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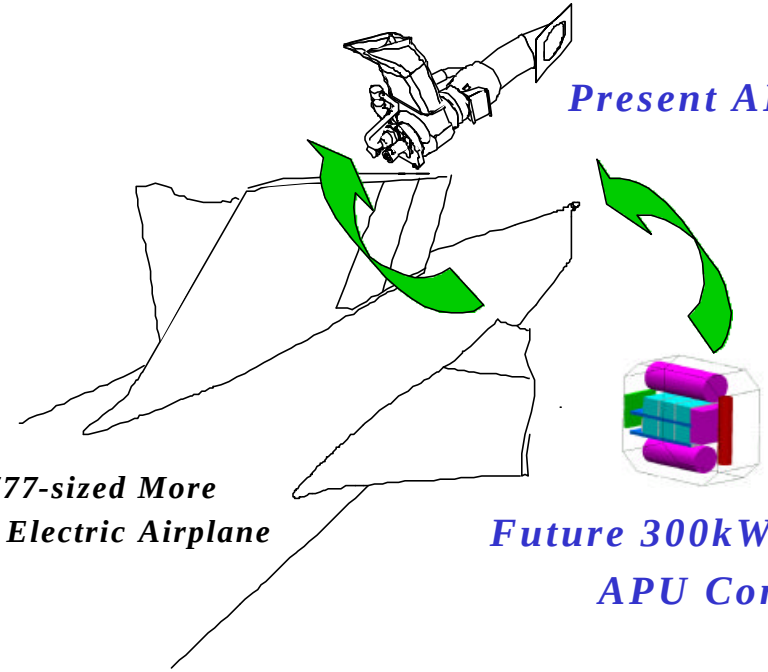
Fuel Cells may one day replace APUs to reduce fuel use and emissions



Heavier, but 2-3 times increased fuel efficiency, drastic emissions reduction and generates water for on-board use

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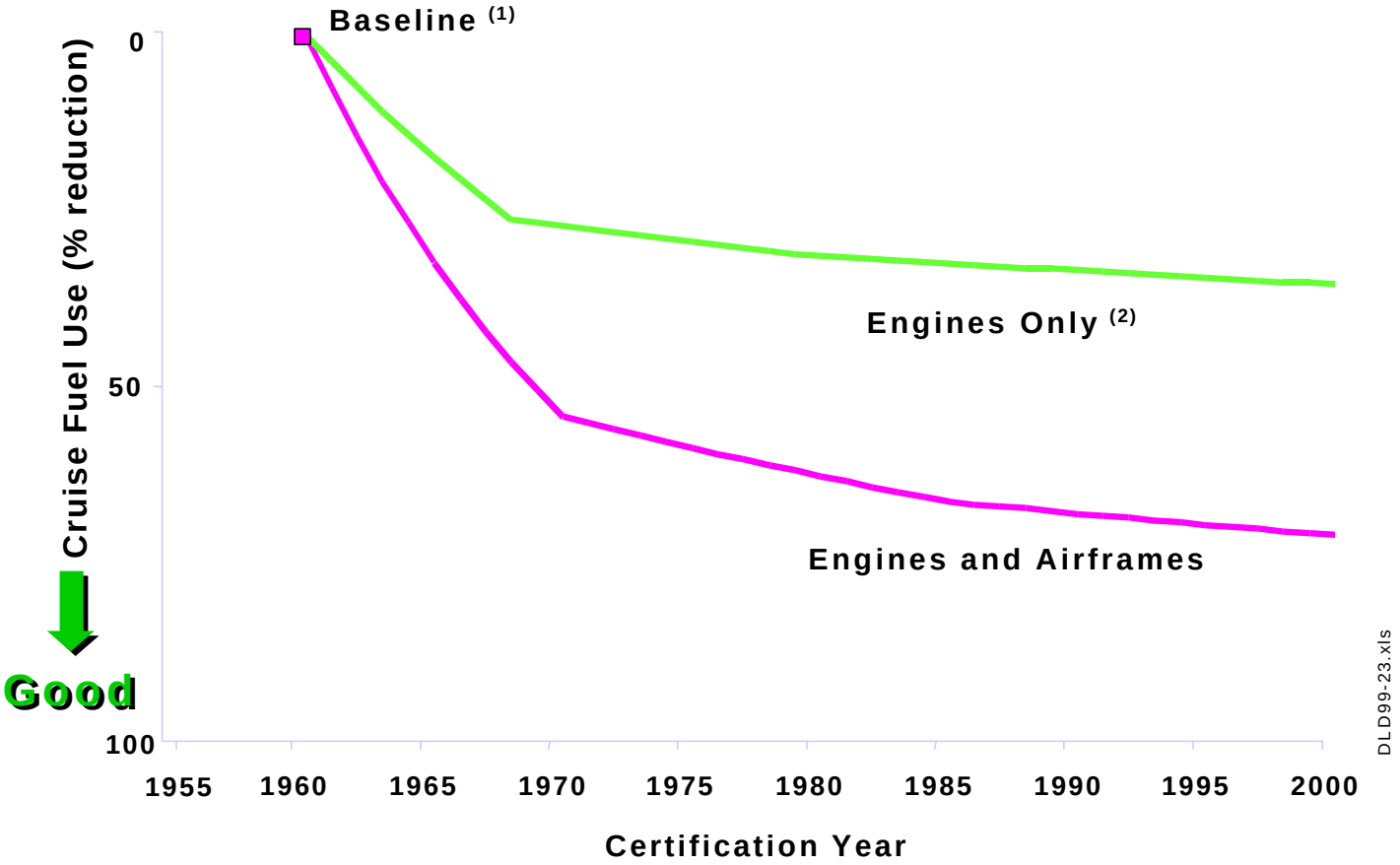
Airframe fuel use reduction matches engines



