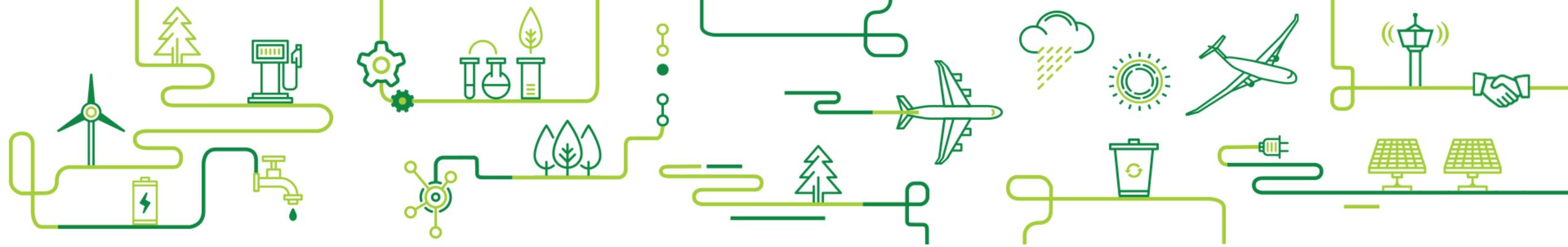




# AVIATION CO<sub>2</sub> REDUCTIONS

ONLINE STOCKTAKING  
PREVIEW

28 APRIL 2020



# Setting the scene: Aviation in-sector CO<sub>2</sub> emissions reductions: trends and achievements

**Neil Dickson**

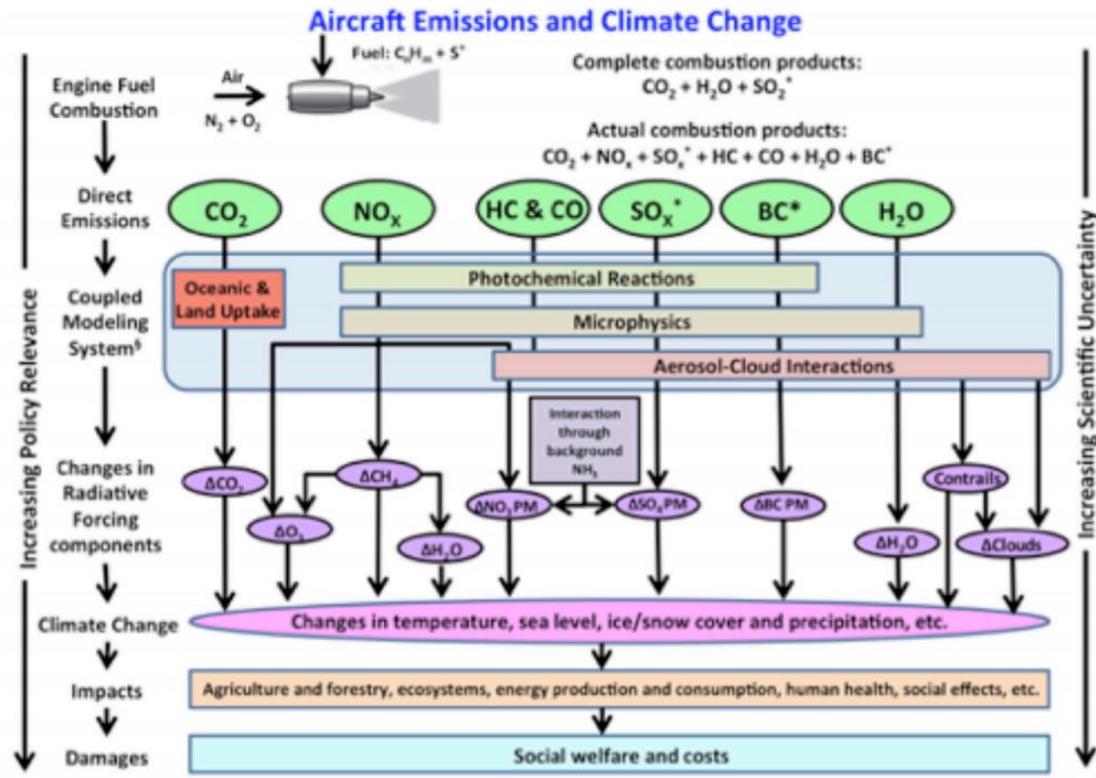
Chief, Environmental Standards, ICAO Secretariat



