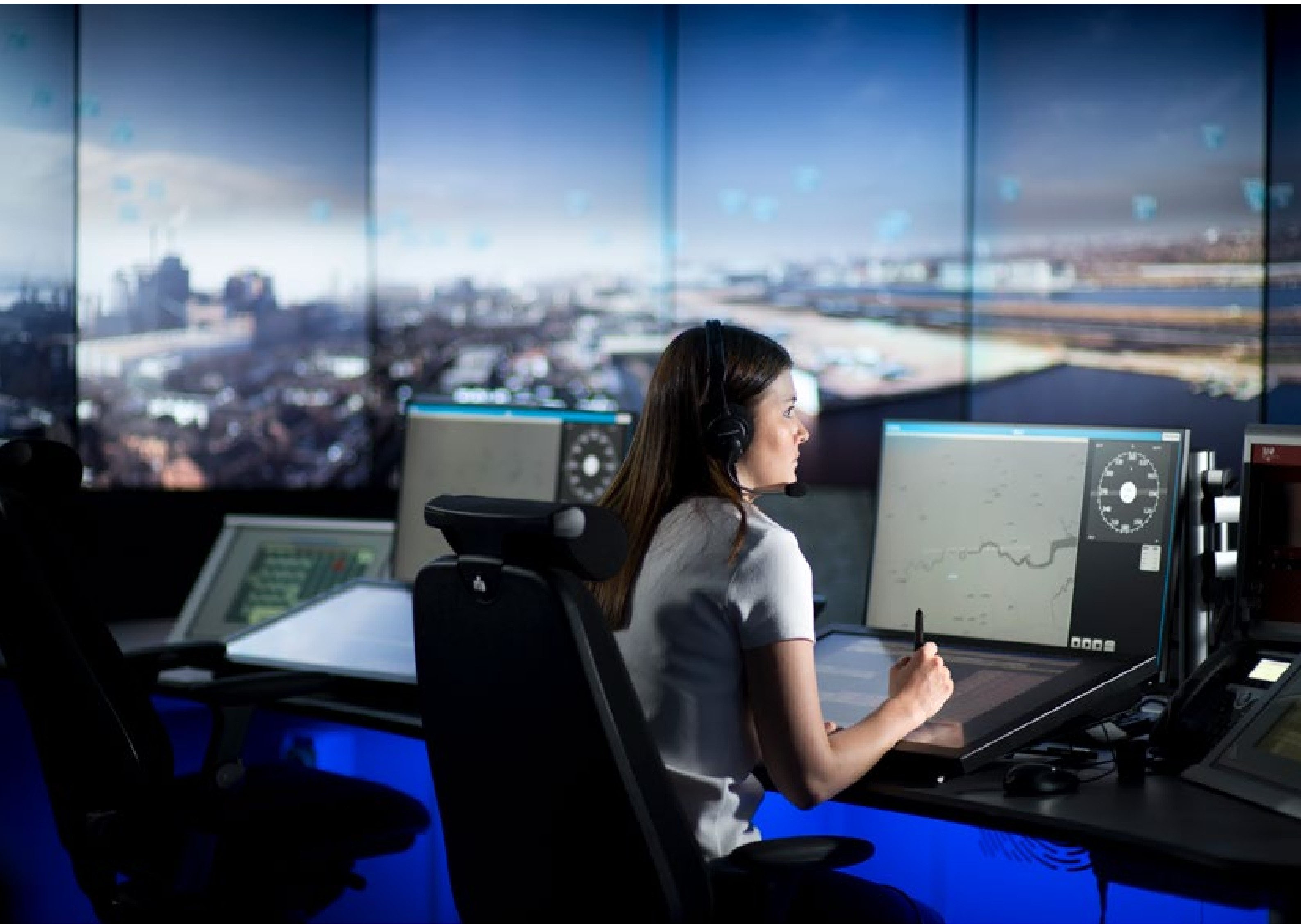
GHG report

Basis of reporting for NATS' airspace, energy and environmental performance data 2018-19



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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 with reference to the World Resources Institute's (WRI) Greenhouse Gas Protocol (GHG Protocol) Corporate Standard and ISO14061.

GHG emission data is reported in accordance with ISO14064-1: 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.

