. See appendix 6.1 for 2017-18 (base year) GHG emission statement.

Every effort is made to ensure that data we report is accurate. However, should more accurate data become available for prior years we will restate it if it results in a movement of at least 5% in the reported data. When this is done, details will be provided in the data notes supporting the reported data. If a new emissions source is included prior year annual figures will be restated, as per the GHG Protocol.

We may restate $CO_2e$ emissions even when there is no change in consumption data, due to corrections to the emissions factors provided by Defra. There are no such changes in 2019-20.

For ATM emission data, any changes to increase accuracy will be restated with accompanying support notes.

## 2.6. Organisational boundary

We apply the operational control method in order to consolidate our organisational boundary in each reporting year.

At the legal structure level, it is considered that we have operational control over an operating entity if we or one of our subsidiaries has the full authority to introduce and implement our 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 and other services at 21 civil and military airfields across the UK and Gibraltar. NSL Ltd also includes a number of subsidiary companies.

NATS Holdings Ltd has authority to implement its environment policy within NERL and NSL.

We also have joint ventures (AQUILA Air Traffic Management Services) and FerroNATS, with a 50% ownership in each. NATS Holdings Ltd does not have authority to implement our environment policy within AQUILA and FerroNATS. However, AQUILA's office is co-located within our 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. We are therefore responsible for reporting energy and environmental performance that occur within facilities over which we or one of our operations has the full authority to introduce and implement our 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 we have 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.

We own 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 or Zenith salary sacrifice car scheme are considered not under our control and are therefore not included in scope 1.

## 2.7. Documentation control

All GHG related records are stored on SharePoint which are subject to document control and tracking.

# 3. GHG emission statement

| Emission source | | 2019-20 emissions ($tCO_2e$) | kg $CO_2e$ | kg $CO_2e$ of $CO_2$ per unit | kg $CO_2e$ of $CH_4$ per unit | kg $CO_2e$ of $N_2O$ per unit |
|---|---|---|---|---|---|---|
| Scope 1 emissions | Direct emissions from combustion of natural gas (biomethane) | 2 | 2,483 | - | - | - |
| | Direct emissions from combustion of road vehicle fuel | 190 | 189,570 | 188,203 | 163 | 1,188 |
| | Direct emissions from combustion of stationary assets (e.g. oil boilers, back-up generators) | 439 | 438,870 | 433,454 | 466 | 4,950 |
| | Fugitive emissions | 675 | 675,419 | - | - | - |
| Total scope 1 emissions (market based) | | 1,306 | 1,306,342 | 621,657 | 629 | 6,138 |
| Total scope 1 emissions (location based) | | 3,477 | 2,791 | 270 | 3,467 | 7,320 |
| Scope 2 emissions (location based) | Emissions from generated electricity usage | 15,301 | 15,301,063 | 15,180,139 | 38,911 | 82,013 |
| Scope 2 emissions (market based) | Emissions from generated electricity usage | 1,064 | - | - | - | - |
| Total scope 1 and 2 (location based) emissions | | 18,779 | 18,778,555 | 17,971,409 | 42,378 | 89,333 |
| Total scope 1 and 2 (market based) emissions | | 2,370 | - | - | - | - |
| Intensity metric | Total scope 1+2 (location based) emissions (tCO2e) per £m revenue | 21.0 | - | - | - | - |
| Intensity metric | Total scope 1+2 (market based) emissions (tCO2e) per £m revenue | 2.7 | - | - | - | - |
| Intensity metric | Total scope 1+2 (location based) emissions (tCO2e) per FTE employee | 4.0 | - | - | - | - |
| Intensity metric | Total scope 1+2 (market based) emissions (tCO2e) per FTE employee | 0.5 | - | - | - | - |
| Intensity metric | Total scope 1+2 (location based) emissions (tCO2e) per flight handled | 0.007 | - | - | - | - |
| Intensity metric | Total scope 1+2 (market based) emissions (tCO2e) per flight handled | 0.001 | - | - | - | - |
| Scope 3 emissions | Category 11<br>Emissions from use of sold products or services (i.e. ATM related CO2 emissions) | - | - | 24,405,000 | - | - |
| | UK territorial / domestic aviation CO2 emissions for net zero reporting | | | 1,069,000 | | |
| Scope 4 emissions | Modelled enabled ATM related CO2 emission reduction | - | - | 30,737 | - | - |

