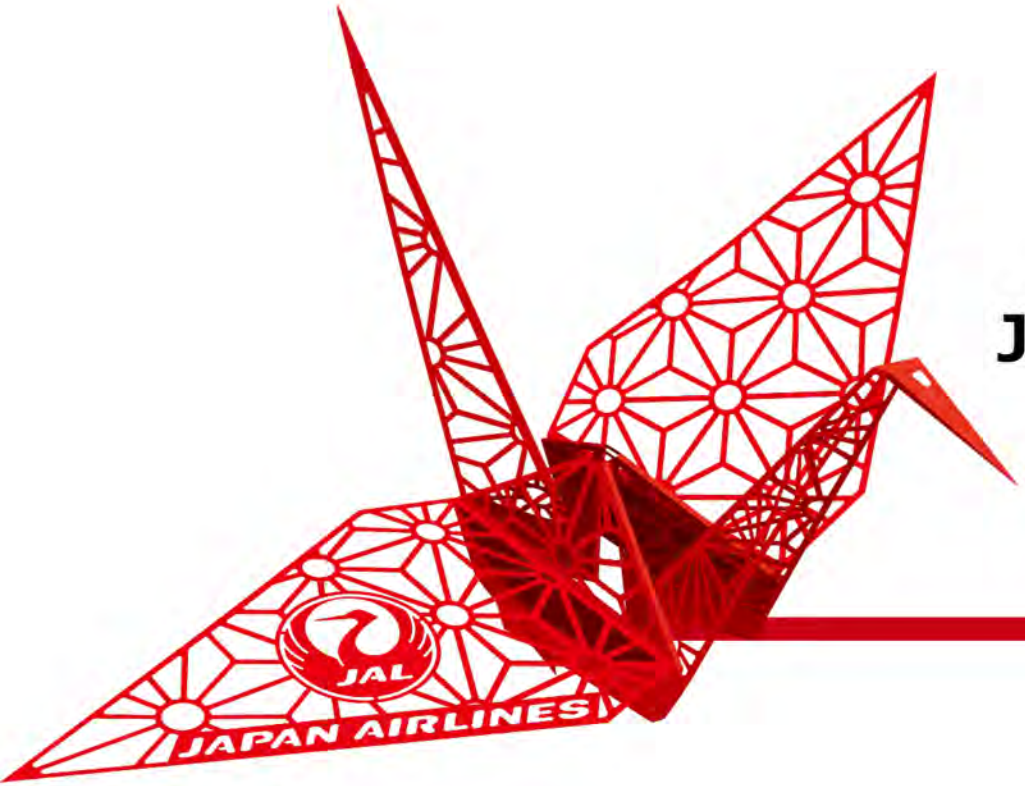
For 35th of ICAS on Sep 14 2026 at Sydney



JAL' challenge to the Net-zero greenhouse gas emissions

JAL Engineering Co., Ltd.
Executive Officer
Vice President
Engineering Department
Masami SUZUKI

JAL JAPAN AIRLINES

JAL Group's CO2 emissions

JAPAN AIRLINES

CO2 emissions from jet fuel during aircraft operations accout for the majority of the problem and are a priority area for improvement.

[FY2025 Emissions (Unit: 10,000 tons)]



During aircraft operations
Derived from jet fuel

Scope 1 (Fuel Combustion)
Aircraft: **9.99 million tons**
Ground: 0.03 million tons

Scop 2 (Electricity usage)

