



| ICAO

CHAPTER SIX

Climate Change Mitigation: CORSIA



Introduction to CORSIA

By ICAO Secretariat

Addressing climate change requires cooperation among all States to reduce the impact of greenhouse gas emissions on the global climate. The international civil aviation sector plays a key role in the global efforts to address climate change. While it presently accounts for about 1.3% of the global CO₂ emissions, its contribution is projected to increase in the coming decades as the world becomes more connected. ICAO and its Member States have recognized the impact of the emissions from international aviation on the global climate, and have resolved to minimize this impact, while ensuring the sustainable growth of international aviation.

In 2010, the 37th Session of the ICAO Assembly adopted two aspirational goals: i) to improve energy efficiency by 2 per cent per year until 2050, and ii) to achieve carbon neutral growth from 2020 onwards. These goals are to be met with the implementation of a basket of measures that includes technological innovations, operational improvements, sustainable aviation fuels, and market based measures.

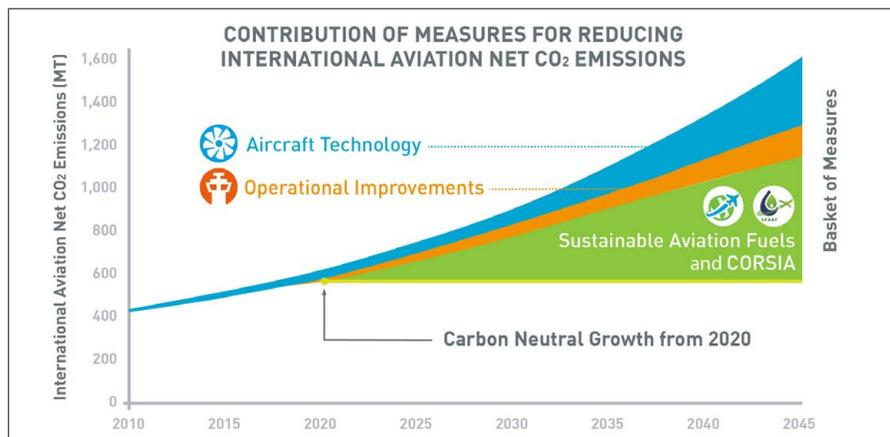
Since the 2010 Assembly which requested the Council to explore the feasibility of a global market-based measure scheme for international aviation, various options for such a global scheme were discussed and analyzed

by the Council and experts around the world, in light of key principles such as environmental integrity, cost effectiveness, and simplicity of such a scheme. Following the important milestone at the 2013 Assembly, which decided to develop a global market-based measure for international aviation, further discussions on its design features and implementation mechanisms were undertaken, including possible means to address special circumstances and respective capabilities of States.

At the 39th Session of the ICAO Assembly in 2016, States finally adopted a global market-based measure scheme for international aviation, in the form of the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA), to address the increase in total CO₂ emissions from international aviation above the 2020 levels (Assembly Resolution A39-3).

CORSIA is the first global market-based measure for any sector and represents a cooperative approach that moves away from a “patchwork” of national or regional regulatory initiatives through the implementation of a global scheme that has been developed through global consensus among governments, industry, and international organizations. It offers a harmonized way to reduce emissions from international aviation ensuring that there is no market

FIGURE 1: ICAO Global Environmental Trends on CO₂ Emissions and Contribution of Measures for Reducing International Aviation Net CO₂ Emissions



distortion, while respecting the special circumstances and respective capabilities of ICAO Member States.

CORSIA complements the other elements of the basket of measures by offsetting the amount of CO₂ emissions that cannot be reduced through the use of technological improvements, operational improvements, and sustainable aviation fuels (Figure 1) with emissions units from the carbon market. It is estimated that between 2021 and 2035, the international aviation sector would have to offset about 2.5 billion tonnes of CO₂ emissions to achieve carbon neutral growth.

HOW CORSIA WORKS

CORSIA will be implemented in three phases: a pilot phase from 2021 through 2023, a first phase from 2024 through 2026, and a second phase from 2027 through 2035. For the first two phases (2021 to 2026), participation is voluntary. As of June 2019, 80 States – representing 76.63% of international aviation Revenue Tonne-Kilometres (RTKs) – have announced their intention to participate in the CORSIA from its outset. From 2027 onwards, participation will be determined based on 2018 RTK data. Specifically, CORSIA will cover all States with an individual share of 2018 RTKs higher than 0.5 per cent of total RTKs or whose cumulative share in the list of States from the highest to the lowest amount of RTKs reaches 90 per cent of total RTKs. According to Assembly Resolution A39-3, Least Developed Countries (LDCs), Small Island Developing States (SIDS) and Landlocked Developing Countries (LLDCs) are exempt from participation (even if they fulfill these RTK conditions), but they can participate in the Scheme on a voluntary basis.

To eliminate market distortion, emissions coverage under CORSIA is based on a route-based approach. This means that emissions from all aeroplane operators performing international flights between two States where both the origin and destination States participate in CORSIA are covered by the offsetting requirements of the Scheme. In contrast, emissions from international flights between two States where the origin and/or destination States do not participate in

CORSIA are excluded from the offsetting requirements of the Scheme. The route-based approach ensures that all aeroplane operators with flights on the same international routes are treated equally irrespective of whether the States to which they are attributed participate in CORSIA. According to Assembly Resolution A39-3, exemptions also apply to aeroplane operators with less than 10 000 tonnes of annual CO₂ emissions, to aeroplanes with less than 5 700kg take-off weight, and to humanitarian, medical and firefighting operations.

Once participating States and routes covered by the CORSIA are defined (starting in 2021), the amount of CO₂ offsetting requirements for individual aircraft operators is calculated, as follows (see Figure 2):

- a) from 2021 through 2029, the amount of CO₂ offsetting requirements is calculated by multiplying the operators’ annual emissions with the international aviation sector’s growth factor every year, following a so-called 100 per cent sectoral approach; and
- b) from 2030 onwards, the amount of CO₂ offsetting requirements is calculated taking into account both the sector’s growth factor and the growth factor of an individual operator; the individual factor’s contribution to the calculation will be at least 20 per cent from 2030 to 2032; and at least 70 per cent from 2033 to 2035.

Starting in 2022, CORSIA will be periodically reviewed, every three years, by the Council. The review will include, among other features, the assessment of its impact on

FIGURE 2: Calculation of offsetting requirements under CORSIA



the growth of international aviation, and the results of this assessment will serve as an important basis for the Council to recommend, as appropriate, adjustments to the scheme for the consideration by the Assembly.

CORSIA IMPLEMENTATION

The success of the implementation of CORSIA relies on the establishment of a robust and transparent monitoring, reporting and verification (MRV) system, which includes procedures on how to monitor the fuel use, collect data and calculate CO₂ emissions; report CO₂ emissions data; and verify CO₂ emissions data to ensure accuracy and avoid mistakes.

At the request of the 39th ICAO Assembly in 2016, the Council requested the Committee on Aviation Environmental Protection (CAEP), to develop Standards and Recommended Practices (SARPs) and related guidance material to facilitate the implementation of the MRV system under the CORSIA. Part of the CAEP work included the development of criteria for the eligibility of emissions units that are to be purchased and cancelled by aeroplane operators for the purposes of the Scheme.

In fact the implementation of CORSIA required a “package” of CORSIA-related SARPs and guidance which comprise of three distinct but interrelated components:

- a) Annex 16, Volume IV, which provides the required actions by States and aeroplane operators (the “what” and “when”) to implement CORSIA;
- b) Environmental Technical Manual (Doc 9501), Volume IV, which provides the guidance on the process (the “how”) to implement CORSIA; and
- c) Five CORSIA Implementation Elements, which are reflected in 14 ICAO documents and are approved by the Council prior to their publication. These ICAO documents are directly referenced in Annex 16, Volume IV and are essential for the implementation of CORSIA.

The Council adopted the First Edition of Annex 16, Volume IV in June 2018. Following its adoption, the First Edition of Annex 16, Volume IV became applicable on 1 January 2019.

The First Edition of the Environmental Technical Manual (Doc 9501), Volume IV was issued under the authority of the ICAO Secretary General in August 2018. This manual will be periodically revised to make the most recent information available to administering authorities, aeroplane operators, verification bodies and other interested parties in a timely manner, aiming at achieving the highest degree of harmonisation possible.

The ICAO Council has been undertaking work, with the contribution of the CAEP, on the development of the five CORSIA Implementation Elements, namely:

- **CORSIA States for Chapter 3 State Pairs** is the list of States participating in CORSIA and will be used to define route-based emissions coverage every year from 2021 onwards;
- **ICAO CORSIA CO₂ Estimation and Reporting Tool (CERT)** aims to simplify the estimation and reporting of CO₂ emissions from international flights for those operators with low levels of activity to fulfil their monitoring and reporting requirements under CORSIA (for more details, see the dedicated article in this chapter);
- **CORSIA Eligible Fuels** cover aviation fuels used for the purposes of CORSIA to reduce the offsetting requirements of aeroplane operators (for more details, see the dedicated article in this chapter);
- **CORSIA Eligible Emissions Units** are emissions units from the carbon market that can be purchased by aeroplane operators to fulfill the offsetting requirements under CORSIA (for more details, see the dedicated article in this chapter); and
- **CORSIA Central Registry (CCR)** is an information management system that will allow the input and storage of CORSIA-relevant information reported by States, as well as calculations and reporting by ICAO, in accordance with the CORSIA MRV requirements as contained in the Annex 16, Volume IV (for more details, see the dedicated article in this chapter).

In June 2018, to ensure that *No Country is Left Behind*, the Council endorsed the ICAO ACT-CORSIA (Assistance, Capacity-building and Training for the CORSIA) Programme, emphasizing the importance of a coordinated

approach under ICAO to harmonize and bring together all relevant actions and promote coherence to capacity building efforts related to CORSIA implementation.

By the end of June 2019, CORSIA buddy partnerships under ACT-CORSIA had been established, involving 15 donor States and 98 recipient States. For more details on ACT-CORSIA see the dedicated article in this chapter.

CONCLUSIONS

CORSIA offers a success story of firsts: the first sector-wide carbon offsetting programme; the first such programme to tackle emissions from a single industry on a global level; the first time international aviation will experience carbon neutral growth; the first global partnership to help build capacity on CORSIA in all

countries of the world. But being first also comes with great challenges that the Organization was able to address with the support of its Members States, industry, other actors and society as a whole.

While ICAO celebrates its successes over the last 75 years, it also acknowledges the challenges ahead. Starting in 2019, ICAO and its Member States are working together to implement the first stages of CORSIA focusing on ensuring that States have in place the necessary regulatory frameworks to facilitate the smooth implementation of CORSIA. More activities are scheduled and will continue over the coming years and decades. The international aviation sector is ready to tackle the future challenges and ensure that international flights are going to be built on a much greener foundation, but this will only be possible with the cooperation and support of all stakeholders involved.

ACT-CORSIA: A Coordinated Approach for Assistance and Capacity-building on CORSIA

By ICAO Secretariat

INTRODUCTION TO ACT-CORSIA

While conceptual discussions were being undertaken on the global market-based measure to be adopted for international aviation in order to reach its post-2020 carbon neutral growth aspirational target, capacity building was already a must-have element for any decision on the matter. Therefore, just after adopting the CORSIA-related SARPs (Annex 16, Volume IV) in June 2018, the ICAO Council endorsed the ICAO Secretariat's plan for the CORSIA-related outreach and capacity building activities, on the understanding that the plan should continue to evolve with the implementation features of CORSIA. The ACT-CORSIA (Assistance, Capacity-building and Training for CORSIA) Programme was launched during the ICAO Seminar on CORSIA, which was held in Montréal, on 2 and 3 July 2018. A number of ICAO Member States need targeted assistance in order to prepare for the implementation of the CORSIA monitoring, reporting and verification (MRV) system as per the SARPs requirements, and time was of essence as the CORSIA-related SARPs were to become applicable on 1 January 2019.

The ACT-CORSIA Programme is composed of various elements, which are intended to facilitate better understanding and the access to information on CORSIA, including: the establishment of CORSIA Buddy Partnerships, the availability of model regulations, Frequently Asked Questions, Brochures and Leaflets, Videos, the CORSIA Seminars and Workshops, Online Tutorials, and other Background Information.

Complete information about the ACT-CORSIA Programme is reflected on ICAO CORSIA public website¹.

ACT-CORSIA BUDDY PARTNERSHIPS

When endorsing the plan for CORSIA-related outreach and capacity-building activities, the Council emphasized the need for a coordinated approach to undertake the global capacity building initiative under ICAO, and that any bilateral or multilateral partnerships among States should be informed and coordinated with ICAO, so that the global progress of such coordinated efforts would be monitored. In this regard the Council encouraged the establishment of “buddy partnerships” among States themselves to help each other to prepare for CORSIA implementation, in particular with regard to the development and approval of aeroplane operators' Emissions Monitoring Plans, and the establishment of national and/or regional regulatory frameworks for CORSIA implementation.

CORSIA Buddy Partnerships are a cornerstone of ICAO's plan to support States to prepare for CORSIA implementation. Under the first phase of the partnerships, technical experts provided by donor States worked together with the CORSIA Focal Points of recipient States to provide on-site training, and to closely follow-up on the preparation and implementation of the recipient States' CORSIA MRV system; in particular on the development and approval of Emissions Monitoring Plans, as well as on the establishment of national and/or regional regulatory frameworks.

¹ www.icao.int/corsia

FIGURE 1: ACT-CORSIA Buddy Partnerships as of 30 June 2019



By 30 June 2019, a total of 15 donor States are providing support to 98 recipient States under ACT-CORSIA Buddy Partnerships. Figure 1 provides information on the established Buddy Partnerships as of 30 June 2019; the most up-to-date information is provided on ICAO CORSIA public website.

Typically, the assistance is in the form of a donor State offering expert(s) on CORSIA to provide individual training to and undertake the necessary follow-up with, the CORSIA Focal Points of the recipient States, in close coordination with the ICAO Secretariat. ACT-CORSIA Buddy Partnerships follow a three-step approach. In step 1, both the experts from donor States and the CORSIA Focal Point from recipient States prepare for the training activities, including the necessary travel arrangements; in step 2, the donor State expert travels to the recipient State and delivers an on-site training; and in step 3, the donor state expert provides remote follow-up to the recipient State CORSIA Focal Point.

It is important that each expert has in-depth knowledge of all relevant documentation relating to the implementation of CORSIA. To ensure the consistency of assistance provided and relevant materials used through the first phase of CORSIA Buddy Partnerships, the involved technical experts were trained by the ICAO Secretariat to the CORSIA requirements. In the initial phase of the CORSIA Buddy Partnerships, training focused on the preparation and implementation of the recipient State's CORSIA MRV system, and in particular, on the development and approval of Emissions Monitoring Plans and the establishment of a national regulatory framework. To ensure a coordinated approach under ICAO, and the consistency of the assistance provided and the materials used, the ICAO Secretariat developed training materials to be used by the donor State experts, including model regulations for CORSIA implementation, and organized the first "Training of Trainers" event in Montréal, Canada from 29 to 31 August 2018, during which experts from donor States were trained to be ready to deliver on-site training to recipient States starting from September 2018 (Figure 2). Using this coordinated approach ensures that in the framework of ICAO's No Country Left Behind initiative, all States are receiving the same high quality training.

