

Presented by

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Noise – a driver for Change

An Aircraft Manufacturer's View

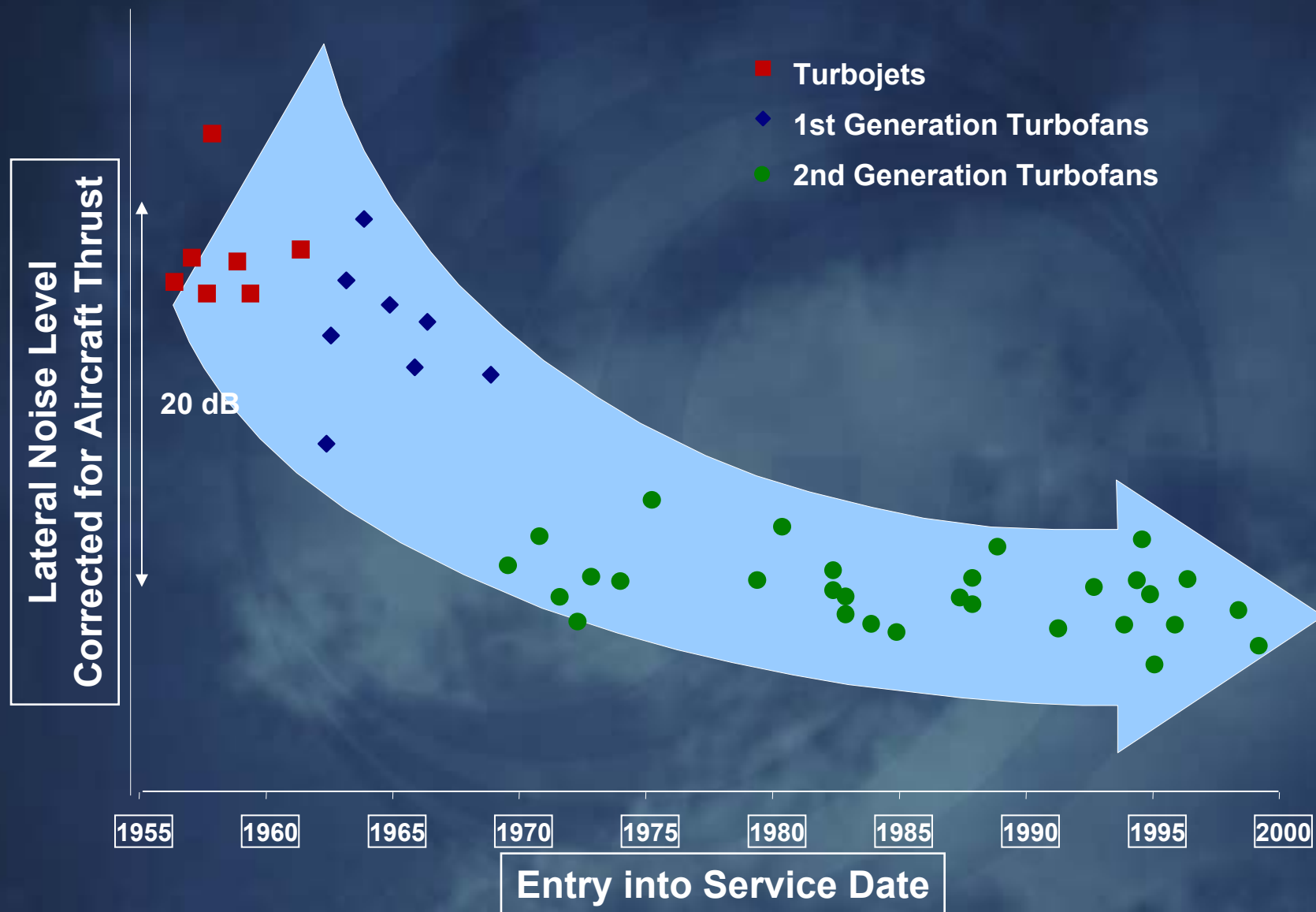
Overview

- History of noise reduction: components, from engine only to whole airframe
- Societal & economical needs: both driver and challenge
- Another step: aircraft operation
- Configuration design for noise: the balanced view