Scope3 (indirect emissions)
Category 3 (*) **1.3 million tons**

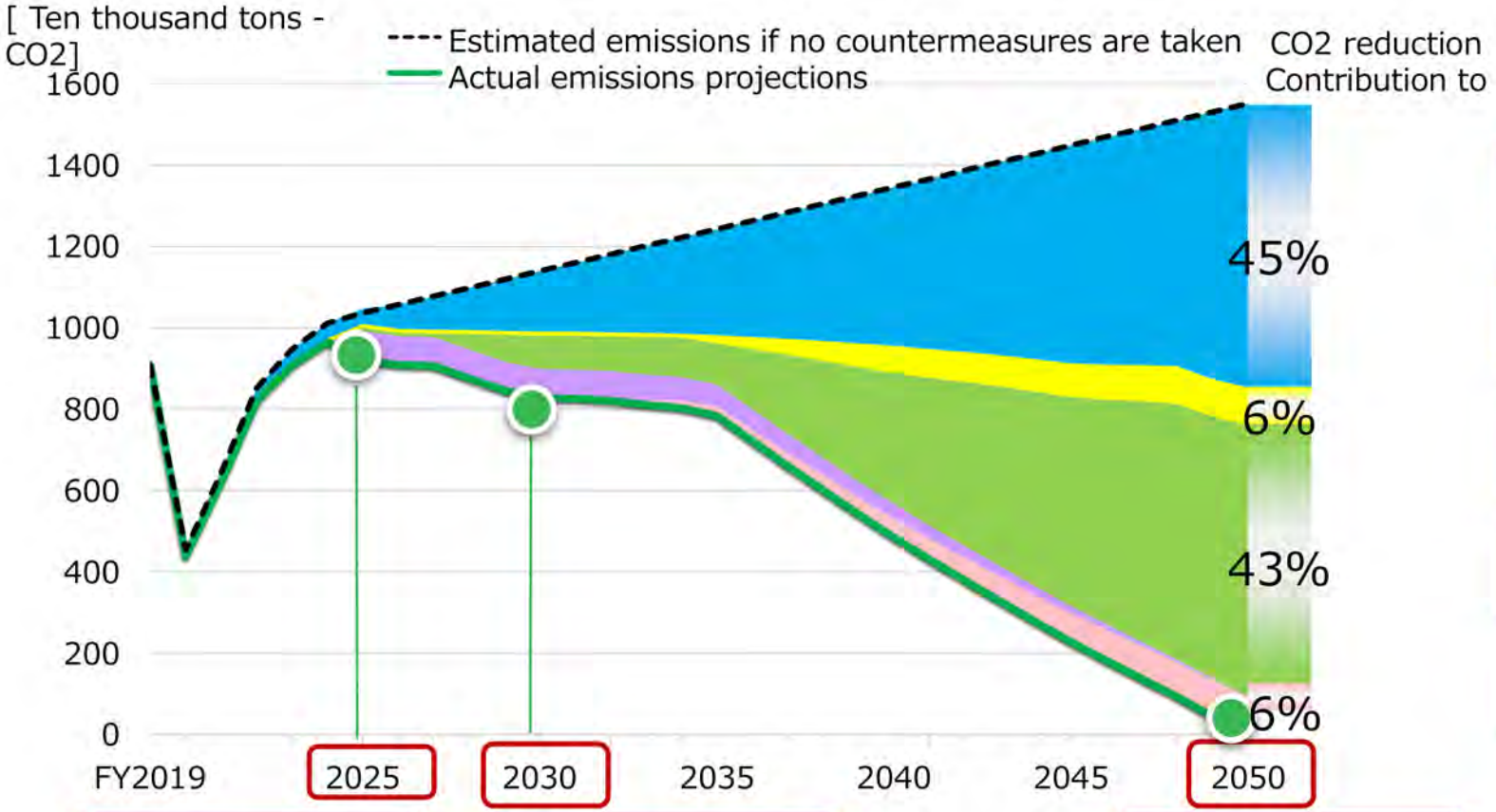
Fuel and energy-related (not included in Scope 1 or Scope 2)
Excluding Category 3 1.2 million tons

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Roadmap to achieving net-zero CO2 Emissions from aircraft by 2050

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In 2020, we established and announced our goal to achieve net-zero emissions by 2050



FY2025 Management Goals
emissions FY2019 or earlier (9.21 million tons)

FY2030 target
Emissions decreased by 10% compared to FY2019 (8.28 million tons) .

FY2050 target
emissions Effectively zero

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Fleet Modernization

Steady renewal of the fleet with fuel-efficient models

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Continuing replacement investment in fuel-efficient aircraft (Achieving not just efficiency, but also exceptional cabin quietness, comfort, and low noise)

The A350 significantly reduces noise and improves fuel efficiency compared to existing aircraft of the same size. With an expected 25% increase in fuel performance, it will substantially lower CO2and NO2 emissions through its innovative technology.

