Session 4: CORSIA MRV System: Verification of CO$_2$ Emissions

ICAO Secretariat
• This presentation will:
  – Provide an overview of the CORSIA verification process for CO₂ emissions
  – Outline the accreditation process for verification bodies
  – Provide information on the ICAO CORSIA Verification Course
**CORSIA AT A GLANCE**

**CORSIA VERIFICATION**

Verification of data compiled by aeroplane operators ensures the consistency of information and identifies any potential errors in the CO₂ Emissions Reports (including additional information on the use of CORSIA eligible fuels, if applicable) and Emissions Unit Cancellation Reports.

CORSIA foresees a three-step verification pathway, which involves different stakeholders:

1. **An internal pre-verification** by the aeroplane operator is recommended.
   - An aeroplane operator conducts an internal verification of its data before submitting the report to the verification body.

2. **A third-party verification** of the report is performed by an independent third-party verification body, before the operator reports to the State Authority.
   - A verification body conducts the verification according to an ISO Standard*, and the CORSIA-specific requirements described in Annex 16, Volume IV, Appendix 6.

3. **After the third-party verification, State Authority conducts an order of magnitude check.**
   - This is the check performed by a State to verify the data against different sources of information that the State has access to.


In order to verify the report of the aeroplane operator under CORSIA, a verification body must be accredited by a National Accreditation Body to an ISO Standard**, and to the relevant requirements described in Annex 16, Volume IV, Appendix 6.

An aeroplane operator may contract a verification body accredited in another State, as long as the State in which the operator has been accredited recognizes this accreditation.

ICAO’s Global Aviation Training Office has launched a CORSIA Verification Course, which will be offered by training centers in all ICAO Regions, and is aimed to provide training on how to verify the reports prepared by aeroplane operators.
### Main Reference Documents

#### ICAO Standards and Recommended Practices (SARPs)
- Annex 16 - Environmental Protection, Volume IV: CORSIA
  - Part II, Chapter 2, 2.4; Chapter 4, 4.4; and Appendix 6

#### ICAO Guidance
- Environmental Technical Manual (ETM), Volume IV (Doc 9501): CORSIA
  - Chapter 3, 3.3.

#### ISO Standards
- ISO 14065:2013 “Greenhouse gases – Requirements for greenhouse gas validation and verification bodies for use in accreditation or other forms of recognition.”
Verification Process

CORSIA
Aeroplane Operator

Operator submits Emissions Monitoring Plan (EMP)

State approves EMP

Monitoring in accordance with EMP

State

State Report to ICAO

ICAO

Verification body

Operator and verification body both submit Emissions Report (ER) and Verification Report (VR) to the State

Verify ER and develop VR

Annual ER

Annual VR

Develop ER

Monitoring of CO₂ emissions throughout the year

Starting on 1 January 2019

Starting on 1 January 2019
What is Verification?

• A process to ensure that the information is accurate without errors prior to an aeroplane operator’s reporting to State

• Requires an independent third-party

• Already in use in various forms (financial auditing, greenhouse gas inventories, emissions reduction projects etc.)
Verification in CORSIA

• Verification is an essential part of the CORSIA, as it ensures the accuracy of the information related to:

  - The amount of CO\textsubscript{2} emissions from international flights
  - The purchase of emissions units from eligible programmes to address offsetting requirements
  - The cancellation of eligible emissions units

Covered in this session

Covered in Session #6: CORSIA Offsetting Requirements
Aeroplane operator’s Emissions Report

The annual Emissions Report is a document subject to a verification procedure

Verification Information Flow

Aeroplane operator reports to State through the annual Emissions Report
Verification Information Flow

1 Internal pre-verification

1 OPERATOR

STATE

ICAO
Voluntary Internal Pre-Verification

• Aeroplane operator’s internal pre-verification:
  – In order to prepare for third-party external verification, an aeroplane operator should consider conducting a voluntary internal pre-verification in order to ensure there will be no large data issues during the verification
  – Each operator decides how to conduct the internal pre-verification of its annual Emissions Report
    • Guidance is provided in ETM (Doc 9501), Volume IV, 3.3.4.1 and Table 3-8.
### Voluntary Internal Pre-Verification

