Handbook

CORSIA

January 2024

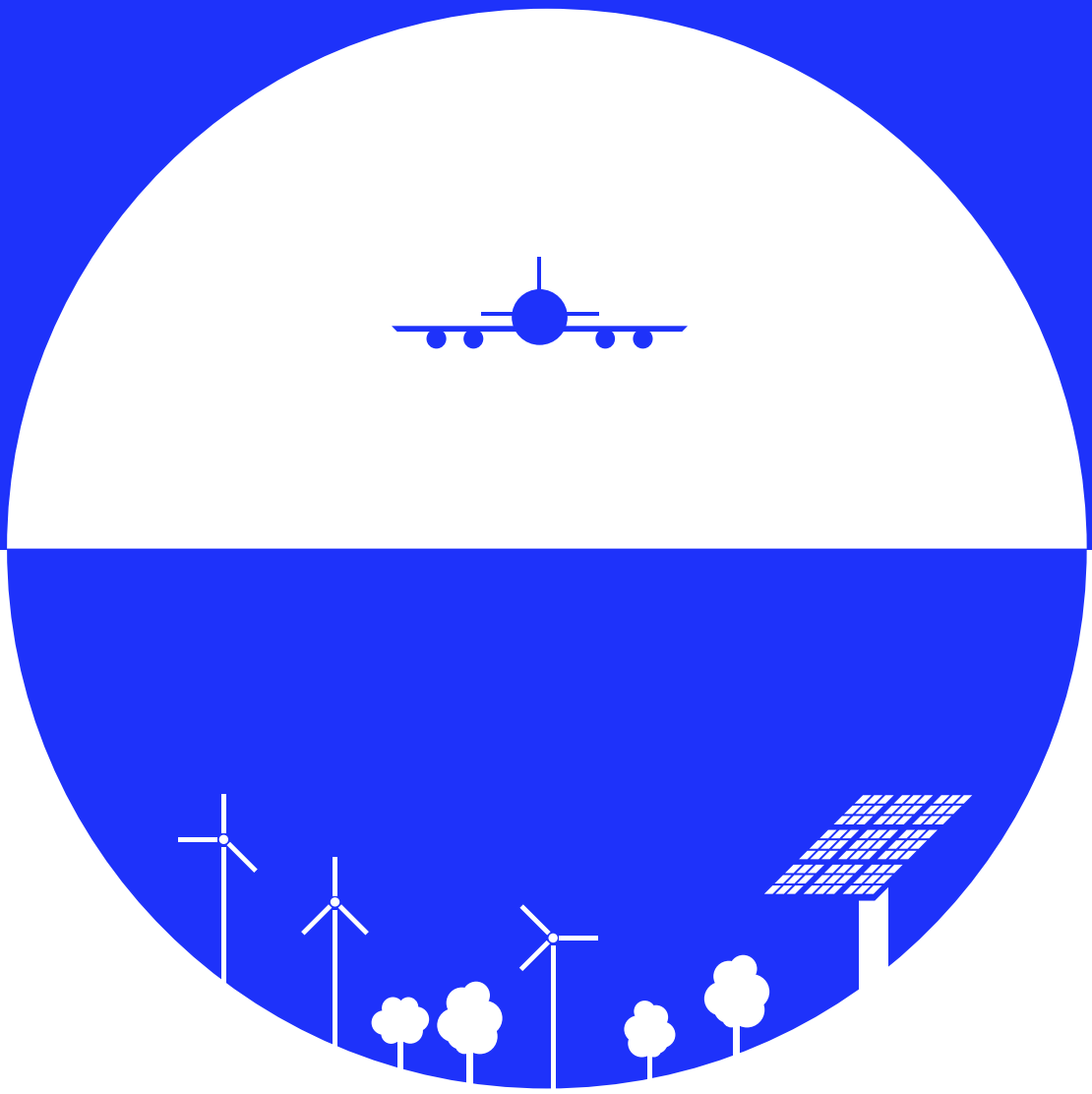

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Table of Contents

Introduction

The aviation sector is singularly committed to its decarbonization. As an early mover[1] and following on the heels of the adoption of the Paris Agreement at the UN Climate Change Conference (COP21) in 2015, the 39th ICAO (International Civil Aviation Organization) Assembly established CORSIA (Carbon Offsetting and Reduction Scheme for International Aviation) in October 2016. CORSIA is the only global market-based measure scheme to address CO_2 emissions from international aviation.

The industry further demonstrated its focus on decarbonization in 2021, when the 77th IATA (International Air Transportation Association) Annual General Meeting in Boston approved a resolution for the global air transport industry to achieve net-zero carbon emissions by 2050. This was followed by the 41st Assembly of ICAO in October 2022, when member states adopted the Long-Term Aspirational Goal (LTAG) for international aviation of net-zero carbon emissions by 2050.[2] Therefore, governments and the aviation industry are wholly united in the mission to ensure that international aviation continues to develop sustainably in recognition of its vital role in global economic and social development.

There are multiple ways to achieve sustainable aviation, involving many necessary developments and innovations (an analysis of these can be found in IATA's Net Zero Roadmaps). In this hard-to-abate sector where no solutions are currently available at scale, every tool in the toolbox must be used. CORSIA will make a significant and early contribution to the industry's decarbonization.

[1] The first time that an industry sector agreed to a global market-based measure in the climate change field.

[2] Resolution A41-21: Consolidated statement of continuing ICAO policies and practices related to environmental protection – Climate Change.

CORSIA

Offsetting

Under CORSIA, aeroplane operators must purchase and cancel "emissions units" to offset the increase in CO_2 emissions covered by the scheme.

CORSIA aims to address any increase in total CO_2 emissions from international civil aviation over a baseline. While it was initially foreseen that the baseline would be determined using the average annual emissions between 2019 and 2020 as reference. However, in June 2020, the ICAO Council agreed that the COVID-19 situation warranted action by the Council to avoid an inappropriate economic burden on international aviation and that 2020 emissions should not be used for the CORSIA design features. Therefore, according to ICAO Assembly Resolution A41-22, only 2019 emissions will be used for the pilot phase of CORSIA (2021-2023), and 85% of 2019 emissions will be used for the baseline in the subsequent compliance phases. (2024-2035).

With the exceptions of humanitarian, medical, and firefighting flights, all international civilian operations of aeroplanes are covered by CORSIA, including, for example, scheduled and non-scheduled flights, passenger and cargo flights, training and maintenance flights, as well as general aviation and private jets.

The term "aeroplane operator" is used by ICAO to exclude helicopter operations from the scope of applicability of CORSIA.[3] For simplicity, "operator" is used in this handbook.

In the context of addressing climate change concerns, offsetting is an action by a company or individual to compensate for their emissions by financing a reduction in emissions elsewhere. While carbon offsetting does not require companies to reduce their emissions "in-house," it provides an environmentally effective option for sectors with limited potential for further emissions reductions or where the abatement costs are unduly high.

Offsetting and carbon markets have been fundamental to global, regional, and national emissions reduction policies. They have operated for decades for compliance purposes and voluntary emissions reductions, and they continue to be an effective mechanism to underpin action against climate change.

There are many ways to achieve CO_2 reductions that can be used as offsets, many of which bring other social, environmental, and economic benefits relevant to sustainable development. Such offsets can be sourced from diverse types of project activities (e.g., renewable energy projects) and can be purchased through specialized offset providers or carbon brokers.

[3] Annex 16, volume IV, Part I, Chapter 1.

International standards and recommended practices

In June 2018, the ICAO Council adopted the International Standards and Recommended Practices (SARPs) for CORSIA as the First Edition of "Annex 16, Volume IV, Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA)". This first edition of the SARPs of Annex 16, Volume IV (commonly called "CORSIA SARPs") has been applied in all ICAO member states since 1 January 2019. In July 2023, a second edition of Annex 16, Volume IV, was published to reflect the outcome of the CORSIA periodic review underpinned in ICAO Assembly Resolution A41-22. The second edition of CORSIA SARPs supersedes the first edition and took effect from 1 January 2024.

Annex 16, Volume IV, contains detailed rules for the administration of CORSIA by states for the monitoring, reporting, and verifying of emissions and for the cancellation of emissions units. It is complemented by the CORSIA implementation elements, which include additional requirements for emissions units and CORSIA eligible fuels.

According to the Chicago Convention and Assembly Resolution A39-3, ICAO member states must implement the SARPs in their national regulations and ensure that domestic requirements are fully aligned with the SARPs. Such uniformity is critical to preventing market distortions and preserving the environmental integrity of CORSIA. However, states that are not able to align their domestic regulations with the SARPs may apply different requirements, provided they inform ICAO of any such differences.

The requirements of Annex 16, volume IV, are detailed in the following chapters. This handbook is based on the CORSIA SARPs adopted by the ICAO Council and does not cover any different requirements that individual member states may impose.

Periodic Review

The ICAO Council will undertake a periodic review of CORSIA for consideration by the Assembly every three years, beginning in 2022. The review intends to consider potential improvements to the scheme.

The periodic review should include an assessment of the scheme's market and cost impacts on States, aeroplane operators and international aviation. It should also assess the "functioning of the scheme's design elements." Based on this assessment, the Assembly would consider potential amendments to the scheme to improve its implementation and effectiveness and minimize market distortions.

Subsequently, a review took place in 2022, resulting in several changes to CORSIA's design elements, including adjusting how its baseline is calculated during its operational years. These changes are detailed in forthcoming sections.

Safeguard clause

In Operative Paragraph 17 of Assembly Resolution A39-3, the Assembly decided to provide safeguards within CORSIA to ensure the sustainable development of the international aviation sector and against inappropriate economic burdens on international aviation. It requested the Council to decide on the basis and criteria for triggering such action and identify possible means to address these issues. The provision was reiterated in Operative Paragraph 16 of Assembly Resolution A40-19 and Paragraph 16 of A41-22.

The safeguard clause explicitly gives authority to the ICAO Council to decide on the basis, criteria and means to address potential issues. As per this safeguard clause, the Council agreed at its 220th session that actual 2020 emissions should not be used for CORSIA's design features, recognizing that the COVID-19 crisis constituted a "situation warranting action by the Council to avoid inappropriate economic burden on international aviation."[4]

[4] ICAO Council, C-DEC 220/13.

International flights

Definition

CORSIA only applies to international flights, which take off in one state and land in another.[5] Domestic flights, i.e., flights between two aerodromes located in the same state, are not included in the scope of CORSIA.

Under CORSIA, the categorization of a flight as international does not consider the operator's nationality or the airspace that may be used to operate the flight. A flight between two aerodromes located in the same state would, therefore, be considered as domestic even if the aircraft flew through foreign airspace or if the operator is administrated by another state.