Table 1 - Scope of verification of GHG emissions

Scope & 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
1. Direct emissions	X				
2. Location based	X				
Market Based	X				
3. 1: Purchased goods and services	X				
2: Capital Goods				X	Not relevant to NATS operations
3: Fuel and energy related activities	X				
4: Upstream transportation and distribution	X				
5: Waste generated in operations				X	Complete data unavailable (insignificant emission source below 1% of total)
6: Business travel	X				
7: Employee commuting				X	Data not considered robust for reporting. Further work is ongoing to improve this.
8: Upstream leased assets				X	Complete data unavailable. This is an area undergoing work.
9: Downstream transportation and distribution				X	Not relevant to NATS operations as a service provider.
10: Processing of sold products				X	Not relevant to NATS operations, as a service provider, we do not have physical products that require end of life treatment.
11: Use of sold products			X		
12: End-of-life treatment of sold products				X	Not relevant to NATS operations
13: Downstream leased assets				X	Not relevant to NATS operations
14: Franchises				X	Not relevant to NATS operations
15: Investments				X	Outside of operational control
4. Avoided		X			

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

We are the main air navigation service provider in the United Kingdom (UK). We provide 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 provide air traffic control services to airports in the UK and Gibraltar.

2.2. Person responsible for GHG reporting

The head of Environmental & Community Affairs, Ian Jopson, is responsible for reporting GHG emissions resulting from our operations.

Management, governance and oversight of Scope 1, 2, 3 and 4 emissions is provided by a technical Environmental Performance Moderation Panel, an Environmental Benefit Delivery Panel and an overall Portfolio Management Meeting, with parallel reporting to an Environment Steering Group, on behalf of the NATS Executive. Additional oversight is provided by the Board audit committee.

The audit committee has requested annual external audit of our airspace, energy and environmental performance data. In 2018-19 this was provided by DNV GL under the ISO 14064:2018 standard. The level of verification is set out in Table 1.

2.3. Competency & training

GHG emissions inventory management is led by the Environmental & Community Affairs team, with close support from Facilities Management, Analytics, Finance, Supply Chain 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 Environmental & Community Affairs.

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.

In seeking external verification, we have gone to tender to procure these services from a firm who is accredited to do the work for our Scope 1-2-3 emissions under ISO 14064-3. Annual verification is kept under review by the Board audit committee, the Head of Internal Audit and the Quality team.

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 2018 – 31st March 2019.

2.5. Base year

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.

2.5.1. Base year recalculations

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 Greenhouse Gas Protocol.

We may restate CO_2 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 2018-19.

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 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.

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		2018-19 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
Direct Emissions (Scope 1)	Direct emissions from combustion of natural gas	2347	2347052	2342714	3062	1276
	Direct emissions from combustion of road vehicle fuel	223	222782	221153	203	1425
	Direct emissions from combustion of stationary assets (e.g. oil boilers, Back up generators)	499	499,497	458,077	501	40,920
	Fugitive emissions	1024	1,024,284			
Total Direct Scope 1 Emissions		**4,094**	**4,093,614**	**3,021,944**	**3,766**	**43,621**
Energy Indirect Emissions (Scope 2) Location based	Emissions from generated electricity usage	16,561	16,560,624	16,432,501	38,612	89,511
Energy Indirect Emissions (Scope 2) Market based	Emissions from generated electricity usage	21,024		21,023,902		
Total Scope 1 and 2 (Location based) emissions		**20,654**				

Other Indirect Emission Source		2018-19 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
Other Indirect Emissions (Scope 3)	Category 1: Purchased goods and service-Indirect emissions from the supply and treatment of water	68	67,628			
	Category 3a Well to tank Purchased fuel	106	106,362			
	Category 3a Well to tank Natural Gas	326	326,235			
	Category 3a Well to tank Owned vehicles	57	56,520			
	Category 3b Well to tank emissions of purchase electricity (Generation and T& D losses)	2,665	2,665,426			
	Category 3c Downstream T&D losses of purchase electricity	1,412	1,411,693	1,398,984	3,506	7,597
	Category 4: Upstream transportation and distribution-Courier	7	7,243	7,191	0.64	51.37
	Category 6: Business Travel- Direct emissions from combustion of road vehicle fuel - private vehicles	245	244,713	242,706	174	1,832
	Category 6: Business Travel-Indirect emissions from business travel (flights, rail, ferry)	5,168	5,167,853	5,141,426	794	25,633
	Category 6: Business Travel-Indirect emissions from business travel (car hire)	229	228,511	226,958	240	1,314
	Category 11: Emissions resulting from services	14614411.00				
Total Scope 3 emissions		**14,624,693**				
Scope 4 Emissions	Modelled enabled ATM related CO_2 emission reduction	**113,695**		**102,628,140**		

There have been no removals or sinks of greenhouse gas emissions in this reporting period.