# Aviation and Climate Change

- Civil aviation accounts for 2% of anthropogenic CO<sub>2</sub> emissions (1.3% - International Aviation)
- This share may increase in the future
- ICAO Assembly Resolution A40-18 – Climate change

*ICAO should continue to take initiatives to promote information on scientific understanding of aviation's impact and action undertaken to address aviation emissions and continue to provide the forum to facilitate discussions on solutions to address aviation emissions;*



# ICAO's climate change policy

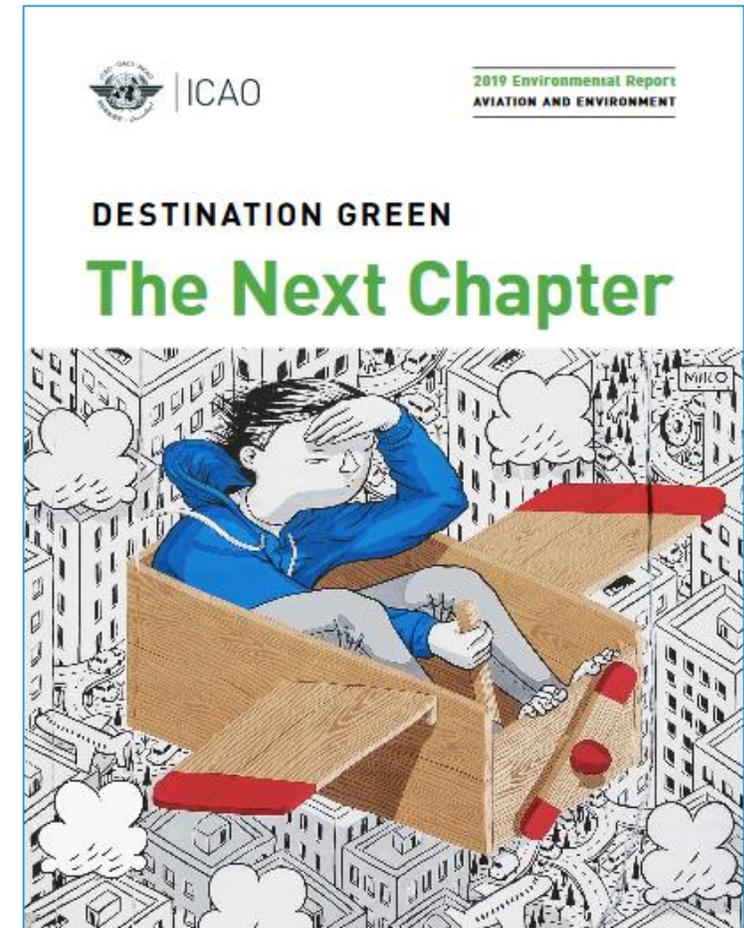
Endorse common goals & support the implementation of actions

- **In 2010, ICAO adopted two Global Aspirational Goals**

Carbon neutral growth from 2020 onwards (CNG2020)

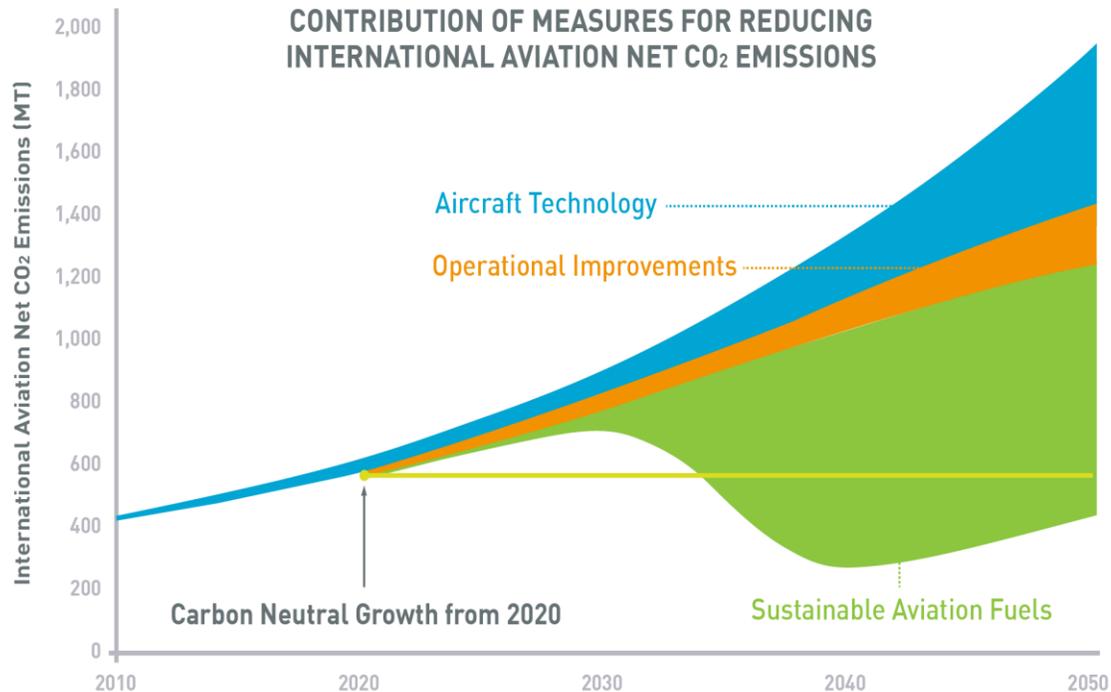
2% annual fuel efficiency improvement through 2050