FIGURE 2: Photo from the first ACT-CORSIA Training of the Training event in Montréal, Canada from 29 to 31 August 2018

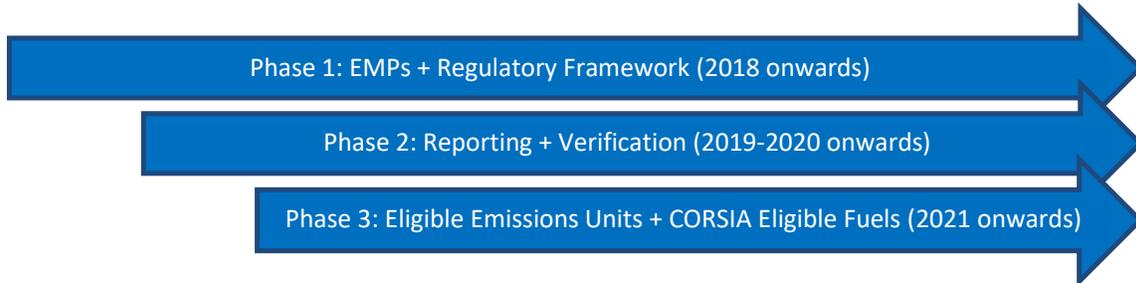


The on-site training is the main part of the ACT-CORSIA Buddy Partnerships activities. A typical ACT-CORSIA Buddy Partnership training takes place over the course of two days. The ICAO Secretariat provided a suggested schedule for the trainings, however, the actual sequence of training activities was agreed between the donor State experts and the CORSIA Focal Point of the recipient State, taking into account the availability of the individuals to be trained, and specific questions of the recipient State. Approximately 80 recipient States have received training under the ACT-CORSIA Buddy Partnerships (see Figure 3).

Following-up with the CORSIA Focal Point of the recipient State and other individuals, as agreed during the on-site training, is a crucial part of the ACT-CORSIA Buddy Partnerships. It provides the opportunity for the donor State trainer to assess if the necessary progress has been made within areas covered by the training and to provide further guidance/assistance to the recipient State. Follow-ups were mainly being provided on a remote basis, however, follow-up on-site training sessions are also being organized as needed to assess the progress achieved and to provide further support.

TOWARDS THE SECOND PHASE OF THE ACT-CORSIA BUDDY PARTNERSHIPS

The 2019 ICAO CORSIA Regional Workshops were organized in all ICAO regions from 21 March to 12 April 2019. Following the initial stage of CORSIA capacity-building which focused on the development of Emissions

FIGURE 4: Three Phases of ACT-CORSIA Buddy Partnerships

Phase of ACT-CORSIA was launched during the 2019 ICAO Environmental Symposium (14 to 16 May 2019), with a specific focus on reporting and verification of CO₂ emissions under CORSIA. In this connection, the second Training of the Trainers event was organized in Montreal on 13 and 14 May 2019, during which the experts from donor States were trained by the ICAO Secretariat to provide harmonized capacity-building to the recipient States during the second phase of ACT-CORSIA Buddy Partnerships. Additional remote training was provided over the summer on the 2019 version of the ICAO CORSIA CERT tool to ensure that the experts have the latest knowledge on this important CORSIA Implementation Element before commencing the training activities with recipients States, foreseen to take place during the second half of 2019. The plan of activities is accessible on the ICAO CORSIA website for full transparency.

Recognizing the need for continuous capacity-building in implementing CORSIA, the contents of the ACT-CORSIA Buddy Partnerships will be adjusted in accordance with the implementation phases of CORSIA. Figure 4 presents the three phases foreseen for ACT-CORSIA: the first phase from 2018 onwards focuses on the development and approval of the Emissions Monitoring Plans as well as on drafting and finalizing the national/regional regulatory frameworks; the second phase in 2019-2020 focuses on reporting and verification aspects of CORSIA implementation; and the third phase will provide assistance on the aspects related to CORSIA eligible emissions units and CORSIA eligible fuels.

ICAO CORSIA VERIFICATION COURSE

In addition to the training provided under the ACT-CORSIA Buddy Partnerships, and in order to provide the necessary training on how to verify CO₂ Emissions Reports that have been prepared by aeroplane operators in accordance with CORSIA-related SARPs and guidance, ICAO developed a 3-day CORSIA Verification Course. The course targets professionals with experience in the verification of CO₂ emissions using ISO 14064-3:2006 who want to get involved in the verification of aeroplane operators' CO₂ Emissions Reports under CORSIA.

The learning objectives of the course include: performing the CORSIA monitoring, reporting, and verification (MRV) requirements as outlined in Annex 16, Volume IV, and the Environmental Technical Manual (Doc 9501), Volume IV; applying the verification requirements as outlined in Annex 16, Volume IV, and the Environmental Technical Manual (Doc 9501), Volume IV, including materiality threshold, verification criteria, verification scope and objectives and the Verification Report preparation and submission requirements; gaining knowledge to correctly identify the scope of applicability for CORSIA MRV requirements, as well as for CORSIA offsetting requirements; and applying a working knowledge of the fuel use monitoring methods and of the ICAO CORSIA CERT estimation tool as outlined in Annex 16, Volume IV.

The most up-to-date information on the ICAO CORSIA Verification course dates and venues is available on ICAO Global Aviation Training Office's website: <https://www.icao.int/training/Pages/training-catalogue-details.aspx?catid=2657&language=0®ion=&ITP=1>

CORSIA Eligible Emissions Units

By ICAO Secretariat

With the adoption of the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) by the 2016 Assembly, ICAO has placed international aviation on the cutting edge of climate policy. CORSIA represents the first example of an international, sector-wide market-based approach to greenhouse gas emissions reductions. One of the most interesting aspects of the scheme is the use of emissions units to ensure carbon neutral growth from 2020 onwards in the international aviation sector, and that the Assembly requested the ICAO Council to determine eligible emissions units for use by airlines under CORSIA.

Under CORSIA, airlines will meet CO₂ offsetting requirements with these eligible emissions units, making them an essential part of the ICAO Basket of Measures to achieve ICAO’s global aspirational goal of carbon neutral growth from 2020. While it is not possible to know beforehand how many emissions units will be needed to meet the carbon neutral growth goal, it could be on the order of 2.5 billion tonnes for the period from 2021 to 2035.

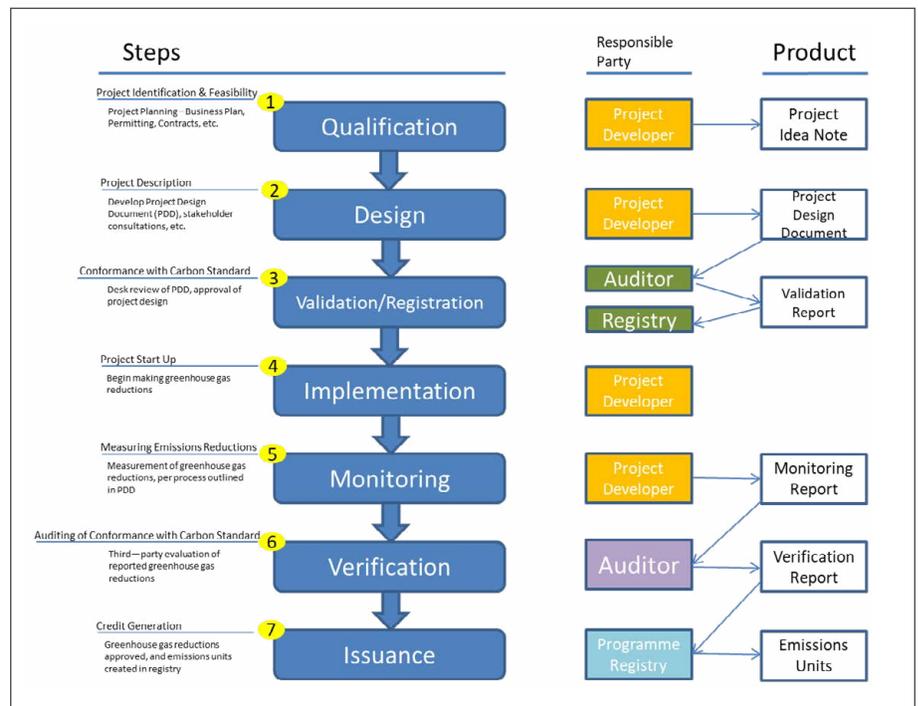
For decades, economists have recommended using emissions units, also known as carbon credits, as part of a market-based approach to address climate change. The United Nations Framework Convention on Climate Change (UNFCCC) Kyoto Protocol included a mechanism for some States to meet their emissions reductions commitments using emissions units. Similarly, the European Union Emissions Trading Scheme (EU ETS) has used emissions units for over a decade to achieve

the European Union’s greenhouse gas reduction goals. Other jurisdictions, from the Republic of Korea to the State of California, now use emissions units to reach their greenhouse gas reduction goals.

Emissions units are generated when emissions from a specific project or programme are reduced, compared to a baseline (or business-as-usual scenario), through the implementation of emission reductions techniques/ technologies. These projects or programmes can be implemented in various sectors, such as electricity generation, industrial processes, agriculture, forestry, and/or waste management.

There is a multi-step process to generate an emissions unit, as detailed in Figure 1.

FIGURE 1: Process to Generate an Emissions Unit



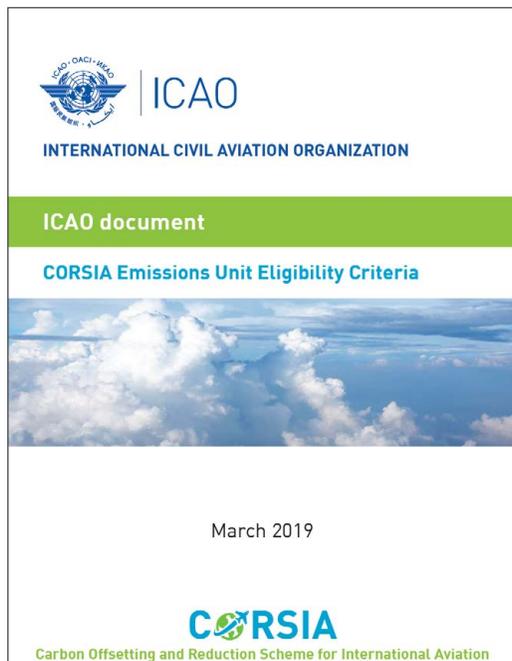
In general, emissions units are issued, or created, in a programme registry. A programme registry is akin to an online bank for emissions units. Emissions units can only exist within a registry, where they are also traded, tracked, and cancelled.

While emissions units exist within a registry, their owner may change. For example, a project developer may sell them to a compliance buyer, such as an airline registered in a State which participates in CORSIA. This transaction can occur through an exchange, a broker, or a direct bilateral contract between the seller and the buyer.

The compliance buyer will then use the emissions units to meet its obligations. In the context of CORSIA, this means that the airline will cancel the required number of emissions units in the registry.

Importantly, the emissions units which are cancelled must not be counted elsewhere, such as for compliance with another programme or Nationally Determined Contribution (NDC) under the UNFCCC Paris Agreement.

FIGURE 2: ICAO CORSIA Emissions Unit Eligibility Criteria



If the emissions units are counted for another emissions reduction programme, then they cannot also count for CORSIA. An emissions unit can only be counted once as a reduction.

In March 2019, the ICAO Council approved the Emissions Units Criteria (EUC), which will be used to undertake the assessment of emissions unit programmes and to determine eligible emissions units for use by airlines under CORSIA. The approved EUC is available at the ICAO CORSIA website¹.

In order to inform its decisions on CORSIA eligible emissions units, the Council established the Technical Advisory Body (TAB), which will make recommendations on eligible emissions units for CORSIA. The 19 members of the TAB are experts nominated by their State and approved by the Council.

As the TAB's Terms of Reference indicates, the body's main tasks are to:

1. undertake the assessment of emissions unit programmes against the emissions unit criteria; and
2. develop recommendations on the list of eligible emissions unit programmes (and potentially project types) whose emissions unit would be eligible for use under the CORSIA, for consideration by the Council.

The TAB started its process by inviting emissions unit programmes to apply for the assessment by TAB. The public will also be invited to comment on the programme applications. This is an open and transparent process, allowing stakeholders to participate in and follow progress through the ICAO website. The TAB will review the programme applications and public comments, and assess whether the programmes meet the EUC, before making its recommendations to the Council on CORSIA eligible emissions units, by March 2020. The Council will take the TAB recommendations into consideration, and make its decisions on the CORSIA emissions units eligibility. More

1 <https://www.icao.int/environmental-protection/CORSIA/Pages/CORSIA-Emissions-Units.aspx>

FIGURE 3: TAB Work Programme and Timeline (as of May 2019)

| Activities | 2019 | | | | | | | | | 2020 | | | | |
|---|------|------|------|--------|------|-----|------|------|------|------|-------|-------|-----|--|
| | May | June | July | August | Sept | Oct | Nov. | Dec. | Jan. | Feb. | March | April | May | |
| 1.1 Initial TAB Activities | | | | | | | | | | | | | | |
| 1.2 Election of Chairperson & Vice-Chairperson | █ | | | | | | | | | | | | | |
| 1.3 Development of TAB work programme and timeline | █ | | | | | | | | | | | | | |
| 1.4 Development of process for the applications by emissions units programmes | █ | | | | | | | | | | | | | |
| 2.1 Programme Applications | | | | | | | | | | | | | | |
| 2.2 ICAO invites programme applications on CORSIA TAB website | | █ | █ | | | | | | | | | | | |
| 2.3 ICAO updates website with application status | | █ | █ | | | | | | | | | | | |
| 2.4 Programme requests clarifications from ICAO | | █ | █ | | | | | | | | | | | |
| 2.5 ICAO webinar on programme applications | | █ | █ | | | | | | | | | | | |
| 2.6 ICAO conducts completeness review of submitted applications. ICAO informs programmes that applications are complete. | | █ | █ | | | | | | | | | | | |
| 3.1 Programme Assessment | | | | | | | | | | | | | | |
| 3.2 TAB conducts initial screening of programme applications and ICAO requests clarifications from programmes in writing | | | █ | █ | | | | | | | | | | |
| 3.3 ICAO publishes programme applications on website, and starts 30 day public comment period | | | | █ | █ | | | | | | | | | |
| 3.4 Possible in-person meetings of TAB with programme representatives | | | | █ | █ | █ | | | | | | | | |
| 3.5 TAB conducts assessment of programme applications against emissions unit criteria, and makes recommendations to Council | | | | █ | █ | █ | █ | █ | █ | █ | | | | |

Note 1: The above TAB Work Programme and Timeline is subject to further changes.