Overseas territories

For CORSIA, aerodromes located in overseas territories are attributed to their respective ICAO member state. This is also the case for overseas territories, which may, in some organizations, be assimilated into small island developing states. For example, flights to and from French Polynesia are treated like flights to and from any other aerodrome in France.

The ICAO Manual on Location Indicators (Doc 7910) contains a list of aerodromes, and the ICAO member states where they are located.

Flight stages and diversions

Under CORSIA, each individual "stage" of a flight with intermediate stops is considered as a separate flight, and the applicability of CORSIA is determined for each flight stage individually. For example, suppose an operator flies between Los Angeles and London with a stop in New York. In that case, the (domestic) flight operation between Los Angeles and New York is considered independent of the (international) operation between New York and London.

This rule applies irrespective of the nature of the intermediate landing, including in cases of unplanned stops such as technical or medical diversions.

[5] Annex 16, volume IV, Part II, 1.1.2.

Monitoring, Reporting, and Verification

Scope

All operators, irrespective of their nationality, have to monitor, report, and verify (MRV) CO_2 emissions from all their international flights to their national authority ("administrating authority") on an annual basis. The requirement to monitor CO_2 emissions has been applicable since 1 January 2019.

Exemptions

CORSIA only applies to international *civil* aviation. State flights are, therefore, excluded from the scope of the scheme. State flights include military, customs, and police flights.[6]

Furthermore, several exemptions of a technical nature are provided for, namely:

- Operations with aeroplanes with a Maximum Take Off Mass (MTOM) below or equal to 5,700 kg;
- Humanitarian, medical, and firefighting operations;
- Operators whose total annual CO_2 emissions from international aviation are below or equal to 10,000 tonnes.

These flight operations are exempt from CORSIA and not subject to any of its MRV or offsetting requirements.

State flights

In accordance with Article 3(b) of the Chicago Convention, state flights include aircraft used in military, customs, and police services. The status of a flight is determined by the function the aircraft performs at a given time, taking into account all the circumstances surrounding a flight, rather than just the registration or ownership of the aircraft. State flights may, for example, be operated by aircraft normally used for civilian purposes.

State flights can, for example, be distinguished through a specific identifier in the flight plan. If Item 18 of the flight plan is marked "STS/HEAD," then the flight is considered a flight with Head of State status according to Doc 4444 – *Procedures for Air Navigation Services – Air Traffic Management*. Other state flights, such as customs and police services, will use the "STS/STATE" indicator in Item 18. Military flights are usually recognizable if item 8 of the flight plan (flight rules and type of flight) is marked with an "M."

Subject to the approval of their administrating authority, operators may use other means to demonstrate that a flight was operated as a state flight. This may include supporting documentation and sources of information that can be used to demonstrate the nature of the flight, including, for example, charter contracts and diplomatic clearances. These documents, and others, can then be made available to verifiers or administrating authorities upon request to demonstrate that the aircraft was operated as part of a contract with a state entity for state purposes and can, therefore, be considered a state flight.

Humanitarian, medical, and firefighting flights

Humanitarian, medical, and firefighting operations are also exempt from the scope of CORSIA. This exemption would extend to flights preceding or following humanitarian, medical, or firefighting flights if they were required to accomplish the humanitarian, medical, or firefighting activities or to reposition the aeroplane thereafter.[7]

Humanitarian flights are typically flights operated for humanitarian purposes that carry relief personnel and relief supplies during or after an emergency and/or

[6] Convention on International Civil Aviation (Chicago Convention), Article 3.

[7] Annex 16, Vol. IV, Part II, 2.1.1 and 2.1.3.

disaster and/or are used to evacuate persons from a place where their life or health is threatened by such emergency and/or disaster.

Medical flights include flights carrying sick or seriously injured persons requiring urgent medical attention and life-critical medical emergency evacuation, as well as flights transporting medical personnel, equipment, organ donors, organs, or other lifesaving medical material urgently required.

Operators must provide evidence that specific flights were operated for humanitarian, medical, or firefighting reasons. Such evidence may, for example, include the information contained in item 18 of the flight plan, which can contain a specific indicator, according to Doc 4444:

- "STS/HUM" for humanitarian flights;
- "STS/HOSP" for medical flights declared by medical authorities;
- "STS/MEDEVAC" for life-critical medical emergency evacuation flights;
- "STS/FFR" for firefighting flights.

As for State flights, subject to the approval of their administrating authority, operators may use other means to demonstrate that a flight was operated for humanitarian, medical, or firefighting reasons.

Small emitters

Operators whose total CO_2 emissions from international flights are below or equal to 10,000 tonnes are exempt from CORSIA. Only flights within the scope of applicability of CORSIA must be included in an operator's total emissions to determine if it emits more or less than 10,000 tonnes of CO_2. Emissions from exempt flight operations (see above) must be excluded.[8]

If an operator's CO_2 emissions increase above the 10,000 tonnes threshold, which may be as a result of an increase in international operations or the start of international operations, it will have to start monitoring its emissions from the beginning of the year, after which its CO_2 emissions pass the 10,000 tonnes threshold.[9]

For example, if an operator's CO_2 emissions increase above 10,000 tonnes in 2023, it must start complying with the MRV requirements of CORSIA from 1 January 2024.

However, with the approval of its administrating authority, an operator may already start monitoring its emissions in the year during which it passes or expects to pass the 10,000 tonnes threshold.

If an operator's emissions decrease below 10,000 tonnes, the operator will fall outside of the scope of applicability of CORSIA and will no longer have to report its emissions. However, it is advised that operators engage with their authority if they are in this situation.

[8] Annex 16, vol. IV, Part II, 2.1.1.

[9] Annex 16, vol. IV, Part II, 2.1.4.

Monitoring

Emissions Monitoring Plan

All operators with annual emissions greater than 10,000 tonnes of CO_2 are required to report CO_2 emissions on an annual basis, with monitoring starting on 1 January 2019.

In order to prepare for the monitoring, reporting, and verification (MRV) of CO_2 emissions, each operator needs to develop an emissions monitoring plan.[10] The emissions monitoring plan shall include information on the operator, its fleet, and operations. The emissions monitoring plan also details the methods the operator uses to monitor fuel use, calculate emissions, and all associated data management.[11]

The emissions monitoring plan is important for the verification process. It helps the verifier to understand the procedures chosen and approved by the authority and check if they have been appropriately applied.

The emissions monitoring plan must be approved by the administrating authority, who should be satisfied that the processes described by the operator are appropriate and sufficient to comply with the prescribed MRV requirements. There is no need for the emissions monitoring plan to be reviewed or approved by a verification body before or after the approval by the administrating authority.

Before approving it, the administrating authority must review the emissions monitoring plan to ensure it is complete and consistent with the requirements of Annex 16 vol. IV. It notably assesses if the procedures in place are sufficient and if the operator has a suitable data management plan in place.

Furthermore, new entrant aeroplane operators must submit an emissions monitoring plan to their respective administrative authority within three months of falling within the scope of CORSIA.

Approval by the administrating authority assures the operator that the processes detailed in its emissions monitoring plan are satisfactory. Additionally, suppose there are material changes made to the information contained within the emissions monitoring plan (for example, changes that would affect the status or eligibility of the operator for an option under the emissions monitoring requirements). In that case, the operator is required to resubmit the emissions monitoring plan to the authority for approval.

The key MRV requirements and information to be included in the emissions monitoring plan are explained in the following sections.

[10] Annex 16, vol. IV, Part II, 2.2.2.

[11] Annex 16, vol. IV, Appendix 4.

Administration

Operators are liable for compliance with the MRV and offsetting requirements under CORSIA, with each operator reporting to a single national authority, their "administrating authority."

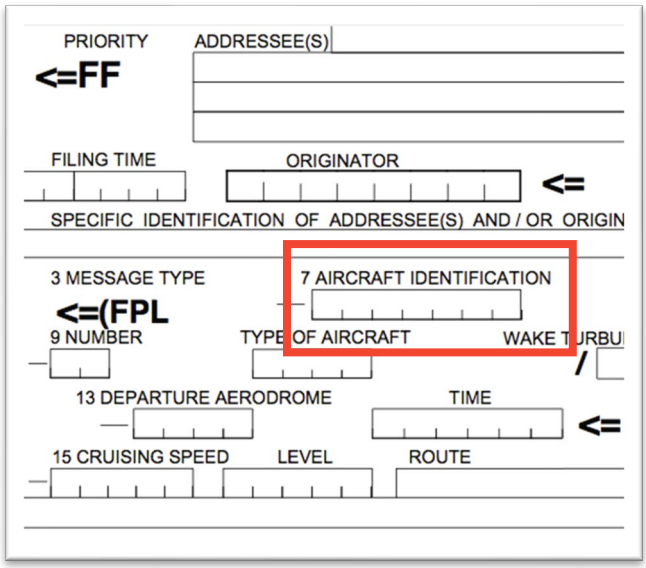
For most commercial operators, the identification of the operator responsible for a flight and the attribution of the operator to a state is based on the ICAO designator.[12] The ICAO designator is a three-letter code used to identify aircraft operating agencies in aeronautical telecommunications services. A list of ICAO designators is published as ICAO Document 8585, *Designators for Aircraft Operating Agencies, Aeronautical Authorities and Services*.

For operators with an ICAO designator, the operator that has been assigned the ICAO designator is the accountable entity, and it is administrated by the state, which has notified ICAO of the designator.

Operators without an ICAO designator are administered by the state that issued their air operator certificate (AOC). In the absence of AOC, they are administrated by the state where they are incorporated.

Two operators may request to be treated as a single entity if one is a wholly owned subsidiary of the other and both are administrated by the same state, subject to the latter's approval.[13] The possibility of treating several operators as a single entity does not apply when they are wholly owned by a holding group that is not an operator itself. If two operators decide to be treated as a single entity, their emissions will be aggregated to calculate the pooled entity's offsetting requirements.

The aircraft identification information in item 7 of the flight plan will be used to associate individual flights with operators.



If an ICAO designator is used to identify the aircraft in item 7, the operator holding the ICAO designator will be responsible for the flight.

The same applies in cases of a wet lease; if a flight is operated under the ICAO designator of the lessee, the obligations related to the emissions from the flight are attributed to the lessee and not to the lessor. Similarly, emissions from a code-share flight marketed by different airlines are only allocated to the operator whose ICAO designator is used in the flight plan.

If a registration mark is used in item 7 to identify an aircraft, the operator in whose AOC, or equivalent document, the aircraft registration mark is listed is responsible for the flight. In addition to registration marks listed in the AOC (or equivalent), and subject to the approval of the administrating authority, registration marks listed in the emissions monitoring plan may be used to attribute flights to an operator.