貢献します。

Weight reduction through the use of carbon fiber composites for 53% of the airframe.



Powered by the new-generation Rolls-Royce Trent XWB engines, custom-developed for the A350.

Exceptional cabin quietness and comfort

Innovative Technologies

Reduced Noise and Fuel Consumption / Lower Emissions

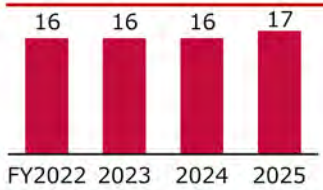
Comparison with Conventional Aircraft (Operating Cost / Fuel Burn / $CO2)

25% Reduction

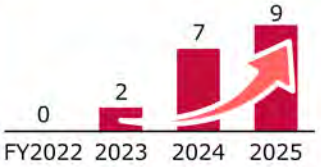
Source: Pusblished by Airbus

A350 Introduction Plan

Domestic A350-900



International A350-1000



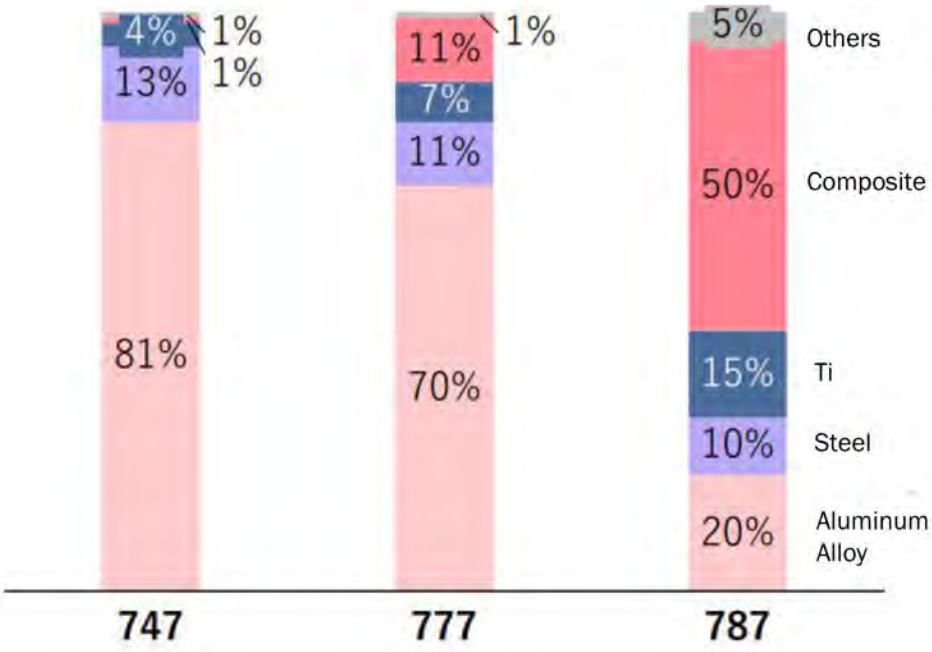
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Advancements in aircraft

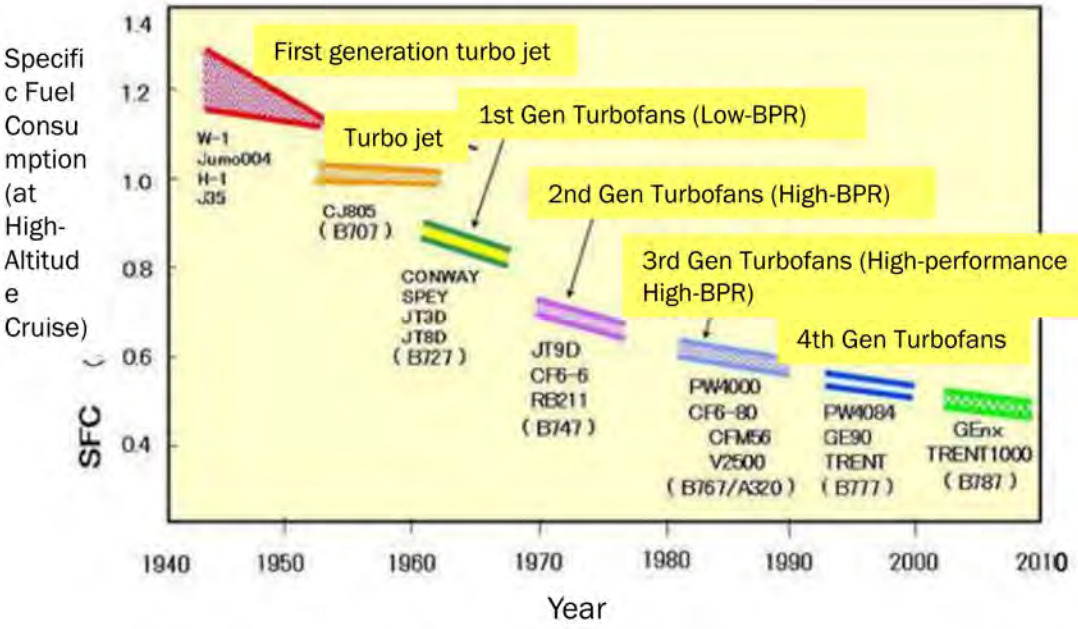
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Steady improvement in historical fuel efficiency driven by technological advancements.

