

Aircraft Development and Fuel Consumption

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飛行機は大量石油消費者？ Aircraft is a Big Fuel Consumer ?

▶ From Haneda to Chitose

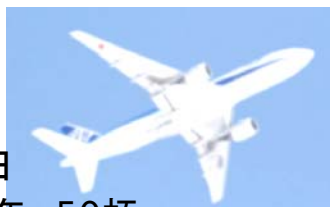


OR



羽田～千歳の飛行 Flight from Haneda to Chitose

- ▶ 羽田～千歳間 920km
- ▶ B777-300 が使用する石油
 - 約10,000 リットル(L) ドラム缶 50杯
- ▶ 燃費(Fuel Consumption)
 - $920/10000=0.092$ km/L
 - 92m/L
- ▶ **300名が搭乗すれば**
 - $0.092*300=28$ km/L



10,000Lの燃料はどこに？

- ▶ 10,000Lの燃料 8トン
- ▶ B777-200
 - 最大離陸重量(Max Take-off Weight)
 - 247 Ton
 - 最大搭載燃料(Max Fuel Capacity)
 - 94 Ton
 - 最大巡航距離(Max Range)
 - 9700 Km
- **燃料は全て主翼の内部**
 - **重心移動を最小化**

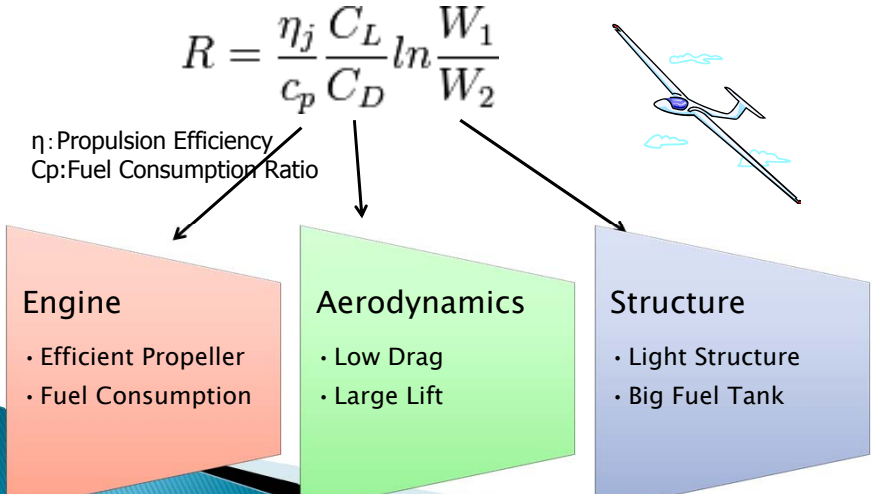


How to Improve Fuel Efficiency

✦ **Breguet's Law (Flight Range)**

$$R = \frac{\eta_j C_L}{c_p C_D} \ln \frac{W_1}{W_2}$$

η_j : Propulsion Efficiency
 c_p : Fuel Consumption Ratio



Engine

- Efficient Propeller
- Fuel Consumption

Aerodynamics

- Low Drag
- Large Lift

Structure



- Light Structure
- Big Fuel Tank

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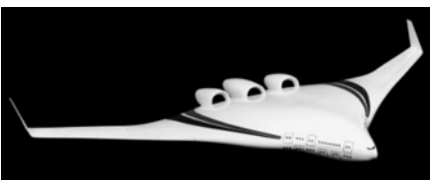
Aerodynamics