Note 2: The TAB process above is iterative, and the second programme application period is foreseen to begin in March 2020.

information on the TAB process, including the TAB work programme and timeline is available on the ICAO website.²

The Council-approved list of CORSIA eligible emissions units will allow airlines to know which emissions units they can purchase for compliance with CORSIA. Such a list will also inform project developers who build and operate emissions reductions projects. These developers will know which projects will produce CORSIA eligible emissions units, and thus which kinds of projects they should develop to meet the demand for emissions units.

The implementation of CORSIA marks a transformation in aviation environmental protection efforts. Starting in 2021, international civil aviation will experience carbon neutral growth, in part thanks to the use of emissions units under CORSIA. This represents a positive example

of international cooperation in the efforts against climate change. The large number of States which will participate in CORSIA means that the atmosphere will see greenhouse gas reductions on the scale of billions of tonnes, compared to a business-as-usual scenario.

Now, the ICAO Council has approved the EUC, and the TAB has begun to assess emissions units programmes, and potentially project types. This will lead to a decision from the ICAO Council on which emissions units are eligible for compliance with CORSIA.

There is a clear timeline with concrete milestones that sets the way forward. ICAO and its Member States know what has to be done by when, and together with the invaluable support and contribution of the international aviation industry, are determined to make it happen.

2 <https://www.icao.int/environmental-protection/CORSIA/Pages/TAB.aspx>

ICAO CORSIA CO₂ Estimation and Reporting Tool (CERT)

By ICAO Secretariat

INTRODUCTION

In an international aviation world where CORSIA is now a reality and where all aeroplane operators are requested to undertake their CO₂ emissions monitoring, the ICAO CORSIA CO₂ Estimation and Reporting Tool (CERT) was developed to provide practical support to users to facilitate their compliance with the CORSIA monitoring, reporting and verification requirements.

CORSIA CO₂ emissions information from aeroplane operators can be obtained either based on actual fuel burn converted to CO₂ emissions or estimated CO₂ emissions generated by the ICAO CORSIA CERT (under certain conditions¹). Monitoring CO₂ emissions can be challenging if no monitoring system is yet implemented. In a simplified manner, the ICAO CORSIA CERT allows for the monitoring of CO₂ emissions with minimum information to be provided, such as the aeroplane type, an aerodrome pair and the number of flights.

The ICAO CORSIA CERT is a versatile tool. In addition to estimating the CO₂ emissions, each aeroplane operator can generate a summary assessment detailing its specific situation. In addition, from 2019, with the introduction of the 2019 version of the ICAO CORSIA CERT, all aeroplane operators may also generate a complete Emissions Report.

This article aims to introduce the ICAO CORSIA CERT in detail – by providing information on the ICAO CORSIA CERT use eligibility, on the development of the tool and how the tool works – but mainly by demonstrating how a complex task

such as the CO₂ emissions monitoring becomes so easy thanks to the ICAO CORSIA CERT.

AEROPLANE OPERATORS ELIGIBLE TO USE THE ICAO CORSIA CERT AND FUNCTIONALITIES

Eligibility – The use of the ICAO CORSIA CERT depends on the level of emissions. All aeroplane operators can use the tool with no restrictions for a preliminary CO₂ assessment. The summary assessment indicates if the aeroplane operator is under the scope of applicability of CORSIA (i.e. if its annual international CO₂ emissions are greater than 10,000 tonnes of CO₂). Furthermore, the summary assessment also indicates if the aeroplane operator is eligible to use simplified compliance procedures. If so, the aeroplane operator may use the ICAO CORSIA CERT as a primary monitoring method, at the condition that its annual international emissions are between 10,000 and 500,000 tonnes of CO₂ for the period 2019-2020 and between 10,000 and 50,000 tonnes

TABLE 1: Aeroplane Operators Eligible to Use the ICAO CORSIA CERT

| CERT | Aeroplane Operators International CO ₂ Emissions (tonnes) 2019 – 2020* | | |
|--|---|------------------------|-----------------------------|
| | ≤ 10K CO ₂ | < 500K CO ₂ | ≥ 500K CO ₂ |
| Function / Use | | | |
| Preliminary CO ₂ Assessment | ✓ | ✓ | ✓ |
| CO ₂ Estimation & Reporting | No CORSIA requirement | ✓ | Not Eligible to use CERT ** |
| Filling Data Gaps | No CORSIA requirement | ✓ | ✓ |

* Note: from 2021-2035 operators can use ICAO CORSIA CERT to estimate and report emissions if their annual emissions from international flights subject to offsetting requirement are < 50 000 tonnes of CO₂ annually.

** Note: If an Aeroplane Operator uses ICAO CORSIA CERT for 2019 CO₂ estimation and reporting (based on their preliminary CO₂ assessment) but exceeds the threshold of 500 000 tonnes in 2019, the State could permit the operator to continue to use ICAO CORSIA CERT during 2020.

1 See the “Aeroplane operators eligible to use the ICAO CORSIA CERT and functionalities” section of this article for more information on conditions

of CO₂ emissions subject to offsetting requirements in 2021 and onward.

Finally, all aeroplane operators with CORSIA requirement can use the ICAO CORSIA CERT for filling data gaps and for populating the Emissions Report template.

The following table summarizes the use of the ICAO CORSIA CERT by aeroplane operators based on their level of international CO₂ emissions.

Functionalities – Over time, new functionalities will be added to the ICAO CORSIA CERT. Since 2018, the tool has offered the possibility for aeroplane operators to estimate their international CO₂ emissions for the determination of simplified compliance procedure eligibility. This version also includes the generation of a summary assessment that may be used as a supporting document for the Emissions Monitoring Plan to be submitted by aeroplane operators to the State to which they are attributed.

From 2019 onward, the tool includes the monitoring and reporting functionalities. The estimation of the CO₂ emissions is based either on Great Circle Distance (GCD) or Block Time (BT).

Finally, from 2021, the list of State pairs subject to offsetting requirements will be added and updated once a year.

DEVELOPMENT OF THE ICAO CORSIA CERT

Every year, a new version of the ICAO CORSIA CERT will be developed. The methodology that underpins the ICAO CORSIA CERT will be updated every single year, in order to increase the number of aircraft types covered by the tool, especially the new generation of aircraft entering the market, and to reflect changes in term of fuel efficiencies that may happen over time. Depending on the year, new functionalities may also be added.

In order to support aeroplane operators eligible to use the ICAO CORSIA CERT as a primary monitoring method, ICAO needs support from operators with sophisticated IT systems monitoring their fuel use.

Data Providing Organizations (DPOs), working with ICAO, collect actual fuel burn data from operators and provide that data to the CORSIA CERT Group (CCG), which is a subgroup of Working Group 4 in the Committee on Aviation Environmental Protection (CAEP). All data collected are then consolidated into a database called the CCG Operations and Fuel database (COFdb).

From this database, CCG generates the ICAO CO₂ Estimation Models (or CEMs). In other words, the ICAO CEMs are a set of coefficients used in a formula allowing the estimation of fuel burn for each aircraft type based either on the distance flown or on block time.

After this crucial step, the ICAO CEMs are reviewed by an independent group of experts and in parallel, the ICAO CORSIA CERT, as a tool, is developed. Then, the tool and its technical document are finalized and are both submitted for recommendation to CAEP. If CAEP recommends the release of the ICAO CORSIA CERT, then the tool is submitted to the Council for adoption.

Once the ICAO CORSIA CERT is adopted, the tool and all related-documentations are made available on the ICAO CORSIA website.

Finally, the ICAO CORSIA CERT as a standalone application can be downloaded and used by aeroplane operators eligible to use the ICAO CORSIA CERT and the ICAO CEMs can also be downloaded and integrated into the IT systems of operators, States, Verifiers or Third Party organizations for the purpose of CORSIA implementation.

This cycle, shown in Figure 1, is repeated every year.

HOW DOES THE ICAO CORSIA CERT WORK?

Brief explanation – The ICAO CORSIA CERT is a very simple tool to use and, starting with the 2019 version, comprises a three-step-process. The first step requires the user to enter the aeroplane operator's information such as the name, the address or the aircraft identification of the operator. The second step is dedicated to the CO₂ estimation by entering an aircraft type, an airport-pair and the number of flights if the estimation is based on Great

Circle Distance (GCD). In the case of using Block Time (BT) as input, the total block time per airport pairs is required. The last step is the generation of the summary assessment report if the ICAO CORSIA CERT is used for assessing the eligibility to use the tool as monitoring method, or the generation of the complete Emissions Report ready to be submitted to verification bodies and States.

Detailed explanation – This section will explain how CO₂ emissions are estimated in more detail. The ICAO CORSIA CERT uses the following equations depending on the inputs (i.e. Great Circle Distance or Block Time):

$$\text{Fuel Burn (kg)} = \text{Intercept (kg)} + \text{Slope (kg/km)} * \text{Distance (km)}$$

$$\text{Fuel Burn (kg)} = \text{Intercept (kg)} + \text{Slope (kg/min)} * \text{Block Time (min)}$$

The intercept represents the fuel burn at 0 km or 0 min, depending if Great Circle Distance or Block Time is used, and the slope represents the fuel rate in kilogram either per kilometer flown or minutes. The intercepts and slopes are the coefficients contained in the ICAO CO₂ Estimation Models (CEMs).

The estimation of the CO₂ emissions follows a two-step process. The first step is to estimate the GCD and identify the scope of applicability and the second step will use

the information generated in the first step to estimate the CO₂ emissions.

Figure 2 illustrates how the ICAO CORSIA CERT calculates the GCD. The tool will start by checking if aerodromes entered are in the ICAO Doc 7910 – *Location Indicators* which is embedded into the tool. If both aerodromes are available then the tool computes the GCD with the coordinates available in Doc 7910, uses the same document to identify the State where the aerodromes are located, highlights if the flight is subject to the scope of applicability of CORSIA (i.e. international flight) and, from 2021, if the flight is subject to offsetting requirements. If one or both aerodromes are missing then the user has to provide information on each aerodrome by entering the name, the latitude and the longitude of the aerodrome plus the name of the State where it is located. In the same manner, the tool then computes the GCD with the latitudes and longitudes provided and identifies the scope of applicability of the flight in the CORSIA scheme.

If Block Time input is provided instead of Great Circle Distance input, the ICAO CORSIA CERT will only use the Doc7910 for identifying the scope of applicability and the user would need to provide the BT information as input.