Key materials for the aircraft structure



Engine fuel efficiency improvement



Source: Japan Aeronautic Association

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Optimization of Flight Operation

JAL Green Operations Promotion

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With safety as the top priority, we are working across departments and with all employees involved to reduce emissions.

CO2 reduction

Preparing for departure 102,300 tons

Parked 14,500 tons

During takeoff 242,200 tons

During flight 5,200 tons

Descending 28,800 tons

During landing 13,600 tons

Outside of operating hours 28,600 tons

① Flight plan ingenuity

② Loading weight reduction



③Reduced utilization of the Auxiliary power

④Cabin window shade policy



PHOTOGRAPHY BY SACHIE ABIKO

⑤Early acceleration and climb



⑥Optimization of flight speed



⑦ Continuous descent operation

⑧ Low flap angle landing procedure

⑨ Delayed flap and gear deployment

⑩ Reduced use of reverse thrust



⑪ one engine taxing



⑫ Engine Water Wash



⑬ Winglets and Aircraft improvements



Riblet application





*CO_2 emissions generated by 680,000 households from electricity consumption over one month**

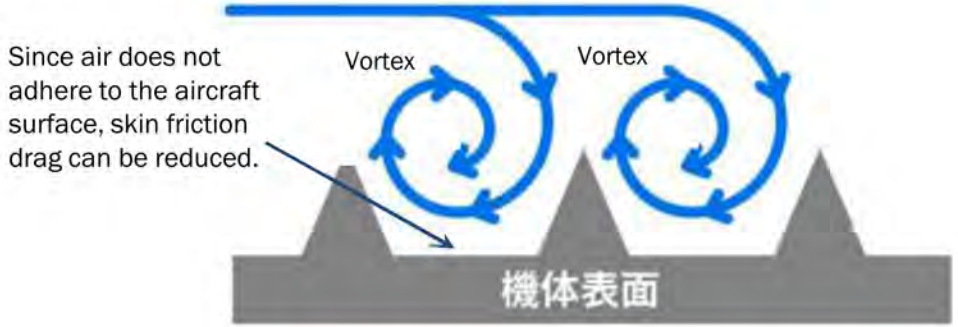
Equivalent to one month's worth for all 670,000 households in Okinawa

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Riblet coating (sharkskin finish)

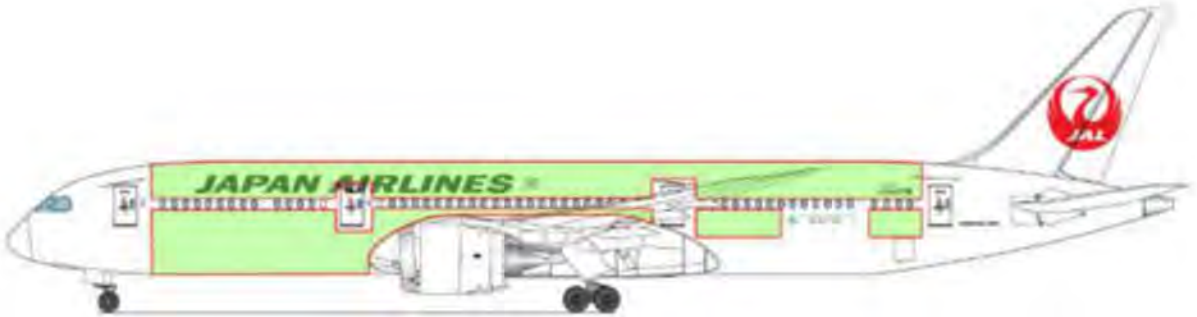
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Reduces frictional resistance caused by turbulent vortices on the aircraft surface.