- **Basket of Measures:**
  - ✓ Aircraft technology improvements
  - ✓ Operational Improvements
  - ✓ Sustainable Aviation Fuels (SAF)
  - ✓ Market-Based Measures (CORSIA)
- **ICAO Standards and Recommended Practices (SARPs)**
- ICAO is exploring a long-term global aspirational goal
- Details about all of ICAO's work are available in the 2019 Environmental Report – Destination Green: the Next Chapter



# ICAO Global CO<sub>2</sub> Emissions Trends

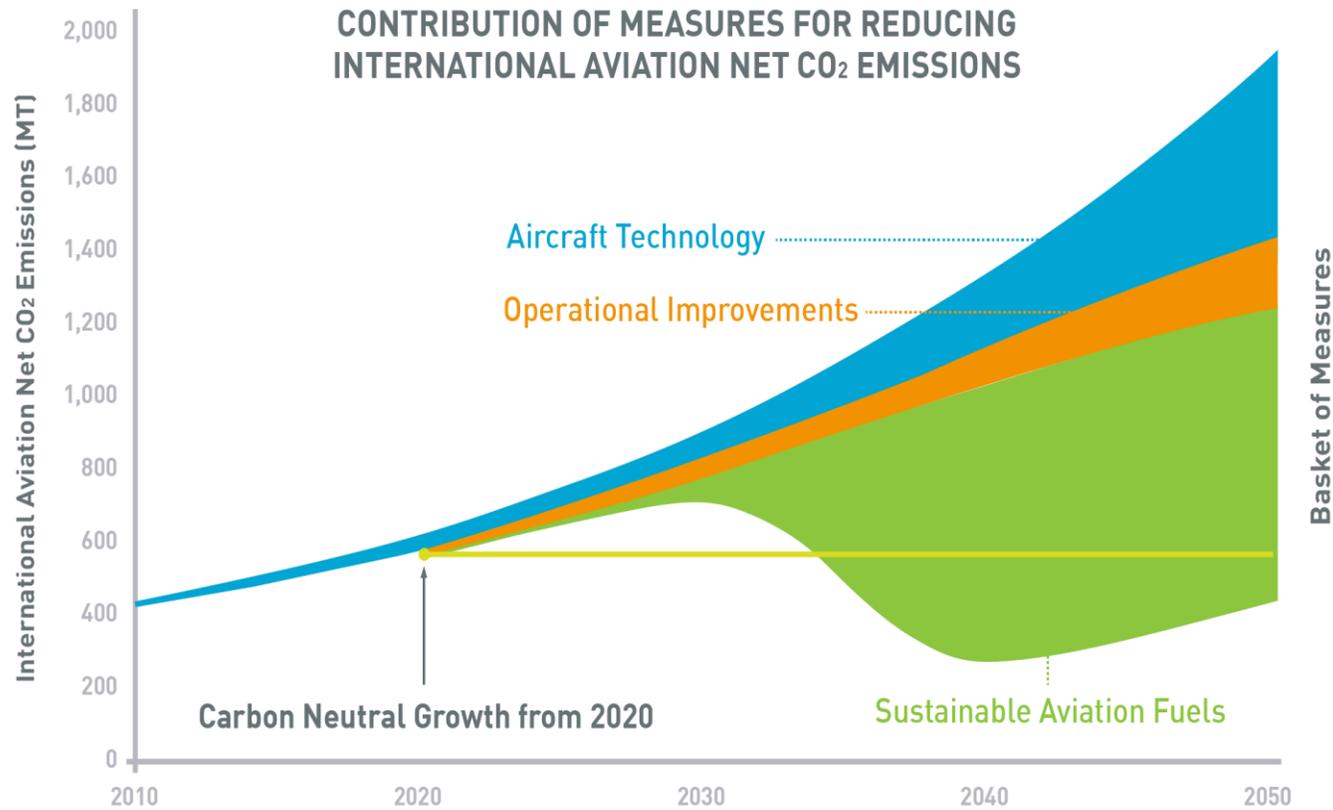
- ICAO Global CO<sub>2</sub> Trends include a range of scenarios for the assessment of future GHG emissions
- Last update: 2019
- Details are provided in the ICAO Environmental Report 2019