It should be noted that during the 2018/19 reporting year, NATS no longer met the operational control criteria for a site which was responsible for approximately 2.8% of scope 2 emissions in 2017/18.

4. Scope 1, Scope 2 and selected Scope 3 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: **https://www.gov.uk/government/collections/government-conversion-factors-for-company-reporting**.
For the current reporting year (1st April 2018–31st March 2019) the 2018 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	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 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. 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 company reporting (2018) 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.	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. **Estimates** 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. 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 Gas cylinders for BBQ's. A small number of gas cylinders may be used in a year at NATS Corporate head office for office BBQ's. The emissions from these have not been captured but are considered to be *de minims*.

Source	Data measurement and recording	GHG emissions quantification	Estimates and assumptions
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. 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 considered, but is not considered to be cost effective. 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.	NATS uses the UK Government GHG conversion factors for company reporting (2018) 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	It is assumed that electricity generated from oil usage is only used by NATS and not exported to the grid. It is possible that welding does occur on NATS site. 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. In January 2019 NATS undertook a project at one of our sites. A diesel backup generator was rented for 6 days and the fuel use was not recorded therefore the emissions from this activity have been excluded.
Fugitive emissions	Fugitive emissions data is collected for all sites where we have operational control. There are two external contractors across all sites that maintain the asset register information of the equipment containing refrigerant gases. This includes information about the equipment type, the charge capacity and the refrigerant type. 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 (the format of these log sheets are specific to each contractor).	NATS uses the UK Government GHG conversion factors for the relevant reporting period (2018) in order to convert activity data (kg) into the component greenhouse gasses. 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) 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	NATS uses the UK Government GHG conversion factors for the relevant reporting period (2017 for the relevant reporting period in order to convert activity data (KM) into GHG emissions. Where the car 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 where mileage is conducted for business use.	**Exclusions:** NATS operates four vehicles at Stansted and Heathrow airports. The fuel invoices for these vehicles was reviewed during the verification process and the data contained on them appears to be spurious. The emissions from these vehicles has therefore been excluded from the 2017/18 reporting cycle. The data and use of vehicles at these sites will be investigated in readiness for reporting requirements for 2018/19.

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. 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	NATS uses the UK Government GHG conversion factors for the relevant reporting period (2017) in order to convert KWH activity data into tCO_2e under the location based method.	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. Electricity generated at four sets of on-site Photo Voltaic panels is used to supplement NATS' energy usage and not exported to the grid. **Estimates** 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. 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.
Electricity consumption-Market based method	Same as for location based	Where the electricity contract has a published CO_2 factor this has been applied to the associated consumption from that contract. 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. Methodology for calculating selected Scope 3 emissions

NATS has applied the GHG protocol guidance on estimated uncertainty for each reported scope 3 emission source, see appendix 6.2 for details and full calculations. The uncertainty percentage is included within estimates and assumptions for each category below.

Source	Data measurement and recording	GHG emissions quantification	Estimates and assumptions
Category 1: Purchased goods and service-Indirect emissions from the supply and treatment of water	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 minims*.	NATS records water consumption in cubic metres (m^3) as recorded on invoices from third party providers. The consumption figures are converted into GHG emissions using the UK Government GHG conversion factors for the relevant reporting period (2017) for the supply and treatment of water. m^3 * Defra conversion factor for supply of water + m3 * Defra conversion factor for the treatment of water.	Limited sites are billed on rateable value (RV) rather than metered consumption and are not included in scope but are considered *de minims*. Estimated uncertainty: 2.8%
Category 3: Fuel-and energy-related activities-T&D losses	See Scope 2 for the collection of electricity data	The electricity data is converted into T&D losses using the UK Government GHG conversion factors for the relevant reporting period (2017) kWh*conversion factor for T&D losses for UK electricity	Estimated uncertainty: 2.5%
Category 3: Fuel-and energy-related activities-Well to tank (Electricity)	See Scope 2 for the collection of electricity data	The electricity data is converted into T&D losses using the UK Government GHG conversion factors for the relevant reporting period (2018). kWh*conversion factor for Well to tank electricity losses for UK electricity	Estimated uncertainty: 2.5%
Category 3: Fuel-and energy-related activities-Well to tank (Natural Gas)	See Scope 1 for the collection of Natural Gas	Natural Gas activity data multiplied by the conversion factor for Well to Tank-natural gas using the UK Government GHG conversion factors for the relevant reporting period (2018	Estimated uncertainty: 2.5%
Category 3: Fuel-and energy-related activities-Well to tank (Fuel)	See Scope 1 for the collection of fuel activity data	Fuel data multiplied by the conversion factor for Well to tank for the relevant fuel using the UK Government GHG conversion factors for the relevant reporting period (2018)	Estimated uncertainty: 2.5%
Category 4: Upstream transportation and distribution-Courier	Courier emissions data refers to the emissions generated as a result of courier deliveries for NATS business purposes. Courier vehicle and miles travelled data is made available in monthly reports by the NATS courier company City Sprint. Data is sent from CitySprint on a monthly basis. The Courier CARBON CALCULATOR monthly reports are sent to The Environment Manager who then aggregates this data into a spread sheet entitled Courier Total Miles	The Courier Total Miles spread sheet containing the validated courier data for the reporting period is converted into GHG emissions by multiplying the activity data by the UK Government GHG conversion factors for the relevant reporting period (2018). Where the van and fuel type is known, a specific emission factor relating to these will be used. Where the van type and fuel type is unknown, an average van and unknown fuel emission factor is used.	Estimated uncertainty: 2.6%