(1) DC8-21 with JT3C-21 engine)
(2) 35,000 ft, Mach ≤ 0.8, uninstalled, ideal nozzle, 100% inlet

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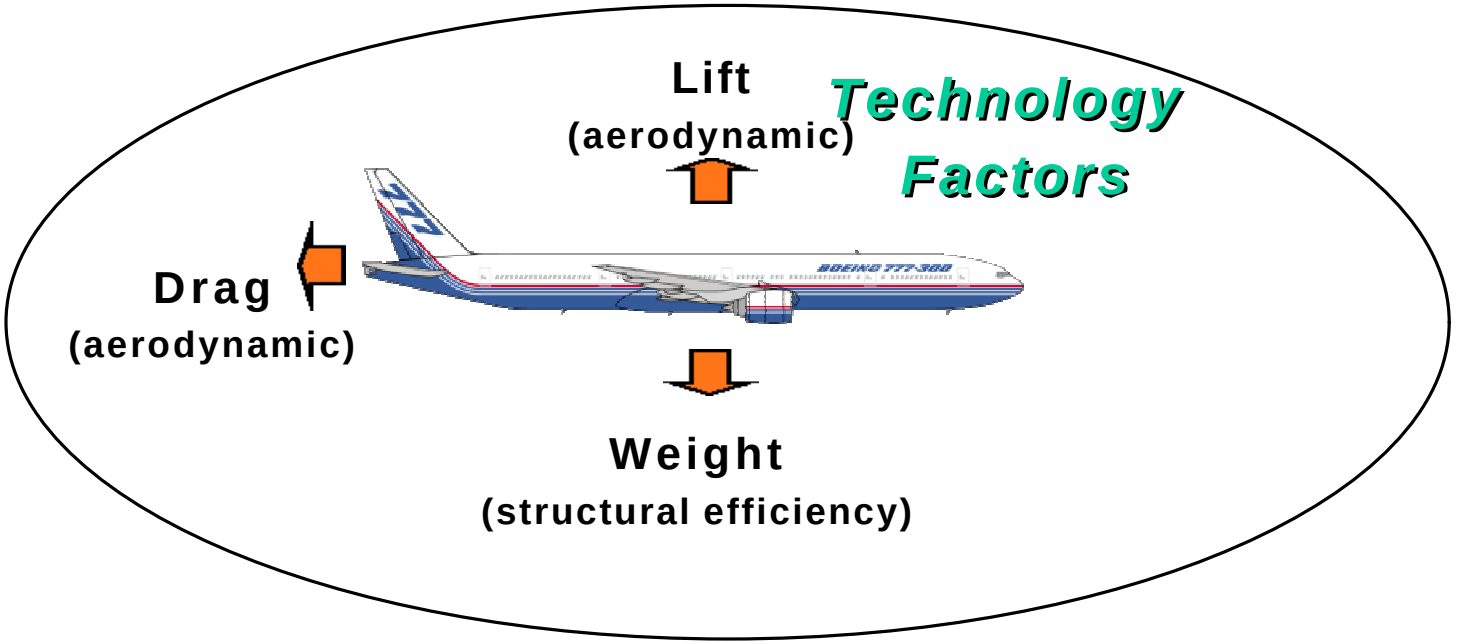
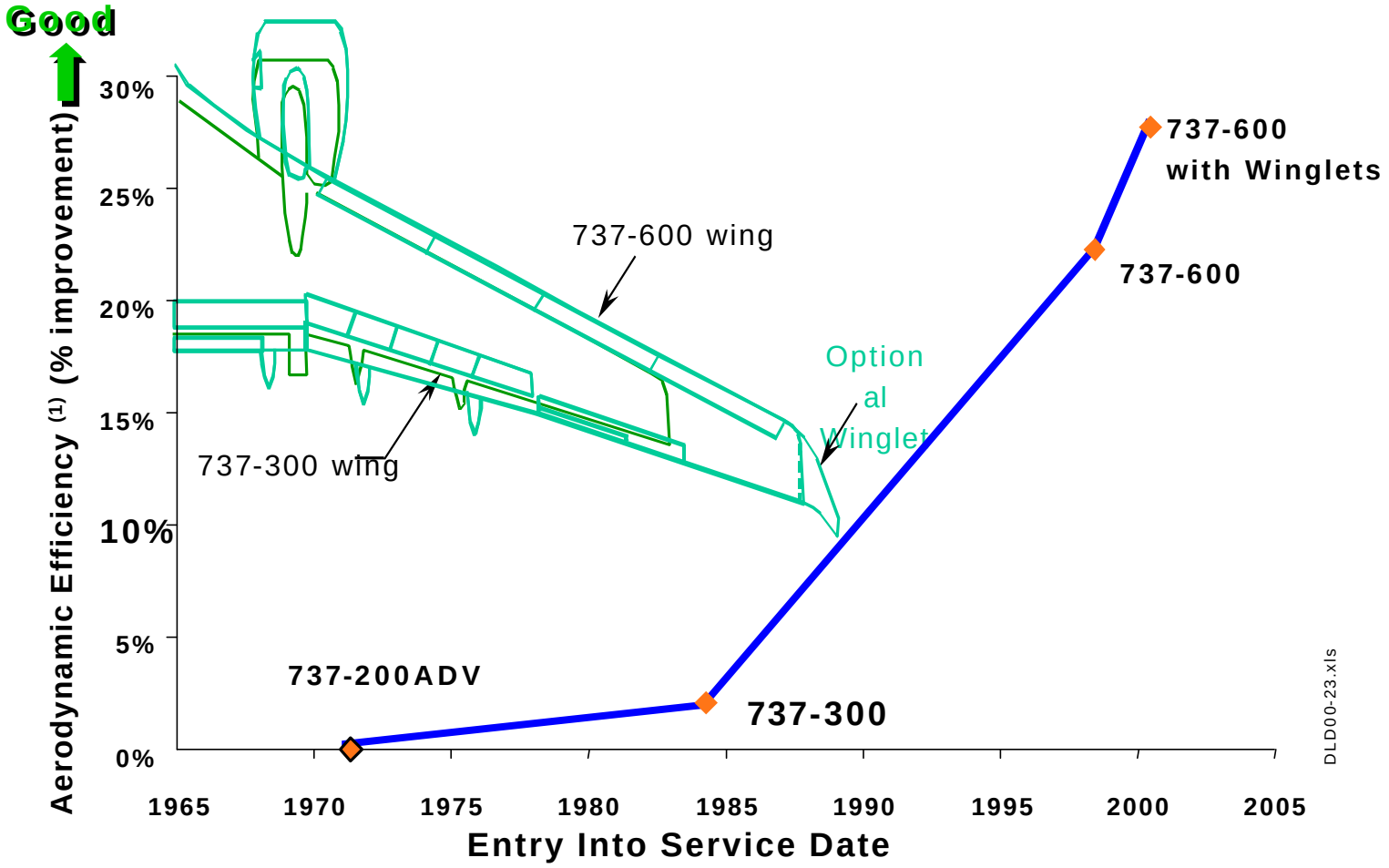
Airframe effects on fuel economy