- **Global air traffic growth** ~ doubles every 15 years ~ x 3.3 times by 2045
- CO<sub>2</sub> emissions directly related to **fuel consumption**
- **~160 Mt** of fuel consumed in 2015
- by 2045, fuel consumption ~ x 2.2 - 3.1 times compared to 2015

# CO<sub>2</sub> Emissions Trends

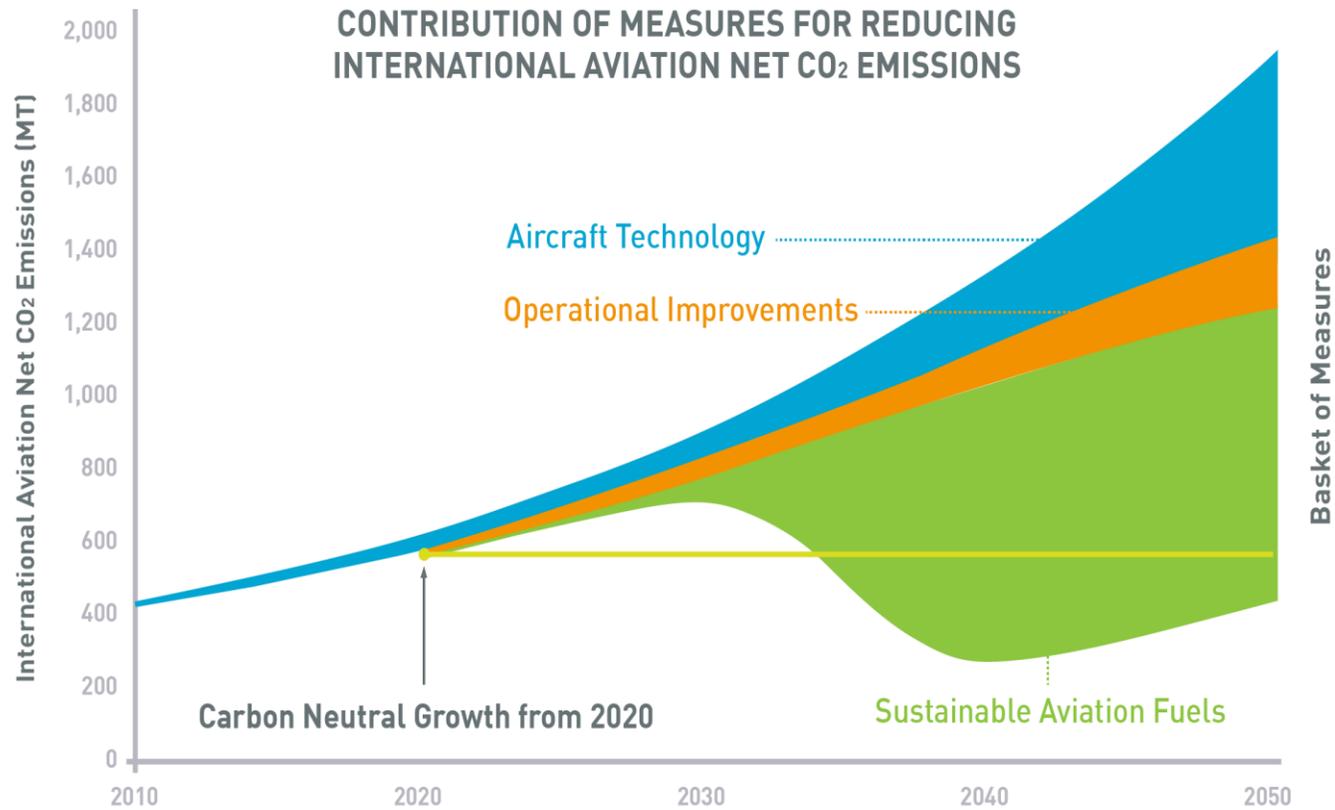
## Aircraft Technology Contribution



- Emission reductions from technology: **up to 25% reduction in 2050**
- Assumption used: 1.5% efficiency improvement per year for new aircraft entering the fleet.