**Table 2 - GHG statement quantified separately for each type per unit**

# 4. Scope 1, 2 and 3 (selected) emissions

## 4.1. Emission factors

For scope 1, scope 2 and selected scope 3 GHG emissions, we follow 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

We use the UK Government GHG conversion factors in order to convert activity data into $tCO_2e$. These are updated annually by the Department for Business, Energy & Industrial Strategy and are available online here. For the current reporting year (1$^{st}$ April 2019–31$^{st}$ March 2020) the 2019 emission factors have been used.

We have used the Global Warming Potential (GWP) conversion factors: 1 for $CO_2$, for 28 $CH_4$ and 265 for $N_2O$.

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

## 4.2. Methodology for calculating scope 1 emissions

| Source | Data measurement and recording | GHG emissions quantification | Estimates and assumptions |
|---|---|---|---|
| Natural gas (biomethane) | Biomethane is procured by NATS centrally.<br><br>Gas combustion is measured through the gas meters included within NATS' operational boundary. NATS receives invoices from the suppliers based on actual meter reads or estimate reads.<br><br>The invoice data is collected by TEAM (Energy Reporting Company) 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.<br><br>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. | NATS uses the UK Government GHG conversion factors for bioenergy for company reporting (2019) in order to convert activity data in kWh into $tCO_2e$.<br><br>Emissions from on-site biomethane combustion where NATS has operational control are classified as scope 1 emissions. | 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.<br><br>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.<br><br>**Estimates**<br>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.<br><br>Estimation techniques are prioritised based on primary data and proxy data.<br><br>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.<br><br>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.<br><br>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.<br><br>For new acquisitions, accruals are estimated based on a comparable site, where supplier estimates from previous tenants are unavailable<br><br>Gas cylinders for BBQ's. A small number of gas cylinders may be used in a year at NATS' head office for outdoor food preperation. The emissions from these have not been captured but are considered to be de minimis. |
| On-site fuel combustion | Fuel usage data such as gas oil or diesel used in machinery or in buildings is captured through invoices. It is assumed that all fuel that is delivered is combusted.<br><br>Many of the remote sites that are fitted with back-up generators consume low levels of oil and often have no reports of oil consumption in any particular reporting period. Metering of remote site back up generation has been | NATS uses the UK Government GHG conversion factors for company reporting (2019) in order to convert activity volume data into $tCO_2e$.<br><br>Emissions from fuel combustion on sites where NATS has operational control are classified as scope 1 emissions. | It is assumed that electricity generated from oil usage is only used by NATS and not exported to the grid.<br><br>It is possible that welding does occur on NATS sites. Currently the emissions from this activity are not captured. It is considered that the emissions from this activity is *de minims*, but efforts will be made to obtain this activity data in future reporting years. |

| | | |
|---|---|---|
| | considered but is not considered to be cost effective.<br><br>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. | |
| Fugitive emissions | Fugitive emissions data is collected for all sites where we have operational control.<br><br>We use two contractors to maintain the asset register information of the equipment containing refrigerant gases across our sites. This includes information about the equipment type, the charge capacity and the refrigerant type.<br><br>Details of refrigerant 'top-ups' during the reporting period are captured on record sheets used for compliance with the EU F Gas Regulations which are consolidated into F-Gas Log Sheets. | NATS uses the UK Government GHG conversion factors for the relevant reporting period (2019) in order to convert activity data (kg) into the component greenhouse gasses.<br><br>Specific emission factors are used for specific refrigerant gases. |
| Road vehicle fuel combustion | Liquid fuel combustion (diesel and petrol) within owned and allocated (lease fully paid and controlled by NATS) company cars (both deemed to be 'controlled' by NATS) is measured and recorded using both the company expenses system and a fuel card system | NATS uses the UK Government GHG conversion factors for the relevant reporting period (2019-20) in order to convert activity data (KM) into GHG emissions.<br><br>Where the car type is known, a specific emission factor relating to these will be used. Where the car type and fuel type are unknown, an average car unknown fuel emission factor is used.<br><br>Emissions from road vehicle fuel combustion in both owned and leased vehicles are classified as scope 1 emissions where mileage is conducted for business use. |