Overview

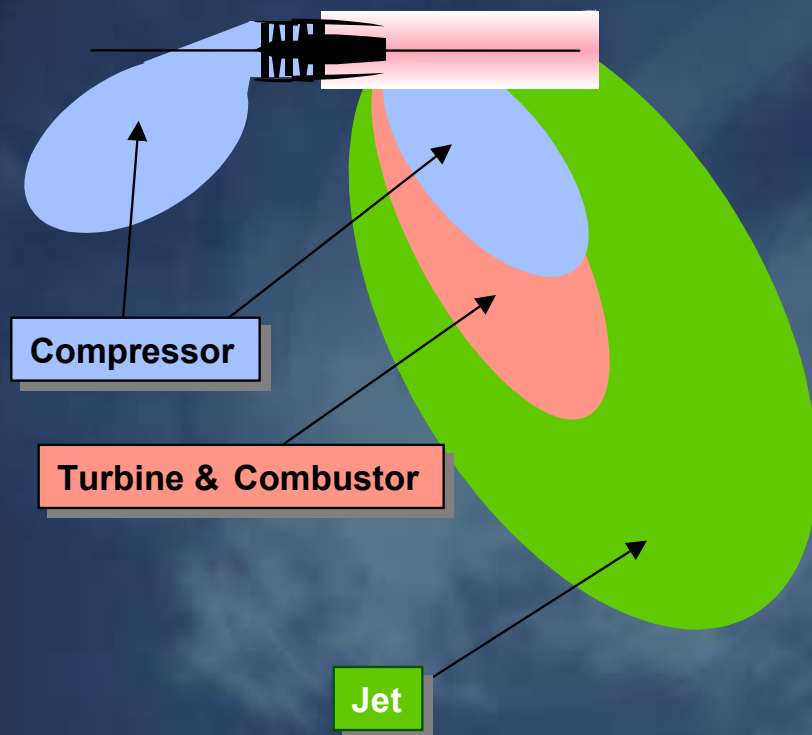
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The early domination of jet noise