# CO<sub>2</sub> Emissions Trends

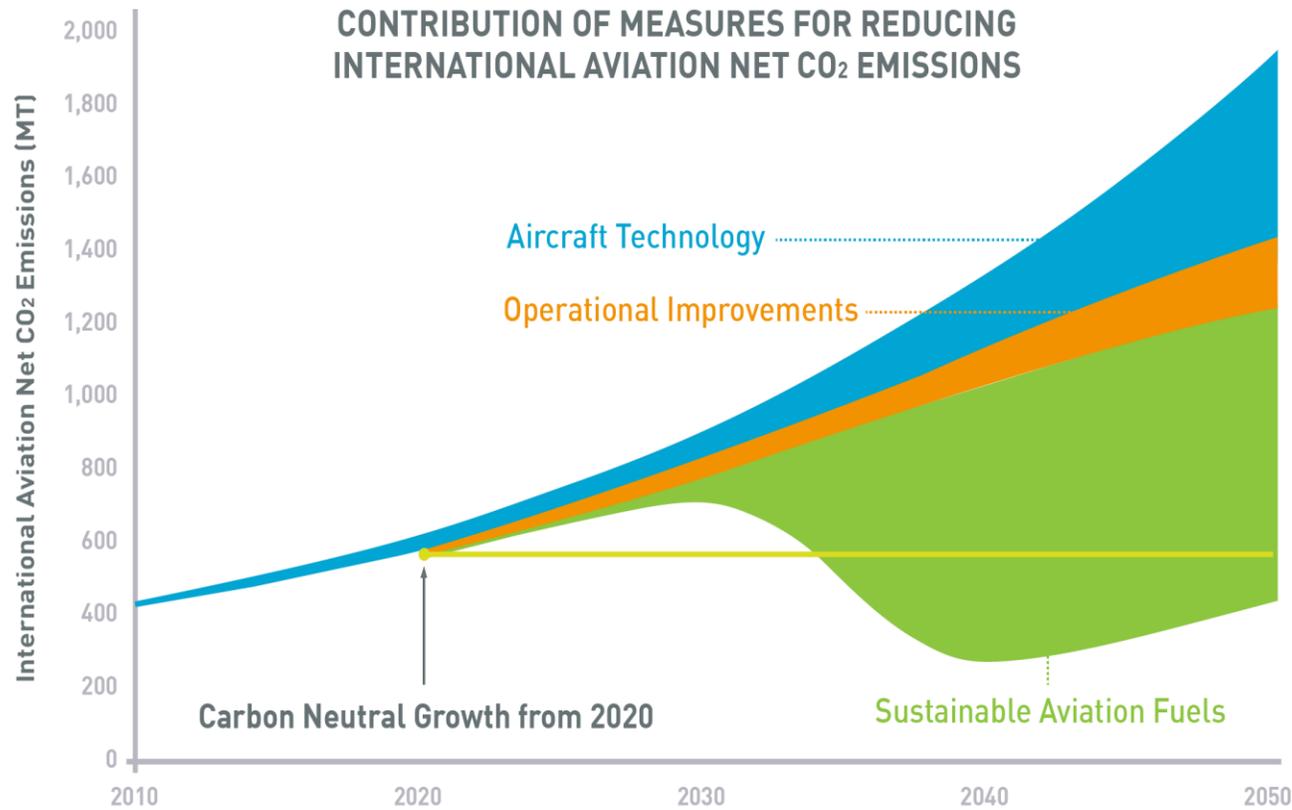
## Operational improvements Contribution



- Emission reductions from operational improvements: **up to 9% reduction**
- Assumptions considered:
  - Electric taxiing systems
  - Removing constraints on vertical and horizontal profiles flight
  - optimized descent profiles
  - RNAV routes, dynamic airspace configurations, ADS-B use

# CO<sub>2</sub> Emissions Trends

## Sustainable Aviation Fuels Contribution

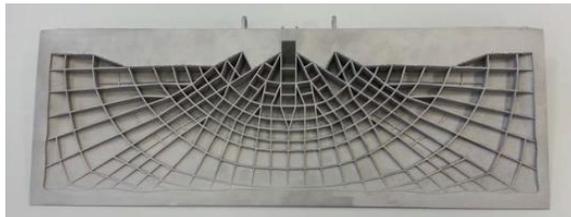


- Emission reductions from SAF: **up to 41% reduction**, under these assumptions:
- 100% replacement with SAF.
- Scenario would require a substantial expansion of the agricultural sector.
- approximately 170 new large bio-refineries to be built every year from 2020 to 2050, at an approximate capital cost of US\$15 billion to US\$60 billion per year