## 4.3. Methodology for calculating scope 2 emissions

| Source | Data measurement and recording | GHG emissions quantification | Estimates and assumptions |
|---|---|---|---|
| **Electricity consumption-Location based method** | Electricity consumption is measured through the electricity meters included within NATS' operational boundary.<br><br>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.<br><br>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.<br><br>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. | NATS uses the UK Government GHG conversion factors for the relevant reporting period (2019-20) in order to convert KWH activity data into $tCO_2e$ under the location-based method. | Electricity supplied at NATS' head office 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.<br><br>Electricity generated at four sets of on-site Photo Voltaic panels is used to supplement NATS' energy usage and not exported to the grid.<br><br>Estimates<br>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.<br><br>Estimation techniques are prioritised based on primary data and proxy data.<br><br>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.<br><br>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.<br><br>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.<br><br>For new acquisitions, accruals are estimated based on a comparable site, where supplier estimates from previous tenants are unavailable. |
| **Electricity consumption-Market based method** | Same as for location based.<br><br>Certified renewable electricity is procured by NATS centrally for almost all sites. | An emissions factor of zero has been applied to renewable electricity tariffs and the DEFRA residual UK grid average factor has been applied to the non-renewable electricity tariffs.<br><br>Where the electricity contract has a published $CO_2e$ factor this has been applied to the associated consumption from that contract.<br><br>Where the electricity contract does not provide a suitable factor the residual UK factor has been applied. | |

This is in accordance with the market-based hierarchy detailed in the GHG Reporting Protocol.

## 4.4. GHG inventory quality management & calibration requirements

NATS has no calibration duties.

| Emission source | Quality management process | Uncertainties and calibration requirements |
|---|---|---|
| Electricity, gas and water data | TEAM (Energy Auditing Agency) Ltd performs an on-going validation process on electricity, gas and water data which is designed to highlight:<br>• Meters without data when data is expected<br>• Meters where invoiced and AMR data do not align<br>• Meters where consumption variance outside of tolerance<br>• Meters where Year on Year variance is outside of tolerance<br><br>The validation results in queries being generated directly with suppliers. Where necessary queries will be address to the NATS FM Systems team to validate discrepancies identified. This is an on-going process which results in a monthly query report. | Gas<br>As Swanwick (one of our major sites) is included in the EU Emissions Trading Scheme, we feel it appropriate that the principles (detailed below) are followed with respect to statements of our overall uncertainty.<br><br>As a "low emitter" [from the consumption of gas], there is a principle described on page 57 of the document "European Union Emissions Trading System (EU ETS) Phase III: Guidance for installations" to assume all gas metering has an accuracy class of 1.5 and therefore to adopt 6% as its Maximum Permissible Error in Service (MPES) for gas consumption.<br><br>Electricity<br>For the consumption of electricity in the UK, "The Meters (Certification) Regulations 1998" [21] state that: The permitted margins of error shall be an error not exceeding + 2.5 %. or -3.5% at any load at which the meter is designed to operate |
| On-site fuel combustion | The NATS Finance team check the fuel invoicing as part of the standard financial internal audit process.<br><br>In addition, the fuel combustion data is checked via both internal and external audit at the Swanwick site (the largest consumer of fuel) which is included within the EU-ETS. | Under EU ETS guidance, gas oil has a 0.5% uncertainty for commercially delivered fuels. We have adopted this uncertainty figure due to Swanwick being in the EU ETS and is our largest consumer of on-site fuel. |
| Fugitive emissions | NATS completes regular compliance audits across the estate as part of the management of ISO14001:2015, this includes an assessment of the compliance with fluorinated gas regulations. | Applying the GHG Protocol uncertainty guidance an uncertainty of 3.8% has been calculated for this emission source. See appendix 6.2 for further information. |
| ATM related $CO_2$ emissions | NATS has two primary internal standards for quality management, in addition to governance systems.<br>The first standard focuses on ATM fuel / $CO_2$ emissions benefits from small scale airspace changes and inventory management.<br><br>The second standard focuses on all remaining ATM fuel/$CO_2$ emission benefit claims, other than large scale airspace change benefits, and includes the process for internal auditing of data and controls. | For ATM related $CO_2$ emissions savings, the majority of assessments are modelled. As industry standards and best practice is followed when undertaking this assessment, uncertainty is minimised. Other assessments are based on full year actual data with the exception of FUA analysis. In the latter case the analysis is deliberately conservative in order to avoid overestimation of fuel savings. None of the potential sources are thought to be material. |