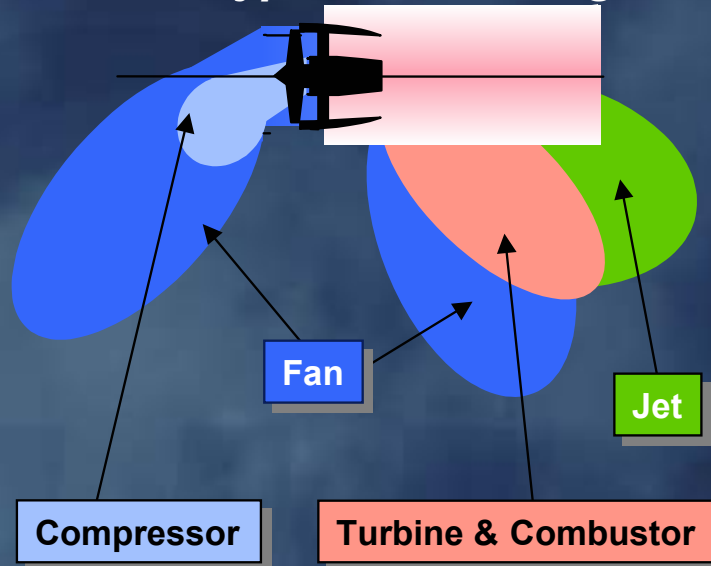


The evolution of engine noise sources

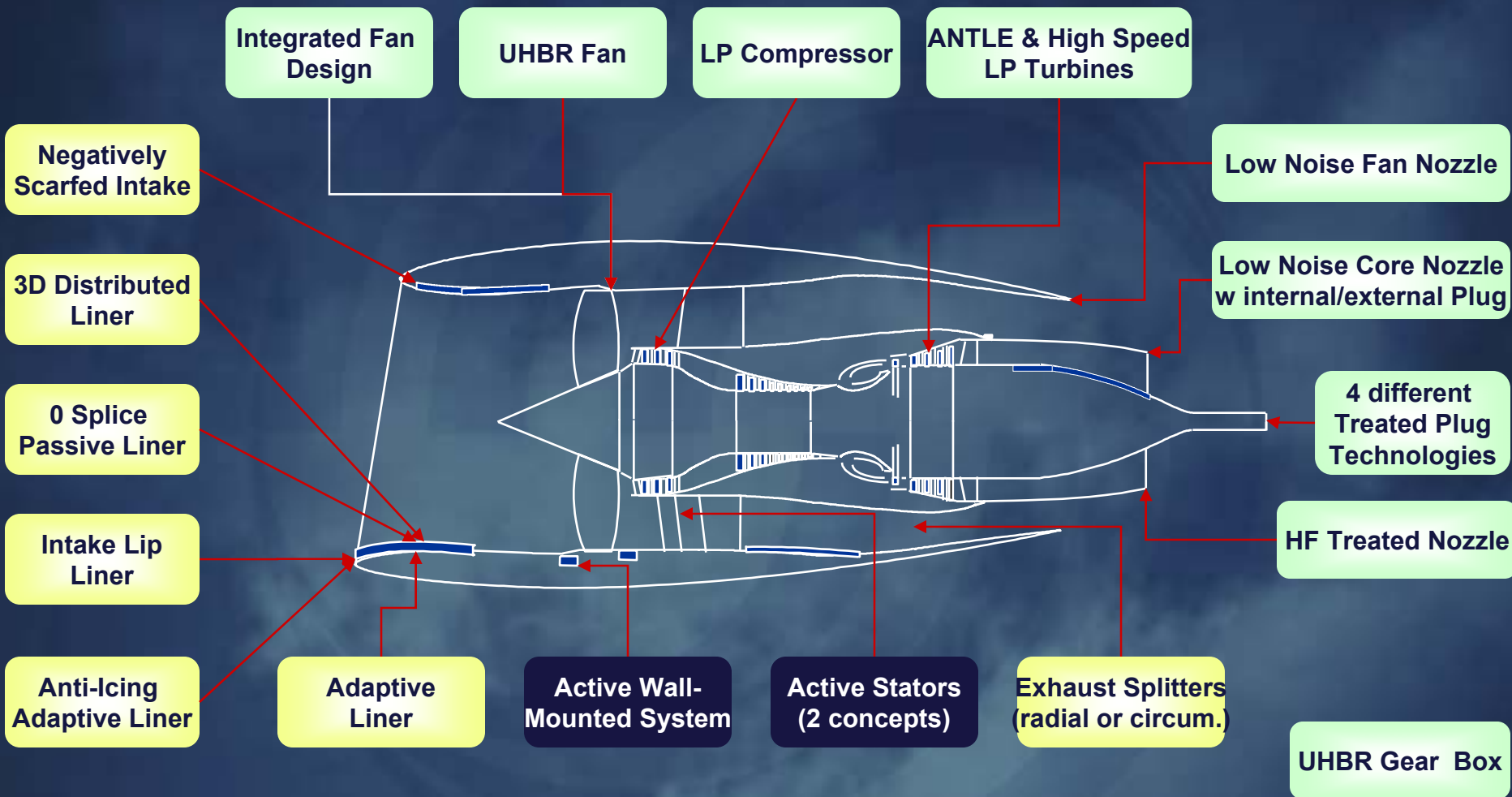
Noise of a typical 1960s engine



Noise of a typical 1990s engine



More and more technologies to address several balanced noise sources



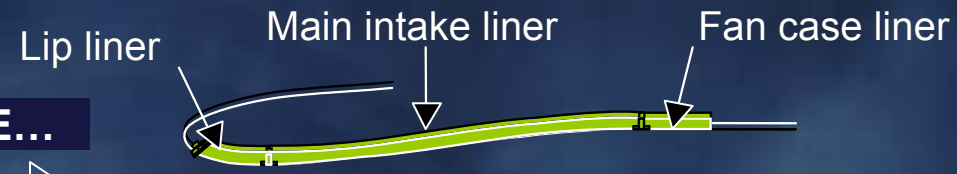
An example: Fan noise

BETTER...

Zero Splice liner
allowing the
maximal attenuation
from liner thanks to
reduced acoustic
mode scattering



MORE...

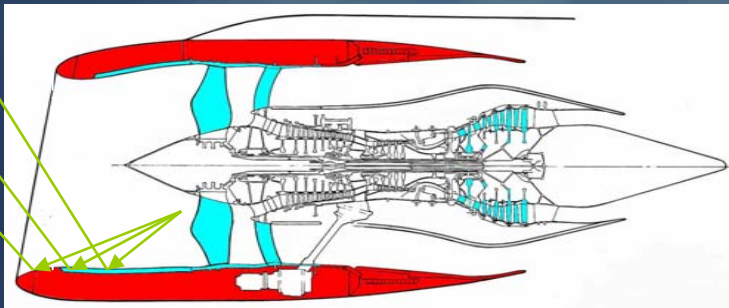


**Extension of liners and further reduction
of acoustic mode scattering
allowing maximal attenuation**



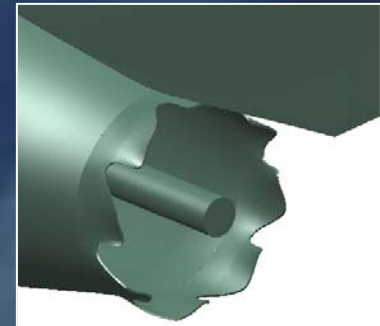
INTO A RESHAPED NACELLE...