Suppose a flight cannot be attributed to an operator based on an ICAO designator or registration mark listed in the AOC or equivalent. In that case, the owner of the aeroplane will be responsible for the flight.

[12] Annex 16, vol. IV, Part II, 1.1 and 1.2.

[13] Annex 16, vol. IV, Part II, 1.2.6.

Monitoring of CO_2 emissions

CO_2 emissions are determined based on fuel use. As a rule, actual fuel use on each individual international flight is used. However, in certain circumstances, operators are eligible to use simplified monitoring.

Simplified monitoring

Operators eligible for simplified monitoring are not required to monitor actual fuel use but can calculate their emissions using the ICAO CORSIA CO_2 Estimation and Reporting Tool (CERT), an estimation tool developed by ICAO. The CERT applies CO_2 Estimation Models (CEMs) to estimate the emissions of a flight based on great circle distance or block time for a given aircraft type.[14]

A new version of the CERT is published annually, and operators must ensure they use the correct one. For example, the 2019 version of the CERT is only valid for the 2019 emissions report.

Operators may implement the CERT's CO_2 Estimation Models (CEMs) in their IT systems to facilitate compliance with CORSIA. They, however, need to ensure that the latest version of the CEMs is implemented and that the results of implementing the CEMs in IT systems are identical to those obtained with the same input from the downloadable CERT version. Annex 16, volume IV, does not provide for the use of any other estimation method for simplified monitoring.

During the baseline period (2019-2020), operators with annual CO_2 emissions (from all international flights) below 500,000 tonnes are eligible for simplified monitoring.[15]

From 2021, an operator may use the CERT:

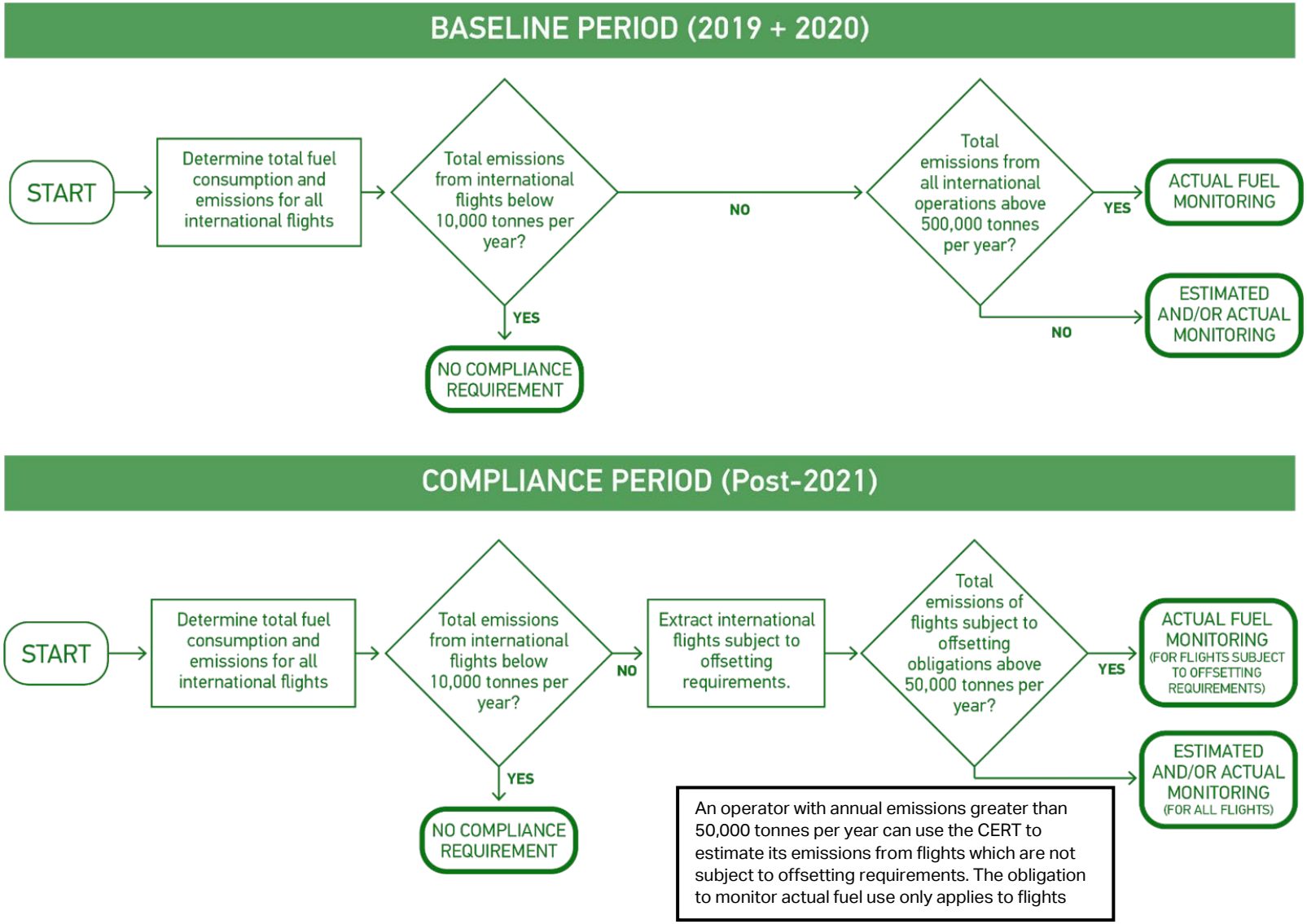
- for flights not subject to offsetting requirements; and
- for flights subject to offsetting requirements, if the total annual CO_2 emissions from these flights are below 50,000 tonnes.[16]

If an operator's CO_2 emissions increase above the 50,000 tonnes threshold for two consecutive years, it will no longer be eligible to use the CERT. The operator will have to submit a revised emissions monitoring plan by 30 September of the following year and then start monitoring its actual fuel use from the following 1 January. For example, if an operator's CO_2 emissions from flights subject to offsetting requirements are greater than 50,000 tonnes in 2024 and 2025, a new emissions monitoring plan must be submitted by 30 September 2026, and actual fuel use must be monitored from 1 January 2027.

If two operators have decided to be treated as a single entity, the eligibility for simplified monitoring is determined based on their aggregated CO_2 emissions.

An operator eligible for simplified monitoring may decide to monitor actual fuel use instead of using the CERT to estimate its emissions.

[14] Annex 16, vol. IV, Appendix 3.
[15] Annex 16, vol. IV, Part II, 2.2.1.2.
[16] Annex 16, vol. IV, Part II, 2.2.1.3.


BASELINE PERIOD (2019 + 2020)
START
Determine total fuel consumption and emissions for all international flights
Total emissions from international flights below 10,000 tonnes per year?
YES
NO COMPLIANCE REQUIREMENT
NO
Total emissions from all international operations above 500,000 tonnes per year?
YES
ACTUAL FUEL MONITORING
NO
ESTIMATED AND/OR ACTUAL MONITORING
COMPLIANCE PERIOD (Post-2021)
START
Determine total fuel consumption and emissions for all international flights
Total emissions from international flights below 10,000 tonnes per year?
YES
NO COMPLIANCE REQUIREMENT
NO
Extract international flights subject to offsetting requirements.
Total emissions of flights subject to offsetting obligations above 50,000 tonnes per year?
YES
ACTUAL FUEL MONITORING (FOR FLIGHTS SUBJECT TO OFFSETTING REQUIREMENTS)
ESTIMATED AND/OR ACTUAL MONITORING (FOR ALL FLIGHTS)
An operator with annual emissions greater than 50,000 tonnes per year can use the CERT to estimate its emissions from flights which are not subject to offsetting requirements. The obligation to monitor actual fuel use only applies to flights

Fuel use monitoring

Where operators monitor actual fuel use, they may select from five fuel monitoring methods.[17]

Different methods may be used for different aeroplane types (as specified in Doc 8643 – *Aircraft Type Designators*), but the same method must be used for all aeroplanes of the same type.

Two variants of an aeroplane which share the same ICAO aircraft type designators cannot be considered as different aeroplane types. For example, an Airbus A320 is assigned "A320" as an ICAO aircraft type designator irrespective of whether it is an Airbus A320-100 or -200 variant or retrofitted with sharklets. In contrast, an Airbus A320 and an Airbus A320neo constitute different types as the A320neo is identified by the "A20N" ICAO aircraft type designator.

Operators should use the same fuel use monitoring method in the baseline period as the one they will use from 2021. With the approval of its administrating authority, an operator may change the fuel monitoring method it uses for its fleet or for a sub-fleet, but the change must not occur in the middle of a 3-year compliance cycle. The change can only become effective from the start of the following compliance cycle.

It is also important to note that while the different fuel use monitoring methods require collecting specific data points, the specific means through which the operator collects the data are not prescribed. In its emissions monitoring plan, the operator needs to describe how it plans to collect the data for applying a specific fuel monitoring method, including the equipment, procedures, and documentation that will be used.

The operator shall identify primary and also secondary data sources, if the primary source cannot be used. The operator also needs to detail the exact points in time when the measurements will be made.

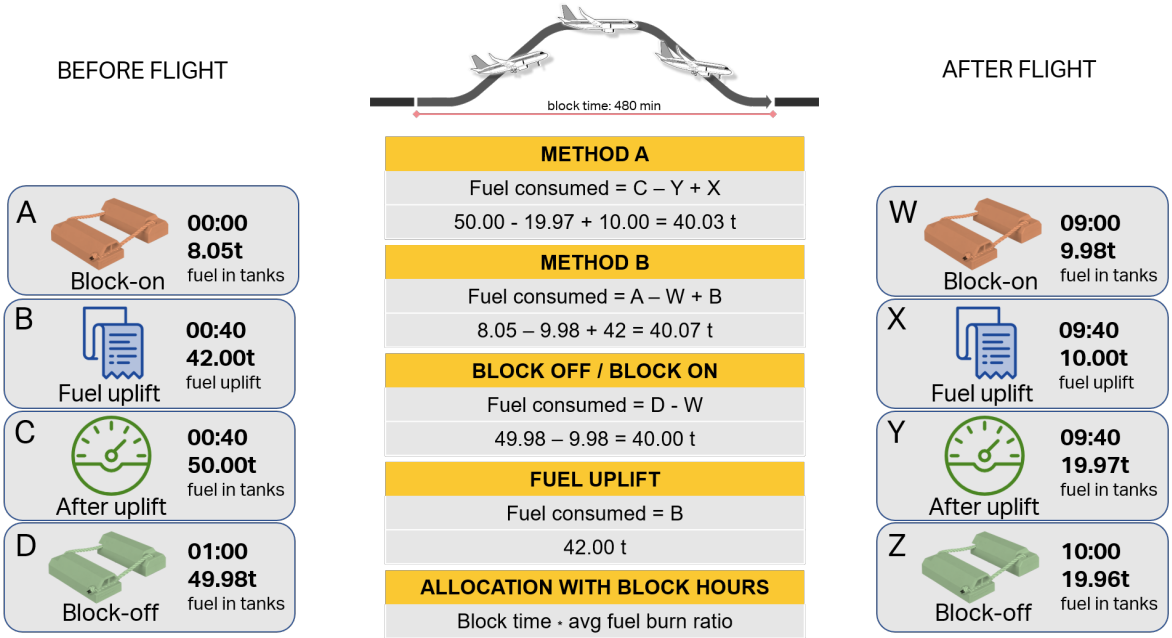
Naturally, like the other elements of the emissions monitoring plan, the processes described in the emissions monitoring plan will need to be considered satisfactory and approved by the administrating authority.