**Example of guidance for operators’ internal pre-verification: ETM, section 3.3.4.1**

<table>
<thead>
<tr>
<th>Completed by</th>
<th>Topic</th>
<th>Task</th>
<th>MRV</th>
<th>Simplified MRV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal Auditor</td>
<td>Emission Calculation &amp; Fuel Data used</td>
<td>Consult Emissions Monitoring Plan to determine how emissions are calculated and perform some cross checks to see if the applied calculation works by adding logics to the report</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td></td>
<td></td>
<td>If based on real fuel figures, cross check how those are recorded and if this has been done correctly or if there are any reoccurring error sources e.g. below</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Calculate if the arrival fuel of the previous flight + the recorded fuel uplift are roughly the same figure as the departure fuel</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cross check if 2 equal fuel uplifts have been recorded for 2 or more consecutive flights and if those are genuine or typing errors</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Check report for very low/high fuel uplifts/figures to see if those are genuine or typos</td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>
Aeroplane operator submits Emissions Report to an accredited verification body

Internal pre-verification
Verification by the Verification Body

- The aeroplane operator shall engage an accredited verification body for the verification of its annual Emissions Report.

- A verification body shall conduct the verification according to ISO 14064-3:2006, and the CORsIA-specific requirements described in Annex 16, Volume IV, Appendix 6.
Verification by the Verification Body

• Some CORSIA-specific considerations:
  – Aeroplane operator’s Emissions Monitoring Plan (EMP) is the starting point for verification:
    • Has the operator’s EMP been approved by the State?
    • Does the EMP meet the requirements of Annex 16, Volume IV?
    • Has the Emissions Report been drafted in accordance with the approved EMP that meet the requirements of Annex 16, Volume IV?

CORSIA
EMISSIONS MONITORING PLAN (EMP)

CONTENTS
1 Version control of Emissions Monitoring Plan
2 Aeroplane operator identification and description of activities
3 Fleet and operations data
4 Methods and means for calculating emissions
4.1 Fuel Use Monitoring Method: Method A
4.2 Fuel Use Monitoring Method: Method B
4.3 Fuel Use Monitoring Method: Block-off / Block-on
4.4 Fuel Use Monitoring Method: Fuel Uplift
4.5 Fuel Use Monitoring Method: Fuel Allocation with Block Hour
4.6 ICAO CORSIA CO₂ Estimation and Reporting Tool (CERT)
5 Data management: data flow, control system, risk analysis and data gaps

Template Information
Template provided by
Version (publication date):

Note: For the purpose of this template, International flight is defined as in Annex 16, Volume IV, Part II, Chapter 1, 1.1.2, and Chapter 2, 2.1.
Verification by the Verification Body

- Data testing in accordance with the Emissions Report sampling plan

- Understanding aeroplane operator’s data flow is essential for the verification

- ETM, Volume IV, provides examples of aviation reference data sources

<table>
<thead>
<tr>
<th>Examples</th>
<th>Categorization</th>
<th>Technical explanation</th>
<th>Usability rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Airline software systems</td>
<td>Secondary internal data</td>
<td>Operational data containing details on flights, loads, routing etc.</td>
<td>Medium-Low</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Includes already processed data</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Potentially internal quality assurance against primary data</td>
<td></td>
</tr>
<tr>
<td>Flight / technical logs and</td>
<td>Primary internal data</td>
<td>Operational data containing details on flights, loads, routing etc.</td>
<td>High</td>
</tr>
<tr>
<td>typically included data</td>
<td></td>
<td>High level of reliability as safety relevant</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Flight logs can be completed manually (hand written) or automatically</td>
<td></td>
</tr>
<tr>
<td>ATC flight plan and OFP</td>
<td>Primary internal data</td>
<td>Operational data needed to operate a flight; contains i.e., aeroplane identification, flight route details</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Does not provide evidence on fuel consumption or whether the flight has indeed taken place or not</td>
<td></td>
</tr>
<tr>
<td>Air traffic control data and</td>
<td>Primary external data</td>
<td>Operational data containing flight details, aeroplane, routing including speed and altitude</td>
<td>High</td>
</tr>
<tr>
<td>invoices</td>
<td></td>
<td>Data generated by third party (ATC); high reliability with sufficient evidence whether a flight took place or not</td>
<td></td>
</tr>
<tr>
<td>Fuel invoices</td>
<td>Primary external data</td>
<td>Invoice from the fuel supplier (per flight)</td>
<td>High</td>
</tr>
</tbody>
</table>
Aeroplane operator submits Emissions Report to an accredited verification body.

Verification body produces Verification Report.