Applying riblet structures to 80% of the aircraft's surface area is expected to achieve an approximately 2% reduction in fuel consumption.

Source:Owell



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Sustainable Aviation Fuel

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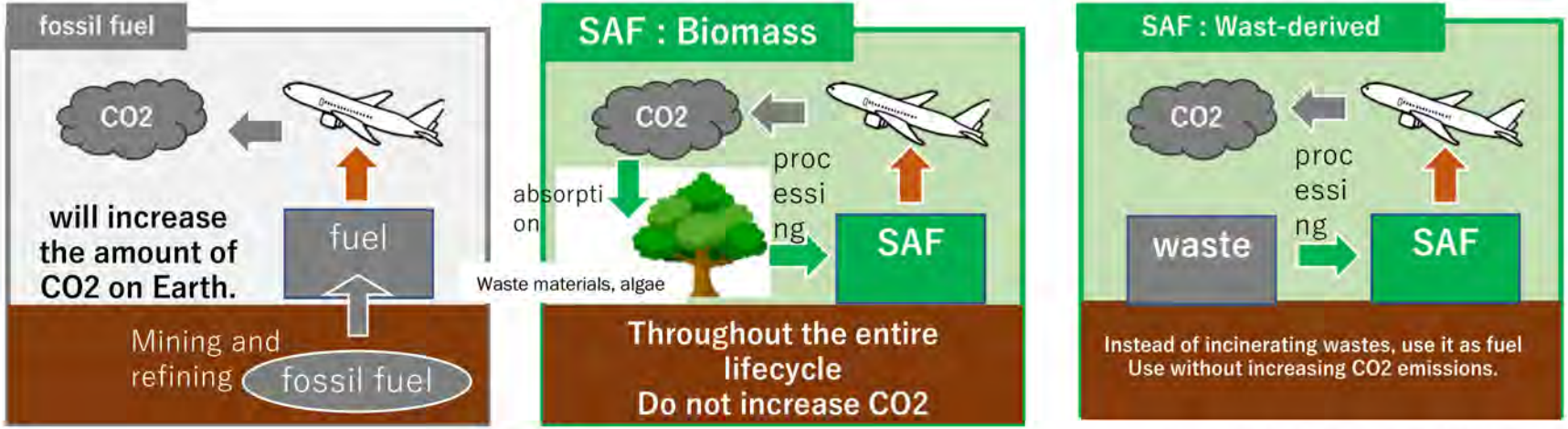
Aviation fuel produced from recycled raw materials, rather than fossil fuels that produce crude oil.

Benefit 1 : Reduces carbon dioxide emissions.
Benefit 2 : Existing infrastructure can be used.
Benefit 3 : Can be made with domestically produced ingredients.

Problem 1 : High manufacturing costs
Problem 2 : Low production volume

CO2 emissions by approximately 80 %

- Reduces CO_2 emissions by approximately 80% compared to conventional jet fuel over its lifecycle—from raw material production and collection to manufacturing and combustion.