Source	Data measurement and recording	GHG emissions quantification	Estimates and assumptions
Category 6: Business Travel- Direct emissions from combustion of road vehicle fuel - private vehicles	This refers to transportation in vehicles owned by employees and not NATS. Mileage data is extracted from the NATS expenses system.	Extracted mileage data is multiplied by the relevant GHG factor. NATS uses the UK Government GHG conversion factors for the relevant reporting period (2017) in order to convert mileage data (KM) into GHG emissions. Where the 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.	Estimated uncertainty: 3.1%
Category 6: Business Travel-Indirect emissions from business travel (public transport)	This refers to transportation of employees for business-related activities during the reporting year (in vehicles not owned or operated by NATS) and includes the Scope 1 and Scope 2 emissions of transportation carriers that occur during use of vehicles (e.g., from energy use). NATS travel agent, are as follows (in addition to the normal personal & booking information): All public transport (air, train and ferry) data is reported to NATS by a single travel provider. An annual report for each transport type is produced which details the mode, distance and class of travel to allow for GHG conversion.	Extracted mileage data is multiplied by the relevant GHG factor. NATS uses the UK Government GHG conversion factors for the relevant reporting period (2017) in order to convert mileage data (KM) into GHG emissions. Where the 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. **Air travel** Flights shall be organised into four categories according to distance to match with the DEFRA methodology for calculating flight emissions: • Domestic (any UK internal flight) • Short haul (below 750km where the origin or destination is the UK • Long haul (over 750km where the origin or destination is the UK) • International (any flight where the origin or destination is outside the UK) Flights shall also be categorised according to class of travel: • Each flight shall list the class of travel. Where this is unavailable and/or unknown, the average passenger conversion factor shall be used as outlined by DEFRA in Table 1. **Radiative Forcing**: • The GHG emissions for each flight are calculated with RF (Radiative Forcing) **Equation:** 1) **Flights:** Domestic/short/long haul X Class X passenger.km X with RF emissions factor (kg CO_2e) 2) **Flights:** Domestic/short/long haul X Class X passenger.km X without RF emissions factor (kg CO_2e)	

Source	Data measurement and recording	GHG emissions quantification	Estimates and assumptions
Category 6: Business Travel-Indirect emissions from business travel (public transport)		**Train travel** The requirements for the train travel data are as follows (in addition to the normal personal & booking information):Each journey shall be split up into different legs where more than one type of rail transport is used, i.e. national, international, light rail & tram and London Underground journeys; Each journey will indicate the distance (KM) travelled; Each leg will indicate the class of travel; The staff traveller categories should are clearly differentiated i.e. NATS, Aquila/ MoD, etc. Each station should include the **Rail:** National / International / Light Rail & Tram / LU passenger.km X emissions factor (kg CO_2e) **Direct business ferry travel** **Data requirements** The requirements for the ferry travel data are as follows (in addition to the normal personal & booking information): Each journey should be split up into different legs where more than one type of ferry transport is used, i.e. foot passenger, car passenger, average; Each journey should indicate the distance (KM) travelled; • The staff traveller categories should be clearly differentiated i.e. NATS, Aquila/ MoD, etc. **Calculation steps** **Equation:** Ferry: Foot / Car / Average passenger.km X emissions factor (kg CO_2e)	
Cat. 6 Business Travel - Car hire	This refers to the emissions generated from the use of car hire. NATS uses a single car hire provider. An annual report detailing the mileage covered on the NATS contract is provided.	Kilometre data is generated from our car hire provider and converted into GHG emissions using the appropriate emission factors. Where the vehicle type is not known an average vehicle and average fuel conversion figure is applied.	In 2018/19 NATS appointed a travel bureau to undertake car hire bookings. The travel bureau has the ability to book hire car through multiple hire companies. Some of these companies were unable to provide vehicle mileage data for NATS. Where this was the case an average km travelled per booking was applied, this was calculated using 2017/18's data and an average vehicle and fuel GHG conversion factor was applied. Estimated uncertainty: 3.1%