# Achievements - Technologies

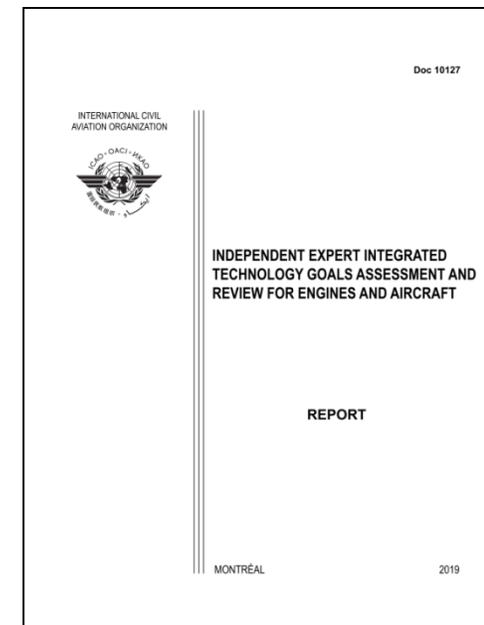
Improve fuel efficiency and reduce fuel consumption

- Today's aircraft are **~80% more fuel efficient** per passenger km than that in the 1960s.
- Reduction in weight is a key factor in reducing fuel burn
- Improvements in
  - ✓ **propulsion** (higher by-pass ratio),
  - ✓ **aerodynamics** (winglets),
  - ✓ **structural design and materials** (composite materials).
- Continuous advancements in **R&D** (hybrid electric propulsion technology)

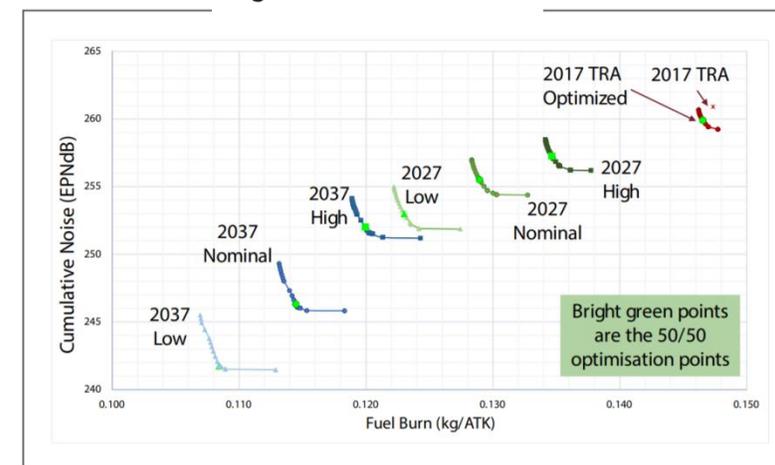


## ICAO work on aircraft technologies

- **Annex 16 Vol III - ICAO Aeroplane CO<sub>2</sub> Emissions Standard (2016)**
  - ✓ New aircraft type designs from 2020
  - ✓ Aircraft that are already in production as of 2023
- **Independent Expert Integrated Technology review (ICAO Doc 10127 - 2019)**
  - Definition of fuel burn technology goals for **2027 and 2037 timeframes**
  - Consideration of interdependencies with noise
  - Technologies and assumptions:
    - conventional aircraft configuration (“tube and wing”).
    - Aerodynamics: basket of technologies including natural laminar flow,
    - Structures: fuselage, wing and empennage weights (composite and metal).
    - Propulsion: gains in thermopropulsive efficiency, mass and drag, derived from all new propulsion technologies
- Result: highest improvement rate of about **1.3% per annum**, with the use of **challenging, but achievable, technology for new aircraft.**



Single Aisle Pareto Fronts



## Achievements - Operations

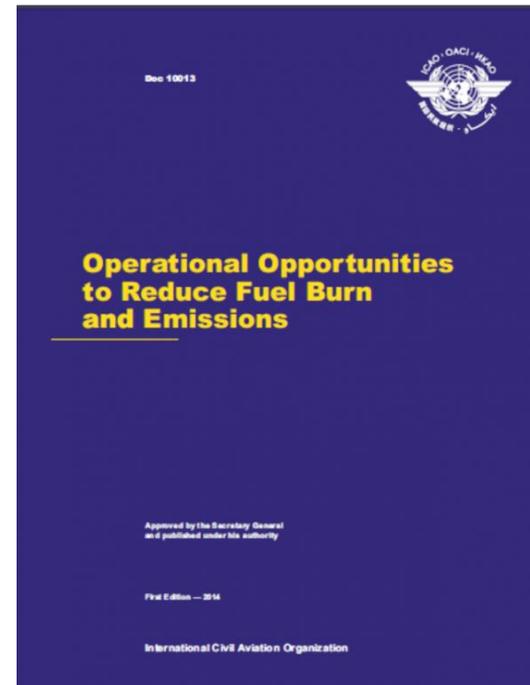
Improve air traffic management and operational procedures

