

Presented by

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Alternative fuels challenges

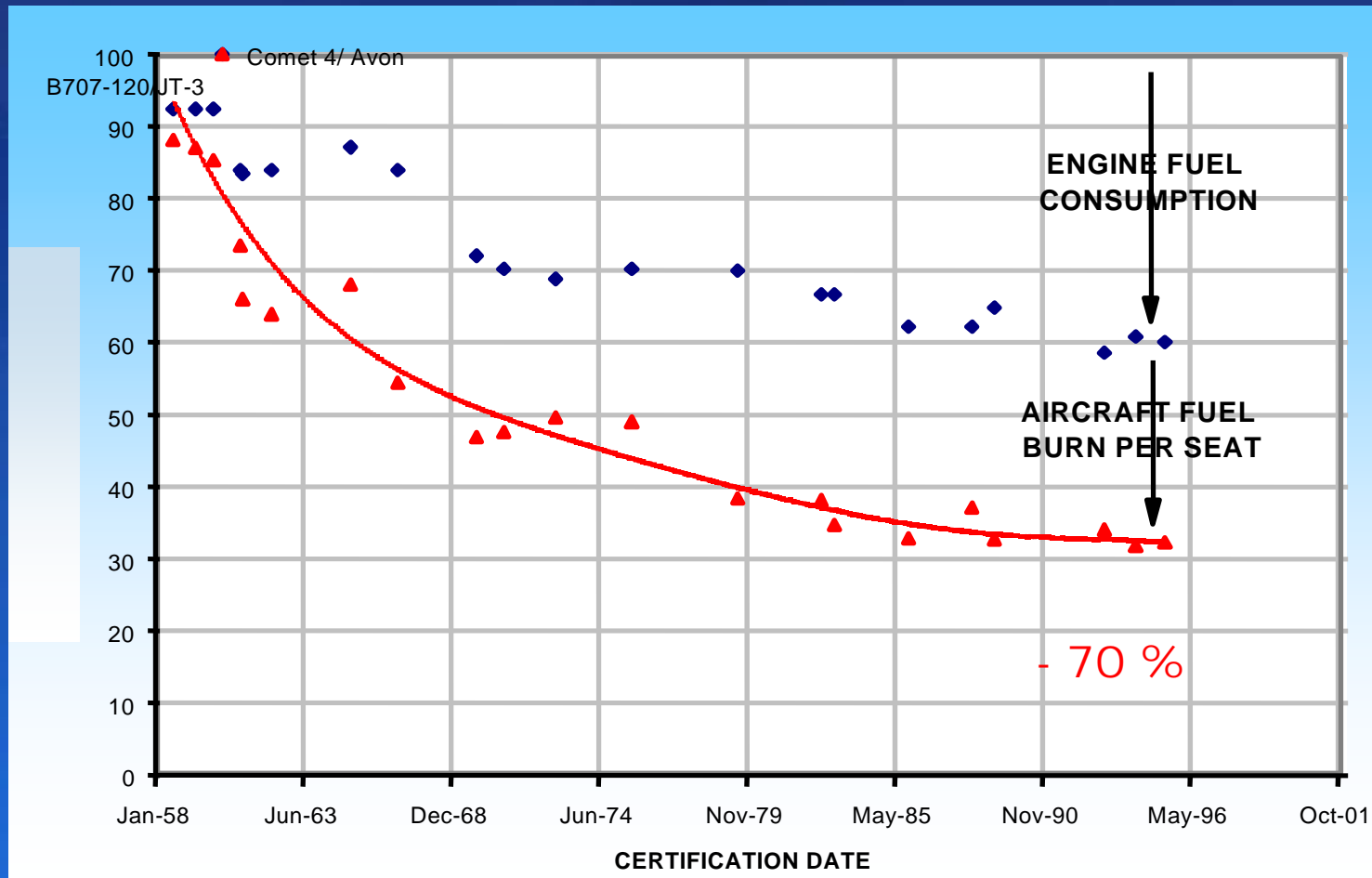
An aircraft manufacturer's view



Fuel burn reduction

A continuous improvement slope

A never-ending challenge



R&T - creating partnerships that matter

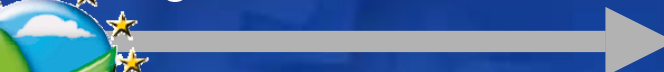