Operational Factors



Airfoil/wing technology has been improving



1) Mach * (Lift/Drag^{max})

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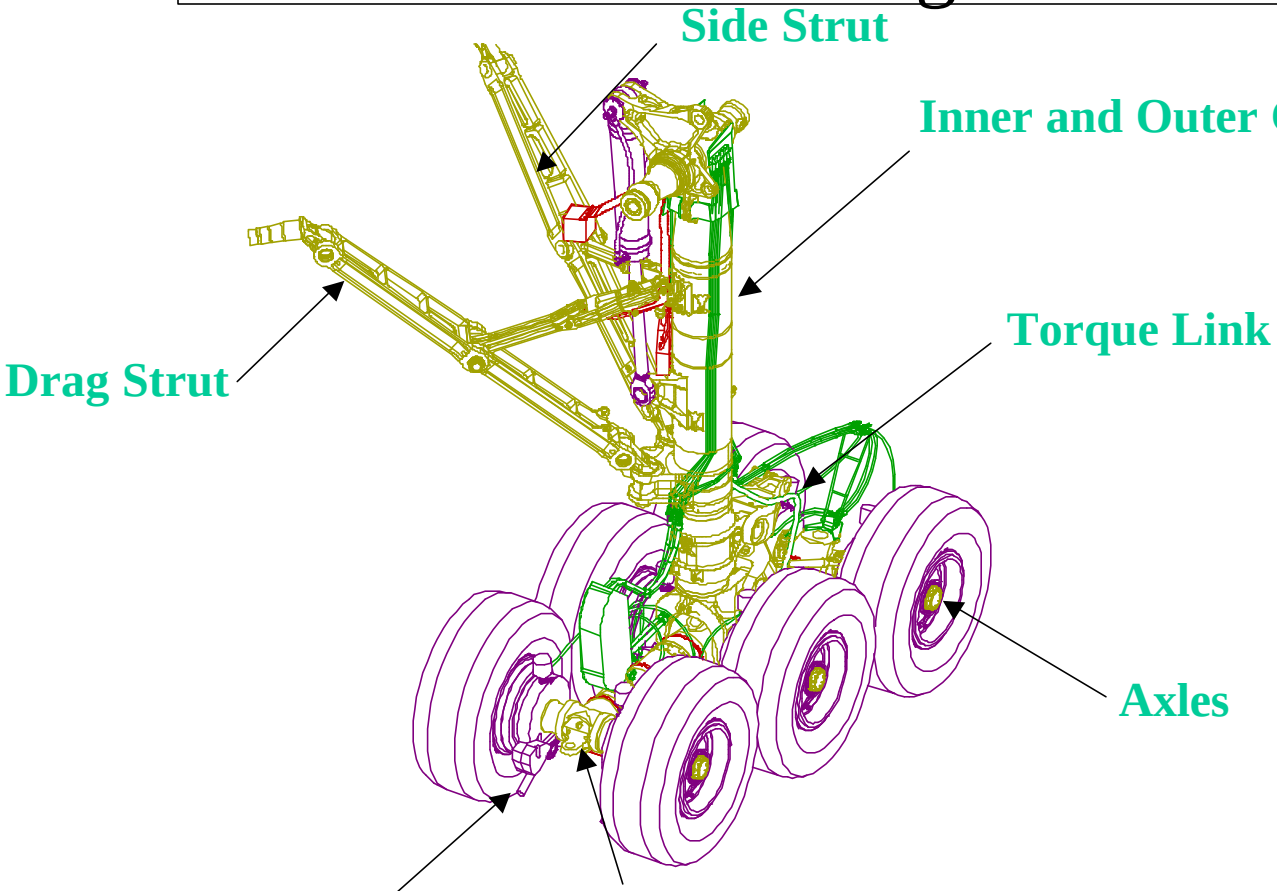
Titanium metal matrix gear reduce weight