- Air Traffic Management efficiency has improved since 1999. The Global ATM system is already between **92% and 94% fuel efficient**
- **At all stages of air travel**
- Improvements in
  - ✓ **More direct flights** (horizontal and vertical, free airspace)
  - ✓ Engine and airframe **maintenance**
  - ✓ Aircraft **mass reduction** (load factor, materials, waste)
  - ✓ Altitude and speed **optimization**
  - ✓ **Ground** operations (one engine on, APU off, solar at gate)
  - ✓ **Airports infrastructures** (green building, renewable energies, ACI Airport Carbon Accreditation programme)



# ICAO work on operational improvements

- The ICAO Global Air Navigation Plan (GANP)
- The ICAO Aviation System Block Updates (ASBUs)
- ICAO Global guidance documents



## Achievements – Sustainable Aviation Fuels

- ✓ First commercial flight in 2008
- ✓ 6 conversion processes certified for use in aviation
- ✓ > 240,000 commercial flights since 2011
- ✓ 7 airports regularly distributing blended SAF
- ✓ Several production facilities under construction

### FEEDSTOCKS



### ICAO

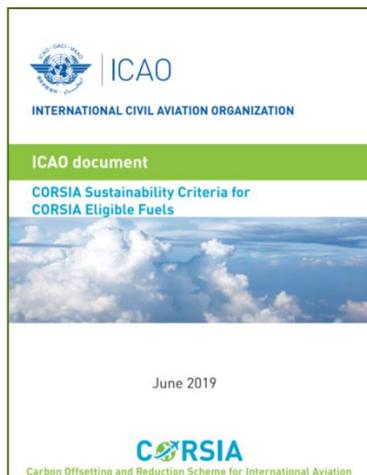
- **The 2050 ICAO Vision for Sustainable Aviation Fuels (2017)**
  - ✓ Called for a significant proportion of SAF use by 2050
  - ✓ A quantified long-term goal for SAF to be defined by 2025
- **The ICAO SAF Stocktaking Seminar (2019)**
- **The ICAO Global Framework on Aviation Alternative Fuels (GFAAF)**

## ICAO work on Sustainable Aviation Fuels

- ✓ ICAO Carbon Offsetting and Reduction Scheme for International Aviation (CORSA)
- ✓ Complementary measure to achieve Carbon Neutral Growth from 2020
- ✓ The use of CORSIA eligible fuels can reduce airlines' offsetting requirements – **CORSIA will incentivize the use of SAF**
- ✓ Global methodologies have been developed to consider SAF in CORSIA



### ICAO document “CORSA sustainability criteria for CORSIA eligible fuels” First Global Approach to Sustainability agreed by States