Objectives for 2020

50% reduction in CO₂

Aircraft manufacturers



Engine manufacturers



Vision 2020



Air and Traffic Mgmt



50% reduction in perceived noise

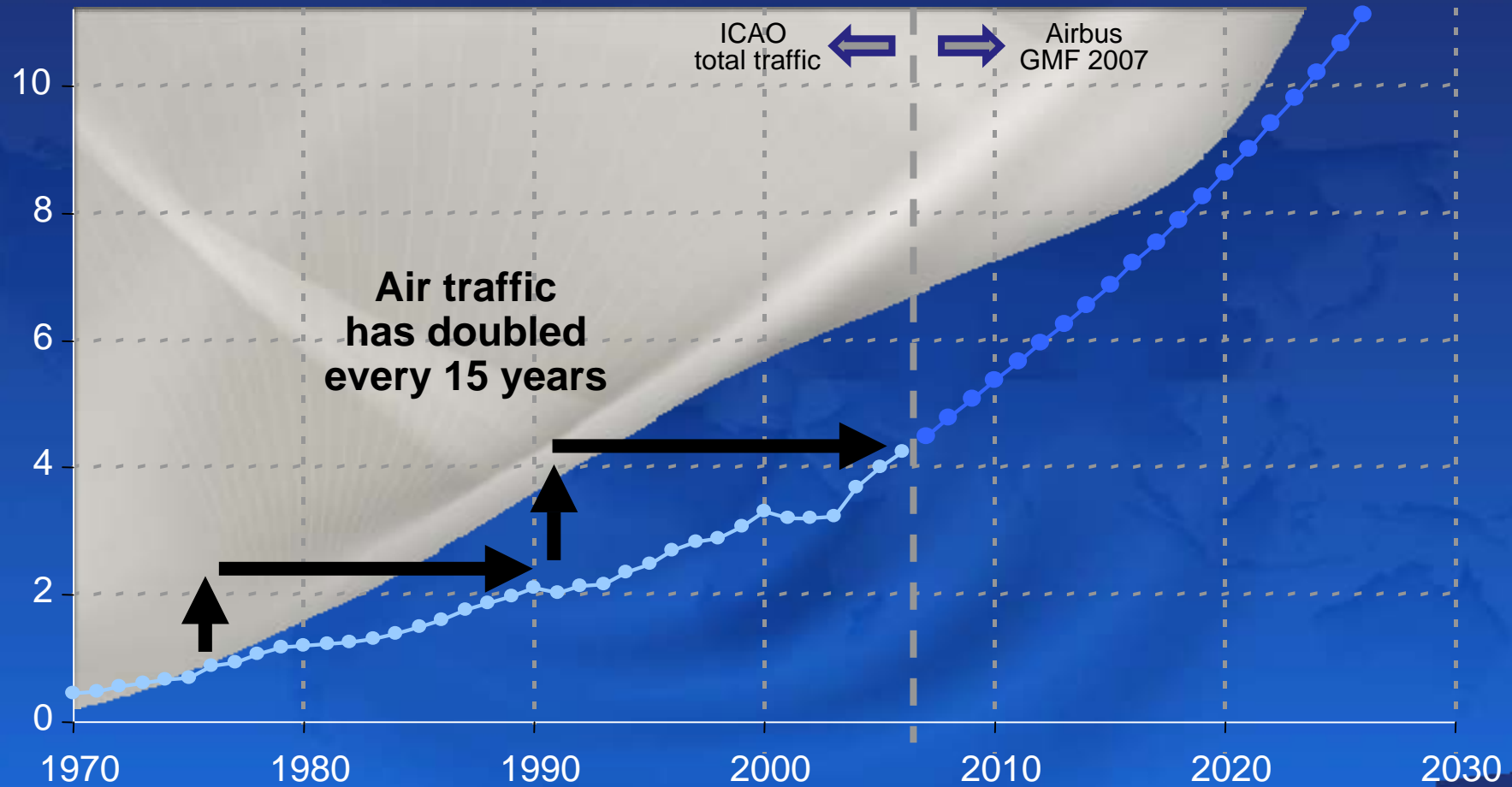
Noise reduction at source

Operational procedures

80% NOx reduction

Air travel is a strong growth market

World annual traffic
(RPKs - trillions)