Diversion of noise
toward sky



Negatively Scarfed Intake Principle

**...AND STILL TAKING CARE
OF EXHAUST NOISE**



**Treated primary
nozzle lip
(squid)**

Aircraft noise: A complex mix of different sources



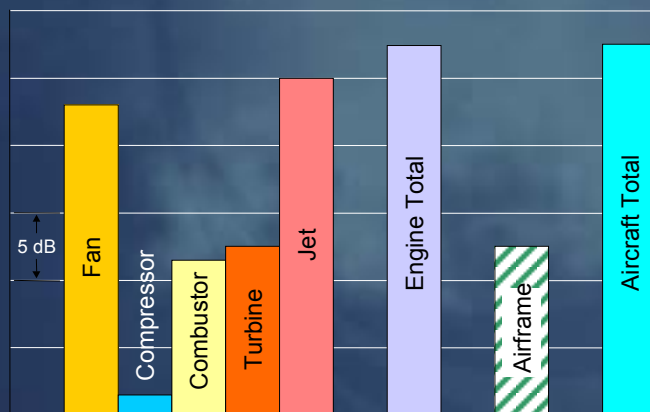
- *Take-off: Jet & Fan*
- *Approach: Fan, Airframe & Turbine*

JET MIXING NOISE

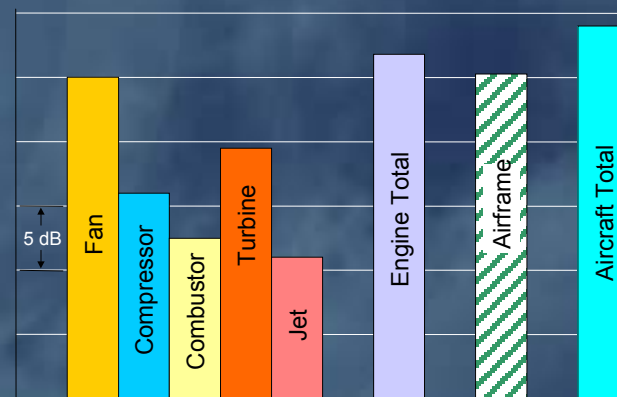
FAN, TURBINE AND
COMBUSTOR NOISE

AIRFRAME NOISE

FAN AND
COMPRESSOR NOISE

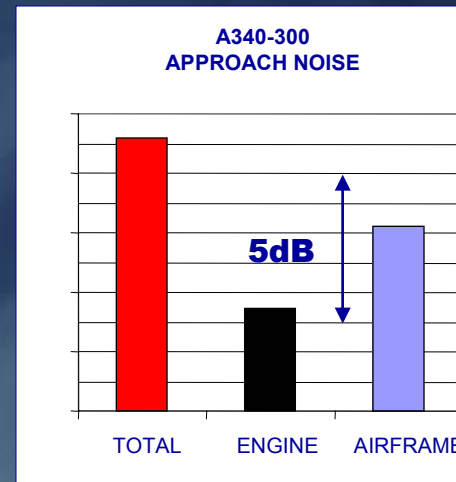
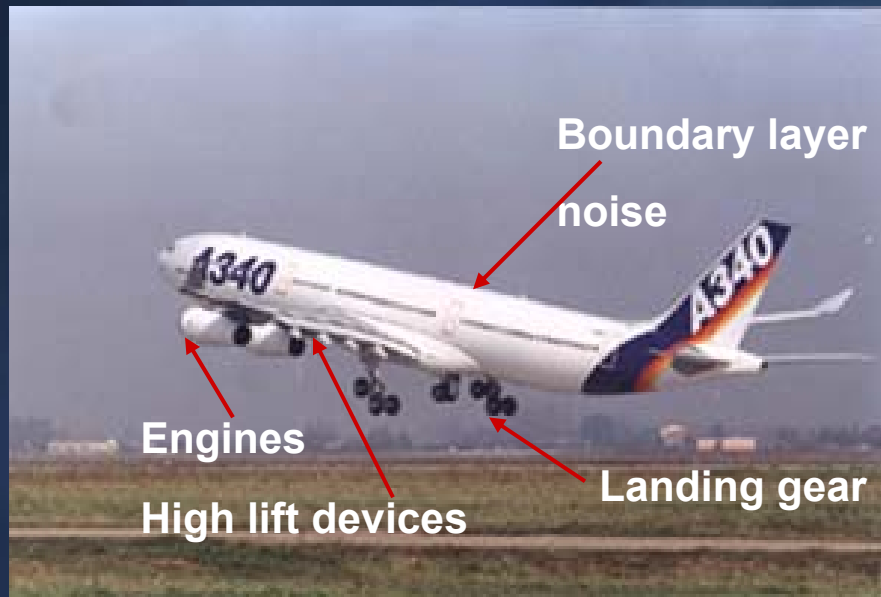