17 © ICAO 2019
Verification Report

• Contents of the VR is provided in the Annex 16, Volume IV, Appendix 6, 3.10.1
  – Includes all verification-related information

• CORSIA specific content:
  – compliance of Emissions Report with the Emissions Monitoring Plan
  – non-compliances of the Emissions Monitoring Plan with SARPs

Demonstration of the Verification Report template after this presentation
Materiality Threshold

2 % > 500,000 tonnes

5 % ≤ 500,000 tonnes

Data have significant avoidable errors(s) and are NOT verifiable

Data have avoidable errors(s) but are verifiable

True value of emissions

Data have avoidable errors(s) but are verifiable

Data have significant avoidable errors(s) and are NOT verifiable
### Materiality Example

<table>
<thead>
<tr>
<th>Item</th>
<th>Verification</th>
<th>Reported value</th>
<th>Verification body’s value</th>
<th>Difference</th>
<th>Materiality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flight 1</td>
<td>Incorrect fuel uplift</td>
<td>50</td>
<td>42</td>
<td>8</td>
<td>3.48%</td>
</tr>
<tr>
<td>Flight 2</td>
<td>Correct</td>
<td>12</td>
<td>12</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Flight 3</td>
<td>Incorrect block-on fuel</td>
<td>15</td>
<td>25</td>
<td>-10</td>
<td>-4.35%</td>
</tr>
<tr>
<td>Flight 4</td>
<td>Incorrect fuel uplift</td>
<td>52</td>
<td>42</td>
<td>10</td>
<td>4.35%</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>230</td>
<td>222</td>
<td>8</td>
<td>3.48%</td>
</tr>
</tbody>
</table>

\[
\text{Difference} \over \text{Total Reported value} = \text{Materiality}
\]
Misstatements and Non-Conformities

**MISSTATEMENT:**
Error, omission, misrepresentation

- Missing flights in the sequence of flights
- Non addressed data gaps as missing fuel uplift
- Implausible data, such as:
  - Fuel uplifts larger than tank capacity
  - Block-on fuel higher than Block-off fuel
  - Wrong unit, etc.

**NON-CONFORMITIES:**
Act or omission or an act that is not in accordance with EMP

- Incorrect application of the fuel use monitoring methods
- Incorrect application of the CERT
- Incorrect version of the EMP used
- Required quality procedures not followed, etc.

AO will correct all misstatements and non-conformities discovered during verification.
Verification Statement

VERIFIED AS NOT SATISFACTORY

- Includes material misstatements and/or non-conformities;
- The scope of verification too limited;
- No sufficient confidence in data.
→ Advise the AO to contact the State

OR

VERIFIED AS SATISFACTORY

+ NO misstatements and/or non-conformities

VERIFIED AS SATISFACTORY with comments

+ Includes non-material misstatements and/or non-conformities;
+ Specify the misstatements and non-conformities.
1. Internal pre-verification
2. Aeroplane operator submits Emissions Report to an accredited verification body
3. Verification body produces Verification Report
4. Aeroplane operator and verification body submit Emissions Report and Verification Report to State
**Verification Information Flow**

1. Internal pre-verification
2. Aeroplane operator submits Emissions Report to an accredited verification body
3. Verification body produces Verification Report
4. Aeroplane operator and verification body submit Emissions Report and Verification Report to State
5. State’s order of magnitude check of Emissions Report
Order of Magnitude Check

- The objective of the State’s order of magnitude check of an aeroplane operator’s Emissions Reports is to assess the completeness of data reported by the operator.

- For an operator with an Emissions Report verified as “satisfactory”, the order of magnitude check will take approximately 3 hours.

Reference: Annex 16, Volume IV, Part II, Chapter 2, 2.4.1
Guidance for Order of Magnitude Check

Table 3-9 of the ETM provides checklist for States’ order of magnitude check of Emissions Reports

Main sections:
- Aeroplane Operator
- Emissions Report information
- Aeroplane fleet
- OPTION 1: State pairs
- OPTION 2: Aerodrome pairs
- Data gaps
- Verification body
- Change of data by State
- Communication with aeroplane operator
- Communication with verification body

<table>
<thead>
<tr>
<th>No.</th>
<th>Question / Issue</th>
<th>Additional Information</th>
<th>Status: OK/Yes/No /Not Applicable</th>
<th>Notes and Results of Checks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Aeroplane Operator/Verification Body both separately submit Emissions Report and Verification Report. Is the content of both submissions identical?</td>
<td>Minimum check: reported fuel consumption and number of flights. Get back to Aeroplane Operator in case of deviations.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Is the name of the Aeroplane Operator given and unambiguous?</td>
<td>Ensure unambiguous identification of Aeroplane Operator in case of uncertainties.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Is there a valid ICAO designator for Aeroplane Operating Agencies? Does it have the correct character length?</td>
<td>Ensure unambiguous identification of Aeroplane Operator in case of uncertainties.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Basic information (address, AOC etc.) plausible?</td>
<td>Ensure unambiguous identification of Aeroplane Operator in case of uncertainties.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Fuel Reported Check

• Are the types of fuel reported plausible and contained in the EMP? *(ETM (Doc 9501), Volume IV, Table 3-9, #31)*
  – Since emissions factors are fuel type-specific, deviation might lead to implausible amount of calculate emissions.