# 5. ATM related $CO_2$ emissions

## 5.1. Acknowledgements

ATM related fuel/$CO_2$ 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.

## 5.2. Emission factors

For ATM related emissions, we take activity data and multiply it by an emission factor which gives an estimate of the $CO_2$ emissions figure.

$tC0_2$ = Activity Data x Emission Factor

We use a fuel: $CO_2$ ratio of 1:3.18 as specified by our regulator[1] in order to convert activity data into tonnes $CO_2$. This conversion factor is consistent over time.

## 5.3. Baseline

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

- Ground movements at UK airports where we provide a tower service
- UK domestic airspace i.e. London and Scottish Flight Information Regions (FIRs)
- North-Atlantic operations (Shanwick sector)

## 5.4. Principles of scope 3 category 11 and scope 4 emissions

### 5.4.1. ATM related $CO_2$ emissions and the GHG protocol

Our scope 3 emissions are overwhelmingly influenced by airlines' scope 1 emissions. We refer to Air Traffic Management (ATM) related emissions, i.e. the emissions from fuel burnt in aircraft engines in airspace we manage or at airports we provide a tower service. Under the GHG Protocol, we opt to include these emissions in scope 3 category 11, which refers to use of sold goods or services. We have calculated an estimated uncertainty for this emission category as 2.5%.

We have opted to refer to the outcome of our efforts (and working with the aviation industry) to reduce these scope 3 category 11 emissions, as scope 4 emissions or avoided emissions.

We were the first air traffic control company to adopt a commitment to reduce ATM related $CO_2$ emissions by 10% per flight on average, in 2008. This has been replaced by a UK industry commitment to achieve net zero emissions by 2050. We wish to track our progress in avoiding

[1] CAA CAP1616 Airspace Design: Environmental requirements technical annex

emissions which would have otherwise occurred, were it not for the work we have done. These avoided emissions are what we track and report as scope 4.

There are a growing number of companies reporting indirect avoided emissions. While we wait for agreed guidance and standards to catch up with this innovation, we seek to be transparent and consistent in our approach to GHG inventory management and reporting of scope 4 emissions.

Aircraft fuel burn/$CO_2$ emissions avoided as a result of our actions are modelled for the domestic UK FIR, airports where we provide a tower service and Shanwick airspace. Using various data sources, tools and assumptions avoided ATM related $CO_2$ emissions are calculated for a given year (as set out below).