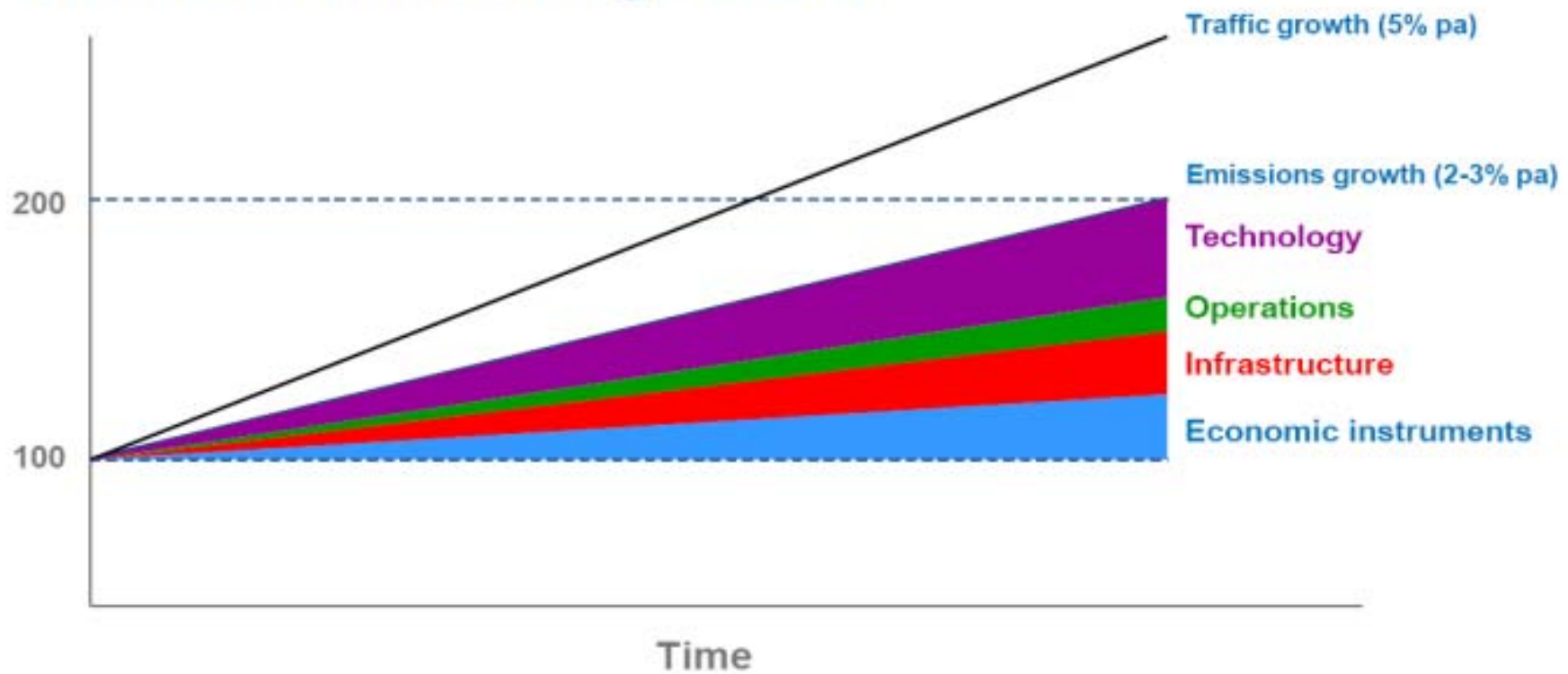


Source: ICAO, Airbus

IATA's commitments



Carbon neutral growth



Hydrogen ?