[17] Annex 16, vol. IV, Part II, Appendix 2.

The five monitoring methods are:

- **Method A**, which is based on measurements after the completion of fuel uplifts (for the flight under consideration and the subsequent flight) and the fuel uplift for the subsequent flight;
- **Method B**, which is based on measurements at block-on times (preceding flight and flight under consideration) and the fuel uplift for the flight considered;
- **Block-off / block-on**, which is based on the fuel consumed between block-off and block-on;
- **Fuel uplift**, which is based on the fuel uplift before each flight, measured in volume and multiplied by a density value; and
- **Fuel allocation with block hours**, which applies the average fuel burn ratio by aeroplane type and during the reporting year in question to the block hours of each flight.

The chart below provides an overview of each method's data points and formulas. The figures in the chart are illustrative and do not indicate any quantitative differences that would be observed using real-life measurements.



Method A

Method A is based on the following measurements:

1. the fuel quantity in tanks after the completion of the fuel uplift for the flight under consideration;
2. the fuel quantity in tanks after the completion of the fuel uplift for the subsequent flight; and
3. the fuel uplift for the subsequent flight.

It must be underlined that the fuel quantity in tanks after the completion of the fuel uplift is a different measurement from the fuel in tanks at block-off. However, (only) in cases where no uplift takes place for a flight, the amount of fuel contained in the tanks at block-off should be used as an alternative to the fuel contained in the tanks after the uplift is complete.

Similarly, in cases where a flight is followed by an activity other than a flight, such as maintenance, the operator may substitute the measurement of fuel in tanks after the uplift for the subsequent flight with the amount of fuel remaining in tanks at the start of the subsequent activity or fuel in tanks at block-on.

It is important to note that method A relies on data from the subsequent flight, which may be a domestic flight. Therefore, to prevent data gaps, it is recommended that operators using method A systematically collect all fuel measurements used in method A for all flights (domestic and international) operated by aircraft that are used in international operations.

Finally, if an operator performs one or more flights for another operator on an ad hoc basis, such as a short-term wet lease, then the necessary data should be acquired from the third party. If this information is not available, the monitoring of fuel consumption shall be done in accordance with the block-off / block-on method.

Method B

Method B is based on the following measurements:

1. the fuel quantity in tanks at block-on at the end of the preceding flight;
2. the fuel quantity in tanks at block-on at the end of the flight under consideration; and
3. the fuel uplift for the flight under consideration.

Similar to method A, the application of method B relies on data from another flight, which may be a domestic flight. Therefore, to prevent data gaps, it is recommended that operators using method B systematically collect fuel quantity at block-on for all flights (domestic and international) operated by aircraft that are used in international operations.

In cases where a flight is preceded by an activity other than a flight, such as maintenance, the operator may substitute the quantity of fuel at block-on at the end of the preceding flight with the amount of fuel remaining in aeroplane tanks at the end of the previous activity.

Finally, if an operator performs one or more flights for another operator on an ad hoc basis, such as a short-term wet lease, then the necessary data should be acquired from the third party. If this information is not available, the monitoring of fuel consumption shall be done in accordance with the block-off / block-on method described below.

Block-off / block-on

Block-off / block-on is based on the following measurements:

1. the fuel quantity in tanks at block-off at the start of the flight under consideration; and
2. the fuel quantity in tanks at block-on at the end of the flight is under consideration.

Commonly, block-off is understood as a point in time between the last door closed and the first engine on, and block-on as a point in time between the last engine off and the first door open.

In its emissions monitoring plan, the operator needs to define the precise point of time at which the measurements are made. If an operator uses a definition of block-off or block-on that is not within the common time windows defined above, such deviation may be approved by the administrating authority if it is in accordance with the operator's existing practices.

Fuel uplift

Fuel uplift is based on:

1. the fuel uplift before each flight.

Adjustments will be required to allocate fuel consumption between different flights when one or more flights are not preceded by a fuel uplift, for example, in the case of fuel tankering. In such cases, the allocation must be proportional to the block hours of the different flights covered by the same uplift.

Fuel allocation with block hours

Fuel allocation with block-hours applies the average fuel burn ratio by aeroplane type to the block hours of each flight. For each aeroplane type used by the operator for international flights, it requires the collection of:

1. total fuel uplifts; and
2. total block hours.

The average fuel burn ratio is calculated by dividing the sum of fuel uplifts by the total block hours. The operator will need to calculate the average fuel burn ratio for each aeroplane type at the end of each reporting year. The average fuel burn ratios will not be calculated using historical data and will only be valid for the reporting year in question. For example, to determine the average fuel burn ratios for 2022, an operator will use the fuel uplift and block hours data collected in 2022.

If the operator can clearly distinguish between fuel uplifts for international flights and fuel uplifts for domestic flights, the average fuel burn ratio shall be calculated based on fuel uplifts and block hours for international flights only.

Fuel density

In instances where fuel measurements are in volume, the operator shall use actual and/or standard density in accordance with the procedures it already has in place for operational and safety purposes. This may include a combination of standard and actual density, for example, where the operator's procedures require actual density for weight-critical flights and standard density for other flights. Nevertheless, in all cases where standard density is applied, the value used must be 0.8 kilograms per liter.

Operators are required to detail the procedures used to determine fuel density in the emissions monitoring plan. They should provide references to the relevant documentation, such as operational manuals.

Emission factor

Once the quantity of fuel used has been identified, the CO_2 emissions are calculated using an emission factor of 3.16 kilograms of CO_2 per kilogram of Jet-A/A1. The same emission factor should be applied to fuels equivalent to Jet-A and Jet-A1, such as TS-1 and No 3 Jet fuel.

The emission factor for Jet-B and AvGas is 3.10 kilograms of CO_2 per kilogram of fuel.

The emission factors used under CORSIA are based on the average molecular weight of the fuels and their combustion product, rounded up to 2 decimal places.[18]

[18] For jet kerosene: emissions factor = 528.114 (g/mol) / 167.311 (g/mol) = 3.1565 (rounded up to 2 decimal places = 3.16)

Data management

As the monitoring and reporting of emissions relies on the collection and handling of large sets of data, a key aspect of MRV is the procedures an operator has in place to manage data.

In their emissions monitoring plans, operators must provide information on the roles, responsibilities, and procedures for data management. They need to describe each step in the management of data, including sources of data, systems used to store and process data, as well as the controls in place to ensure the quality of data processing and integrity of the data itself.

Operators also need to assess the risks associated with the management of data and the measures they implement to mitigate those risks. The risks may be associated with potential deficiencies in the systems used to collect data, but they may also be related to the storage of records.

Operators must have in place a plan for record keeping. It is required that operators keep relevant records to demonstrate compliance with the requirements of CORSIA for a period of 10 years.[19]

Material changes

An operator is required to resubmit its emissions monitoring plan if there are any significant changes to the information it contains ("material changes").[20]

Material changes include changes that would affect the status or eligibility of the aeroplane operator for an option under the emissions monitoring requirements or that would otherwise affect the decision by the state to which the aeroplane operator is attributed with regard to whether the aeroplane operator's approach to monitoring conforms with the requirements of Annex 16, vol. IV.

Changes to the information that affects the administration or identification of an operator (for example, the ICAO Designator), changes that affect the eligibility to use simplified monitoring, changes to methodologies to monitor fuel use or determine fuel density, and changes to data management processes are examples of material changes.

In contrast, for example, changes in ownership structure that do not affect the accountable entity or changes to the contact information, list of aeroplanes, or state pairs provided in the emissions monitoring plan are not material and do not require the submission and approval of an amended emissions monitoring plan. Such changes should, however, be notified to the administrating authority in the annual Emissions Report.

[19] Annex 16, vol. IV, Part II, 1.4.1.

[20] Annex 16, vol. IV, Part II, 2.2.2.3.

Reporting

After each reporting year's end, operators must compile the fuel and emissions data collected in an annual emissions report. Annual reports may also include information on CORSIA-eligible fuels if they intend to claim emissions reductions from the use of CORSIA-eligible fuels.

The emissions reports need to be verified by a verification body prior to their submission to the administrating authority.

The deadline for the following emissions reports will be 30 April (for example, 30 April 2022 for the 2021 emissions report).[21]

CO_2 emissions

Data requirements

Operators must report the consolidated CO2 emissions data collected during a given reporting year to their administrating authority in their emissions reports.

By default, emissions data need to be reported by state-pair, but an administrating authority can request that the data be reported to them by aerodrome-pair.[22]

Inbound and outbound flights must be treated as distinct pairs (for example, flights that depart from A and land in B are to be reported separately from flights that depart in B and land in A).

Information that has to be included in the emissions report includes operator identification, information on the reporting cycle, reference to the most recently approved emissions monitoring plan, fleet and fuel information, and data gaps.[23]

In cases where several operators report jointly, the emissions data relating to each subsidiary has to be provided as appendices to the main emissions report.

Data gaps

Data gaps occur when an operator is missing data relevant to the determination of the fuel use of a flight in accordance with the approved fuel monitoring method. Gaps in emissions-related data can occur due to various reasons, including irregular operations, data feed issues, or critical system failures.

In cases where the operator can use a secondary data source to determine fuel use in accordance with the approved fuel monitoring method, this would not constitute a data gap. For example, if an operator typically uses ACARS data and, due to a problem, is missing data for a flight, it may be able to source actual fuel data from fuel invoices or technical logs (the secondary sources).

If no primary or secondary data is available and the approved fuel monitoring methodology cannot be applied, then a data gap occurs, and the operator will have to use the CERT to fill the data gap.