FIGURE 1: Development of the ICAO CORSIA CERT

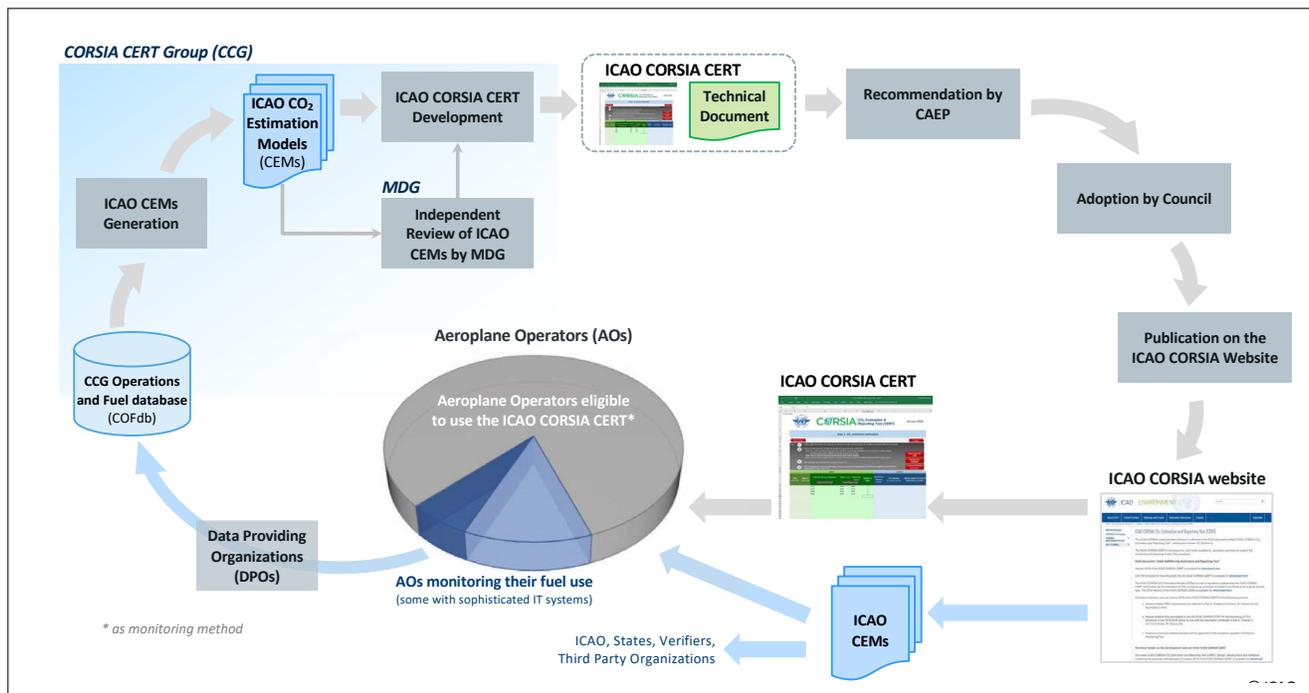


FIGURE 2: Estimation of the CO₂ Emissions with the ICAO CORSIA CERT – Step 1

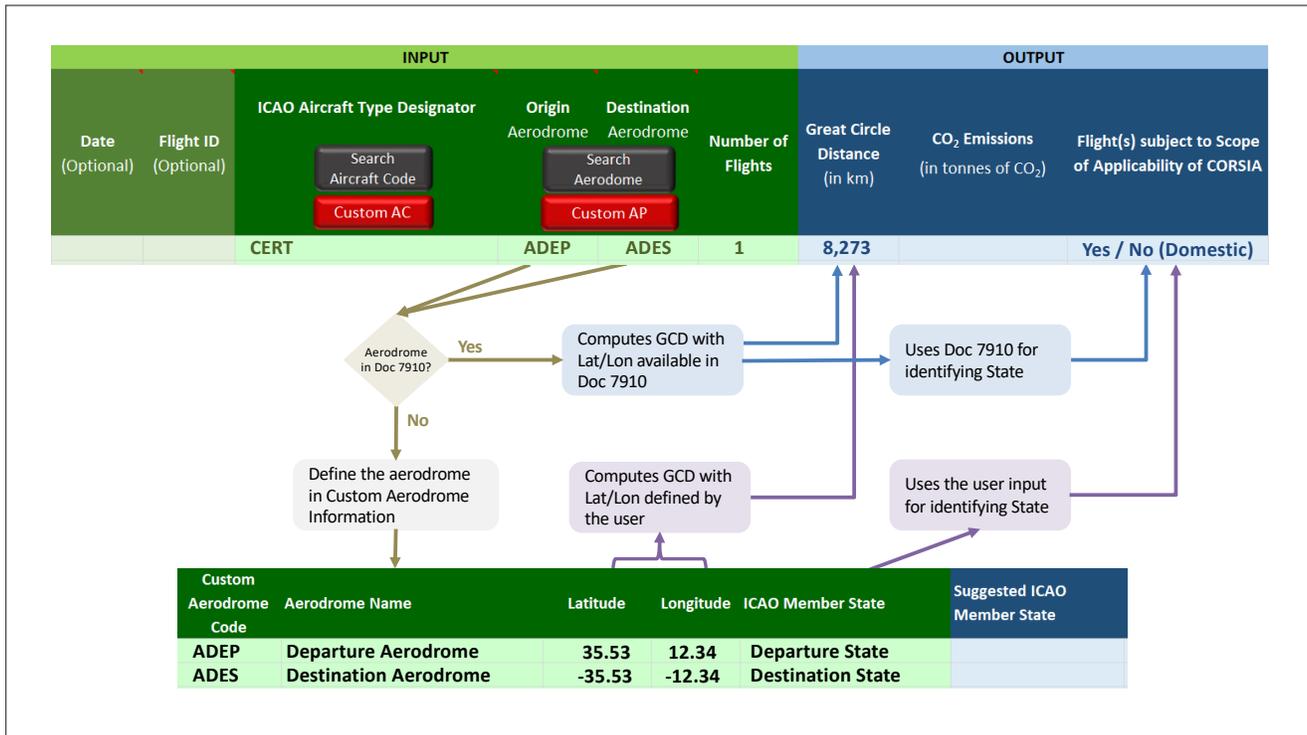
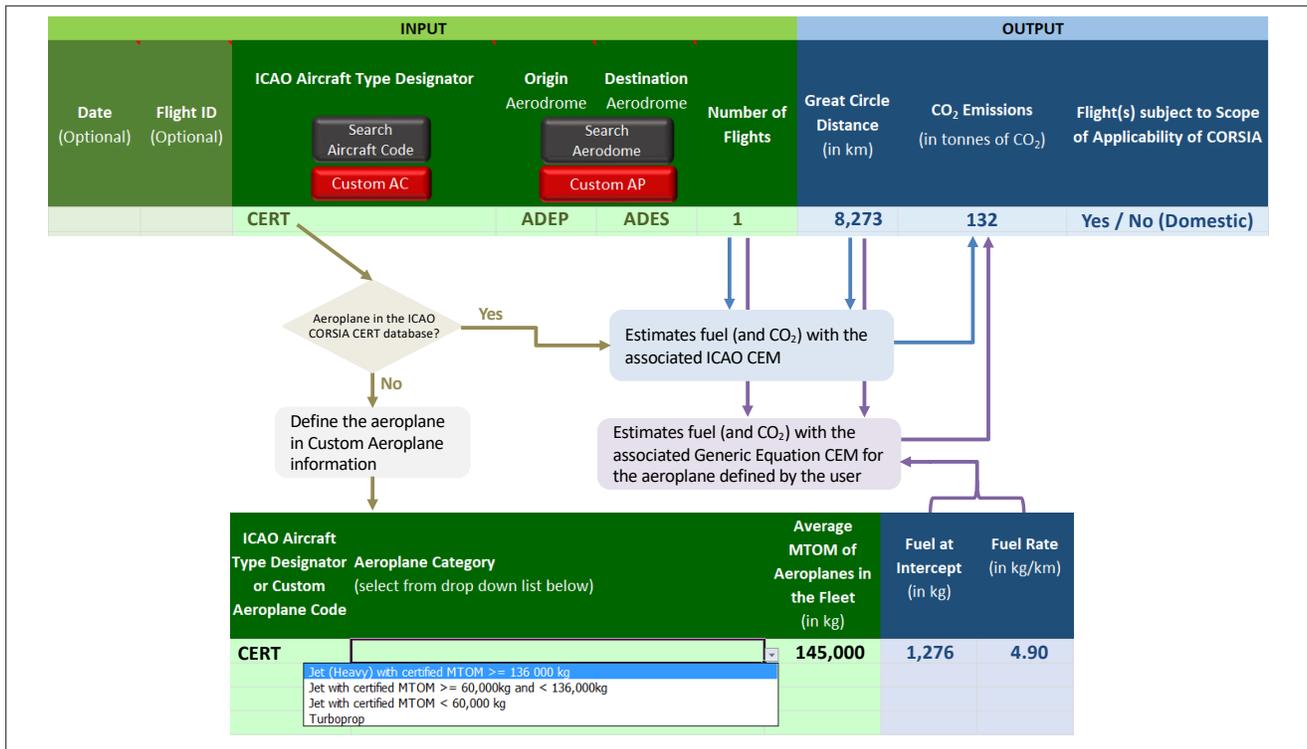


FIGURE 3: Estimation of the CO₂ Emissions with the ICAO CORSIA CERT – Step 2



The second step of the process for estimating the CO₂ emissions, as illustrated by the Figure 3, follows the same logic as the first, except that this step will focus on the type of aeroplane used. The tool will check if the aeroplane is in the ICAO CORSIA CERT database, in other words, if ICAO CEMs exist for this type of aeroplane. If they do, then the system will estimate the fuel burn and CO₂ emissions with the associated ICAO CEM by taking into consideration the number of flights and the GCD/BT. In the scenario where a type of aeroplane is not available, the tool will ask for additional information such as the aeroplane category from a selection of four options (turboprop or three jets with different certified Maximum Take Off Mass – MTOM) and the average MTOM of the aeroplane in the fleet. Based on this information, the ICAO CORSIA CERT will automatically compute a fuel rate and a fuel burn at the intercept. As previously, the tool will estimate fuel burn and CO₂ emissions with the associated Generic Equation CEM and by taking into consideration the number of flights and the GCD/BT.

CONCLUSION

The methodology behind the ICAO CORSIA CERT, as described above, seems to be complicated but from a user point of view, the use of the ICAO CORSIA CERT is very simple.

The main reason for using the ICAO CORSIA CERT is the simplification of the CO₂ estimation tasks for all users such as States, verification bodies and of course aeroplane operators. It is an easy-to-use ICAO-approved tool with a user-friendly interface, available free of charge and which comes with a detailed and transparent technical manual entitled “*ICAO CORSIA CO₂ Estimation and Reporting Tool (CERT): Design, Development and Validation*”.

Furthermore, the ICAO CORSIA CERT was developed by, and will continually be updated by talented people and with the immeasurable support of Data Providing Organizations (DPOs). Without the support from those aeroplane operators and States in providing fuel burn data, the ICAO CORSIA CERT would not be as reliable as it is today!

The CORSIA Central Registry

By ICAO Secretariat

INTRODUCTION

The CORSIA Central Registry (CCR) is one of the five Implementation Elements of the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) and in accordance with Annex 16, Volume IV, it is the specific means for States to report CORSIA-related information and data to ICAO.

The purpose of the CCR is to assist States by providing a standardized way to report information on the implementation of CORSIA (see Table 1), while enabling ICAO to consolidate this information and make it publicly available on the ICAO CORSIA website.

States have already started reporting information with the submission of their lists of aeroplane operators attributed to each State, and the list of the verification bodies accredited in each State (due by 30 April 2019)¹. However, the bulk of the information (CO₂ emissions, etc.) will be submitted starting in 2020.

Using the information reported by States, ICAO will calculate the baseline CO₂ emissions (2019-2020) for international aviation in 2021. Each year from 2022 onwards, ICAO will compile the reported CO₂ emissions for the previous year and determine the Sector’s Growth Factor (SFG) for the previous year and report back to the States. States will use the SFG to determine the CO₂ offsetting requirements for each of their aeroplane operators.

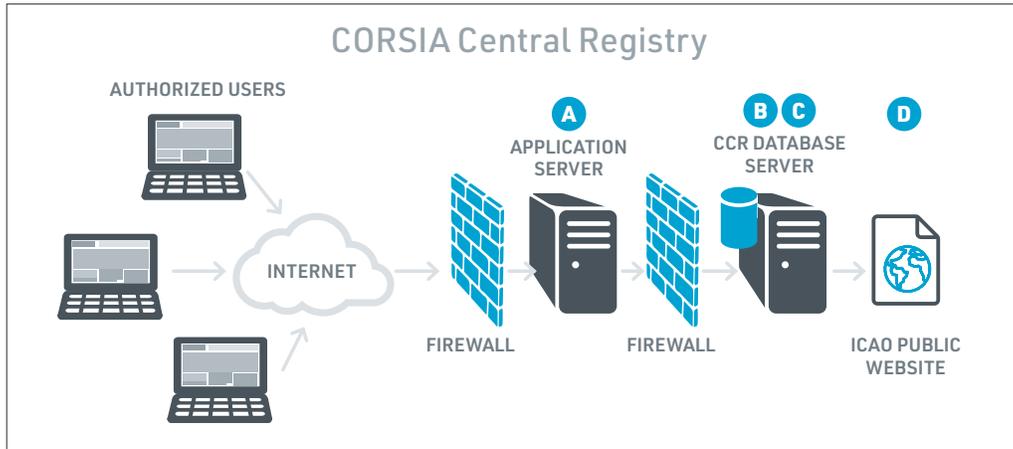
TABLE 1: Summary of CORSIA-relevant Information to be Reported by States to ICAO (2019-2026)

| Information type | Baseline | | Pilot Phase | | | First Phase | | |
|---------------------------|----------|-----------------------|-----------------------|----------------|----------------|----------------|------------------------|----------------|
| | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 |
| Aeroplane Operators | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Verification Bodies | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| CO ₂ Emissions | | ✓ 2019 data | ✓ 2020 data | ✓ 2021 data | ✓ 2022 data | ✓ 2023 data | ✓ 2024 data | ✓ 2025 data |
| CORSIA Eligible Fuels* | | Optional 2019 data | Optional 2020 data | ✓ 2021 data | ✓ 2022 data | ✓ 2023 data | ✓ 2024 data | ✓ 2025 data |
| Cancelled Emissions Units | | | | | | | ✓ 2021-2023 data | |

* Information can be reported annually or once at the end of each three-year cycle.

1 For 2019, ICAO developed and made available an online spreadsheet that States have used to submit information on aeroplane operators and verification bodies. The information submitted through the online spreadsheet will be incorporated into the CCR once it is operationalized.

FIGURE 1: Main Components of the CCR



COMPONENTS AND FEATURES OF THE CCR

The CCR is being implemented as an online web application supported by a database and a workflow engine, and comprises of the following components (see Figure 1):

- A. Web application with predefined forms and automated checks;
- B. Data transfer and storage;
- C. Administrative console to perform internal checks and manage data and users;
- D. ICAO website for the publication of information.

Each State will have one account on the CCR. Access to this account will be granted only to authorized users, who will be nominated by each State. Each State user will have unique login details (username and password) and will be given access to certain functions of the CCR based on a pre-defined list of permissions (see Table 2).

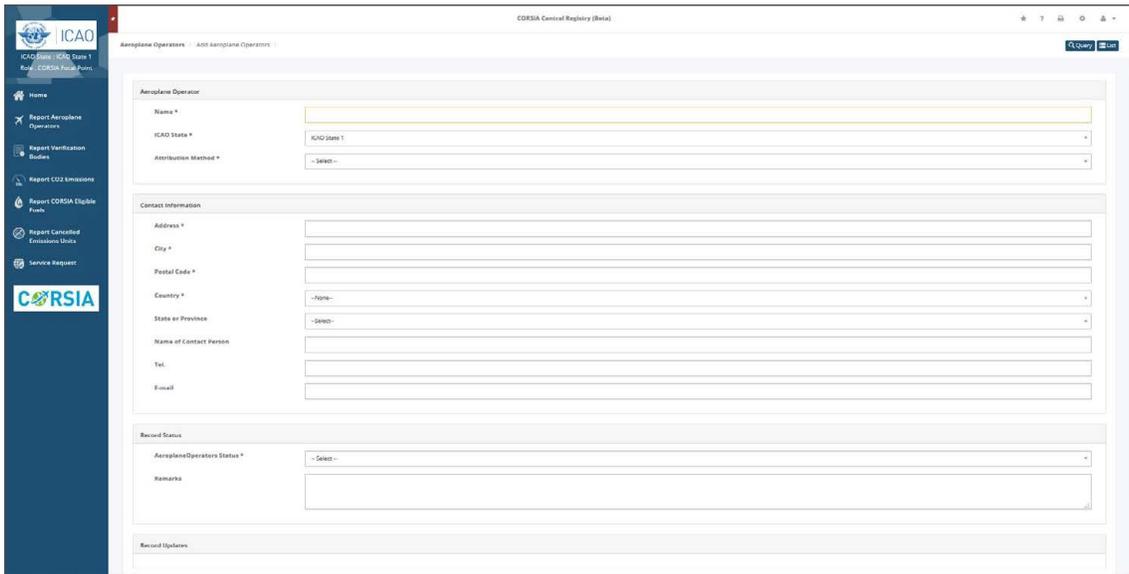
The State users will be able to provide new information and/or update previously submitted information. All user actions will be time-stamped and recorded (including the electronic signature of the State user who initiated an action) to ensure traceability and data integrity. If a State user needs to make changes to previously submitted information, the previous version of the information will not be deleted, but will be archived for future reference. It is important to note that only the CORSIA Focal Point can submit the data relevant to the State to ICAO.

Information and data will be uploaded on the CCR and submitted to ICAO using a secure web interface (web application/portal) through the use of predefined forms (see Figure 2 for an example). These forms facilitate entering information using, where possible, dropdown lists (for example list of ICAO States, attribution options, feedstocks used for CORSIA eligible fuels etc.) to minimize typing errors. Business rules have been created to check information and data before submitting to ICAO; for example, numerical data cannot contain letters or symbols, emissions data cannot be negative numbers etc.

TABLE 2: Examples of Permissions to CCR Main Functions per User Group

| User Group | CCR Functions | | | |
|--------------------|---------------|------------------------|---------------------|--------------------|
| | View Data | Add, Edit, Delete Data | Submit Data to ICAO | Manage Other Users |
| CORSIA Focal Point | Yes | Yes | Yes | Yes (State Users) |
| State User | Yes | Yes | No | No |

FIGURE 2: Example of the CCR Form to Enter Information on an Aeroplane Operator



(This image is provided for illustrative purposes based on the alpha version of the CCR and may not be a precise depiction of the final design of the CCR.)

OUTPUTS OF THE CCR

The information and data uploaded in the CCR will be used to produce five ICAO documents that are mentioned in Annex 16, Volume IV. Specifically:

1. ICAO Document “*CORSIA Central Registry (CCR): Information and Data for the Implementation of CORSIA*” is an umbrella document that contains:
 2. ICAO Document “*CORSIA Aeroplane Operator to State Attributions*” that contains a list of Aeroplane Operators and the State to which they are attributed
 - Availability: 31 May 2019 (First Edition published; to be updated regularly)
 3. ICAO Document “*CORSIA 2020 Emissions*” that contains the total 2020 CO₂ emissions to determine the first year in which a new entrant has offsetting requirements
 - Availability: As soon as practicable during the second half of 2021
 4. ICAO Document “*CORSIA Annual Sector’s Growth Factor*”
 - Availability: 31 October 2022 (to be updated annually)

5. ICAO Document “*CORSIA Central Registry (CCR): Information and Data for Transparency*” contains:

- List of verification bodies accredited in each State
- Total average CO₂ emissions for 2019 and 2020 aggregated for all aeroplane operators on each State pair route
- Total annual CO₂ emissions aggregated for all aeroplane operators on each State pair (with identification of State pairs subject to offsetting requirements)
- Information and data for each aeroplane operator
- Information and data on CORSIA eligible fuels claimed
- Offsetting requirements and emissions units cancelled (at State and global aggregate level for a specific compliance period)
 - Availability: 31 May 2019 (First Edition published; to be updated regularly)

All five ICAO documents will be published on the ICAO CORSIA website, following their approval by the ICAO Council, in accordance with the above timelines.