New configurations



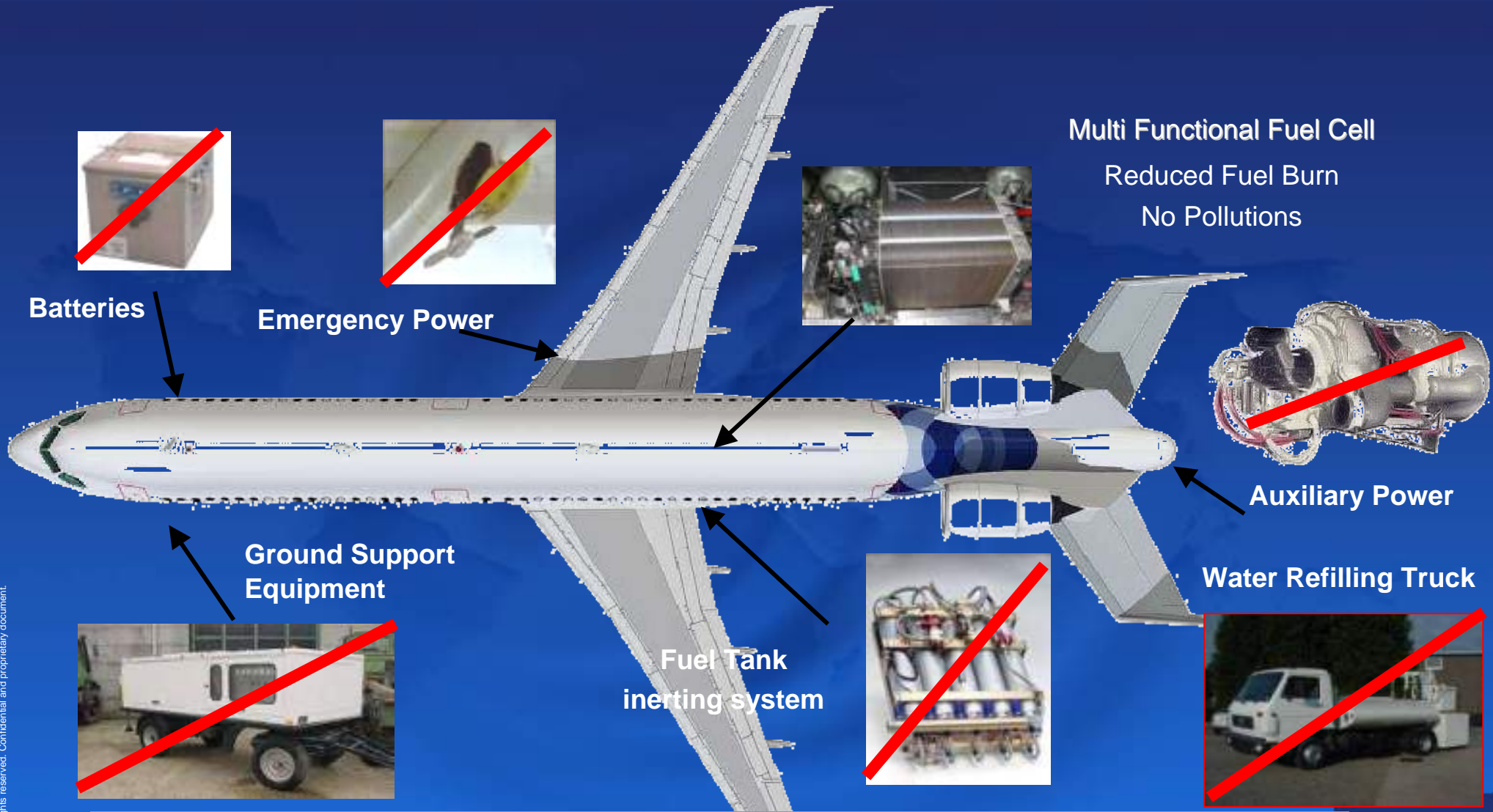
**Some will remain...
... paper aircraft**



... and others simply dreams.



Low Emissions System : Fuel Cells



Fuel cell technology will initiate a step change in aircraft systems through enhanced integration architectures

Piles à combustible



GDM 08/2008S



EMISSION FREE POWER FOR CIVIL AIRCRAFT: AIRBUS SUCCESSFULLY DEMONSTRATES FUEL CELLS IN FLIGHT

Airbus has successfully tested a fuel cells system in flight. For the first time on a civil aircraft this innovative energy source powered the aircraft's back-up hydraulic and electric power systems. The test conducted in February is part of Airbus' overall plans for an eco-efficient aviation industry. It supports the on-going research to evaluate the potential use and environmental benefits of fuel cell technology and zero emissions power generation in civil aviation.

During the test, the hydrogen and oxygen based fuel cell system generated up to 20 Kilo Watts (kW) of electrical power. The emission free fuel cell system generates water as a "waste" product. The fuel cell system powered the aircraft's electric motor pump and the back-up hydraulic circuit and also operated the aircraft's ailerons. The system's robustness was confirmed at high gravity loads ("g" loads) during turns and zero gravity aircraft manoeuvres. During the flight test, the fuel cells produced around 10 litres of pure water.