Take-off



Approach

Approach noise



IMPORTANCE OF AIRFRAME NOISE IN APPROACH

High Lift Devices:
Add-on Treatment &
Low Noise Design



Landing Gear:
Fairing & Low Noise Design

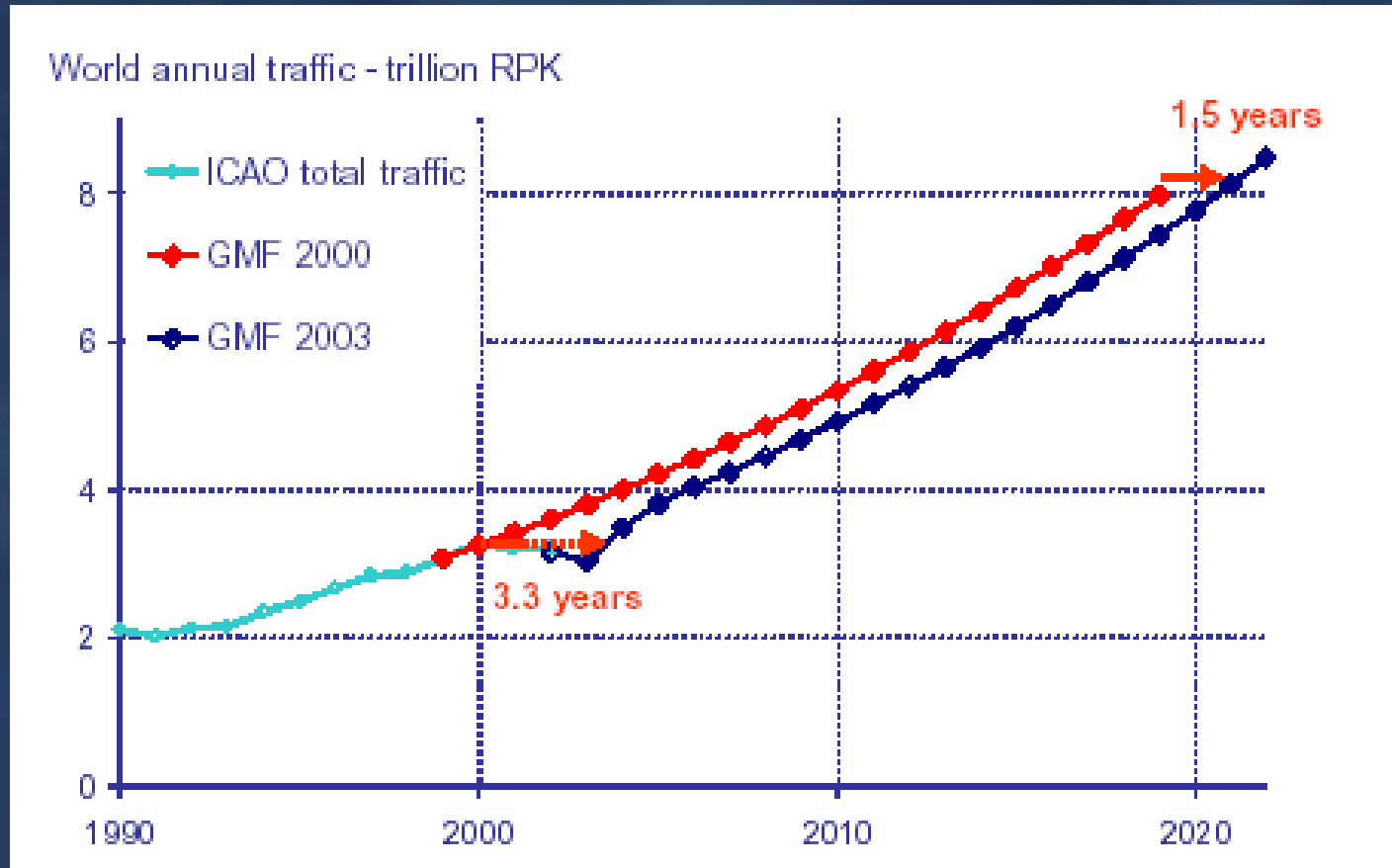


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A societal expectation for more travelling

Revenue Passenger Kilometer (RPK) is forecasted to triple from year 2000 to 2020