DEVELOPMENT TIMELINE

In accordance with Assembly Resolution A39-3 (paragraph 20 g)), the CCR should be established for operationalization no later than 1 January 2021. ICAO initiated the process for the development of the CCR in October 2018 with the publication of the tender document on the ICAO website. The documentation included the terms of reference, which were based on the CCR functional requirements that were approved by the ICAO Council in June 2018.

The successful vendor was selected in early 2019 and following contractual negotiations, the development work started in mid-March 2019. The beta version of the CCR was delivered in early July 2019 for testing by ICAO. According to the agreed timeline, version 1 of the CCR is expected to be ready for deployment in late 2019 or early 2020. After the CCR is deployed, training will be provided to ensure that the potential State users are familiar with all of its functions.

An Overview of CORSIA Eligible Fuels (CEF)

By ICAO Secretariat

As explained in Chapters 4 and 5, the development and deployment of sustainable aviation fuels (SAF) is one element of the ICAO basket of measures to reduce aviation emissions. As a consequence, ICAO is pursuing several initiatives to support the further development and deployment of SAF.

Specifically on CORSIA, the ICAO Assembly Resolution A39-3 requested the development of a methodology “to ensure that an aircraft operator’s offsetting requirements under the scheme [CORSIA] in a given year can be reduced through the use of sustainable alternative fuels, so that all elements of the basket of measures are reflected” (Resolution A39-3, paragraph 6).

In line with this Assembly request, Annex 16, Volume IV defines a “CORSIA eligible fuel” (CEF) as a “CORSIA sustainable aviation fuel” or a “CORSIA lower carbon aviation fuel”, which an operator may use to reduce their offsetting requirements. This article presents the specific procedures and methodologies that will allow operators to claim emissions reductions from the use of CORSIA eligible fuels, as well as details on how such processes were developed by CAEP.

CORSIA DEFINITIONS

Historically, terms such as “alternative fuels” or “sustainable fuels” have been used in many instances to designate fuels produced from non-conventional processes and, consequently, lower environmental impact. In the context of CORSIA, Annex 16, Volume IV includes the following definitions related to fuels:

CORSIA eligible fuel. A CORSIA sustainable aviation fuel or a CORSIA lower carbon aviation fuel, which an operator may use to reduce their offsetting requirements.

CORSIA lower carbon aviation fuel. A fossil-based aviation fuel that meets the CORSIA Sustainability Criteria under this Volume.

CORSIA sustainable aviation fuel. A renewable or waste-derived aviation fuel that meets the CORSIA Sustainability Criteria under this Volume.

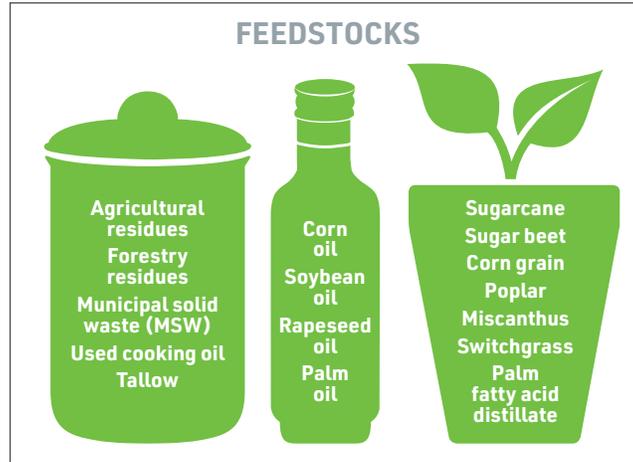
HOW DOES A FUEL BECOME A CORSIA ELIGIBLE FUEL (CEF)?

In order to understand how a fuel becomes a CORSIA eligible fuel, this section will provide an overview of the fuel supply chain – from the feedstock, to the conversion process, to the sustainability certification process, and finally its consideration as a CORSIA eligible fuel.

FEEDSTOCK

Several feedstock types have the potential to produce a CORSIA eligible fuel (CEF). As of February 2019, CAEP has developed default life cycle emission values for CORSIA sustainable aviation fuels produced from sixteen distinct feedstocks, as provided in Figure 1. Work is ongoing in CAEP to develop specific methodologies for the consideration of CORSIA lower carbon aviation fuels. More feedstock types may become available to fuel producers as the CEF industry evolves.

FIGURE 1: Feedstocks with CORSIA Default Life Cycle Emission Values (February 2019)



FUEL CONVERSION

The identified feedstock types are converted into aviation fuel through a fuel conversion process. The international standard-setting organization, ASTM International, has certified six fuel conversion processes for use in aircraft, as listed below (ASTM 7566 and ASTM 1655). This certification relates to the technical specifications of the fuel and ensures that the product is safe for use in an aircraft, by meeting the same safety standards as any other jet fuel.

SUSTAINABILITY CERTIFICATION

Beyond the technical certification process described above, fuels must also go through a sustainability certification process if they are to be used in CORSIA. Following the request of the ICAO Assembly, CAEP developed a sustainability certification process based on existing sustainability approaches, whether regulatory or voluntary, for the sustainability demonstration of aviation fuels.

Many aviation fuels already go through a voluntary or regulatory sustainability certification process, but the method described below refers to the CORSIA-specific process recommended by CAEP.

FIGURE 2: Fuel Conversion Processes Approved by ASTM International

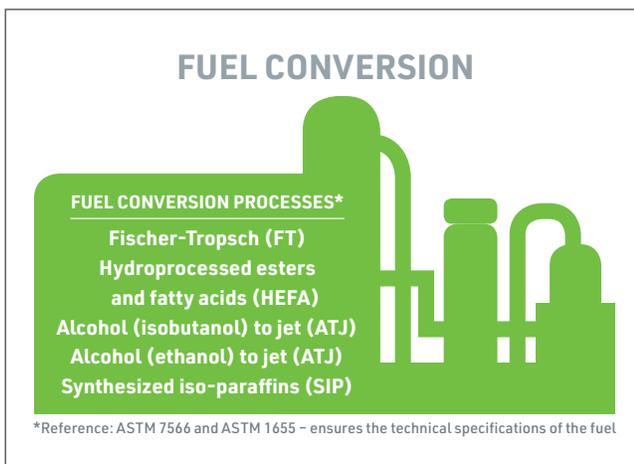


FIGURE 3: Sustainability Certification



LIFE CYCLE EMISSION VALUE (LSf)

The use of CEF can reduce aviation CO₂ emissions on a life cycle basis (i.e., from production to combustion). The reduction of CO₂ emissions from CEF depends on a variety of factors, for example, the feedstock used, how the feedstock was produced, the fuel conversion process used, etc. These factors combine to provide a fuel's life cycle emissions value (LSf).

CORSIA IMPLEMENTATION ELEMENT FOR CEF

The procedures and requirements for a CEF to be considered under CORSIA are defined within five ICAO documents, which are referenced in Annex 16, Volume IV. These documents form the CORSIA Implementation Element for CEF. They are:

1. CORSIA Eligibility Framework and Requirements for Sustainability Certification Schemes (SCS)
This ICAO document defines the requirements that SCS need to comply with, in order to be approved by ICAO to perform the sustainability certification of CORSIA eligible fuels, as well as to assess the life cycle emission value (LSf) of CEFs.
2. CORSIA Approved Sustainability Certification Schemes
This ICAO document will include the list of SCSs approved by the ICAO Council, in accordance with the Framework and Requirements laid out in ICAO document (1).
3. CORSIA Sustainability Criteria for CORSIA Eligible Fuels
This ICAO document presents the Sustainability Criteria that needs to be observed by a given fuel. The first edition of the document, which applies until December 31st, 2023 (end of the CORSIA pilot phase), can be accessed from the ICAO CORSIA webpage¹.

4. CORSIA Default Life Cycle Emissions Values for CORSIA Eligible Fuels

This ICAO document provides a list of Default Life Cycle Emissions Values for CEFs, as a function of the feedstock, conversion process, and production region. This is the simplest option available to determine the LSf value of a given CEF.

The CORSIA supporting document “CORSIA Eligible Fuels – Life Cycle Assessment Methodology” (available from the ICAO CORSIA webpage²) provides technical information and describe ICAO processes to manage and maintain this ICAO document.

5. CORSIA Methodology for Calculating Actual Life Cycle Emissions Values

This ICAO document provides methodologies that can be used by fuel producers to calculate Actual Life Cycle Emissions Values. These methodologies allow fuel producers to claim Life Cycle Emissions Values lower than the default values in ICAO document (4), in case they can support that with proper technical information.

Each of these documents will be made available on the ICAO website, as they are approved by the ICAO Council.

SUSTAINABILITY CERTIFICATION SCHEMES

Sustainability Certification Schemes (SCSs) will ensure that a CEF meets the CORSIA Sustainability Criteria (3), and will ensure that the Life Cycle Emission Value of the CEF is obtained correctly (4 and 5). SCSs must be approved by the ICAO Council to perform this sustainability certification process (1), (2).

1 <https://www.icao.int/environmental-protection/CORSIA/Documents/ICA0%20document%2005%20-%20Sustainability%20Criteria.pdf>

2 https://www.icao.int/environmental-protection/CORSIA/Documents/CORSIA%20Supporting%20Document_CORSIA%20Eligible%20Fuels_LCA%20Methodology.pdf

USING CEF IN CORSIA

An aeroplane operator can reduce its CORSIA offsetting requirements by claiming emissions reductions from the use of CEF through the following process:

1. The operator obtains the life cycle emissions value (LSf) of the CEF. This is determined during the CEF sustainability certification process, as described above.
2. The operator calculates the CEF emissions reductions (ER_y) as follows:

FIGURE 4: CEF Emissions Reductions Formula

*Fuel Conversion Factor, fixed value,
3.16 for Jet-A/ Jet-A1 or 3.10 for AvGas/ Jet B
[kg CO₂/kg fuel]*

$$ER_y = FCF \times \left[\sum_f MS_{f,y} \times \left(1 - \frac{LS_f}{LC} \right) \right]$$

*Total mass of CEF claimed
in the year y, by fuel type f [tonnes]*

*Baseline life cycle emissions,
fixed value, 89 for jet fuel or
95 for AvGas [gCO_{2e}/MJ]*

Example: If, in 2021, an operator uses 10,000 tonnes of Jet-A fuel produced from Used Cooking Oil (default **LSf=13.9 gCO_{2e}/MJ***), the amount of emissions reductions will be:

$$ER_{2021} = 3.16 \times \left[10,000 \times \left(1 - \frac{13.9}{89} \right) \right] = 26,665 \text{ tonnes of CO}_2$$

3. The operator includes information on CEF in its Emissions Report, including:
 - CEF emissions reductions (ER_y) claimed
 - Fuel type, mass, and life cycle emissions value (LSf)
 - Evidence of compliance with CORSIA sustainability criteria
4. A verification body verifies information on CEF provided in the Emissions Report. (More information on verification is available throughout this chapter.)
5. The State collects and aggregates verified information on CEF from all aeroplane operators attributed to it, and reports aggregated information to ICAO through the CORSIA Central Registry (CCR).

CONCLUSION

The processes described in this article ensure that an aircraft operator’s offsetting requirements under CORSIA can be reduced through the use of CEF. Through CAEP work, ICAO has coordinated with fuel producers, sustainability certification schemes, airlines, States, and additional stakeholders to ensure that the process for using CEF in CORSIA is feasible, while ensuring the environmental integrity of the scheme. As the CEF industry progresses, ICAO will continue to work with these stakeholders towards the achievement of ICAO’s aspirational goals.

One tonne of CO₂ in Tokyo shall be one tonne of CO₂ anywhere in the world

Assurance of the Verified CORSIA CO₂ Emissions Reports Through Accreditation

By Chikako Makino, Deputy General Manager, Strategy Planning Division, Japan Accreditation Board, and Co-Chair, IAF GHG and Energy WG

SUMMARY

The International Accreditation Forum (IAF) is supporting developing economies to establish accreditation infrastructures for ISO 14065 *Greenhouse gases -- Requirements for greenhouse gas validation and verification bodies for use in accreditation or other forms of recognition* working together with local accreditation and verification bodies. For the purposes of the International Civil Aviation Organization (ICAO) Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA), IAF has established a structured Multilateral Recognition Arrangement (IAF MLA) based on ISO 14065. This MLA provides a harmonized global approach for verification bodies to achieve and maintain accreditation. It also promotes trust and builds confidence among accreditation bodies by ensuring that reports under CORSIA are treated the same way by all verification bodies using the same procedures to both verify them and produce trusted accredited verification statements for the purposes of the global ICAO Scheme.

INTRODUCTION

The International Accreditation Forum (IAF) is a global organization of accreditation bodies, and stakeholders involved in conformity assessment activities which support among others, the following goals:

- the recognition of competent and equally reliable accredited conformity assessment activities through global arrangements;
- the development and harmonization of accreditation practices; and
- the promotion of accreditation as an effective mechanism that provides confidence in goods and services.

The aim of IAF is to develop a worldwide accreditation program that ensures the equivalency of accreditation schemes offered by the IAF members. IAF defines and promotes application documents and provisions for national accreditation bodies while providing oversight of IAF members' accreditation schemes.

As of 30 June 2019, IAF membership totals 112, out of which 84 are Accreditation Body (AB) Members, 22 are Association Members, and six are Regional Accreditation Group Members: AFRAC (African Accreditation Cooperation), ARAC (Arab Accreditation Cooperation), EA (European Cooperation for Accreditation), IAAC (Inter American Accreditation Cooperation), APAC (Asia Pacific Accreditation Cooperation Incorporated), and SADCA (Southern African Development Community in Accreditation). Several other membership applications are in progress.

ACCREDITATION UNDER CORSIA

The international nature of aviation and the overall objective of CORSIA not to introduce market distortions while offsetting and reducing CO₂ emissions has led ICAO to develop an accredited verification scheme that reduces the risk of diverging accreditation and verification standards for the purposes of CORSIA.

IAF has participated in ICAO discussions on the development of Annex 16, Volume IV, specifically on the accreditation scheme for the verification of emissions reports under CORSIA. The accreditation scheme that is included in Annex 16, Volume IV is founded on proposals made by various ICAO States based on ISO 14065 *Greenhouse gases -- Requirements for greenhouse gas validation and verification bodies for use in accreditation or other forms of recognition* working.