4.5. 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: • Meters without data when data is expected • Meters where invoiced and AMR data do not align • Meters where consumption variance outside of tolerance • Meters where Year on Year variance is outside of tolerance 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 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. 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. 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
On-site fuel combustion	The NATS Finance team check the fuel invoicing as part of the standard financial internal audit process. 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.	EU ETS gas oil is 0.5% for *de minims*.
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	
ATM related CO_2 emissions	NATS has two primary internal standards for quality management, in addition to governance systems. The first standard focuses on ATM fuel / CO_2 emissions benefits from small scale airspace changes and inventory management. 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.

tC02 = Activity Data x Emission Factor

We use a fuel: CO_2 ratio of 1:3.18 as specified by our regulator 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 flight3. 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 (London and Scottish Flight Information Regions)
- 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 navigation services provider to adopt a commitment to reduce ATM related CO_2 emissions by 10% per flight on average, in 2008. We wish to track our progress in avoiding emissions which would have otherwise occurred due to increasing traffic, 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 , 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 and stored in the our data warehouse;
- 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 our 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

Often referred to as Airspace Efficiency Database (AED) changes, these small projects relate to routings or level restrictions, usually developed by controllers at our 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. 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 emission reductions based on actual flight routes taken.

The changes assessed last year were:

- Route changes
- Level restriction changes

The methodology is to compare the current) flight procedures/ plan to the proposed (or scenario) flight procedures/ plan. Our 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

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. Continuous Climb and Descent

Arrivals and departures to and from airfields are most fuel efficient if aircraft can perform continuous climbs and descents (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. Controllers also enable improved performance in their day-to-day control and through provision of distance-to-run information to pilots.

Changes in continuous climb and descent (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

5.5.3. 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 taxi-ing on fewer than all engines. Heathrow airport have specified a RET application rate as part of the Sustainable Aviation group so, for this airfield only, we can calculate the fuel benefit of reduced engine taxi for departure traffic.

Research has identified that the benefit of RET is 40-50% for twin engine aircraft and 20-25% for quad engine aircraft. We have taken the mid-point of the weighted average of the traffic mix at Heathrow, i.e. 41%. 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 30% of the average taxi fuel flow.

Data and models used:

- Data source: Flights in the data warehouse, RET application rate from Heathrow Airport
- 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

5.5.4. 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

Changes in reduced engine taxi…

5.5.5. 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

5.5.6. Flexible Use of Airspace

We work closely with the military to maximise both the amount of time that Special Use Areas (SUA) are available for civil use and the amount of notice that civil aircraft are given to enable airlines to plan efficiently. When a Special Use Area is available to civil aircraft, this enables flights to plan shorter routes. NATS and the MOD work to improve both the availability of these routes and the notice period of their availability so that the airspace can be used as flexibly and efficiently as possible. Our assessment estimates the fuel/CO_2 impact of changes in the availability of Special Use Areas for civil use. This is also known as Flexible Use of Airspace (FUA).For this analysis each of the SUA groups across the UK is analysed. The benefit in each group is calculated using the methodology:

- For each departure-destination routing that uses the SUA, identify the best available planned route through the SUA
- Calculate the track extension between the best available planned route though the SUA and the routes that do not use the SUA
- Calculate the proportion of flights that used the SUA in the baseline and in the current financial year
- The track distance saving of the SUA compared to the alternative route is calculated using the fuel burn per nautical mile at the average requested flight level of the aircraft type
- The overall fuel impact is calculated for each departure-destination pair in each SUA as (change in track extension)*(number flights in the year)*(average fuel burn)
- 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 that used the SUA groups in the most recent calendar year
- Tools: NEMO and FUA profile generating tool
- Models: BADA aircraft performance tables

5.5.7. Time based separation (TBS)

At Heathrow Airport, a new method of maintaining separation of aircraft on final approach has been implemented whereby aircraft are separated by the time between them rather than distance. This ensures that during periods of strong headwinds, the typical gap between aircraft is maintained to minimised. The environmental benefit of this is the knock-on reduction in stack holding delay and its associated fuel burn.