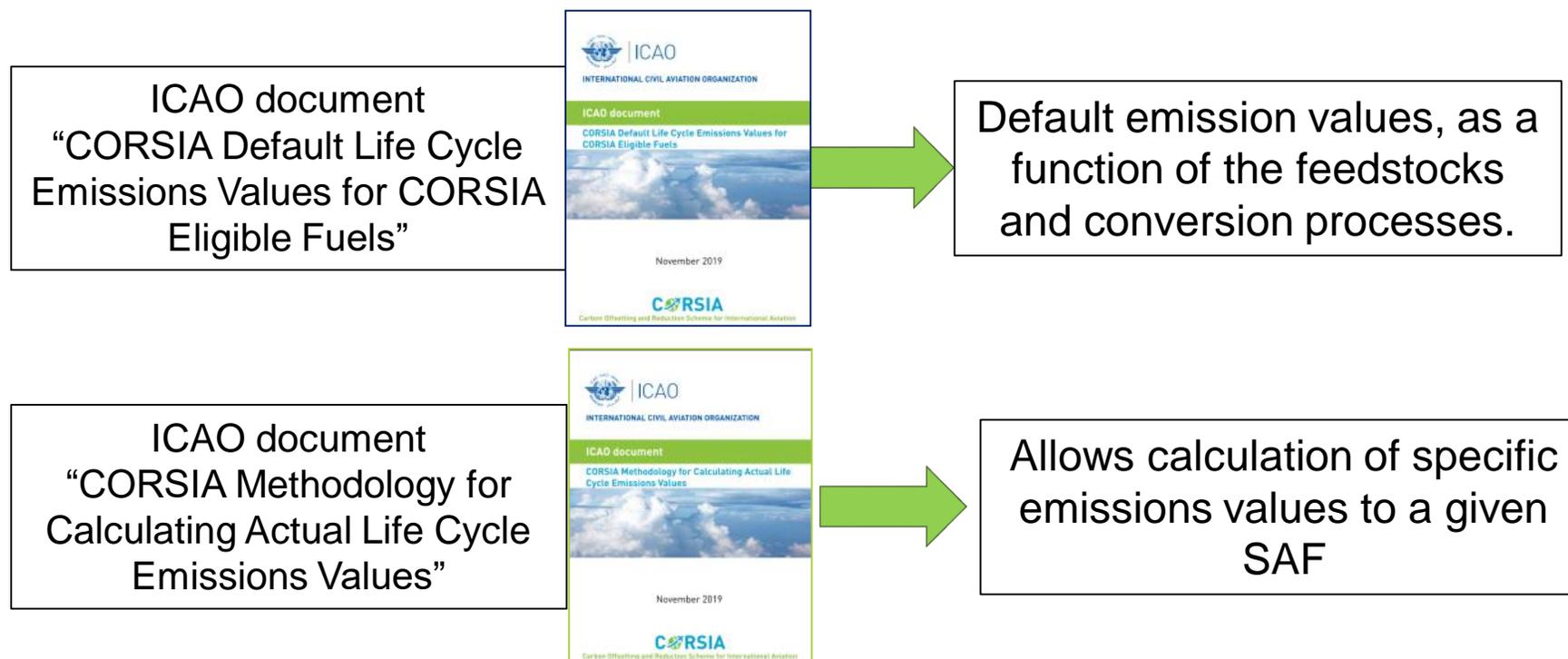


- net GHG emissions reductions of at least 10% on a life cycle basis.
- No feedstock from primary forest deforested areas after 2008
- Work ongoing on other themes:
  - Water; Soil; Air; Conservation; Waste and Chemicals; Human and labour rights; Land use rights and land use; Water use rights; Local and social development; and Food security

# ICAO work on Sustainable Aviation Fuels

## Life Cycle Assessment Methodologies for SAF

In CORSIA, there are two options to obtain the life cycle emissions of SAF:



**First global approach to life cycle assessment**

# Sharing of information and best practices on SAF



<b>DOMINICAN REPUBLIC</b>	<b>TRINIDAD AND TOBAGO</b>	<b>BURKINA FASO</b>	<b>KENYA</b>
<b>FEASIBILITY STUDY ON THE USE OF SUSTAINABLE AVIATION FUELS</b>	<b>FEASIBILITY STUDY ON THE USE OF SUSTAINABLE AVIATION FUELS</b>	<b>FEASIBILITY STUDY ON THE USE OF SUSTAINABLE AVIATION FUELS</b>	<b>FEASIBILITY STUDY ON THE USE OF SUSTAINABLE AVIATION FUELS</b>
ICAO-EUROPEAN UNION ASSISTANCE PROJECT: CAPACITY BUILDING FOR CO <sub>2</sub> MITIGATION FROM INTERNATIONAL AVIATION	ICAO-EUROPEAN UNION ASSISTANCE PROJECT: CAPACITY BUILDING FOR CO <sub>2</sub> MITIGATION FROM INTERNATIONAL AVIATION	ICAO-EUROPEAN UNION ASSISTANCE PROJECT: CAPACITY BUILDING FOR CO <sub>2</sub> MITIGATION FROM INTERNATIONAL AVIATION	ICAO-EUROPEAN UNION ASSISTANCE PROJECT: CAPACITY BUILDING FOR CO <sub>2</sub> MITIGATION FROM INTERNATIONAL AVIATION



## Conclusions

- The aviation industry is working to reduce its CO<sub>2</sub> emissions
- Many initiatives in place for further reductions – main challenge is to implement them in a faster way
- ICAO is working to **shorten the time between knowledge and implementation by**
  - Setting goals and defining steps to achieve them
  - Ensuring representation of diverse stakeholders
  - Encouraging transparency and the sharing of best practices
- ICAO welcomes participation of all stakeholders in that process

**It's time to turn challenges into opportunities!**



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# Thank You