The provisions of Annex 16, Volume IV are consistent with the World Trade Organization (WTO) Technical Barriers to Trade (TBT) Agreement¹, which encourages its members to “base their measures on international standards as a means to facilitate trade”. Accordingly, for the purposes of CORSIA, the international standards ISO 14065:2013 and ISO 14064-3:2003 *Greenhouse gases -- Part 3: Specification with guidance for the validation and verification of greenhouse gas assertions* apply. ISO 14065 ensures that aeroplane operators receive a technically competent and fair verification with safeguards and respect to confidentiality concerns. In particular, verification bodies should ensure:

- Appropriate competencies with technical knowledge and skills for the international aviation sector.
- Fair verification processes, of a reasonable duration and cost, implemented as planned with sufficient data sampling.
- Communication of responsibilities to a client, appropriate records management and safeguards to address confidentiality of information.

- Insurance arrangements and availability of sufficient reserves to cover liabilities arising from the verification activities.
- Processes to manage, evaluate, take necessary corrective action(s), and make decisions on appeals and complaint are in place along with continuous improvement of service(s) by internal audit and management review processes.

In general, the accreditation process under ISO 14065 involves the assessment of an application by a verification body, a review of the provided documentation to determine whether it is appropriate, an office visit to the verification body premises to evaluate the verification process and determine the competencies of the personnel, and an on-site witness to evaluate the ability to perform the verification. The process is completed with granting accreditation credentials. Initial accreditation, regular surveillance and reaccreditation is based on ISO/IEC 17011 *Conformity assessment -- Requirements for accreditation bodies accrediting conformity assessment bodies*.

IAF member accreditation bodies monitor the performance of accredited verification bodies continuously, and if they identify any fraudulent behavior could decide to perform spot checks, or impose sanctions, or suspension if requirements are not met (for example, this could be the case where a verification body has been found to be manipulating data for the benefit of its clients).

IAF member accreditation bodies that accredit to ISO 14065², and grant accreditation for 247 validation and verification bodies globally may be able to demonstrate competence of verification bodies for the purposes of CORSIA. This requires that the IAF members have access to the competent technical assessors and experts, as appropriate, as soon as the CORSIA accreditation assessments start. Accordingly internal accreditation processes need to be analyzed to ensure that the additional CORSIA requirements can be implemented, before endorsement of the new scheme.

1 https://www.wto.org/english/docs_e/legal_e/17-tbt_e.htm#articleVI

2 For example, Austria, Belgium, Bulgaria, Croatia, Czech, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Italy, Latvia, Norway, Poland, Portugal, Rumania, Slovakia, Slovenia, Spain, Sweden, the Netherland, United Kingdom, Canada, Indonesia, Japan, Mexico, Mongolia, Singapore, Sri Lanka and the United States

In addition to this, for those national accreditation bodies starting ISO 14065 accreditation for ICAO CORSIA, e.g., China and India, we expect their ISO 14065 accreditations for CORSIA will be granted in 2019-2020.

THE IAF MULTILATERAL RECOGNITION ARRANGEMENT

IAF member accreditation bodies around the world, the competence of whom has been evaluated by peers, have signed an arrangement, the IAF Multilateral Recognition Arrangement (MLA), that enhances the acceptance of goods and services across national borders.

The purpose of the IAF MLA is to ensure mutual recognition of accredited verification amongst signatories to the IAF MLA, and subsequently the acceptance of accredited verification in many markets based on one accreditation. Accreditations granted by IAF MLA signatories are recognized worldwide based on their equivalent accreditation schemes, therefore reducing costs and adding value to business and consumers.

The IAF MLA now has 73 AB Signatories from 66 economies and 5 Recognized Regional Accreditation Group MLAs. The IAF MLA has four Main Scopes with 10 Sub-Scopes. The Main Scope of the IAF MLA, which demonstrates that accredited conformity assessment results are equally reliable, now covers Management System Certification ISO/IEC 17021-1, Product Certification ISO/IEC 17065, Certification of Persons ISO/IEC 17024 and Greenhouse Gas Validation and Verification ISO 14065.

The endorsed IAF MLA Main Scope 'Validation and Verification ISO 14065' allows regional accreditation groups and single national ABs to demonstrate the ability of ISO 14065 accreditation.

There is a process to evaluate IAF member applicants to become IAF MLA signatories. The national accreditation bodies' applicants cannot become signatories until they have met the relevant requirements, and there is an on-going assessment process to confirm the fulfillment of these requirements. AB members of IAF are admitted to the MLA only after a stringent evaluation

of their operations by a peer evaluation team. It is the responsibility of this peer evaluation team to assess that the applicant members comply with both the international standards and the associated IAF documents.

At present three regional MLAs (the EA MLA, APAC MLA, and IAAC MLA) with 32 signatory members have been peer evaluated under the oversight provided by the IAF MLA for ISO 14065 for these regional MLAs and their signatories for ISO 14065 as appropriate. It is critical to this arrangement that a comprehensive peer evaluation process is established, under which IAF MLA national accreditation bodies undergo regular evaluations to ensure consistent application of the international standards. The MLA will be an effective tool for ensuring the consistent application of the CORSIA verification provisions worldwide as it will ensure that the accreditation scopes of IAF MLA national accreditation bodies for CORSIA is identical.

In October 2018, the IAF General Assembly endorsed the extension of the IAF MLA under the Main Scope of Validation and Verification for CORSIA for Level 4 and Level 5 Sub-Scopes.

The IAF MLA for CORSIA provides confidence that verification bodies accredited by IAF MLA's national accreditation bodies and their verification activities are assessed equally and consistently by all IAF MLA national accreditation bodies against ISO standard and ICAO standards e.g., CORSIA SARP.

In practical terms, accreditation under CORSIA through the provisions of the MLA will ensure that an aeroplane operator receives the same verification services whether it uses a verification body accredited in its own or in a different state. The MLA therefore increases the availability of the verification bodies resulting in improved services and lower costs while maintaining the verification provisions contained in the CORSIA Standards and Recommended Practices (SARPs) related guidance included in the Environmental Technical Manual.

In 2018, 32 IAF AB members and 5 IAF Regional Accreditation Group members offered ISO 14065 accreditation; this means that 37 ICAO States may be able to receive the local accredited verification by IAF AB



members and the related Regional Accreditation Group members. In addition, nine more IAF AB members are ready to start ISO 14065 accreditation. The prerequisite for these 46 IAF AB members and related Regional Accreditation Group members to start the accreditation for CORSIA is to receive the appropriate training for the CORSIA requirements. It is expected that the regional MLAs will start to extend the scope to sub-scope for CORSIA in 2019, and the first signatories of the IAF MLA for CORSIA are expected for 2020. Usually, the transition of an IAF MLA Main Scope to a Sub-Scope (such as for CORSIA) takes two to three years.

Signature of a Memorandum of Understanding (MoU) between IAF and ICAO, expected in the near future, will enhance the capacity of accreditation bodies and verification bodies by providing training for the CORSIA-specific verification requirements. In addition, through this MoU, IAF and ICAO will share information on CORSIA requirements and future updates of the Annex 16, Volume IV, IAF requirements and accreditations of IAF AB members in relation to CORSIA, including the above IAF MLA scopes and related CORSIA monitoring, reporting and verification requirements adopted by the ICAO Council and endorsed by IAF.

CORSIA – En Route and On Time

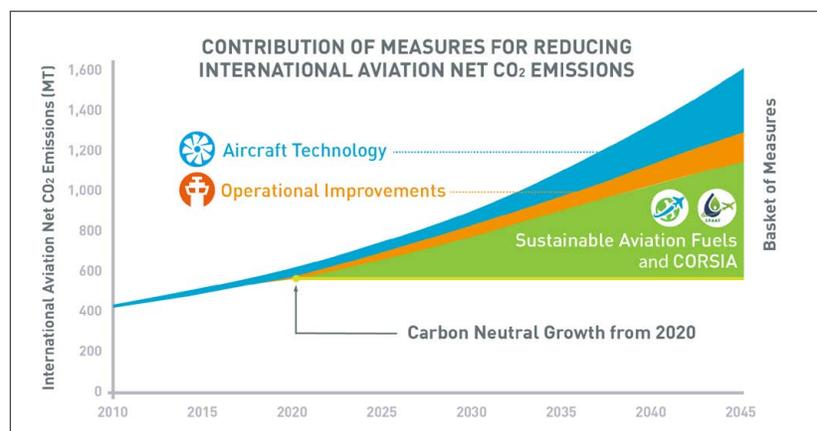
By Eva Weightman, International Emissions Trading Association (IETA)

The adoption of the Carbon Offsetting and Reduction System for International Aviation (CORSIA), the world's first global sector-wide emissions reduction system, was hailed as a great step towards tackling aviation's rising emissions. Carbon market participants and stakeholders have kept an even closer eye on developments since then. Now the key question everyone wants to know the answer to remains unanswered: what kind of emissions units will be eligible for CORSIA compliance.

CORSIA has been developed in order to achieve ICAO's aspirational goal of carbon neutral growth in the aviation sector from 2020. It represents only one part of a so-called basket of measures, which also includes improved aircraft technology, operational improvements, and the use of sustainable aviation fuels. These three are sometimes referred to as the non-market-based measures. While ICAO has been clear that the non-market-based measures are the preferred long term tools to ensure carbon neutral growth, it has also accepted that in the next 15 years they may not be sufficient. That is why a market-based mechanism, CORSIA, is needed.

Over the last couple of years, ICAO has assisted both states and aircraft operators with preparations for CORSIA. The main focus has so far been on getting the monitoring, reporting and verification (MRV) requirements in place. This is crucial as the baseline will be determined by emissions in 2019 and 2020. Aircraft operators that exceed this baseline in subsequent years will have to buy emissions units to offset this increase.

The CORSIA discussions are taking place at the same time that international carbon markets have seen increased interest, following the adoption of the Paris Agreement in December 2015. Article 6 of that Agreement allows for the cross-border trade of reduction units as well as establishing a new emissions mitigation mechanism to encourage sustainable development. In December last year, governments gathered in Poland to finalise the Paris Agreement Rulebook but, despite the best efforts, the rules for Article 6 remained unfinished. However, despite the disappointment there is a silver lining: Article 6 will receive negotiators' full attention and will play a key role at the UN talks later this year in Chile. IETA feels optimistic that an agreement can be reached.



SOURCE: ICAO website, www.icao.int

CORSIA has provided another reason for optimism. In March 2019, the ICAO Council announced the approval of the emissions unit criteria (EUC) and establishment of the Technical Advisory Body (TAB). Both are critical steps in defining what kind of emissions units will be eligible under CORSIA. EUC provide principles which will help determine the eligible emissions units under CORSIA. The TAB will assess candidate programmes seeking to supply such emissions units to the CORSIA market against these criteria. These announcements did not come as a surprise, as both are envisaged in the Assembly resolution itself. However, it sent an encouraging signal to market participants to see things staying on track for a timely completion.

The published EUC consist of two parts. The Program Design Elements refer to the rules and procedures expected to be in place by programmes that will apply

to become CORSIA-eligible emissions units providers, while the Carbon Offsets Credit Integrity Assessment Criteria define the qualities that ICAO expects the eligible emissions units to have. The aim is to ensure delivery of real and verifiable emissions reductions, as well as preventing the double-counting of reductions. The criteria are robust enough to provide the confidence of environmental groups as well as market participants. Now it is the TAB's task to make the assessments of programmes in achieving the criteria.

But the clock is ticking. Generating emissions reductions often takes years – from the start of construction of a project through to the first issuance of carbon credits – and time is in increasingly short supply as far as climate change is concerned.

CORSIA EMISSIONS UNITS CRITERIA (EUC)

In March 2019, the ICAO Council approved the CORSIA emissions unit eligibility criteria, consisting of **Program Design Elements** and **Carbon Offset Credit Integrity Assessment Criteria**. The CORSIA emissions unit eligibility criteria should apply at the program level.

Program Design Elements:

1. *Clear Methodologies and Protocols, and their Development Process*
2. *Scope Considerations*
3. *Offset Credit Issuance and Retirement Procedures*
4. *Identification and Tracking*
5. *Legal Nature and Transfer of Units*
6. *Validation and Verification procedures*
7. *Program Governance*
8. *Transparency and Public Participation Provisions*
9. *Safeguards System*
10. *Sustainable Development Criteria*
11. *Avoidance of Double Counting, Issuance and Claiming*

Carbon Offset Credit Integrity Assessment Criteria:

1. *Carbon offset programs must generate units that represent emissions reductions, avoidance, or removals that are additional*
2. *Carbon offset credits must be based on a realistic and credible baseline*
3. *Carbon offset credits must be quantified, monitored, reported and verified*
4. *Carbon offset credits must have a clear and transparent chain of custody within the offset program*
5. *Permanence*
6. *A system must have measures in place to assess and mitigate incidences of material leakage*
7. *Are only counted once towards a mitigation obligation*
8. *Carbon offset credits must represent emissions reductions, avoidance, or carbon sequestration from projects that do no net harm*

SOURCE: ICAO's CORSIA At a Glance Series,

There is a steady supply of emissions units from projects developed in accordance with programmes around the world, some of which are already accepted for compliance markets. These systems have been developed over many years and apply a level of rigour comparable to the EUC. Allowing airlines access to these markets for CORSIA compliance would help keep down compliance costs, provide a ready-made stream of credits, and support innovative projects which benefit those most in need.

Tapping an existing market for emissions units instead of designing a new system, with all the accompanying methodologies, rules and procedures, would also allow for more energy to be spent on the more technical issues, such as calculating the industry baseline based on reported emissions. This will be critical in firming up the market's understanding of the amount of demand they will need to satisfy. But this will change over time, as the system begins to operate. Project developers are keenly focused on the TAB's progress, because it will signal the types of supply they need to produce.

Market analysts are beginning to assess these supply and demand dynamics for CORSIA, but they cite a number of variables involved and many uncertainties to evaluate. Are there going to be restrictions on project types? Will some emissions units only be eligible for compliance in the Pilot/First phase? How well will the other measures work to deliver efficiency improvements and biofuels? These are common themes in any emissions market analysis. But importantly, once the market gets clarity on these fundamentals, participants will respond with investment, project development and emissions units deliveries.

When the Kyoto Protocol's Clean Development Mechanism (CDM) was developed, it took several years to finalise the rules. But the first project developers started looking at early project opportunities far sooner. This meant that, once the rules were adopted and the institutions started operations, projects developed rapidly. The service sector around the project development – like project verification and legal drafting – also became vibrant. In those early days, it could take more than a year to get the project approved by a government, implemented, verified by a third party and registered.

This project cycle should be better for CORSIA. It can benefit from the lessons of the CDM and other markets; we're no longer starting anew, but with two decades of experience under our belts. During this time, carbon markets have evolved significantly and adapted to the user's needs, from the EU's cap-and-trade system to Colombia's tax and offset programme. The inherent flexibility of market mechanisms enables them to achieve real emissions reductions, quickly and at lowest cost. IETA itself is celebrating its 20th anniversary this year and, despite the occasional bump in the road since our inception, we are confident that market-based mechanisms are the right tool to deliver the climate ambition the world needs.

Ensuring sufficient supply of emissions units while maintaining the environmental integrity of the market system is a fine, but achievable, balancing act. The elements are all there – the experience, the robustness, the project pipeline, the investment. Time is of the essence to ensure CORSIA achieves what it is intended to.