Alternative Fuels Lifecycle (e.g. Bio Fuels)

Feedstock selection



Feedstock seeding

Feedstock growth



Feedstock crop

Biofuel transportation to Airport



Feedstock conversion into Biofuel



Feedstock transportation

Biofuel uplift



Biofuel burn



Alternative Fuels Technology Readiness Level

TRL	Description
9	Actual fuel flight proven through successful mission operation
8	Full scale plant operational
7	Fuel listed in international Standards, e.g. US ASTM & UK Def Stan
6	ASTM technical evaluation passed & Engine and Airframe manufacturers approval
5	Alternative fuel for approval defined & Small scale plant operational
4	Industrial roadmap validated & Gated review point
3	Small fuel sample available from laboratory & Cradle to Grave life cycle analysis
2	Feedstock and complete Process concept identified
1	Feedstock and Process basic principles identified

Sasol 50% CTL
(in service since 1999)

Sasol 100% CTL

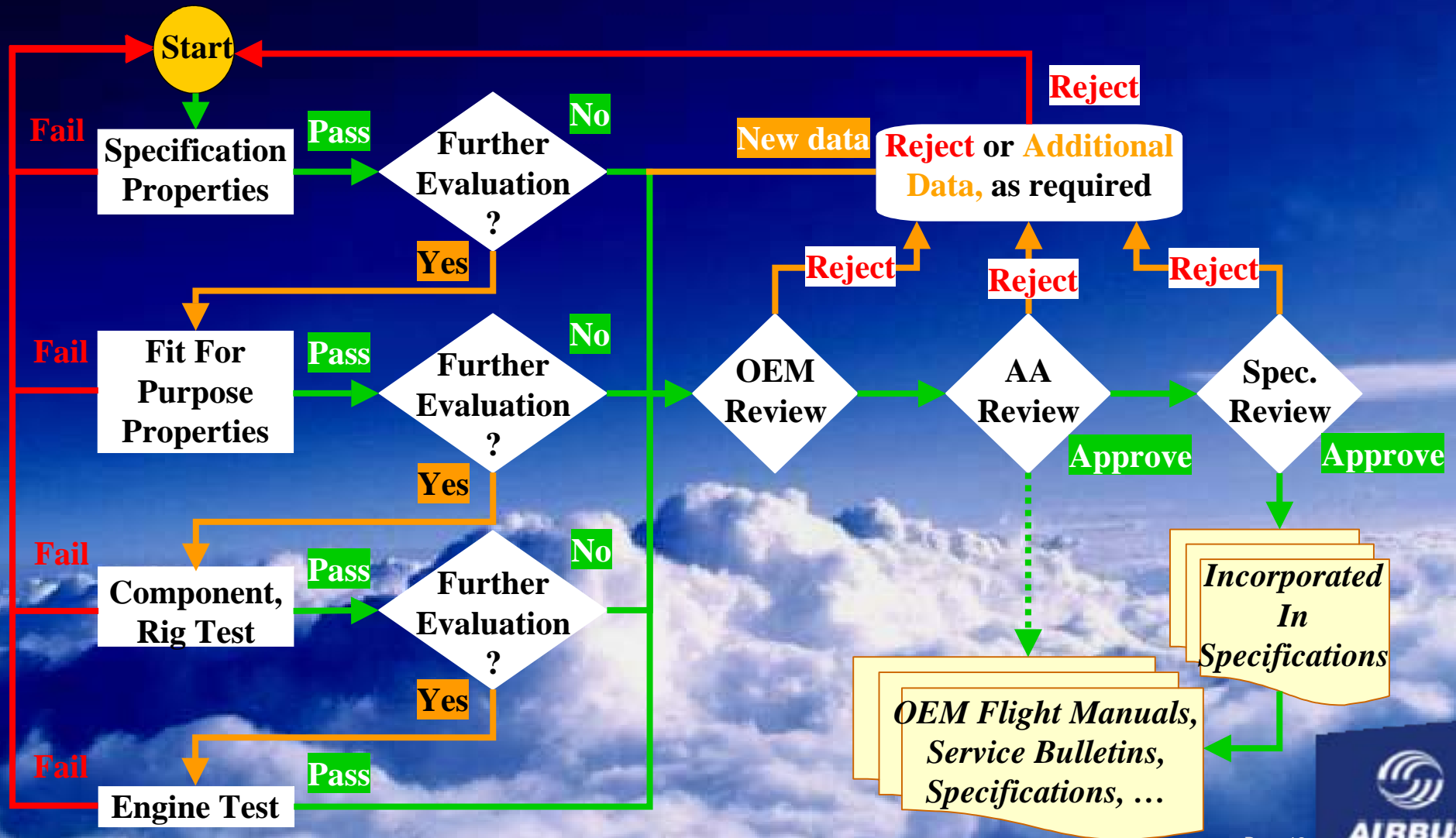
50% GTL
50% BTL

1st Generation HVO

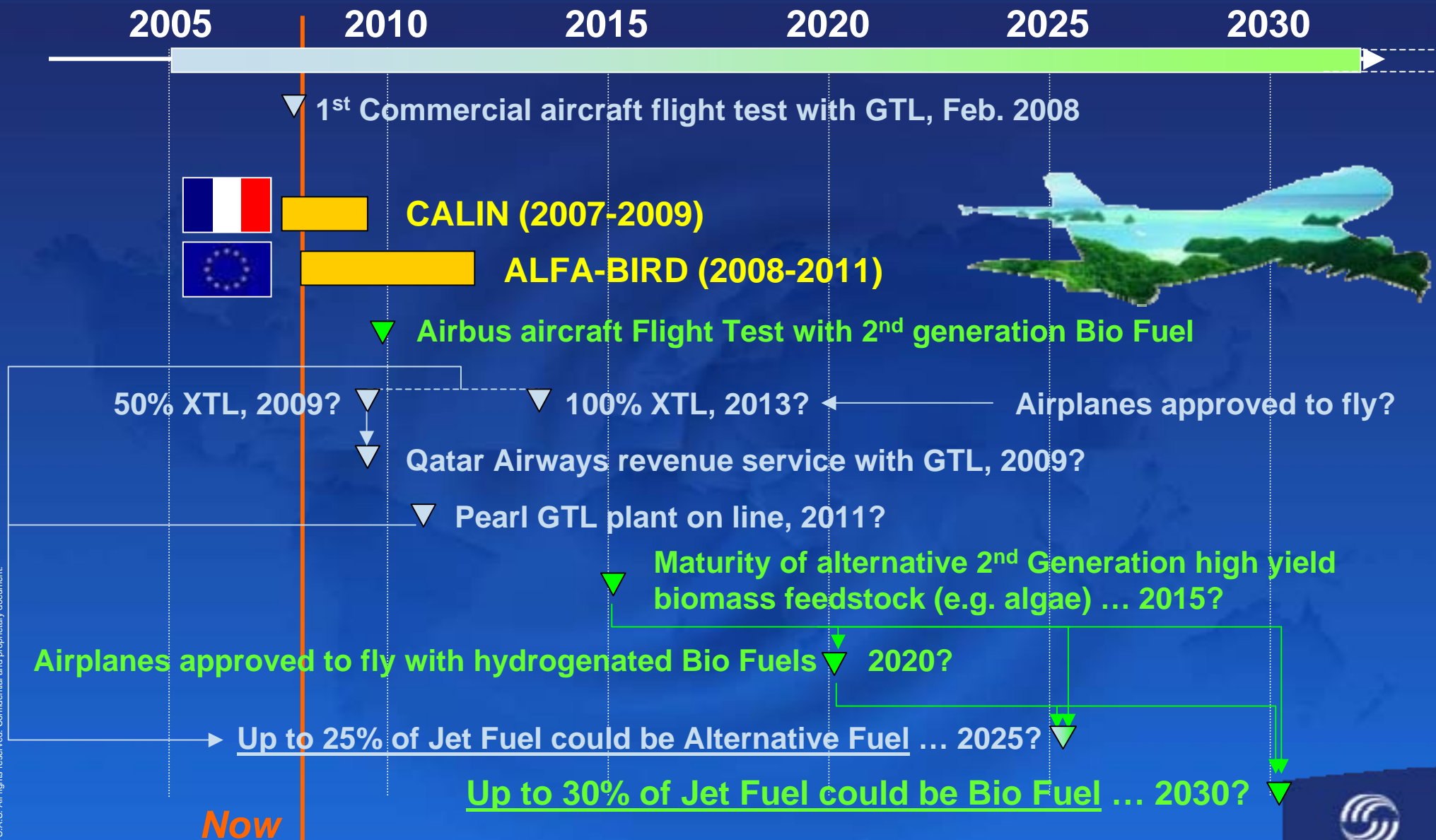
50% BTL (Algae)
HVO (Algae)