### 5.4.2. Types of savings

Our approach to analysis of ATM related $CO_2$ emissions is to categorise savings as follows:

- Savings enabled by airspace change i.e. savings based on a procedure versus procedure comparison which an airline can flight plan;
- Savings enabled by network management and air traffic controller tools i.e. based on a change to network management and/or controller toolsets which reduce fuel burn, but which don't affect flight plan routes;
- Savings realised from controller intervention i.e. based on a non-flight plannable change and/or intervention by controller to reduce fuel burn;
- Realised savings from trials for any project, tool, or intervention type.

The modelled savings delivered during the financial year are aggregated on the basis of the project having been implemented in the given year, i.e. the changes we have implemented have enabled savings which are available to airlines to flight plan accordingly. We have no direct control over how the airlines flight plan across our network, but we can estimate how much traffic is likely to take advantage of the change we have enabled. As a result, and with the agreement of our stakeholders who are interested the pace of implemented change, benefits from airspace projects (i.e. safety, cost, fuel/$CO_2$, capacity, etc.) are accrued in full in the year of implementation, typically aligned with the AIRAC cycle[2], rather than split pro-rata based on the implementation date in the reporting year.

### 5.4.3. Data modelling

All ATM related fuel/$CO_2$ emission data is modelled based on the best available data, tools and estimation techniques, in the absence of access to airline flight management system data.

Model output is calculated in tonnes of fuel and may be abbreviated in reports to the kilo tonne, which is aggregated and then converted to $CO_2$. As a result, some rounding may occur, but is *de minimis*.

Estimated uncertainty: 2.7%

### 5.4.4. Primary data sources

We use 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 of actual flight tracks, also stored in the data warehouse;

[2] Aeronautical Information Regulation And Control (more information available here)

- Airspace data, covering routes and navigation points, sourced from the CFMU and stored in our data warehouse.

### 5.4.5. Fuel uplift

Fuel uplift is fuel which is burned merely to carry other fuel. For example, an airspace change may save 50 kg of fuel per flight, but extra fuel would have been uploaded and burned merely transporting that 50 kg until it was burned. We have analysed the relationship between distance flown and the percentage of fuel uplift using flight planning software and found it to be linear. We use 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.

### 5.4.6. Toolset

A number of industry standard and bespoke tools are used to model ATM fuel/$CO_2$:

- Aviation $CO_2$ emissions data is prepared using the Eurocontrol 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;
- We have 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), we have 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;
- The Oceanic Air Traffic Simulator (OATS) is a bespoke fast-time simulation model which estimates the environmental performance of flights crossing the North Atlantic under various operational concepts. The tool simulates daily demand and optimises the routes for total fuel burn, using meteorological data to adjust aircraft speed, flight time and calculates the changes to fuel burn as a result of airspace network changes;
- The FUA profile generating tool was developed to improve the accuracy of Special Use Areas usage and maximise network efficiency for airlines. The tool analyses the relevant airspace sectors and calculates the benefits.

## 5.5. Types of operational changes and assessment methodologies

On an on-going basis we operate a number of different project types which contribute to the enabled savings through planned and tactical changes. These initiatives are from small-scale projects, large airspace change projects, new tools and tactical improvements, detailed below. For all changes that can affect airline flight planning, the benefit to fuel uplift is also calculated and claimed.

### 5.5.1. Small projects

Sometimes referred to as Airspace Efficiency Database (AED) changes, these small projects relate to routings or level restrictions, usually developed by controllers at our units, which don't require a formal airspace change described in CAP1616. 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. We enable 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 $CO_2$ emission reductions based on actual flight routes taken.

For route changes, the approach is to compare the existing 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 NATS 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.

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.

### 5.5.2. Manchester Expected Arrival Time (EAT) Queue Management (QM)

Expected Arrival Time data (EAT) for arrivals at Manchester Airport has been made available at the Supervisor position at Prestwick Centre. This allows the supervisor to see when bunches of arriving traffic are expected and therefore when aircraft are likely to be subject to low-level holding and vectoring. A procedure is then be put in place to allow the supervisor to instruct adjacent controllers to slow the inbound traffic from approximately 300nm away to smooth the arrival traffic flow. This reduces the expected airborne delay for those flights.