It should be noted that data gaps may not affect more than 5% of all international flights in the 2019-2020 period, and more than 5% of international flights subject to offsetting requirements in 2021-2035. The 5% thresholds are assessed based on the number of flights, not in relation to fuel use or CO_2 emissions. If these thresholds are exceeded, the operator is required to take remedial action in consultation with its administrating authority.[24]

[21] Annex 16, vol. IV, Appendix 1.
[22] Annex 16, vol. IV, Part II, 2.3.1.2.
[23] Annex 16, vol. IV, Appendix 5.
[24] Annex 16, vol. IV, Part II, 2.5.1.1.

CORSIA eligible fuels

Operators are entitled to claim emissions reductions from fuels that meet defined sustainability criteria and are certified by an approved certification scheme. These "CORSIA eligible fuels" (CEF) include "sustainable aviation fuels," which are renewable or waste-derived fuels, as well as "lower carbon aviation fuels," which are fossil-based fuels.[25]

To meet CORSIA's sustainability criteria, a specific CORSIA eligible fuel needs to achieve net greenhouse gas emission reductions of at least 10% compared to conventional jet fuel on a life cycle basis. Furthermore, a CORSIA-eligible fuel must not be made from biomass obtained from land with high carbon stock. [26] Additional sustainability criteria applicable for CORSIA Sustainable Aviation Fuel and CORSIA lower carbon aviation fuel by a certified fuel producer on or after 1 January 2024 were adopted by the ICAO Council. [27]

The accounting of CORSIA-eligible fuels is based on purchasing and blending records, excluding fuels sold to a third party or claimed under other greenhouse gas emissions schemes. CORSIA eligible fuels used on domestic flights may be claimed under CORSIA, provided they are not claimed under any other greenhouse gas emissions schemes. [28] According to purchasing and blending records, claims of emissions reductions by an operator from using CEFs are based on the mass of CEFs.

CORSIA-eligible fuels should be reported during the same compliance period as when the blending occurs. It is recommended that operators make CORSIA-eligible fuel claims on an annual basis, but operators may decide when to make a claim within a given compliance period.[29] For example, if a batch of CORSIA eligible fuel is blended in 2024, it is recommended that the batch be included in the 2024 emissions report. Nevertheless, the operator may instead decide to report it with its 2025 or 2026 emissions. However, in all cases, the associated emissions reductions can only be claimed in relation to offsetting requirements for the 2024-2026 compliance cycle.

In addition to detailed information on the CORSIA eligible fuels claimed, operators need to provide a list of all other greenhouse gas schemes that they participate in. Only schemes where emission reductions from CORSIA eligible fuels may be claimed need to be included in that list. They also need to include a declaration that they have not made claims for the same batches of CORSIA eligible fuel under any other schemes.[30]

The emissions reductions that an operator can claim from CORSIA-eligible fuels are proportional to the life cycle emissions benefits of the fuels used, compared to a baseline life cycle emissions value of 89 gCO_2e/MJ for jet fuel. Life cycle emissions include emissions from the full supply chain of production and use ("core LCA") and emissions from induced land-use change ("ILUC"). The emissions reductions will be deducted from the operator's total offsetting requirements at the end of each 3-year compliance period.[31]

[25] Annex 16, vol. IV, Part II, Chapter 1.
[26] Annex 16, vol. IV, Part II, 2.2.4.
[27] ICAO Document CORSIA Sustainability Criteria for CORSIA Eligible Fuels (November 2022)
[28] Annex 16, vol. IV, Part II, 2.2.4, note 1.
[29] Annex 16, vol. IV, Part II, 2.3.3.4
[30] Annex 16, vol. IV, Part II, 2.3.3.
[31] Annex 16, vol. IV, Part II, 3.4.

Publication of data

Requirements

Some of the data reported to states will be disclosed to the public, after aggregation. The information that ICAO will publish includes:

- the annual CO_2 emissions on each state-pair, aggregated for all operators.

It will also include, for each operator:

- the total annual CO_2 emissions;
- the total annual CO_2 emissions for state-pairs subject to offsetting requirements; and
- the total annual CO_2 emissions for state-pairs not subject to offsetting requirements.

The information will be made available through the CORSIA Central Registry (CCR).

Where an operator is concerned that the publication of its data, including after aggregation, could result in the disclosure of commercially sensitive information, it can submit a written and justified request to its national authority that the related data be treated as confidential and not be disclosed to the public[32].

Commercially sensitive information

Fuel is the most important cost item for commercial operators. Therefore, CO_2 emissions data, which is derived directly from fuel use, provides a very good indication of an operator's main cost item, even if the price paid for its fuel remains undisclosed.

Airline competition on some routes is fierce, with operators competing to keep and gain market share. In such an environment, having the lowest fuel consumption – or even a relatively low level – is a key advantage to sustain the competition. As a corollary, intelligence on a competitor's fuel use on a specific route can be used to inform pricing and other commercial strategies, aiming to reduce a competitor's market shares.

Therefore, annual CO_2 emissions of an operator on a state-pair are considered commercially sensitive if they are determined based on actual fuel use.

This is why Annex 16, Volume IV only foresees the disclosure of aggregated data. However, it also identifies several situations where aggregated data may enable the determination of commercially sensitive state-pair information.

- An operator operates very few international state-pairs (for example, Operator A in the table below)
- An operator operates very few state-pairs subject to offsetting requirements or very few state-pairs not subject to offsetting requirements (for example, Operator B in the table below)
- An operator operates a state-pair that no or very few other operators fly (for example, Operator C in the table below).[33]

It is important to note that commercially sensitive data will not automatically be treated as confidential. The operators concerned will need to submit a written and justified request to their national authority that the related data be treated as confidential and not be disclosed to the public. If the national authority approves the operator's request, it should ensure that the data is identified as confidential when it reports the data to ICAO to prevent its publication by ICAO. When evaluating whether the level of aggregation would be sufficient to prevent the disclosure of commercially sensitive data, potential corporate relationships between operators should be considered.

[32] Annex 16, vol. IV, Part II, 2.3.1.6 and 2.3.1.6.

[33] Annex 16, vol. IV, Part II, 2.3.1.6 and 2.3.1.7.

Operator	State-pairs operated	Data published		
		Total CO_2	CO_2 for all flights subject to offsetting requirements	CO_2 for all flights not subject to offsetting requirements
A	A <-> B	A <-> B	A <-> B	n/a
B	A <-> B A <-> C A <-> D A <-> E	A <-> B A <-> C A <-> D A <-> E	A <-> B A <-> C A <-> D	A <->E
C	A <-> B A <-> C A <-> D A <-> E A <-> F	A <-> B A <-> C A <-> D A <-> E A <-> F	A <-> B A <-> C A <-> D	A <-> E A <-> F
In this example, all three operators are administered by State A. There are no other operators administered by State A. *All state-pairs are subject to offsetting requirements, except A< - >E and A <-> F.* *Operator C is the only operator flying between State A and State F.*				

Verification

An external and independent body must verify annual emissions reports before being submitted to the administrating authority. This also applies to emissions reports of operators who are eligible to use the CERT for simplified monitoring.[34]

Verification requirements also apply to the reports that operators need to submit on the emissions units canceled to meet offsetting requirements. The verification of the emissions units cancellation report (EUCR) is covered separately in the next chapter.

Internal pre-verification

While it is not a mandatory requirement, it is recommended that operators prepare for the third-party verification process by selecting an internal auditor to review the draft emissions report to check the data, processes, and resulting output. This will allow the operator to identify potential irregularities and take corrective actions before third-party involvement.

The internal auditor will, for example, check if the responsibilities assigned to various staff have been completed, how data compares to previous years, whether it is complete, and if measurements have been taken in accordance with the agreed procedures.

Before engaging a verification body, the operator is recommended to confirm the verification body's accreditation status, which can be found in ICAO's document titled "CORSIA Central Registry (CCR): Information and Data for Transparency." Furthermore, the type of engagement between the operator and the verification body shall be verification. The "agreed-upon procedure" engagement type is not applicable to CORSIA.[35]

[34] Annex 16, vol. IV, Part II, 2.4.

[35] Annex 16, vol. IV, Appendix 6, 3.1.

Third-party verification

Scope

The verification of the emissions report shall cover an operator's CO_2 emissions from international flights and any CORSIA-eligible fuel claims during the reporting period in question.[36]

The CO_2 emissions within the scope of the verification all fall within the scope of CORSIA's monitoring and reporting requirements, irrespective of whether they are subject to offsetting requirements.

This implies that while the verifier needs to ensure that all international flights subject to monitoring requirements have been included, the emissions from domestic flights, state flights, humanitarian flights, firefighting flights, or flights with aeroplanes with an MTOM below 5,700 kg are not to be verified.

Objective

The verification body must check if the emissions reported are accurate and supported by sufficient evidence.

One of the main tasks of the verification body is to ensure that the monitoring of CO_2 emissions has been undertaken in accordance with the emissions monitoring plan. The verification body will, for example, check if the fuel use was calculated in line with the selected methodology, if fuel density was determined in accordance with the procedures detailed in the emissions monitoring plan, etc.

The verification body must also check that the stated amount of CORSIA-eligible fuels is accurate and that the claimed batches have not been claimed under any other voluntary or mandatory schemes in which the operator has participated.

If the report's accuracy is satisfactory, the verification body issues a written declaration confirming that the CO_2 emissions statement is within the defined level of assurance and materiality. In cases where the verification body may find misstatements and other irregularities in the emissions report, the operator needs to take corrective actions.

In accordance with Annex 16, volume IV, the objectives of the verification of an emissions report are[37]:

- The emissions statement is materially fair and an accurate representation of emissions and is supported by sufficient and appropriate evidence;
- Emissions have been monitored, quantified, and reported over the period of the emissions report in accordance with the applicable standards and the approved emissions monitoring plan;
- The correct method of flight attribution has been applied;
- The stated amount of emissions reductions from the use of CORSIA-eligible fuels is materially fair and an accurate representation of emissions reductions over the reporting period and is supported by sufficient and appropriate internal and external evidence;
- The claimed batches of CORSIA-eligible fuels have not been claimed under any other schemes it has participated in;
- Emissions reductions associated with the use of CORSIA-eligible fuels have been monitored, quantified, and reported over the period of the emissions report in accordance with the applicable standards.[38]

[36] Annex 16, vol. IV, Appendix 6, 3.4.
[37] Annex 16, vol. IV, Appendix 6, 33.
[38] Annex 16, vol. IV, Appendix 6, 3.2.

Requirements

Level of assurance

The objective of the verification process is to allow the verifier to issue a verification opinion on whether the emissions report is without material discrepancy.