CORSIA: The Airlines' Perspective

By Michel Adam, International Air Transport Association (IATA)

FROM 2009 TO 2019

Reducing fuel use (and associated emissions) has been a priority for airlines since the start of commercial air travel. With fuel costs representing about a quarter to a third of operating costs, improving fuel efficiency has been an evident strategic choice for airlines. At today's price of fuel (as of April 2019), when an aircraft emits 1 tonne of CO₂, it burns over USD200 worth of fuel.

But fuel costs are not the only incentive for airlines to mitigate their emissions. Airlines recognize that air transport contributes to climate change - currently 2% of man-made CO₂ emissions - and they are taking the responsibility to lessen this impact extremely seriously.

In 2009, under the umbrella of the Air Transport Action Group (ATAG), representatives of the entire aviation industry adopted three targets for the sector:

1. An improvement of its fuel efficiency by an average of 1.5 per cent per annum from now through 2020;
2. Capping the growth of its net carbon emissions from 2020 (carbon-neutral growth from 2020); and
3. Halving its net emissions by 2050 compared to 2005 levels.

Ten years after the adoption of these targets, the sector is more resolute than ever to deliver on its commitments. The short-term goal to improve fleet fuel efficiency by an average of 1.5% per annum from 2009-2020 is on track, with current analysis showing a 2.3% improvement on a rolling average - an efficiency improvement of 17.3% since 2009 (source: IATA/ATAG). And while fuel efficiency improvements will not be sufficient to stabilize emissions at 2020 levels in the short- to medium-term, ICAO's Carbon Offsetting and Reduction Scheme for International

Aviation (CORSIA) and sustainable aviation fuels will enable the sector to achieve carbon neutral growth.

However, both our short-term efficiency goal and the CORSIA project will not be enough by themselves for our industry to play its part in the global response to climate change - our long-term goal and the associated *reductions* in CO₂ from the sector will be required.

COUNTDOWN TO CORSIA

The implementation of CORSIA has raised a few challenges for the airline and business aviation community. It is estimated that close to a thousand operators worldwide fall within the scope of CORSIA's obligations, with many of them being small operators with limited resources.

In 2017, the Air Transport Action Group (ATAG) and IATA, in coordination with IBAC and regional airline associations, launched "Countdown to CORSIA". The "Countdown to CORSIA" campaign included workshops, guidance materials and information toolkits. Close to 700 participants, representing more than 270 aircraft operators, took part in the workshops held in 2017 and 2018. More workshops will be held in the second half of 2019.

Another challenge some airlines have faced in their initial preparations for CORSIA has been to ensure their systems are appropriate to handle the significant amount of data that will need to be collected and reported. To offer a solution to interested airlines, IATA developed FRED+, a system which operators can use to store, handle and compile data for CORSIA. The system also allows data to be transmitted from operators to states and verifiers and can be paired with the fuel management software

that airlines already use. This complements the ICAO CO₂ Estimation and Reporting Tool and other systems that airlines will be able to rely on to facilitate compliance with CORSIA.

The Countdown to CORSIA campaign and capacity building efforts have been a very successful joint-effort from the aviation community. Together with the efforts of ICAO and its Member States to prepare administering authorities under the ACT-CORSIA initiative, they have created a solid foundation for the implementation of CORSIA.

AVIATION AND OFFSETTING

For airlines, the implementation of CORSIA does not distract from the attention put on fuel efficiency measures. Offsetting is not intended to replace advances in technology, operations and infrastructure within the sector. Nor would CORSIA make fuel efficiency any less of a day-to-day priority. Rather, CORSIA can help the sector achieve its climate targets in the short and medium term by complementing emissions reduction initiatives within the sector.

While the airline community views CORSIA and offsetting as a necessary element of its climate change strategy, the large support from airlines is also related to the contribution carbon offsetting projects will make to communities and the Sustainable Development Goals. Indeed, there are many ways to achieve emissions reductions that can be used as offsets, many of which bring other social, environmental or economic benefits relevant to sustainable development.

The demand from aviation for carbon offsets will trigger a lot of investment in new climate mitigation. It is forecast that CORSIA will mitigate around 2.5 billion tonnes of CO₂ between 2021 and 2035, representing an investment in climate projects of at least USD40 billion.

In addition, strong criteria, based on principles commonly applied under

existing trading mechanisms and well-accepted carbon offset certification standards, have been adopted by ICAO to determine eligible offsets and will ensure that CORSIA is an effective climate measure.

TARGETING 2050

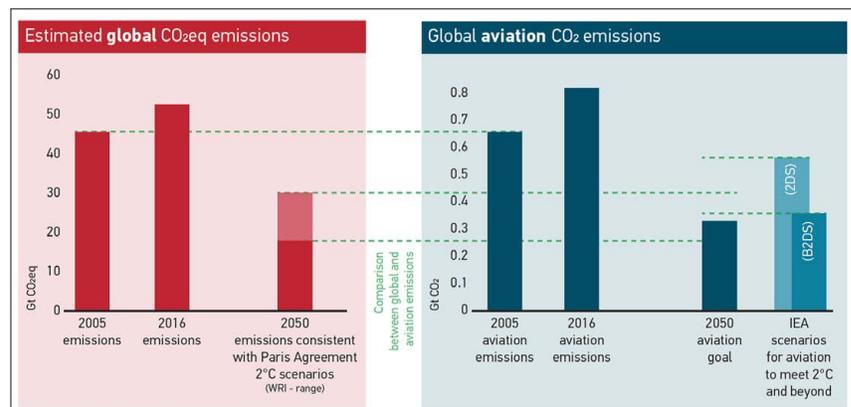
The focus right now is on the success of CORSIA and this work is pressing. However, airlines are on course towards their long-term target of halving net CO₂ emissions by 2050, compared with 2005 levels.

While international aviation was not included under the Paris Agreement’s nationally-determined contributions, this does not mean that our sector does not have to play its part in reaching the Paris Agreement’s ambitions. On the contrary.

In its 2017 *Energy Technology Perspectives*, the International Energy Agency (IEA) estimates that emissions from the aviation sector should decline to 0.3 GtCO₂-eq by 2060 under their “Beyond 2°C Scenario”. The IEA notes that this is consistent with the industry’s long-term target to halve its net emissions by 2050, compared to 2005.

Naturally, airlines and the broader industry need to put all efforts into ensuring the sector does not deviate from its course. This will require airlines to implement all available fuel efficiency measures and take part in the long-term

FIGURE: Comparison of the aviation industry 2050 goal vs. global emissions levels expected to result from implementation of the NDCs under the Paris Agreement and IEA 2°C scenarios (source: ATAG)



energy transition of air transport towards sustainable aviation fuels. Also, as the fuel efficiency improvement potential of current aircraft configurations is likely to be reduced in the next decades, the development of radically new aircraft, and their seamless integration in future operations, needs to materialize. From 2035 onwards, radical technological innovations with higher fuel efficiencies including new aircraft configurations and new forms of propulsion such as battery or hybrid electric power, can become a reality. Some airlines have already partnered with technology start-ups and research establishments, on some of the over 100 electric aircraft projects currently under investigation. This shows the sector's increasing interest in new technologies.

But the industry cannot achieve its long-term goal on its own. Governments need to support investment in research and development in academic institutions and with joint research programmes with industry. Governments must also foster policies that help support the growth in sustainable fuel deployment and promote their use for aviation, either by providing a level playing field with other uses or by prioritising its use in air transport.

WHAT WE CAN ALREADY LEARN FROM CORSIA

The experience gained in the development and initial implementation of CORSIA is that multilateralism and cooperation between all stakeholders are key to the sustainable development of air transport.

In 2016, ICAO's Member States were able to agree on the first-ever global carbon pricing instrument for a sector.

In less than three years, ICAO was able to adopt international standards to regulate the implementation of the scheme. These standards were drafted jointly by experts from governments, industry, environmental non-governmental organizations and the European Commission and they were adopted by ICAO's Council for their universal implementation in 193 member states.

ICAO, Governments and industry then engaged in large-scale capacity efforts to support all actors involved in the implementation of CORSIA.

And what will be achieved through a global mechanism such as CORSIA – the mitigation of over 2.5 billion tonnes of CO₂ and over USD 40 billion in finance for climate projects – cannot be achieved by a Government, a regional group, or an industry on their own.

While we can be proud of our past and current achievements, aviation cannot ignore the challenges ahead and all stakeholders must preserve the spirit of international cooperation and multilateralism that brought us to where we are. The next necessary milestone: the adoption of a long-term goal by Governments in ICAO, hopefully at the 41st session of the ICAO Assembly.



Zambia's Climate Change Mitigation: Implementing the Carbon Offsetting and Reduction Scheme for International Aviation

By Mr. Cuthbert Lungu (Zambia)

BACKGROUND

Zambia is a landlocked developing country with a population of approximately 14 million people, which is situated in Southern Africa between the longitude of 22° to 34° East and latitude of 8° to 18° South. It is a member state of the International Civil Aviation Organization (ICAO), and also a member of ICAO's Carbon Offsetting and Reduction Scheme for International Aviation (CORSA). The country voluntarily joined CORSA and successfully submitted its first Aviation Emissions Action Plan to ICAO in November 2017. Zambia belongs to the ICAO East and Southern African (ESAF) regional group.

IMPLEMENTING CORSA

The project which Zambia has embarked on to reduce its carbon footprint has focused on the Civil Aviation Authority working in collaboration with the aircraft operators registered in Zambia. The Civil Aviation Authority has been leading the way in aircraft guiding the operators to reduce their fuel burn for each International flight. It also assists them in monitoring, reporting, and verifying their fuel use, for onward reporting of that information to ICAO.

Since voluntarily joining CORSA, Zambia has made great strides in its efforts to attain carbon neutral growth (CNG) by the year 2020.

The Civil Aviation Authority (CAA) was mandated by an Act of Parliament in 2012 to undertake all aviation related activities in the country. Since then, the CAA has assumed a leading role in guiding the aviation industry and explaining the benefits of CORSA.

In 2017, Zambia's Civil Aviation Authority took the initiative and collaborated with ICAO, the African Civil Aviation Commission (AFCAC), and the Southern African Development Community (SADC), and hosted a CORSA workshop which took place in Lusaka in August 2017.

The seminar was officially opened by Zambia's Minister of Transport and Communications, Dr. Brian Mushimba and for the first time in Zambia, CORSA received considerable publicity. Seminar participants included officials from neighboring countries such as Tanzania and Zimbabwe. The event was an opportunity for the Civil Aviation Authority to promote and publicize the relatively new concept of CORSA to all stakeholders within Zambia and beyond. Proflight Zambia, a major aircraft operator in Zambia that operates international flights was also present at the seminar. Other stakeholders that attended were: Zambia Environmental Management Agency (ZEMA), Energy Regulation Board (ERB), and Indeni oil refinery.

The journey towards carbon neutral growth began with the development of Zambia's Aviation Emissions Action Plan which was based on the ICAO Resolution A38-18. That resolution called for consolidated statements of continuing ICAO policies and practices related to Environmental protection and climate change. The ICAO assembly agreed on a comprehensive strategy to advance all elements of its "basket of measures" namely: technology, operations, alternative fuels, basket-based measures, and regulatory measures. Pursuant to ICAO's basket of measures, the Civil Aviation Authority of Zambia organized a series of stakeholder meetings with the major aircraft operator in Zambia, Proflight Zambia, which operates international flights. During those consultative meetings, that company was asked to choose which of ICAO's basket of measures could be applied to Proflight Zambia. As a result of that consultation process, Proflight Zambia chose to implement the following measures:

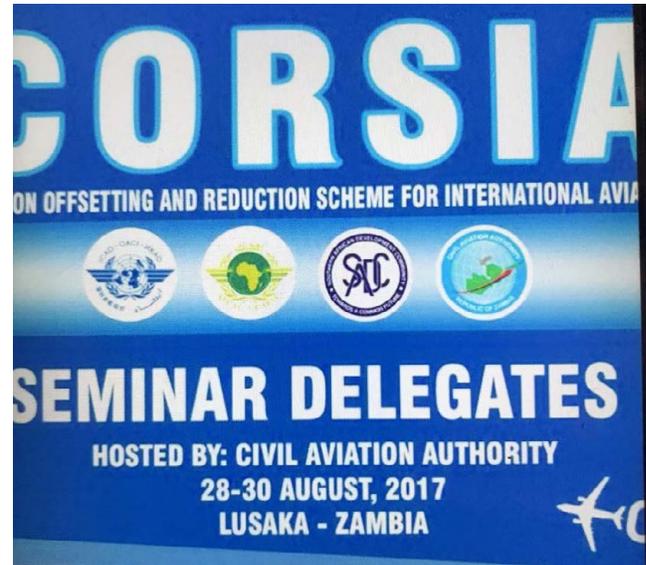
1. Improved air traffic management (ATM) and infrastructure use.

Under this measure, Proflight chose to improve its optimum flight levels, and the use of optimum routings, and to also employ continuous climb/continuous decent operations.

2. More efficient operations.

Under this measure, Proflight chose to minimize aircraft weight by introducing a number of measures including: paperless cockpit, reducing inflight magazines, limiting duty free items, and reducing catering equipment and commercial portable water. Other measures agreed to are: minimizing use of reverse, using single engine taxi operations, re-training pilots, optimizing aircraft maintenance such as engine washes, and selecting the aircraft best suited for the mission.

The implementation of the above mitigation measures selected by Proflight Zambia is projected to collectively result in the reduction of approximately 1,240 metric tonnes of CO₂ emissions from international aviation annually. In terms of more efficient operations, it is estimated that implementation of these measures will



account for about a 79% reduction in CO₂ emission by Zambian aviation by the year 2040.

THE ICAO BUDDY PARTNERSHIP PROGRAMME

Under the umbrella of the ICAO Assistance, Capacity building and Training for CORSI A (ACT-CORSIA) Programme and related Buddy Partnerships, Zambia received training from South Africa. Other recipient States which are receiving support from South Africa are; Lesotho, Botswana, Zimbabwe, Namibia and Malawi. The training assistance which Zambia received included development of an Emissions Monitoring Plan (EMP) and development of CORSI A regulations based on ICAO Annex 16, Volume IV. Under the Buddy Partnership Programme, Zambia invited its major aircraft operator (Proflight Zambia) and the airport operator to participate in the workshop. The training was conducted by South Africa's Ms. Chinga Mazhetese.

After the training, it was evident that Zambia needed to develop a time-bound activity plan as shown in Table 1.