The expected reduction in airborne delay is estimated from ATC expertise and is taken to be 10 seconds for aircraft entering the UK from the west and 15 seconds for all other aircraft. The reduction in airborne delay is converted into a fuel burn saving using the average fuel burn in holding and approach phase at Manchester.

Data and models used:

- Data source: Flights in the data warehouse;
- Data sample: All Manchester arrivals in 2017;
- Tools: NEMO;
- Models: BADA fuel model as contained in NEMO.

### 5.5.3. Gatwick Extended Arrival Manager (XMAN)

The XMAN system is used to minimise stack holding at airfields by reducing the speed of arrival aircraft whilst they are still in the cruise phase of flight. A fuel benefit is achieved because fuel burn is lower at cruise levels compared with holding levels.

With the XMAN system, aircraft are instructed to reduce speed at a radius of 350NM from the arrival airport. The instruction is often given, therefore, by neighbouring ANSPs from which it is not possible to get complete instruction data. For this assessment, a sample of dates in October 2019 was used and the resulting saving was annualised.

Data and models used:

- Data source: Holding times from the data warehouse, instruction data from MUAC and RUAC, XMAN log data;
- Data sample: 3rd – 22nd October 2019 (excluding 10th and 12th October due to data quality);
- Tools: NEMO;
- Models: BADA aircraft performance data and fuel models as used in NEMO.

### 5.5.4. Cost index calculations

Cost index is the mechanism by which airlines balance the cost of time and the cost of fuel for flights, with a lower cost index resulting in fuel savings. It can be applied across the entire flight profile or to climb, descent and cruise separately. If an airline adopts a cost index of zero (CI=0) when climbing it results in a reduction of climb speed, which can be calculated. NATS enables this benefit by allowing pilots to tactically implement this change.

### 5.5.5. Reduced engine taxi (RET)

Pilots can choose to taxi between the stand and the runway using fewer than all engines. Whilst all engines need to be fully warmed before take-off, they only need to run for 5 minutes prior to the take-off time. At airfields where pilots have an accurate departure time, they can save fuel by taxiing on fewer than all engines. Through the Sustainable Aviation group, NATS has obtained information on how RET is applied by different airlines and at different airfields. This data has been used to estimate the amount of fuel saved through using RET at UK airfields.

Research has identified ICAO data describing the benefit of RET as a 40-45% fuel saving for twin engine aircraft while taxiing and a 20-25% fuel saving for quads. We have assumed a 30% saving for three-engine aircraft. The weighted average of these savings for the baseline traffic mix at each airfield gives a mid-point fuel saving rate of between 37.6% and 42.4% for the relevant airfields. The fuel reduction is assumed to be applicable to the whole of the departure taxi time excepting the last 5 minutes.

The annual benefit of RET is calculated by multiplying

- The application rate;
- The average departure taxi time minus 5 minutes;
- The number of aircraft;
- And percentage of the average taxi fuel flow saved.

Data and models used:

- Data source: Flights in the data warehouse, RET application rate from Sustainable Aviation data;
- 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.

### 5.5.6. Taxi-time

Fuel burnt whilst taxiing between stands and the runway at airports (taxi-time) can be reduced by initiatives to reduce ground holding times. Similarly, fuel burn can be reduced by aircraft taxiing on less than all engines. We seek to minimise taxi-times and reduced engine taxi at the airfields we operate a service at and so includes any changes in this ground fuel use in the annual assessments.

Changes in taxi time performance year-to-year are monitored and captured in annual assessments. A summary of the methodology is set out below.

The 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 (incorporating any RET claimed separately);
- 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 the 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.

### 5.5.7. Tactically Enhanced Arrivals Mode (TEAM)

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

Changes in performance year-to-year are monitored and captured in annual assessments. A summary of the methodology is:

- The 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 disbenefit and are recorded accordingly.

Data and models used:

- Data source: Flights in the 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.