An absolute level of assurance is neither attainable nor required for CORSIA. For CORSIA, a "reasonable level of assurance" [39] is required, which means the verifier must be able to conclude that the emissions report is materially correct and a fair representation of the operator's emissions and information and that the emissions report is prepared in accordance with the applicable regulatory requirements.[40]

The level of assurance required influences the approach taken by the verifier. For example, to attain a reasonable level of assurance, the verifier needs to test the CO_2 data and information in the report. It isn't sufficient for the verifier to simply conclude that there is no evidence of material errors or inconsistencies with regulatory requirements.

Materiality

The concept of materiality is used to identify information that, if omitted or misstated, would significantly misrepresent the operator's emissions assertion.

A margin of uncertainty in the emissions report is tolerated ("materiality threshold"), but it may not exceed 2% of total emissions for operators with annual CO_2 emissions greater than 500,000 tonnes from international flights. The materiality threshold for operators with annual CO_2 emissions from international flights equal to or less than 500,000 tonnes is 5%.[41]

The materiality threshold is assessed based on the discrepancy between (total) emissions declared by the operator and the verification body's estimation of the total amount of emissions. Overstatements and understatements in the operator's emissions report are allowed to balance out.

However, materiality is not only assessed quantitatively, but also on a qualitative basis. Non-conformities or misstatements that may not lead to the materiality threshold being exceeded could influence the verification body's conclusions. This may be the case of systematic underestimations of emissions or an operator not applying the procedures approved in its emissions monitoring plan.

Verification process

Verification plan

The verification body shall prepare a verification plan describing the responsibilities and activities for each variable that may potentially impact the reported emissions.[42]

The verification plan shall be elaborated based on a strategic analysis of the scope and complexity of the operator's activities. The scope [43] and complexity depend on variables such as the type and size of operations, whether the operators have parent companies, whether the administrating authority has imposed specific conditions, etc.

On the basis of the strategic analysis, the verification body identifies and quantifies risks inherent to the activity (for example, errors in the data collection process) and risks that control activities (such as data validation processes) would not detect errors and discrepancies. The verification body must also assess the risk that discrepancies may not be detected in the verification process. The risk analysis is informed not only by the complexity of the operator's activities but also by the maturity and robustness of the control and data flow activities the operator implements.

[39] Annex 16, vol. IV, Appendix 6, 3. and ISO 14064-3:2019 section 5.1.3

[40] Annex 16, vol. IV, Appendix 6, 3.2.
[41] Annex 16, vol. IV, Appendix 6, 3.5.

[42] Annex 16, vol. IV, Appendix 6, 3.8.
[43] Annex 16, vol. IV, Appendix 6, 3.4.

Verification activities

During the verification process, the verification body reviews the operator's information systems and controls to ensure that the control activities that were identified in the emissions monitoring plan are effectively implemented. This includes the procedures to track changes in the fleet and ensure the completeness of all flights, the procedures to determine which flights are exempt from monitoring or offsetting requirements, and the processes to validate data and identify erroneous values. If data flow activities are outsourced, the verification body will assess if controls are in place to ensure the quality of the outsourced activities.

The verification activities naturally also include an assessment of the emissions data. The assessment should include evidence-gathering to compare the data used to prepare the report with primary and secondary data sources, such as flight plans, flight logs, and fuel invoices.[44] Data sources also include external reference data such as ATC data and invoices, fleet databases, or timetables.

The verification body should, however, not only rely on sampling but also apply analytical procedures to check full datasets. Such checks can be based on indicators such as the average fuel burn of flights or maximum tank capacity to identify data that may be erroneous.

The verification body also needs to ensure that the operator has complied with the requirements of Annex 16, volume IV (as implemented in the operator's state) and the approved emissions monitoring plan. The verification body must, among others, check that the fuel use monitoring methods have been implemented correctly and, for example, that the appropriate measurement points have been used.[45]

If the operator includes a claim for CORSIA eligible fuels, the verification body needs to confirm that the sustainability documentation is reliable and from an approved Sustainability Certification Scheme. The verification process should also ensure that the reported batch volumes, mass, and life cycle emissions align with the supporting documentation and that the CORSIA-eligible fuels have not been sold to a third party or claimed under another scheme. The purchase agreements, delivery documentation, sustainability certificate, and declarations made by the operator in other schemes allow to cross-check the information.[46]

During its activities, the verification team should conduct site visits to interview staff and check the practical application of the procedures, if the risk assessment and evidence-gathering plan requires such a visit to reduce the verification risk.

Verification report

The verification team shall submit a copy of the verification report to the operator and, upon their authorization, forward a copy of the report, together with the emissions report, the emissions unit cancellation report, or both, to the administrating authority of the respective state. The verification team shall choose between two verification opinion statements: "verified as satisfactory" or "verified as unsatisfactory." If the verification body finds any misstatements (erroneous or missing data) or non-conformities (incorrect application of requirements), it will contact the operator to identify potential corrective actions. The information the operator provides to correct misstatements and non-conformities should be verifiable. If no corrective action can be taken, the misstatements and non-conformities are included in the verification report and considered in the materiality assessment.

If the verification body is satisfied that the emissions report contains no misstatements or non-conformities, the emissions report is "verified as satisfactory."

If the emissions report contains misstatements or non-conformities, the verification body may still conclude that the report is satisfactory if the misstatements or non-conformities are not material. In such a case, the verification opinion is that the emissions report is "verified as satisfactory with comments."

If the emissions report contains material misstatements or non-conformities, it is "verified as non-satisfactory."

[44] Annex 16, vol. IV, Appendix 6, 3.9.
[45] Annex 16, vol. IV, Appendix 6, 3.6.
[46] Annex 16, vol. IV, Appendix 6, 3.4.2.

Verification body

A key principle of the verification process is that it should be undertaken by a body that is independent of the activity being verified and free from bias and conflict of interest.

To minimize impartiality, if the leader of the verification team undertakes six annual verifications for CORSIA or any other greenhouse gas verification for one operator, then the leader of the verification team shall take a break of three consecutive years from providing verification services to that same operator.[47]

Furthermore, operators can only engage verification bodies accredited by a National Accreditation Body (NAB) to ISO 14065:2020 and additional CORSIA-specific requirements. An operator may engage a verification body accredited by a national accreditation body from another state.[48]

In addition to the ISO standards, the verification body has to satisfy several personnel and team competency requirements. The verification team must, for example, demonstrate knowledge of general technical processes in the field of civil aviation, aviation fuels, and related processes, fuel use monitoring and measurement devices and procedures, data management systems and controls, etc.

Engaging a verifier

The operator should exercise due diligence to ensure the verification body is accredited for CORSIA[49] and has the required personnel competency and expertise.

When the operator engages a verifier, it should ensure that the contractual basis specifies the conditions for the verification.

Annex 16, volume IV, provides that the following should be specified in the contract:

- Scope of verification, verification objectives, level of assurance, materiality threshold, and relevant verification standards – ISO/IEC 17029, ISO 14065; ISO 14064-3; Annex 16, vol. IV; the Environment Technical Manual (Doc 9501), vol. IV – *Procedures for demonstrating compliance with the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA)*;
- Flexibility to change time allocation if this proves necessary because of findings during the verification;
- Requirement of the aeroplane operator to accept the audit as a potential witness audit by national accreditation body's assessors, potentially accompanied by peer review assessors or other observers;
- Requirement of the aeroplane operator to authorize the release of the emissions report, the emission unit cancellation report, where applicable, and the verification report by the verification body to the state;
- Requirements of the verification body to communicate any suspected intentional misstatement or noncompliance by the operator to the State as soon as practicable (ISO 14064-3:2019 section 5.4.3); and
- Liability coverage.[50]

To perform verification activities, the operator needs to provide access to all relevant documents and data sources to the verification body. The operator and the verification body should identify the data sources and access needs before the verification exercise. Given the confidential nature of the information the verification body has access to, the operator and the verification body should include appropriate confidentiality clauses in their contract.

In addition, the operator and the verifier may wish to include clauses on fees, dispute settlement, and force majeure situations.

[47] Annex 16, vol. IV, Appendix 6, 2.2.
[48] Annex 16, vol. IV, Part II, 2.4.2.

[49] The latest list of verification bodies accredited in States can be found in ICAO CORSIA Central Registry (CCR)

[50] Annex 16, vol. IV, Appendix 6, 2.9.

State review

The administrating authority performs an order of magnitude check of the verified emissions reports submitted by operators.[51]

The administrating authority does not need to review the emissions reports in detail but should perform checks to ensure that the information in the report is plausible and complete.

The administrating authority should, for example, check if the information on the operator and its fleet is accurate. It should make sure that the proper template has been used for the emissions report, that the emissions report was verified and by a verification body accredited for CORSIA, that the approved fuel monitoring method was used, that the reported CO_2 emissions and number of flights are roughly plausible, etc.

The administrating authority may, for example, estimate the typical fuel consumption for a flight using the CERT and compare it with the data reported by the operator. The order of magnitude review will also ensure that the data has been aggregated at the right level and that state pairs have appropriately been classified as subject or not subject to offsetting requirements. The administrating authority will also consider whether any data gaps existed during the reporting year and whether potential comments from the verification body have been considered.

[51] Annex 16, vol. IV, 2.4.1.6.

Offsetting

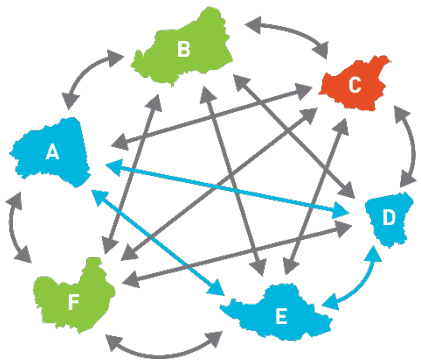
Phased implementation

In order to address the concerns of developing states and to take into account the special circumstances and respective capabilities of states, CORSIA will be implemented in phases.

The phased implementation, however, only relates to offsetting requirements. All operators that emit more than 10,000 tCO_2 per year on international flights have to monitor and report emissions for all international flights since 1 January 2019, including flights to and from exempted states.[52]

Pilot phase (2021-2023) and first phase (2024-2026)

From 2021 until 2026, offsetting requirements will only apply to international flights between states that volunteer to participate in the pilot and/or the first phases (states **A**, **E,** and **D** in this example).[53]



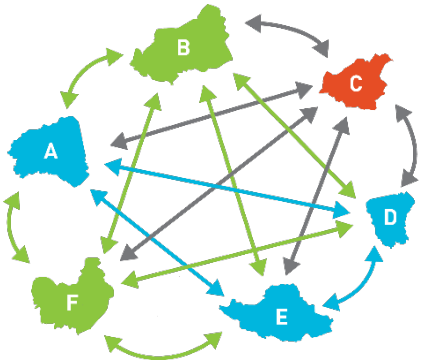
Any operator flying between volunteering states (↔ blue lines) will be subject to offsetting requirements, even if the operator is based in a state that has not volunteered. All other international flights to and from states that have not volunteered (**B**, **F,** and **C**) will be exempt from offsetting requirements (↔ grey lines).