**Example:**
An aeroplane operator has reported the following information in its ER:
• Total amount of Jet A1 Fuel = 250,000 tonnes (FCF = 3.16 tonnes of CO₂/tonne of fuel)
• Total amount of AvGas = 50,000 tonnes (FCF = 3.10 tonnes of CO₂/tonne of fuel)

You can use this information to calculate the total CO₂ emissions:
CO₂ emissions = (250,000 x 3.16) + (50,000 x 3.10) = 790,000 + 155,000 = 945,000 tonnes

*Compare the result with total reported CO₂ emissions*
Number of Flights Check

• Is the given information regarding number of flights plausible?  
  *(ETM (Doc 9501), Volume IV, Table 3-9, #30)*
  – Does aeroplane operator report a noticeable small number of flights on typical destinations of the airline?

**Example based on reporting State pairs:**
An aeroplane operator has reported the following information in its ER:
• Total no of flights per year = 7,500
• Total no of aeroplanes = 5

You can use this information to calculate an average number of flights per aeroplane:
Average = 7,500 flights / (365 days x 5 aeroplanes) = about 4 flights/aeroplane/day

**Could be considered as plausible for an operator on short- and medium-haul flights**
Two Specific Fuel Consumption Checks

• Are there State pairs with more than 250 tonnes average fuel consumption per flight? *(ETM (Doc 9501), Volume IV, Table 3-9, #38)*

• Are there State pairs with less than 2.5 tonnes average fuel consumption per flight? *(ETM (Doc 9501), Volume IV, Table 3-9, #39)*

Example:

<table>
<thead>
<tr>
<th>State of Departure</th>
<th>State of Arrival</th>
<th>Total No of Flights</th>
<th>Total Amount of Fuel (tonnes)</th>
<th>Average Fuel Consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>State A</td>
<td>State B</td>
<td>150</td>
<td>250</td>
<td>1.7</td>
</tr>
<tr>
<td>State A</td>
<td>State E</td>
<td>150</td>
<td>2,000</td>
<td>13.3</td>
</tr>
<tr>
<td>State C</td>
<td>State D</td>
<td>40</td>
<td>15,000</td>
<td>375.0</td>
</tr>
</tbody>
</table>

Example calculation:

\[ \frac{250}{150} = 1.7 \]
**Timeline for Verification of 2019 Data**

**Aeroplane Operator**

- **1 Jan to 31 Dec 2019:** Monitor 2019 CO\(_2\) emissions from international flights

<table>
<thead>
<tr>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
</tr>
</thead>
</table>

**Verification Body**

- **Sep – Dec 2019:**
  1. Pre-contract stage
  2. Strategic analysis
  3. Risk analysis
  4. Verification plan

- **1 Jan – 31 May 2020:**
  5. Verification
  6. Addressing misstatements and non-conformities
  7. Verification Report
  8. Independent Review

**Aeroplane Operator and Verification Body**

- **31 May 2020:** Submit ER and VR to State

**States**

- **1 Jun – 31 Aug 2020:** Conduct order of magnitude check
- **31 Aug 2020:** Submit CO\(_2\) emissions to ICAO
Accreditation Process for Verification Bodies
Accreditation of verification bodies (1/2)

- A verification body shall be accredited by a national accreditation body in order to be eligible to verify Emissions Reports in CORSIA:
  - ISO 14065:2013 “Greenhouse gases - Requirements for greenhouse gas validation and verification bodies for use in accreditation or other forms of recognition”
  - CORSIA-specific requirements as described in Annex 16, Volume IV, Appendix 6

- A national accreditation body shall be working in accordance with ISO/IEC 17011 “Conformity assessment - General requirements for accreditation bodies accrediting conformity assessment bodies”

Reference: Annex 16, Volume IV, Part II, (Chapter 2, 2.4.2) and Appendix 6
Accreditation of verification bodies (2/2)