### 5.5.8. Continuous climb and descent operations

Arrivals and departures to and from airfields are most fuel efficient if aircraft can perform continuous climb and descent operations (termed CCOs and CDOs). We enable improvements in this performance through engagement at a strategic level with airlines and airports providing data on achievement levels to target improved performance, through Sustainable Aviation[3]. Controllers also enable improved performance in their day-to-day control and through provision of distance-to-run information to pilots.

Changes in continuous CCO and CDO performance, and the resulting impact on fuel burn, are captured in our annual assessment. A summary of the methodology is:

- The radar data within the 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 disbenefit and are recorded accordingly.

Data and models used:

- Data source: Flights in the 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.

### 5.5.9. Large airspace change (Farnborough, SAIP and PLAS)

NATS regularly makes changes to its airspace which impact environmental performance. Many of these changes are delivered through the Long-Term Investment Plan and are delivered in accordance with the CAA's CAP1616 process. Farnborough, SAIP and PLAS are airspace change projects delivered under this process.

The methodology used in these assessments are to model both the baseline (current) operation and the proposed operation in the fast-time simulator AirTOp. The simulated trajectories of the aircraft in both scenarios are run through the NATS fuel calculator (NEMO) to obtain the fuel burn change. Fuel uplift is also applied using the standard methodology.

Data and models used:

- Data source: Flights in NATS data warehouse; traffic growth forecasts taken from NATS base case forecasts;
- Data sample: a minimum of 2 busy summer days;
- Tools: NEMO and AirTOp;
- Models: BADA aircraft performance and fuel models as contained in NEMO; NATS fuel uplift equation.

[3] https://www.sustainableaviation.co.uk/wp-content/uploads/2018/06/A-Guide-to-CDOs-Booklet1.pdf

### 5.5.10. UK airspace $CO_2$ emissions

Aircraft fuel burn/$CO_2$ emissions are modelled for the domestic UK FIR and six airports equipped with Electronic Flight Progress Strips (EFPS), but other airports where we provide a tower service are excluded at this time. Using a Business Intelligence platform, EFPS, radar data and tools reviewed in this chapter, the $CO_2$ emissions are modelled for actual traffic in a given year.

This data is additionally used to estimate the UK's territorial / domestic aviation $CO_2$ emissions for net zero reporting[4]. The query is filtered to show only domestic flights within the UK FIR, i.e. excluding flights to/from UK Crown dependencies and Overseas territories.

### 5.5.11. Shanwick airspace $CO_2$ emissions

Aircraft fuel burn/ $CO_2$ emissions are modelled for the Shanwick Oceanic operation. The oceanic NASCAR data contains flight times, flight levels and locations. This is combined with the BADA fuel models to calculate the fuel burn for all flight segments.

## 5.6. Changes to quantification methodologies previously used

ATM GHG data 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. In particular:

- The FUA methodology previously used was based on small scale tactical assessments of traffic flows. More recent large-scale airspace changes, linked to project Lightning and others, has the potential to alter the flow of traffic at the network level. As a result, it is not possible to undertake a complete, consistent or accurate assessment of the tactical $CO_2$ benefits from the flexible use of military airspace and so this category is no longer included;
- Further post implementation analysis has revised upwards the benefits from ExCDS and eTBS projects;
- Shanwick airspace $CO_2$ emissions are now included in 2018-19;
- Actual traffic has replaced forecast traffic for the reporting year.

In addition, there has been a change in the source reference of the $CO_2$ emissions factor of 3.18 from our Regulator, the CAA. Previously the source was document CAP725 which has now been replaced by document CAP1616. The emissions factor remains unchanged.