However, the CO_2 emissions from all international flights, including flights exempt from offsetting requirements, will have to be monitored, reported, and verified annually.

Second phase (2027-2035)

From 2027, offsetting requirements will apply to ***all*** international flights (including those that did not volunteer to be part of the first phases: **B** and **F**), ***except*** flights to or from states that meet one of the two following criteria (**C**):

- Least Developed Countries, Small Island Developing States, and Landlocked Developing Countries; ***or***
- States that represent a small share of international aviation activities (in RTKs): these include the States that account for less than 0.5% of total RTKs from international aviation in 2018.[54]



Voluntary participation

Exempted states can decide to join the scheme at the beginning of any year. The only requirement is to communicate their decision to ICAO according to the timeline detailed in Annex 16, volume IV, Appendix 1.

States who decide to participate in CORSIA on a voluntary basis may discontinue their voluntary participation in the scheme from 1 January of any

[52] Annex 16, volume IV, Part II, 2.1.1.
[53] Annex 16, volume IV, Part II, 3.1.3.
[54] Annex 16, volume IV, Part II, 3.1.3. The Second phase applies to all flights between States that have an individual share of international aviation activities in RTKs in 2018 above 0.5 percent of total RTKs or whose cumulative share in the list of States from the highest to the lowest amount of RTKs reaches 90 percent of total RTKs, except LDCs, SIDS and LLDCs unless they volunteer to participate in this phase. The RTK taken into account will be the aggregated RTK from international flights by all operators registered in the State in question.

given year, provided they inform ICAO no later than 30 June of the preceding year.

Calculation of offsetting requirements

Principles

The calculation of offsetting requirements will evolve from a "sectoral" approach to a combination of a "sectoral" component and an "individual" component.

The sectoral component is based on the total CO_2 emissions of each operator. Each operator will have to offset a given percentage of its CO_2 emissions from flights subject to offsetting requirements. This percentage, the sector's "growth factor," will be identical for all operators and determined based on the aggregated emissions from all operators. It will be calculated by dividing the total increase in CO_2 emissions over a baseline for the given year, by the total CO_2 emissions on state-pairs subject to offsetting requirements in the given year.

In contrast, the individual component is based solely on the increase in CO_2 emissions of each operator.

All CO_2 emissions from flights exempt from CORSIA or not subject to offsetting requirements, as a result of the phased implementation or technical exemptions, are excluded from the calculation of offsetting requirements.

The weighting between the sectoral and individual components will evolve over time as follows (according to A41-22):

	PILOT PHASE	FIRST PHASE	SECOND PHASE		
	2021-2023	2024-2026	2027-2029	2030-2032	2033-2035
SECTORAL	100%	100%	100%	100%	85%
INDIVIDUAL	0%	0%	0%	0%	15%

Calculation of an operator's sectoral component

The sectoral component is obtained by multiplying the operator's total CO_2 emissions covered by CORSIA (Chapter 3 emissions) with the "sector's growth factor" (SGF), both for the year of consideration.

The sector's growth factor is obtained by dividing the aggregated increase in total CO_2 emissions above the baseline from all operators for the given year by the total CO_2 emissions from international civil aviation in the given year. Only the emissions from state-pairs subject to offsetting requirements are considered in determining the sector's growth factor.[55]

For example, if the total CO_2 emitted (by all operators) on state-pairs subject to offsetting requirements (Chapter 3 emissions) in 2030 is 750 million tonnes of CO_2 and the baseline for 2030 (85% of 2019 emissions on the same state-pairs as those applicable in 2030) are 500 million tonnes of CO_2, the sector's growth factor in 2030 would be:

$$(750–500) \div 750 = 33.3\%$$

If an individual operator emits 150,000 tonnes of CO_2 in 2030, the sectoral component of its offsetting requirements would, therefore, be:

$$150{,}000 \times 33.3\% = 50{,}000 \text{ tonnes of } CO_2$$

[55] Annex 16, vol. IV, Part II, 3.2.

Calculation of an operator's individual component

The individual component is effectively the difference between an operator's CO_2 emissions in a given compliance year and its baseline emissions for that year[56] (calculated as 85% of the annual CO_2 of the operator in 2019, within CORSIA scope considering the participating states for that year).

For example, if the CO_2 emitted by an operator on state pairs subject to offsetting requirements in 2030 is 1.2 million tonnes of CO_2 and the operator's baseline emissions for the same state pairs are 800,000 tonnes of CO_2, the operator's individual component would be 400,000 tonnes of CO_2 for 2030:

1,200,000 – 800,000 = 400,000 tonnes of CO_2

Calculation of an operator's offsetting requirements

Once an operator's sectoral and individual components are known, they should be multiplied by the applicable weightings.

In compliance years where the approach is 100% sectoral, an operator's offsetting requirement will be its sectoral component. In compliance years where offsetting requirements are a combination of the individual and sectoral components (from 2033 to 2035), the components should be multiplied by the respective weightings.

For example, in 2033, when the weighting is 15% individual and 85% sectoral, an operator's offsetting requirements will be:

0.15 × individual component + 0.85 × sectoral component = CO_2 to offset in 2033

The table below provides illustrative values:

Illustration of calculation of offsetting requirements for an operator			Baseline for a given year	2025	2030	2035
Total emissions		*tCO_2, in thousands*		650	710	790
Total emissions from state-pairs subject to offsetting requirements in:	2025	*tCO_2, in thousands*	380	400		
	2030	*tCO_2, in thousands*	430		500	
	2035	*tCO_2, in thousands*	430			550
Sector's growth factor			N/A	20%	30%	40%
Sectoral component		*tCO_2, in thousands*	N/A	400 x 20% = 80	500 x 30% = 150	550 x 40% = 220
Individual component		*tCO_2, in thousands*	N/A	Not applicable	Not applicable	550-430 = 120
Offsetting requirements		*tCO_2, in thousands*	N/A	100% x 80 = 80	100% x 150 = 150	85% x 220 + 15% x 120 = 205

[56] Annex 16, vol. IV, Part II, 3.2.4.

Offsetting requirements

Compliance cycle

While the reporting of emissions will take place on an annual basis, offsetting requirements will be aggregated by 3-year compliance cycles. For every compliance cycle, operators will need to offset and cancel a quantity of eligible emissions units corresponding to their offsetting requirements.

Administrating authorities will notify operators of their final offsetting requirements for each year by 30 November of the following year.[57] For example, by 30 November 2027, the states shall calculate and inform operators that are attributed to them of their offsetting requirements for 2026.

The offsetting requirements of an operator will be determined by its administrating authority. The final offsetting requirements will however benefit from a reduction if an operator has used CORSIA eligible fuels that meet the applicable sustainability criteria.

When an emissions unit is canceled, it is taken out of circulation and becomes unavailable for any other uses. It is only if an emissions unit is canceled for the purpose of compliance with CORSIA that it can be used to comply with offsetting requirements.

The deadline to complete the cancellation of the required number of units will be 31 January, following the administrating authority's notification of the final offsetting requirements. However, if the administrating authority were to notify the final offsetting requirements later than 30 November, the operator would have 60 days to complete the cancellation. Naturally, operators do not have to wait until they are notified of their final offsetting requirements to purchase and cancel emissions units and may do so before.[58]

Information on the emissions units canceled will need to be compiled in an "emissions unit cancellation report" and submitted to the administrating authority after verification.

In the CORSIA Central Registry, ICAO will publish the following information, aggregated at the state and global level[59]:

- Total final offsetting requirements over each compliance period;
- Total quantity of emissions units canceled over the compliance period; and
- Consolidated information on the canceled emissions units (eligible emissions unit program, unit type, host country, methodology, and program-designated registry name).

Compliance cycle	Notification of final offsetting requirements	Cancellation of emissions units	Submission of verified emissions unit cancellation report
2021-2023	By 30 November 2024	By 31 January 2025*	By 30 April 2025
2024-2026	By 30 November 2027	By 31 January 2028*	By 30 April 2028
2027-2029	By 30 November 2030	By 31 January 2031*	By 30 April 2031
2030-2032	By 30 November 2033	By 31 January 2034*	By 30 April 2034
2033-2035	By 30 November 2036	By 31 January 2037*	By 30 April 2037

** or, if the notification of final offsetting requirements occurs after 30 November, 60 days after the notification of the final offsetting requirements.*

[57] Annex 16, vol. IV, Appendix 1.
[58] Annex 16, vol. IV, Appendix 1.
[59] Annex 16, vol. IV, Appendix 5.

New entrants

A "new entrant" is an operator that commences operating international flights falling within the scope of CORSIA on or after 1 January 2019 and whose operations are not in whole or in part a continuation of operations previously performed by another operator.

To be considered a "new entrant," the operations must not be, even partially, a continuation of the operations of another operator. For example, if an airline creates a new AOC for its regional flights and splits its network between the parent company and the new AOC, the new AOC would not be considered as a new entrant. Similarly, if an airline operating domestic flights only takes over the international flights of another airline it has merged with, this would likely not be a situation of a "new entrant."

New entrants are exempt from offsetting requirements for three years from the year their total annual emissions within CORSIA's scope exceed 10,000 tonnes.[60] The 3-year "grace" period includes the year during which they exceed this ceiling.[61] For example, if an operator produces more than 10,000 tonnes within CORSIA's scope in 2024, it will be exempt from offsetting requirements in 2024, 2025, and 2026. It will be subject to offsetting requirements for its 2027 emissions onwards.

As a caveat, at any time during the "grace period," if the operator's total annual CO2 emissions exceed 0.1% of the total CO_2 emissions from international flights in 2019, the operator will be subject to offsetting requirements from the following calendar year.

CORSIA eligible fuels

The emissions reductions that an operator can claim from CORSIA-eligible fuels will be proportional to the life cycle emissions benefits of the fuels used, compared to a reference value for fossil fuels[62] (for Jet-A/A1, Jet-B, TS-1, or No. 3 Jet fuel, 89 gCO_2e/MJ; for AvGas, 95 gCO_2e/MJ).

For example, if an operator used 1,000 tonnes of sustainable aviation fuels with a life cycle emissions value of 20 gCO_2e/MJ, the corresponding emissions reduction would be:

Emissions reduction = 3.16*1000*(1-20/89)

where 3.16 (kg CO_2/kg fuel) is the emissions factor for jet fuel and 89 (gCO_2e/MJ), the default life cycle emissions value for conventional aviation fuel.