- ▶ **Wing Tip Device**

Wing-Tip A319

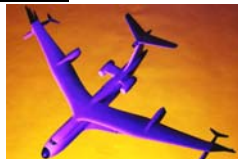



B737-800 Winglet
- ▶ **Blended Wing Body BWB Concept**



NASA
- ▶ **Truss-braced Wing Concept**

IATA Technology Roadmap



- ▶ Structure and Material
 - CFRP carbon reinforced plastic

- ▶ Jet Engine
 - High bypass ratio
 - Geared Turbo Fan
 - 3 shaft engine

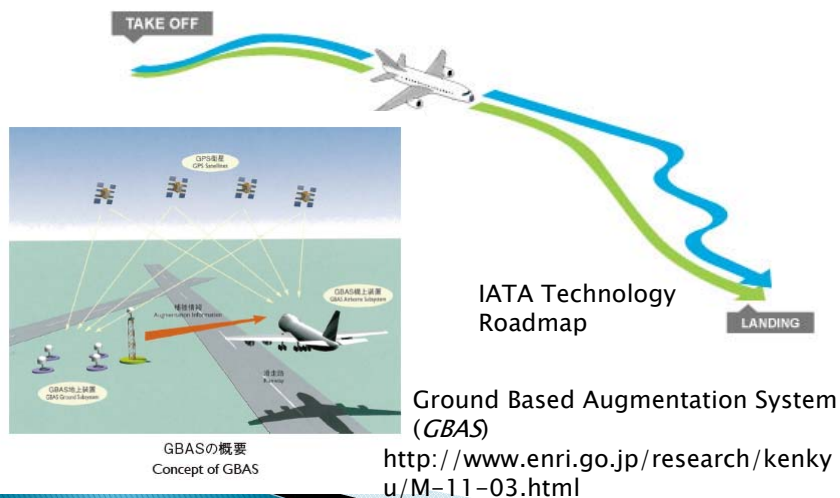
 - **Open Rotor**



NASA

Flight Trajectory Optimization

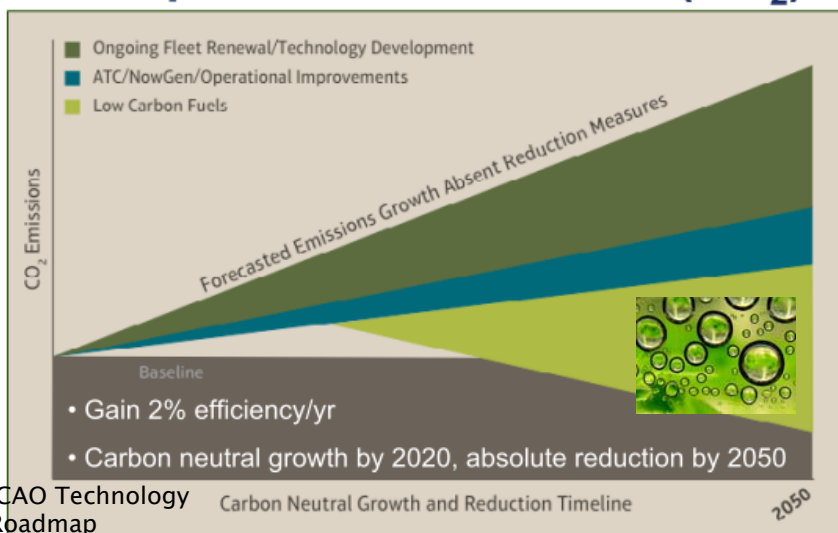
- CDA (Continuous Descent Arrival)



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ICAO Road Map

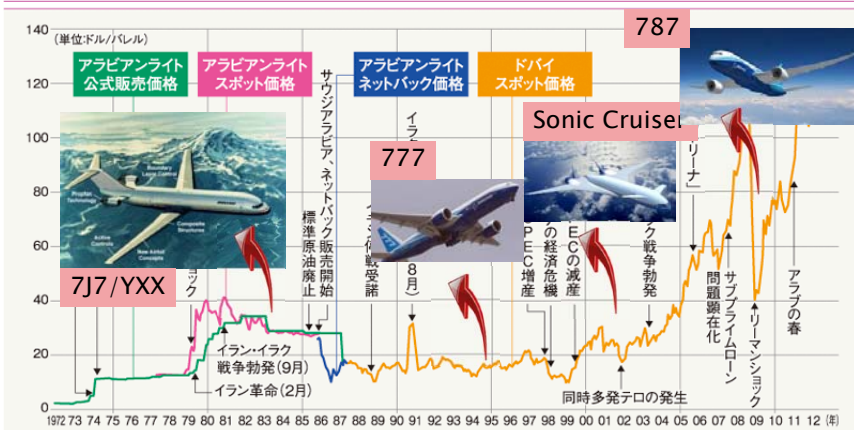
Sample Plan for Success (CO₂)



Oil Price and Aircraft Design

▶原油価格の推移

出所:各種資料より石油連盟が作成



http://www.jogmec.go.jp/library/contents8_01.html

102ドル台後半[NY石油](27日午前)(時事通信)27日

Next generation regional jet MRJ

- ▶ 20% Reduction of Fuel Consumption



Mitsubishi Heavy Industries,LTD.sp

Next generation regional jet MRJ

- ▶ 20% Reduction of Fuel Consumption



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