Source: Scheduled Airlines Association of Japan

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SAF Feedstocks

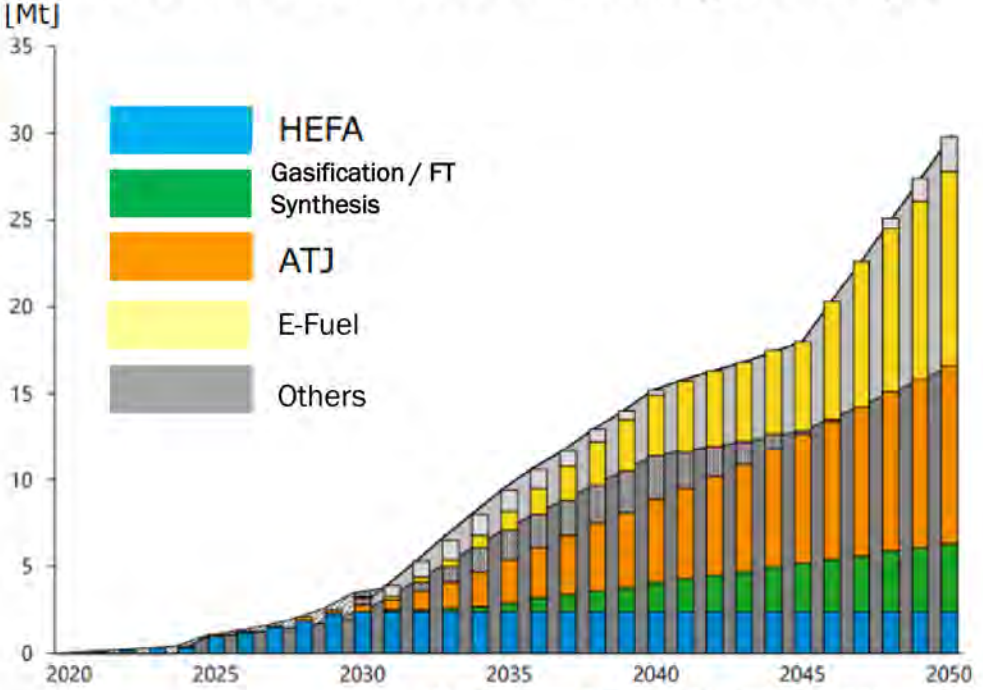
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A sufficient amount of SAF in the future , we expect diversification of raw materials and technologies.

<SAF Feedstock and Technology Categories>

Prpduction Technology	Primary Feedstock
HEFA Hydroprocessed Esters and Fatty Acids	Waste cooking oil, Tallow, Pongamia, Microalgae, etc.
ATJ Alcohol to JET	•First-generation bioethanol (sugarcane, corn, etc.) •Second-generation bioethanol (non-food plants, waste paper, municipal waste)
Gasification / FT Synthesis	Municipal waste, Waste plastics, etc.
E-Fuel	CO_2, Hydrogen

<Outlook for Future SAF Production Technologies in Europe>



（出所）Sky NRG A Market Outlook on SAF

(Source) Ministry of Economy, Trade and Industry

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Our approach to SAF

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Our company will continue the activities we have been working on for many years to expand

2009

Successful test flight

2018





First Domestic Flight Powered by Domestically Produced SAF

2021

Air for Sky

Voluntary Alliance to Commercialize and Promote Domestically Produced SAF

2022



Joined the “Fry to Fly Project” to Fly on Waste Cooking

2023



Launched an Initiative to Collect Household Waste Cooking Oil with Yokohama City, Ota City, and Others

2024

Phase1



Phase2



Phase3



Phase4



Launched a project to produce domestic SAF from clothing cotton (Later succeeded in 2020)





Used SAF for the "Sustainable Challenge Flight" (Following 2022)



Launched the “JAL Corporate SAF Program” to Provide Carbon Insetting Options for Corporations"

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Industry collaboration to expand the distribution of domestically produced SAF

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We will accelerate our efforts to ensure stable SAF production and supply within Japan.





- ✓ On March 2, 2022, JAL established “ACT FOR SKY,” a voluntary alliance dedicated to the commercialization, promotion, and expansion of domestically produced SAF, alongside JGC Holdings Corporation, ANA, and Revo International Inc.
- ✓ A total of 46 organizations, including companies directly involved in domestic SAF, businesses essential for supply chain development, and local governments (as of April 2025), are collaborating and coordinating their efforts.
- ✓ The alliance aims to drive behavioral changes by raising awareness among citizens and businesses, while emphasizing the critical importance of SAF, carbon neutrality, and resource recycling.

https://actforsky.jp/

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Collaboration with Local Governments for Domestic SAF Production

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An initiative in collaboration with local governments and companies nationwide, also aiming to raise public awareness