Using the activity plan in Table 1, the CAA's Aviation Emissions Working Group was able to develop draft regulations which were submitted to the stakeholders for comment. Stakeholders responded positively and the

**TABLE 1:** Zambia’s Activity Plan for CORSIA

| ACTIVITY | PROPOSED START DATE | ACTUAL COMPLETION DATE | STATUS QUO |
|---|--------------------------|------------------------|------------|
| 1 Meet Zambia Bureau of Standards | 09/10/2018 | 09/10/2018 | Completed |
| 2 Hold a meeting with committee members to draft activity plan | 10/10/2018 | 10/10/2018 | Completed |
| 3 Recess for drafting of national regulations on CORSIA. Committee will seat with legal team | 22/10/2018 to 26/10/2018 | | Completed |
| 4 Committee to have a workshop with stakeholders to explain the new requirements and receive comments from stakeholders | 5/11/2018 to 7/11/2018 | | Completed |
| 5 Make inclusions to national requirements (if any) | 12/11/2018 | | Pending |
| 6 Submission to Director General CAA for approval of requirements | 19/11/2018 | | Pending |
| 7 Promulgation of requirements through a NOTAM and Aeronautical Information Circular (AIC) | 1/12/2018 | | Pending |

document is now in the final drafting stages and will be promulgated before the end of April 2019.

Under the guidance of the Civil Aviation Authority, Proflight Zambia has already started collecting fuel data which will be reported to ICAO at the end of 2019.

Another Zambian registered aircraft operator, Mahogany Air, has expressed interest in flying international flights by end of April 2019. In preparation for that, a one-day workshop has been planned for Mahogany Air called “Introduction to CORSIA” which will be conducted at CAA headquarters.

Recently, Proflight Zambia was successfully guided by Civil Aviation Authority to develop its first Emissions Monitoring Plan (EMP). That plan was approved by the CAA who shared it with Zambia’s Buddy Programme partner, donor state South Africa.

It is expected that over the next three years more aircraft aeroplane operators will come on board and will require oversight from the Civil Aviation Authority. Therefore

there will be need for the CAA to develop a standard one day workshop program which will cover modules “Introduction to CORSIA” and “Developing an Emissions Monitoring Plan”. These two activities have been identified as essential for new entrants to: appreciate the need for CORSIA, how to go about developing the necessary documentation, and how to be compliant with CORSIA requirements.

CONCLUSION

Zambia’s Civil Aviation Authority has embraced ICAO’s CORSIA scheme and has been working hard to implement it. The CAA will do its best to guide the aviation industry and will use all the available resources under the ICAO Buddy Partnership Programme to ensure that CORSIA is a success in Zambia. It will also ensure that all aircraft operators attributed to Zambia understand CORSIA and submit Emissions Monitoring Plans as well as monitoring, reporting, and verifying their emissions and then submitting that info to the Civil Aviation Authority which will in turn submit it to ICAO.

Implementation of the ICAO ACT-CORSIA Initiative in the Southern African Development Community (SADC) Region

Experience of the Republic of South Africa with Buddy Partnerships

By Chinga Mazhetese (South African Civil Aviation Authority)

BACKGROUND

The Republic of South Africa (RSA) is a country at the most southern part of the African continent. The country has modern and well-developed transport infrastructure, with its rail and air networks being the largest on the African continent¹. The Department of Transport (DoT) is responsible for the regulation of transportation, which covers: public transport, rail transportation, civil aviation, shipping, freight and motor vehicles. The DoT's motto is: **'Transport is the heartbeat of South Africa's economic growth and social development'**

SOUTH AFRICA'S APPROACH TO REDUCING CARBON DIOXIDE (CO₂) EMISSIONS

South Africa is one of 193 ICAO Member States and fully supports the environmental work being done by ICAO. The country is devoted to providing an excellent transport system that reduces the quantity of Greenhouse Gases (GHGs) and other pollutants emitted by the sector². Emissions from the transport sector are responsible for 10.8% of the country's total GHG emissions. Of this, aviation contributes only 5% of the transport sector's GHG emissions³. The National Development Plan (NDP) (Vision 2030), produced by the Department of the Presidency⁴, provides an overall guideline on the strategic approach for the country's response to climate change. The NDP proposes the movement towards a low carbon economy. Different spheres of government have various roles to play to fulfil this vision. The DoT's objective in supporting the

1 South African Government, Department of Transport: *Transport Infrastructure Report*, 2017. <http://www.transport.gov.za/documents/11623/39906/6_TransportInfrastructure2017compressed.pdf/5f92a2ff-748a-4f7b-9d09-16a877a768e1>

2 South African Government, Department of Transport: *Green Transport Strategy for South Africa (2018-2050)*, 2018. http://www.transport.gov.za/documents/11623/89294/Green_Transport_Strategy_2018_2050_onlineversion.pdf/71e19f1d-259e-4c55-9b27-30db418f105a

3 South African Government, Department of Environmental Affairs: *GHG Mitigation Report*, 2014.

4 South African Government, Department of the Presidency: National Development Plan: Vision 2030.

transition to a low carbon economy is to, 'increase the contribution of transport to environmental protection'. Accordingly, in 2018 the DoT adopted measures to address the significant contribution of all modes of transport to national GHG emissions by developing, a Green Transport Strategy (GTS) that intends to minimize the adverse impact of transport on the environment.

The implementation of the GTS will be the responsibility of the various DoT parastatal organizations. The South African Civil Aviation Authority (SACAA) is one of the agencies of the DoT and it is governed by the Civil Aviation Act of 2009. Its mandate is to control, promote, regulate, support, develop, enforce, and continuously improve, the safety and security levels throughout the civil aviation industry. The SACAA plays a major role in ICAO's work on the environment by its contribution as a Member of the ICAO Council as well as the Committee on Aviation Environmental Protection (CAEP). Accordingly, South Africa participates in aviation environmental protection decisions presented at the highest levels in ICAO. Furthermore, for several years the country has been the only African ICAO Member State that belongs to the CAEP.

REDUCING THE ENVIRONMENTAL FOOTPRINT OF THE SECTOR - SOUTH AFRICA'S PARTICIPATION IN ACT-CORSIA

The SACAA assists other regional States in numerous aviation disciplines such as aviation medicine and aerodrome certification. Under the umbrella of the ICAO Assistance, Capacity building and Training for CORSIA (ACT-CORSIA) Programme, the SACAA volunteered to assist some States within the Southern African Development Community (SADC)⁵ region to implement CORSIA. Thus, the ACT-CORSIA initiative paved the way for South Africa, through the SACAA, to also provide assistance with aviation environmental protection. GHG emissions and their impact on climate change are not localized within States. Their consequences go beyond borders and therefore regional and global collaboration is required to produce positive climate change adaptation

FIGURE 1: SADC Member States (SADC).



and mitigation outcomes. The SADC region recently bore the consequences of Cyclone Idai, one of the worst tropical cyclones to ever affect the African continent. Two of the States receiving assistance from South Africa, Malawi and Zimbabwe, suffered from the disastrous destruction caused by this intense cyclone. Moreover, in previous years, bad weather has resulted in some flights in South Africa to be diverted from airports like Oliver Reginald (OR) Tambo and Cape Town International. It was no surprise therefore, that in response to the ICAO's State Letter, South Africa volunteered to participate in ICAO's initiative to reduce carbon dioxide emissions by assisting some of the States within the SADC region. South Africa provides assistance to six of the sixteen SADC Member States.

These six States are Botswana, Lesotho, Malawi, Namibia, Zambia, and Zimbabwe. These particular States were selected because of their proximity to South Africa, along with their official language of communication, being the same as that of South Africa. Through the ACT-CORSIA initiative, South Africa is honored to contribute to ICAO's No Country Left Behind (NCLB) campaign by assisting the Recipient States in implementing the Annex 16, Volume IV Standards and Recommend Practices (SARPs). This will greatly contribute to the improvement of aviation environmental performance by aeroplane operators in the SADC region and might, in the long run, contribute to more participation in ICAO's work on the environment by the SADC geographical region.

5 Southern African Development Community (SADC), Overview <<https://www.sadc.int/about-sadc/overview/>>

ACT-CORSIA Buddy Partnerships were established with these States, and under this initiative, South Africa (as the Donor State) provided the technical expert to work together with the CORSIA Focal Point (CFP) of each Recipient State. To ensure consistency, ICAO provided training to South Africa’s technical expert and an ICAO Environmental Officer was assigned to work with, and provide guidance to this technical expert.

**ASSISTANCE PROVIDED
- IMPLEMENTATION OF THE
ACT-CORSIA BUDDY PARTNERSHIPS**

The implementation of the ACT-CORSIA Buddy Partnerships involved the following three steps:

Step #1: Training Session(s)

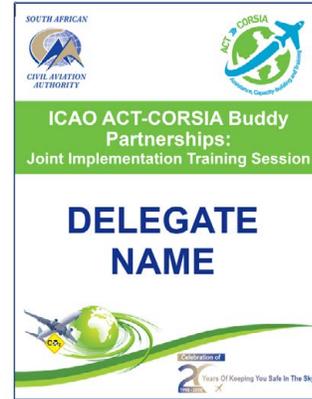
In September 2018, the Recipient States were invited to a three-day training session, which was named ‘Joint Implementation Training Session’.



The focus of the training was on the development of Emissions Monitoring Plans (EMPs) and the establishment of CORSIA regulatory frameworks. Three sessions (covering the same content) were conducted and were comprised of two classroom sessions and one teleconference session. The 1st session was in South Africa and the 2nd session was in Zambia. These venues were chosen as the central points to reduce the travel costs for the CFPs and their delegates. States were advised to select the venue that was most convenient for them.

TABLE 1: Details of the training sessions.

| Session | Venue | Dates | Attendees |
|---------|--|----------------------|--------------------------------|
| 1 | Emperors Palace, Johannesburg, South Africa, | 26-28 September 2018 | Botswana, Namibia and Zimbabwe |
| 2 | Protea Towers Hotel, Lusaka, Zambia | 02-04 October 2018 | Zambia |
| 3 | Remote (Teleconference) | 06 November 2018 | Malawi |



The representatives in the first session were all from the Civil Aviation Authorities (CAAs) in their respective countries. The second session was attended by the Zambian CAA, an aircraft operator (Proflight Zambia), as well the Zambian Airports Corporation Limited (ZACL). Malawi was unable to attend the two sessions that were scheduled for Johannesburg and Lusaka therefore; teleconference training was conducted for them on 6 November 2018. The presentations used in the classroom sessions were sent to Malawi prior to the teleconference. These were then clarified by the expert from South Africa to the Malawian Department of Civil Aviation (DCA) on the day of the teleconference. Concerning Lesotho, it was understood by both South Africa and ICAO, that Lesotho currently has no requirements under CORSIA. Nevertheless, assistance was offered by South Africa through information provision and the offer of invitations to future workshops.

Step #2: Remote Follow-up

Subsequent to the Joint Implementation Training Sessions, South Africa conducted remote follow-ups in the form of emails and teleconferences. Each Recipient State developed an Activity Plan showing the steps they would take to ensure that their aircraft operators developed the EMPs within the CORSIA timelines, and how the CAAs

FIGURE 2: Session 1 Delegates at Emperors Palace, Johannesburg, South Africa [from left: Mr. Filemon Ngwedha (Namibia), Mr. Thabo Mogale (Botswana), Mr. Judah Dube (Zimbabwe), Mr. Kabelo Kgosimore (Botswana), and Mrs. Chinga Mazhetese (South Africa)]. [Photo Credit: SACAA]



FIGURE 3: Session 2 Delegates- Protea Towers, Lusaka, Zambia. [from left: Mr. Jackson Chirwa (ZACL Zambia), Mrs. Chinga Mazhetese (South Africa), Mr. Cuthbert Lungu (Zambia CAA), Ms. Audrey Sichula (Proflight Zambia), Mr Coster Malambo (ZACL Zambia), and Captain Phil Lemba (Proflight Zambia)]. [Photo Credit: SACAA]



FIGURE 4: Template of the Activity Plan

| STEP | ACTIVITY | PROPOSED START DATE | STATUS QUO | PROGRESS NOTES | ACTUAL COMPLETION DATE |
|------|----------|---------------------|------------|----------------|------------------------|
| 1 | | | | | |
| 2 | | | | | |
| 3 | | | | | |
| 4 | | | | | |
| 5 | | | | | |
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| 7 | | | | | |
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| 9 | | | | | |
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| 12 | | | | | |
| 13 | | | | | |
| 14 | | | | | |
| 15 | | | | | |

would ensure that regulatory frameworks were established in their respective States. The Activity Plans were sent to the Donor State via email.

Teleconferences between the Donor, Recipients, and ICAO were conducted between November 2018 and March 2019. The objective was to check the progress in implementing the Activity Plans and to render any assistance the States may have required.

- 14 and 16 November 2018 (Zambia, Botswana and Zimbabwe)
- 14 and 22 January 2019 (Malawi and Namibia)
- 6 February 2019 (Malawi)
- 5 March 2019 (All Recipient States – experiences gained)

Step #3: Final In-State Training

South Africa provided further assistance to some of the States, like Botswana, which requested that the Joint Implementation Training be extended to their regulation developers as well as their aeroplane operators. On-site training was conducted at the Botswana CAA in Gaborone from 20 - 30 November 2018. Three aeroplane operators attended the training: (Air Botswana, Kalahari Air Services, and Major Blue). Further on-site training is similarly

scheduled for the Malawian DCA in Lilongwe from 29 - 30 May 2019. The attendees will be the Malawian DCA and some of the aeroplane operators in Malawi.

ASSOCIATED QUANTITATIVE/ QUALITATIVE BENEFITS - EXPERIENCE GAINED AND THE FUTURE OF BUDDY PARTNERSHIPS

South Africa is honored to have participated in the first phase of the ACT-CORSIA Buddy Partnerships. Both quantitative and qualitative benefits were realized by the donor and recipient States:

- South Africa as the Donor State contributed to ICAO’s work on environmental protection and played a role in the ICAO No Country Left Behind initiative.
- The support rendered resulted in an improved understanding of the CORSIA in the region.
- The States had different levels of understanding and implementing the CORSIA. Through the deliberations under the ACT-CORSIA Buddy Partnerships, States that were new to the CORSIA managed to engage and share information with other States that were a step ahead.

- Collaboration is now taking place within the Buddy Partnership on efforts to achieve and enhance responsibility for the CORSIA. Each of the six States is now in a position to engage other States in the Buddy Partnership.
- Most of the Recipient States' aircraft operators managed to develop EMPs.
- Some regional aircraft operators benefited by receiving the training that was offered by ICAO through the Donor State and managed to develop their EMPs.
- The ACT-CORSIA Buddy Partnership campaign served as an information source. State authorities received information on the CORSIA SARPs and model regulations to assist them with regulation development.
- The training was offered free of charge thus catered for the different economic challenges faced by the recipients. In addition, it was provided in the region hence the recipients did not have to incur costs for international travel, accommodation etc.

Despite the very positive experiences highlighted above, there was, however, very little time for the development of regulatory frameworks by 1 January 2019. Different States have very diverse steps to establish regulations. The CORSIA's applicability date of 1 January 2019 made it a challenge for each of the States to develop and establish and implement regulatory frameworks. Nevertheless, each State initiated the framework for the regulation development and work is continuing towards getting the regulations promulgated.

THE FUTURE OF THE BUDDY PARTNERSHIP

South Africa intends to continue providing assistance to the six Recipient States under the ACT-CORSIA initiative throughout the CORSIA compliance cycles. Therefore, South Africa will follow ICAO's directives regarding the next steps in the Buddy Partnership activities. The upcoming support may involve assistance with verification requirements, plus the development of Emissions Reports.