Over 5% weight savings

Engine integration is an important factor

Propfan Engines
(Potential fuel use savings >30% but increases noise, & maintenance, slower cruise speed with increased technical risk)

Hi Tech Wing
(Reduced mfg cost, smaller, lighter, less drag and faster)

"T" Tail
(Required for high wing. Adds weight and drag)

Fatigue/Sound Deadening
(Needed to handle increased noise. Adds weight and cost)

Body Gear
(Increased weight and drag)

High Wing
(Required to use propfan engines. Adds weight and drag)

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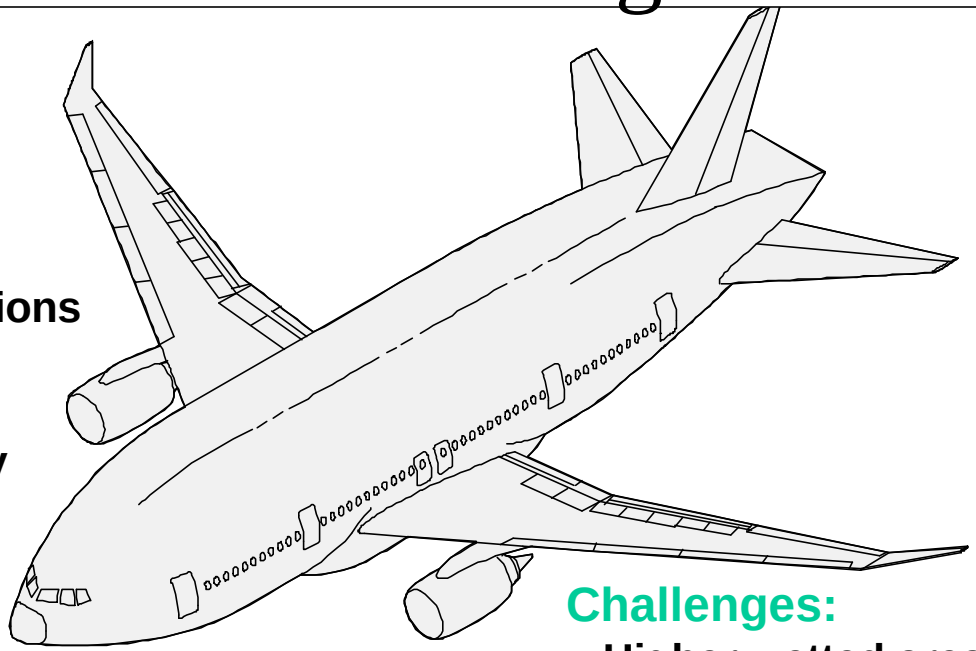
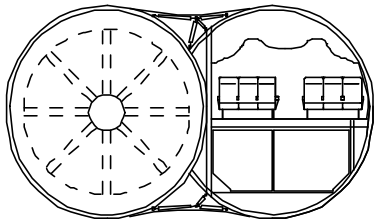
Alternate fuels (H_2) presents challenges



Advantages:

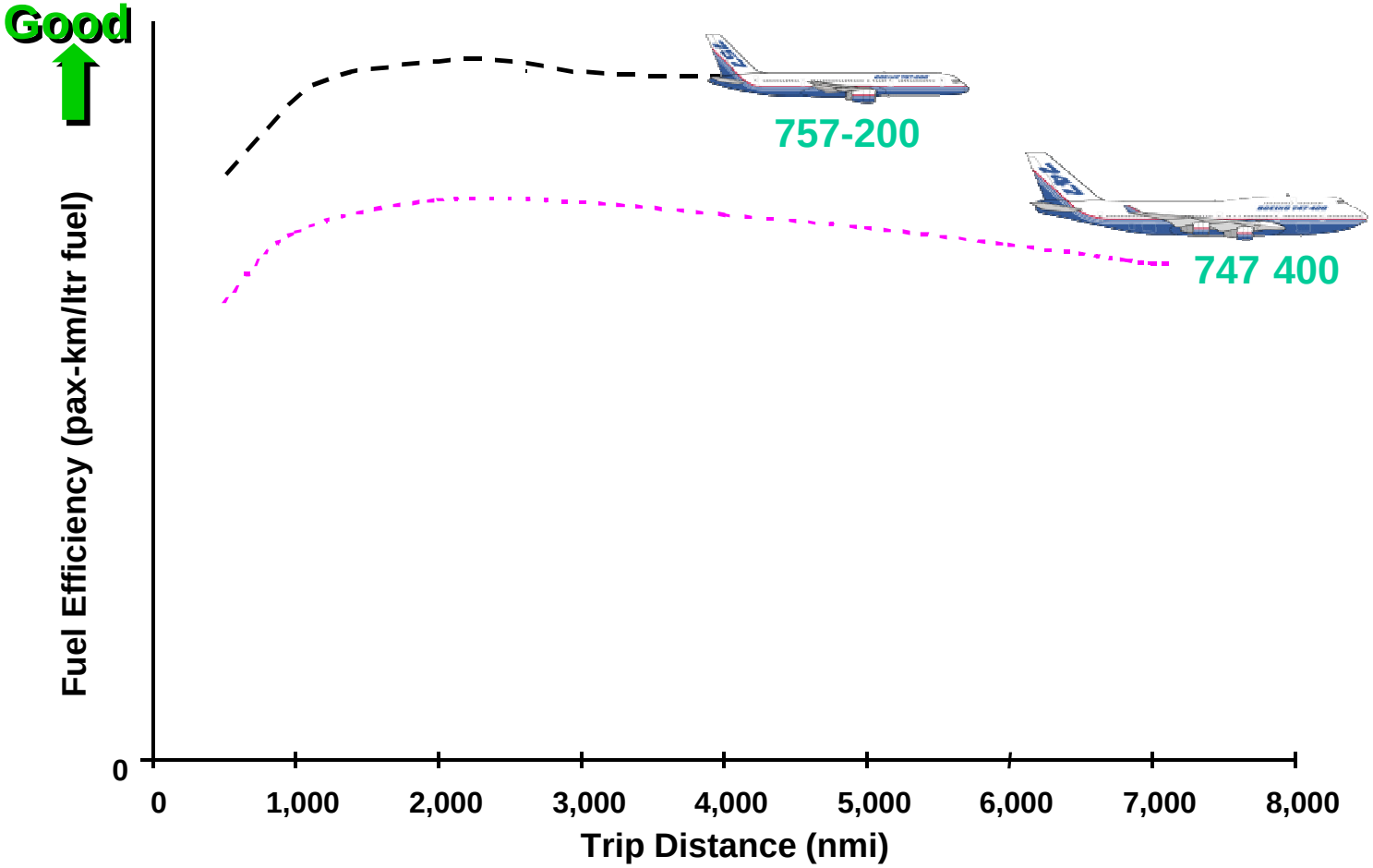
- Zero CO_2 emissions
- Zero HC & CO
- Reduced NOx
- High fuel energy density



Challenges:

- Higher wetted area, weight and drag per passenger
- High technical risk
- Passenger acceptability
- Increased contrails
- New LH_2 production method and infrastructure required

Mission Length Affects Fuel Efficiency



70% passenger load factor

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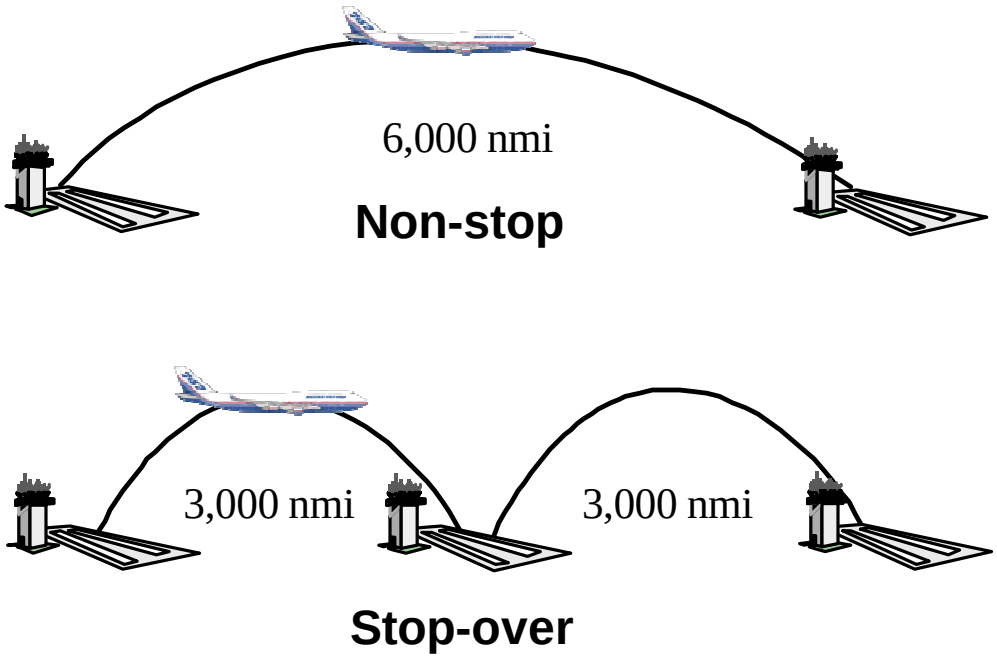
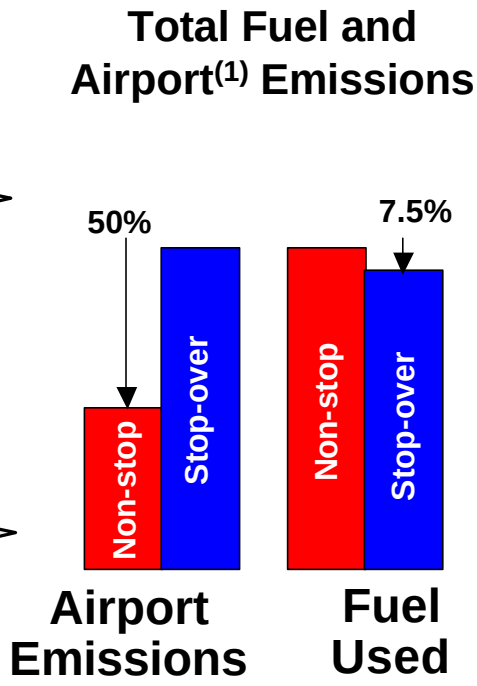
Designing an airplane for shorter range would improve fuel efficiency, but it would increase airport emissions





(1) Landing Take Off cycle

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Summary

- Airframe and engine manufacturers are continuing to pursue aerodynamic, structural and propulsive efficiency gains.
- ICCAIA's overall goal is to design and offer safe, efficient, affordable airplanes with excellent environmental performance.

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AVIATION OPERATIONAL MEASURES FOR FUEL AND EMISSIONS REDUCTION WORKSHOP

Thank you !

Ottawa, 5-6 November 2002

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