[4] https://www.ons.gov.uk/economy/environmentalaccounts/articles/netzeroandthedifferentofficialmeasuresoftheuksgreenhousegasemissions/2019-07-24

# 6. Appendix

## 6.1. Base year emission statement

| Emission source | | 2017-18 emissions ($tCO_2e$) | kg $CO_2e$ | kg $CO_2e$ of $CO_2$ per unit | kg $CO_2e$ of $CH_4$ per unit | kg $CO_2e$ of $N_2O$ per unit |
|---|---|---|---|---|---|---|
| Scope 1 emissions | Direct emissions from combustion of natural gas (biomethane) | 2,086 | 2,086,280 | 2,082,248 | 2,938 | 1,094 |
| | Direct emissions from combustion of road vehicle fuel | 233 | 233,228 | 231,505 | 236 | 1,487 |
| | Direct emissions from combustion of stationary assets (e.g. oil boilers, back-up generators) | 377 | 377,460 | 348,203 | 407 | 28,850 |
| | Fugitive emissions | 1,285 | 1,284,909 | - | - | - |
| Total scope 1 emissions (location based) | | 3,982 | 3,981,877 | 2,661,956 | 3581 | 31,431 |
| Scope 2 emissions (location based) | Emissions from generated electricity usage | 21,223 | 21,223,217 | 2,1059,618 | 37,429 | 126,171 |
| Total scope 1 and 2 (location based) emissions | | 25,205 | - | - | - | - |
| Intensity metric | Total scope 1+2 (location based) emissions (tCO2e) per £m revenue | 27.6 | | | | |
| Intensity metric | Total scope 1+2 (location based) emissions (tCO2e) per FTE employee | 5.9 | | | | |
| Intensity metric | Total scope 1+2 (location based) emissions (tCO2e) per flight handled | 10 | | | | |
| Scope 3 emissions | Category 11<br>Emissions from use of sold products or services (i.e. ATM related CO2 emissions) | | 14,627,205 | | | |
| Scope 4 emissions | Modelled enabled ATM related CO2 emission reduction | | 228,073 | | | |

**Table 3 - Base year (2017-18) emissions statement**

## 6.2. Uncertainty assessment calculations

| Emission source | Uncertainties and calibration requirements |
|---|---|
| Scope 1 | |
| Gas | As Swanwick (one of our major sites) is included in the EU Emissions Trading Scheme, we feel it appropriate that the principles (detailed below) are followed with respect to statements of our overall uncertainty.<br><br>As a "low emitter" [from the consumption of gas], there is a principle described on page 57 of the document "European Union Emissions Trading System (EU ETS) Phase III: Guidance for installations" to assume all gas metering has an accuracy class of 1.5 and therefore to adopt 6% as its Maximum Permissible Error in Service (MPES) for gas consumption. |
| On-site fuel combustion | Under EU ETS guidance, gas oil has a 0.5% uncertainty for commercially delivered fuels. We have adopted this uncertainty figure due to Swanwick being in the EU ETS and this site is our largest consumer of on-site fuel. |
| Fugitive emissions | Applying the GHG Protocol uncertainty guidance an uncertainty of 3.8% has been calculated for this emission source. See below for further information on the calculations |
| Scope 2 | |
| Electricity | For the consumption of electricity in the UK, "The Meters (Certification) Regulations 1998" [21] state that: The permitted margins of error shall be an error not exceeding + 2.5 %. or -3.5% at any load at which the meter is designed to operate |
| Scope 3: Other indirect emissions | |
| | See table below. |

**Table 4 - Uncertainties and calibration requirements**

| Category | Precision | Completeness | Temporal representation | Geographical representativeness | Technological representatives | Basic uncertainty factor | Uncertainty (%) |
|---|---|---|---|---|---|---|---|
| Scope 1: Fugitive emissions | 1.5 | 1.1 | 1 | 1 | 1 | 1.2 | 2.8 |
| Scope 3 Category 11: use of sold products | 1 | 1 | 1.1 | 1 | 1 | 1.05 | 2.5 |
| Scope 4: modelled enabled ATM emissions savings | 1.2 | 1.1 | 1.2 | 1.02 | 1.02 | 1.05 | 2.7 |

**Table 5 - Uncertainties and calibration requirements**