Collection bottles



Disposal oil recycling box



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Adaption of new technology

Riblet application

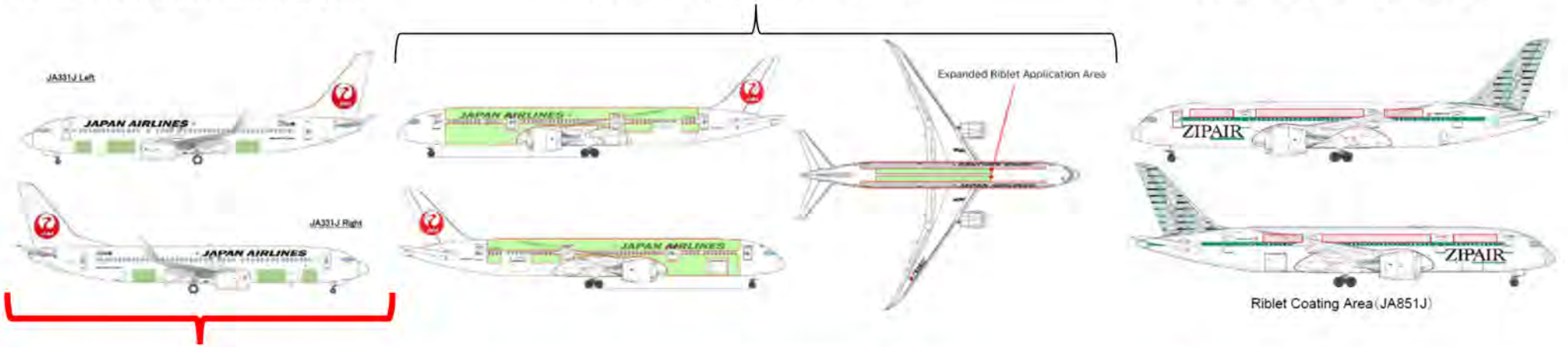
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[Current Status]
JAL has incorporated the large riblet painting into the following 3 airplanes by using the Paint-to-Paint method.

B737-800 (25 ㎡) in 2023

B787-9 (270 ㎡) in 2025

B787-8 (41 ㎡) in 2026



The durability test of the riblet painting has been continued since 2023 on B737-800.
Obvious deterioration, crack or peeling are ***NOT*** found for more than 3 years
and the sufficient durability is validated for keeping the reduction of skin friction.

[Future Plan]
JAL plans to apply the riblet painting to some of our airplanes in 2026.

JAL will improve the application method with O-well and conducts the flight data analysis to identify the improvement in fuel consumption with JAXA through JAL's daily flight operation.

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Contribution to Climate Change Research

JAPAN AIRLINES

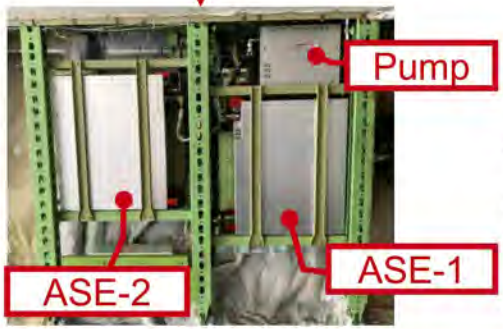
CONTRAIL Project Overview

- The CONTRAIL (*1) Project is a collaborative research initiative that utilizes commercial aircraft to observe greenhouse gas concentrations, primarily carbon dioxide (CO_2)
- The aim is to elucidate the global carbon cycle and climate change mechanisms

(*1) **C**omprehensive **O**bservation **N**etwork for **Tr**ace gases by **Air**liner



この飛行機は上空のCO_2濃度を観測しています。
In-Flight Observation of Atmospheric CO_2.



ASE： Automatic Air Sampling Equipment
Collects in-flight air samples into specialized flasks inside ASE-1 and ASE-2. Samples are analyzed in laboratories for multiple trace gases (CO_2, CH_4, CO, H_2, N_2, SF_6).