Overview of Alternative Fuels Approval

- Approval process for an alternative fuel estimated to take about 3 years

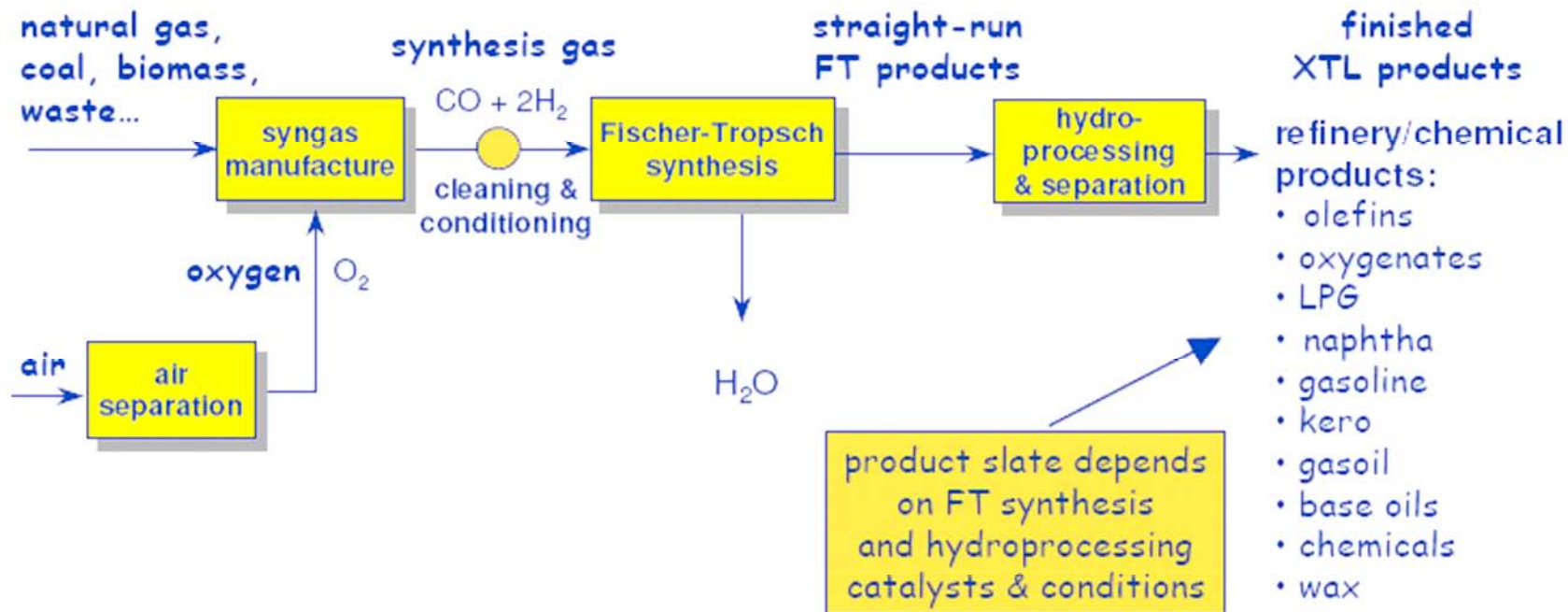


Alternative fuels Roadmap



XTL available for other transport modes

Anything-to-Liquids (XTL) is a process that converts carbon & energy containing feedstock to ultra-clean fuels and speciality products via the Fischer-Tropsch synthesis process



Shell Gas & Power

Alternative fuels...

- International & cross-Industry collaboration is essential to develop alternative Jet Fuels for commercial aviation
- Airbus is actively supporting generic alternative fuels approval for commercial aviation via agreed industry protocols.

- Cross industry consensus is that:
“any short/medium alternative fuel should be a ‘drop-in’ fuel”