The methodology is to estimate the increase in landing rate (number of arrivals per hour) achieved under TBS and use that to estimate the reduction in stack holding that has been achieved as a result. A summary of the methodology is:

- The data warehouse is used to calculate the cumulative distance saving across the day of TBS operations and converted in to an average hourly landing rate increase
- The average stack holding time in these hours is also calculated from records in the data warehouse
- The estimated total number of minutes of stack holding saved as a result of TBS is then estimated by multiplying the average holding time by the landing rate increase in each hour across the sample and taking the sum of all those minutes
- 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

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 in NEMO and stored in the data warehouse

5.5.8. SAIP (an LTIP airspace change project)

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. SAIP is an airspace change project delivered under this process.

The methodology used in this assessment is 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.

5.5.9. UK ATM related 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 and Shanwick airspace are excluded at this time. Using a Business Intelligence platform, EFPS, radar data and tools reviewed in this section, the CO_2 emissions are calculated for actual traffic in a given year.

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 and tool has been revised
- 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.

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
Direct Emissions (Scope 1)	Direct emissions from combustion of natural gas	**2086**	2,086,280	2,082,248	2,938	1,094
	Direct emissions from combustion of road vehicle fuel - owned fleet vehicles	**8**	7,890	7,810	1	79
	Direct emissions from combustion of road vehicle fuel - leased vehicles - Fuel card	**225**	225,338	223,695	235	1,408
	Direct emissions from combustion of stationary assets (e.g. oil boilers, Back up generators)	**377**	377,460	348,203	407	28,850
	Fugitive emissions	**1285**	1,284,909			
Total Direct Emissions (Scope 1)		**3,982**	**3,981,877**	**2,661,956**	**3,581**	**31,431**
Energy Indirect Emissions (Scope 2) Location based	Emissions from generated electricity usage	**21,223**	21,223,217	21,059,618	37,429	126,171
Energy Indirect Emissions (Scope 2) Market based	Emissions from generated electricity usage			20,627,816		

Total Scope 1 and 2 (Location based) emissions		**25,205**				
Other indirect emissions (Scope 3)	Category 1: Purchased goods and service-Indirect emissions from the supply and treatment of water	**57**	57,464			
	Category 3a Well to tank Purchased fuel	**81**	80,522			
	Category 3a Well to tank Natural Gas	**315**	315,495			
	Category 3a Well to tank Owned vehicles	**60**	59,564			
	Category 3b Well to tank emissions of purchase electricity (Generation and T& D losses)	**3,700**	3,699,997			
	Category 3c Downstream T&D losses of purchase electricity	**1,984**	1,984,319	1,968,623	3,622	12,074
	Category 4: Upstream transportation and distribution-Courier	**5**	5,091	5,034	0	57
	Category 6: Business Travel- Direct emissions from combustion of road vehicle fuel - private vehicles	**121**	120,709	119,750	110	850
	Category 6: Business Travel-Indirect emissions from business travel (flights, rail, ferry)	**5,447**	5,446,680	5,419,117	533	27,031
	Category 6: Business Travel-Indirect emissions from business travel (car hire)	**225**	224,886	223,246	234	1,405
	Category 11: Emissions resulting from services			14,627,205		
Total Scope 3 emissions		**11,995**	**11,994,727**	**22,362,975**	**4,499**	**41,417**
Scope 4	Modelled enabled ATM related CO_2 emission reduction			**228,073**		

6.2. Uncertainty assessment calculations

Category	Precision	Completeness	Temporal representation	Geographical representativeness	Technological representativeness	Basic uncertainty factor	Uncertainty (%)
1: Purchased goods and services	1.5	1.1	1	1	1	1.2	2.8
3: Fuel and energy related activities	1.1	1	1	1	1	1.05	2.5
4: upstream transportation and distribution	1.1	1.1	1	1	1	1.05	2.6
6: business travel	1.2	1.1	1	1	1	2	3.1
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

Based on the GHG Protocol Guidance Note on Quantitative Inventory Uncertainty.

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