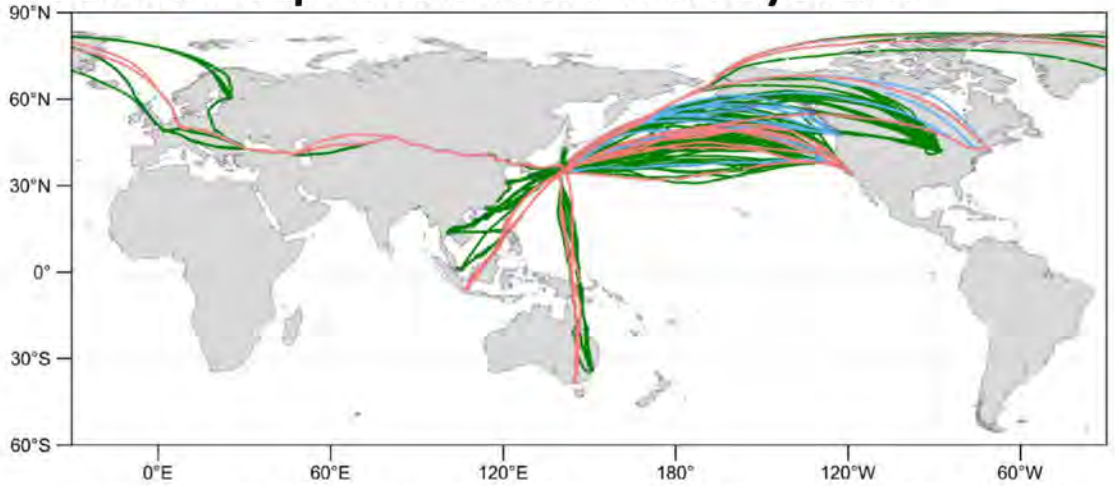
CME：Continuous CO_2 Measuring Equipment
Continuously measures and records atmospheric CO_2 concentrations during flight.

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Contribution to Climate Change Research

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JAL operates a dedicated fleet of 5 modified Boeing 787-9 aircraft equipped with an Atmospheric Observation System.



(Green : 777-300ER、Blue/Pink : 787-9、Transitioning from 777 to 787)

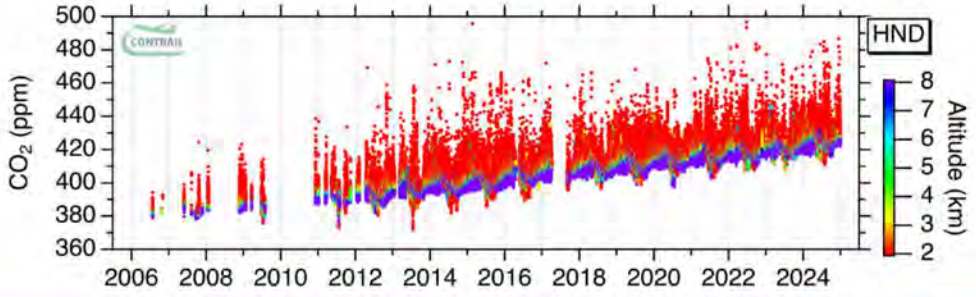
<u>High Frequency & Density:</u>
The project utilizes regular commercial flight networks for continuous global monitoring

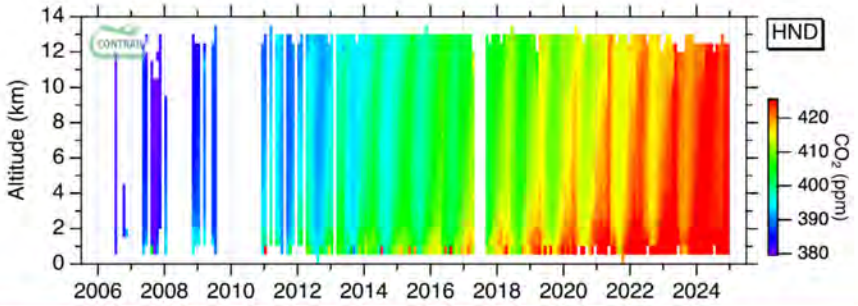
<u>3D Spatial Coverage:</u>
Detailed atmospheric profiles are captured during takeoff and landing

Long-Term Data Insights

<u>Continuous Atmospheric Growth Trend</u>

CO_2 concentrations have been increasing at all altitudes up to 12 km with clear seasonal variations. The growth rates are almost the same as those observed on the ground.





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