ICAO will publish default life cycle values for some CORSIA eligible fuels. An operator may, however, decide to use the actual life cycle emissions if a fuel producer can demonstrate lower lifecycle emissions than the default value or if a fuel producer is using a pathway that does not have a default value. In order to do so, the operator will select an approved Sustainability Certification Scheme (SCS) from a list that will be included in an ICAO document entitled "CORSIA Approved Sustainability Certification Schemes." The SCS will ensure that the methodology applied is approved for CORSIA. While ICAO will approve SCS, ICAO will not certify the CORSIA eligible fuels.

The emissions reductions will be deducted from the operator's total offsetting requirements at the end of each 3-year compliance period. The deduction can, however, only be claimed for the compliance period during which the CORSIA-eligible fuel was blended.[63]

[60] Annex 16, vol. IV, Part II, 2.1.1.

[61] Annex 16, vol. IV, Part II, 3.1.2.

[62] Annex 16, vol. IV, Part II, 3.3.

[63] Annex 16, vol. IV, Part II, 2.3.3.4.

Eligible emissions units

To meet their offsetting requirements, operators will have to purchase and cancel a quantity of "CORSIA eligible emissions units" corresponding to their final offsetting requirements. The ICAO Council will determine which emissions units are eligible for use under CORSIA.[64]

The Council's decision will be informed by a recommendation from the Technical Advisory Body and by eligibility criteria approved by the Council. The list of eligible emission units is available on the ICAO website in an ICAO document entitled "CORSIA Eligible Emissions Units."

Assembly Resolution A39-3 stipulates that emissions units generated from mechanisms established under the UNFCCC and the Paris Agreement shall be eligible for use in CORSIA, provided that they align with decisions by the ICAO Council. This was further supported in Assembly Resolution A41-22.

In addition to emissions units from the compliance market, there are several offset standards that could offer high-quality offsets for international aviation and could be considered for CORSIA, including voluntary offset standards and REDD+.

Several standards were developed to provide companies and individuals wishing to offset their emissions on a voluntary basis the certainty that the offsets that they purchase are environmentally effective. Provided these standards meet ICAO's criteria, they could make high-quality offsets available to aviation, often with co-benefits for biodiversity, employment, health, and more.

Examples of offset certified under voluntary standards include those from wind energy, landfill methane, smaller community-focused energy efficiency, and clean cookstove projects.

Operators can purchase any eligible emissions unit and can, therefore, choose to privilege emissions units from projects hosted in their home state, in states they operate to, or in developing countries as long as those units are held as CORSIA eligible.

Emissions Units Criteria

The Emissions Units Eligibility Criteria guarantee that eligible emissions units deliver the desired CO_2 reductions. The criteria are based on principles commonly applied under existing trading mechanisms and certification schemes.

Additionality, permanence, and leakage

A key requirement is that the CO_2 reduction or removal used as an offset be 'additional' to business-as-usual activity. Additionality addresses the question: "would the activity have occurred, holding all else constant, were the activity not implemented as an offset project?" Or, in simpler terms, "would the project have happened anyway?"

Offsets must also represent a permanent reduction of emissions that cannot be reversed. Similarly, an activity that generates offsets should not result in unintended increases in emissions elsewhere.

Baseline and quantification

A baseline must be determined to quantify the emission reduction benefits from an offsetting project. The baseline corresponds to what would have happened if the project had not been implemented. The baseline being a hypothetical scenario, it is important that it be realistic and credible. The emissions reductions calculated against the baseline should be quantified using accurate measurements, valid protocols, and be externally audited.

No double-counting and traceability

Generally speaking, double counting occurs when an emissions reduction is counted more than once towards attaining climate change mitigation.

One type of double counting is double use. Double use occurs if the same emissions unit is used twice by the same operator to attain different mitigation requirements or pledges.

[64] Annex 16, vol. IV, Part II, 4.2.

In contrast, to double use, double selling (same emissions unit is used by two entities) and double issuance (more than one unit is issued for the same emission reduction) are within the control of emissions unit programs. Double claiming would occur if a country that hosts emissions unit programs were to count the reductions associated with units used for CORSIA towards its own mitigation pledges.

Emissions Units Programs will need to demonstrate that they have procedures in place to ensure identification and tracking of units. They will also need to provide information on how they address risks of double-counting and demonstrate that host countries of emissions reduction activities do not include the respective reductions in their national greenhouse gas accounting. On the other hand, the host country needs to conduct the corresponding adjustment to deduct the emissions units claimed by aircraft operators for CORSIA compliance purposes from its national repository. The Verification Body will need to ensure that the operator hasn't used the units canceled for CORSIA to offset any other emissions.

Environmental and social risks

Emissions unit programs will also need to have in place safeguards to address environmental and social risks and disclose how the sustainability criteria are satisfied.

Purchasing emissions units

Operators can purchase emissions units through different ways, including from:

- Project developers: an operator could purchase emissions units directly from the person or organization coordinating a carbon offset project;
- Brokers: as emissions units are intangible commodities traded in a market exchange, one common way to purchase emissions units is through a market trader or broker. Brokers will locate emissions units that respond to the operators' quantitative and qualitative requirements and introduce the buyer to the seller(s).
- Aggregators: aggregators will develop a carbon offset portfolio for their clients from a variety of projects.
- Retailer/wholesale: some organizations sell carbon offsets to the public in small or large quantities.

As tradeable commodities, the price of emissions units can vary significantly depending on the characteristics of the emissions units, notably the type of project, the standard under which it is certified, and market dynamics.

Cancelling emissions units

In order to meet their offsetting requirements, it is essential that operators "cancel" the required quantity of emissions units. When an emissions unit is canceled, it is taken out of circulation and becomes unavailable for any other uses. It is only if an emissions unit is canceled for the purpose of compliance with CORSIA that it can be used to comply with offsetting requirements.

The cancellation of an emissions unit will be reflected in a registry. Registries are databases which allow to keep track of emissions units and related transactions. Registries are notably important to minimize the risk of double-counting.

Operators will have to request that the registry in which its emissions units are canceled publishes detailed information on the units canceled. The information should include the quantity, serial numbers, the date of cancellation, the program, the unit type, the host country, the methodology, the demonstration of unit date eligibility, and the name of the operator in whose name the units were canceled.[65]

Emissions unit cancellation report

The information on the emissions units canceled by an operator will need to be compiled in an emissions unit cancellation report for submission to the administrating authority after verification.[66]

Operators will have until 30 April following the notification of their final offsetting requirements to submit the verified report.[67]

The emissions unit cancellation report will need to include information on the operator, the compliance period years reported, the total final offsetting requirements, and the total quantity of emissions units canceled. Detailed information for each batch of emissions units canceled will also have to be provided: serial numbers; date of cancellation; eligible emissions unit program; unit type, host country, methodology, demonstration of unit date eligibility; registry name; identifier for the registry account to which the batch was cancelled; the name of the operator in whose name the units were cancelled; identifier for the registry account from which the cancellation was initiated.[68]

[65] Annex 16, vol. IV, Part II, 4.2.2.
[66] Annex 16, vol. IV, Part II, 4.3.
[67] Annex 16, vol. IV, Appendix 1.
[68] Annex 16, vol. IV, Appendix 5.

Verification of Units

Like the annual emissions reports, the emissions unit cancellation report will have to be verified by an independent verification body.[69]

The objective of the verification will be to ensure that the operator has accurately reported cancellations of eligible emissions units and that the number of emissions units canceled is sufficient to meet the operator's final offsetting requirements. The verification will also aim to ensure that the emissions units have not been used to offset any other emissions.

The verification body engaged for the emissions unit cancellation report may be the same as for the emissions report, but the scope of its accreditation shall specifically include the verification of emissions unit cancellation reports. This requires the verification body to demonstrate knowledge of greenhouse gas information, data management systems, controls, and basic knowledge of greenhouse gas markets and emissions unit program registries.

Verification requirements

Like the emissions report, the verification body will need to provide "reasonable assurance" that the claimed volume of eligible emissions unit cancellations is accurate and sufficient to meet the operator's offsetting requirements for the given compliance period.[70]

In accordance with Annex 16, volume IV, the objectives of the verification of an emissions unit cancellation report are:

- The operator has accurately reported cancellations of its eligible emissions units;
- The number of canceled eligible emissions units is sufficient for meeting the operator's total final offsetting requirements;
- The operator can demonstrate the sole right of use to the canceled eligible emissions units; and
- The eligible emissions units canceled have not been used to offset any other emissions.[71]

An important difference between the verification of the emissions report and the emissions unit cancellation report is the materiality threshold. Such a "tolerance margin" is not allowed for the verification of the emissions unit cancellation report, and the verifier must verify that each reported canceled emissions unit is included in the report. This implies that the verifier should not use sampling[72] and that it needs to verify that none of the units have been used by the operator to offset any other emissions.

Verification activities

The steps in the verification process for the emissions unit cancellation report are the same as for the emissions report. The verifier will need to conduct a strategic analysis and a risk analysis to understand the scope and complexity of the verification as well as inherent and control risks. The strategic and risk analyses will inform the verification plan and guide the verification activities.

The verification body will need to review and confirm that cancellations have been made in the name of the aeroplane operator, that the emissions units are eligible for CORSIA, and that they have been canceled in a program registry in accordance with CORSIA's requirements. The review will be based on the information published in the relevant program registry, the list of CORSIA-eligible emissions units to be published by ICAO, and the emissions unit cancellation report.

The verification body will also confirm that the number of canceled eligible emissions units is sufficient and ensure that the operator has the sole right of use to the canceled eligible emissions units. The sole right of use can, for example, be demonstrated by the operator with contractual evidence of acquisition/transfer of the units, contractual evidence of instructions to a third party to cancel the units on behalf of the operator, the terms and conditions of the program registry where the units have been canceled, and the information published by the program registry.

The verifier will also seek to ensure that the units have not been used by the operator to offset any other emissions. This includes the use of the units under other regulatory schemes (domestic or international), as well as any voluntary schemes. The operator will

[69] Annex 16, vol. IV, Part II, 4.4.
[70] Annex 16, vol. IV, Appendix 6, 3.2.
[71] Annex 16, vol. IV, Appendix 6, 3.3.
[72] Annex 16, vol. IV, Appendix 6, 3.9.2.

need to inform the verifier about any schemes it has participated or is participating in. The verification body will review information regarding the scheme to determine whether the eligible emissions units may also be used under the other program(s) and, if so, review cancellation information under the other schemes. The verifier should also check the operator's internal control and risk management procedures put in place to mitigate the risk of double use. Voluntary schemes may include programs under which the operator offsets their own emissions and also carbon offsetting programs made available to customers. In addition to relevant registries, the verifier will review public reporting materials, such as CSR reports or submissions made under reporting initiatives.