• How to ensure sufficient availability of accredited verification bodies to aeroplane operators, in support of verification activities under CORSIA?
  – National accreditation bodies and verification bodies need to have the required knowledge
    • ICAO has developed a training course on CORSIA verification for both national accreditation bodies and verification bodies
  – Operators need to have access to verification bodies accredited for CORSIA
    • Annex 16, Volume IV allows an operator to work with a verification body accredited by the national accreditation body of another State
    • ICAO will compile and publish, on an annual basis, a list of verification bodies accredited for CORSIA to facilitate operators’ access to accredited verification bodies
ICAO CORSIA Verification Course
The CORSIA Verification Course that has been developed by ICAO provides training on how to verify CO₂ Emissions Reports that have been prepared by aeroplane operators, in accordance with the provisions of the CORSIA Standards and Recommended Practices (SARPs).

- [https://www.icao.int/training/Pages/training-catalogue-details.aspx?catid=2657&language=0&region=&ITP=1](https://www.icao.int/training/Pages/training-catalogue-details.aspx?catid=2657&language=0&region=&ITP=1)
Course Objectives

• After having successfully completed this course, participants will be able to:
  – Perform the CORSIA monitoring, reporting, and verification (MRV) requirements as outlined in Annex 16, Volume IV - Environmental Protection - CORSIA, and Environmental Technical Manual (Doc 9501), Volume IV
  – Apply the verification requirements as outlined in Annex 16, Volume IV, and Doc 9501, Volume IV, including materiality threshold, verification criteria, verification scope and objectives and the Verification Report preparation and submission requirements
  – Correctly identify the scope of applicability for CORSIA MRV requirements, as well as for CORSIA offsetting requirements
  – Apply a working knowledge of the fuel use monitoring methods and of the ICAO CORSIA CO₂ Estimating & Reporting Tool (CERT) estimation tool as outlined in Annex 16, Volume IV.
Target Audience and Pre-requisites

• Target Audience:
  – 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.

• Pre-requisites:
  – Working knowledge of ISO 14064-3:2006 is required
  – Knowledge of ISO 14065:2013 is desirable
## Upcoming Sessions for ICAO CORSIA Verification Course (as of 12 March 2019)

<table>
<thead>
<tr>
<th>Location</th>
<th>Tentative Schedule 2019</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Montreal (ICAO HQ)</td>
<td>10-12 April</td>
<td>Confirmed</td>
</tr>
<tr>
<td>2. Washington DC, USA</td>
<td>15-17 April</td>
<td>Pending</td>
</tr>
<tr>
<td>3. Kingston, Jamaica</td>
<td>24-26 April</td>
<td>Confirmed</td>
</tr>
<tr>
<td>4. Brasilia, Brazil</td>
<td>8-10 May</td>
<td>Pending</td>
</tr>
<tr>
<td>5. Santiago, Chile</td>
<td>13-15 May</td>
<td>Tentative</td>
</tr>
<tr>
<td>6. Amsterdam, Netherlands</td>
<td>20-22 May</td>
<td>Confirmed</td>
</tr>
<tr>
<td>7. Abu Dhabi, UAE</td>
<td>3-5 June</td>
<td>Pending</td>
</tr>
<tr>
<td>8. Addis Ababa, Ethiopia</td>
<td>12-14 June</td>
<td>Confirmed</td>
</tr>
<tr>
<td>9. Johannesburg, South Africa</td>
<td>17-19 June</td>
<td>Confirmed</td>
</tr>
<tr>
<td>10. Casablanca, Morocco</td>
<td>24-26 June</td>
<td>Confirmed</td>
</tr>
<tr>
<td>11. Beijing, China</td>
<td>24-26 June</td>
<td>Confirmed</td>
</tr>
</tbody>
</table>

Also see: [https://www.icao.int/training/Pages/training-catalogue-details.aspx?catid=2657&language=0&region=&ITP=1](https://www.icao.int/training/Pages/training-catalogue-details.aspx?catid=2657&language=0&region=&ITP=1)
Frequently Asked Questions

A selection of Frequently Asked Questions (FAQs) on CORSIA verification and related responses is available for download via the CORSIA webpage: www.icao.int/corsia

- Does an aeroplane operator have to be certified under ISO 14065?
- How does a verification team meet the technical expertise requirements?
- What may a witness audit involve during the accreditation process of a verification body?
- Is a third-party verification needed when using the ICAO CORSIA CERT?
- Does the verification body have to be from the administering State?
- How does a verification team meet the knowledge requirements?
- How does an independent reviewer meet the knowledge and technical expertise requirements?