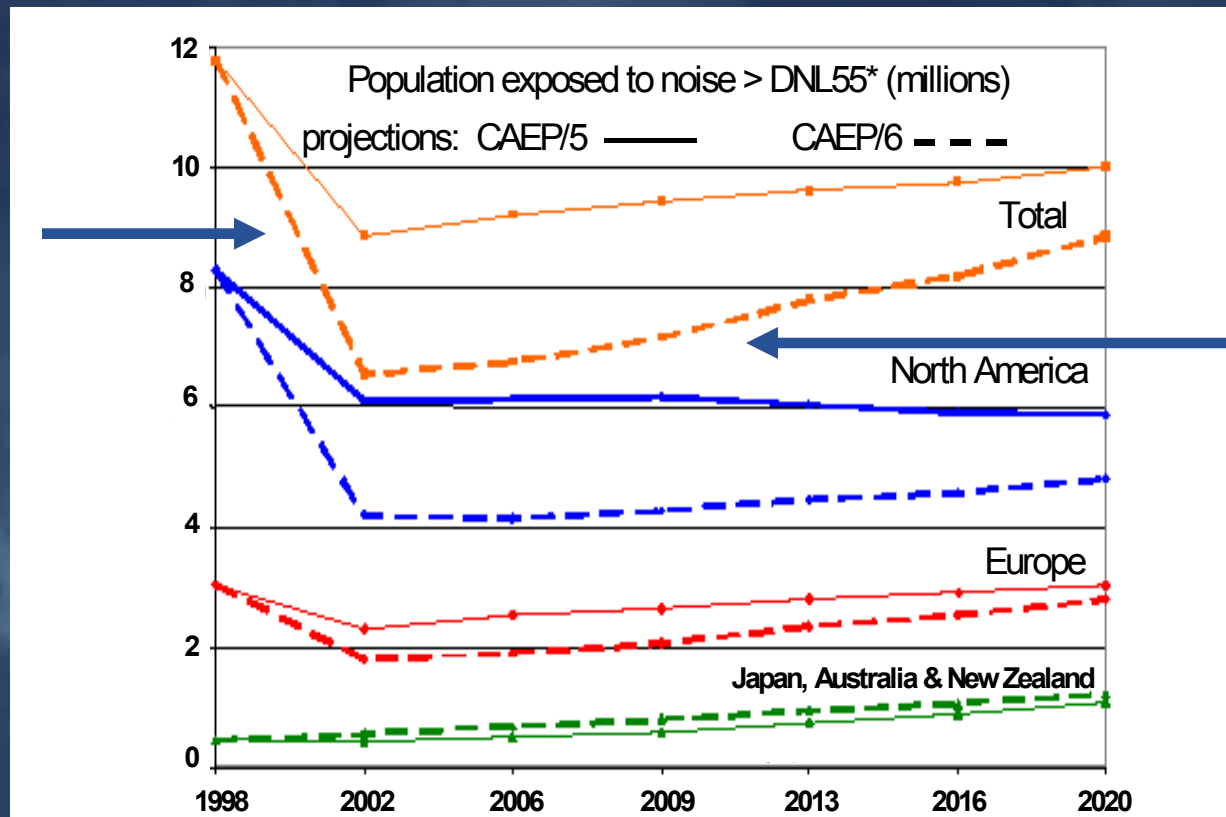


The Airbus Global Market Forecast may also be found on the Internet at <http://www.airbus.com>

An increased community noise?

At the same time the traffic increase may lead to growing noise impact

Removal of
Chap II a/c
& 9/11 effect



Traffic growth

$$* Ldn = 10 \log \left[\frac{1}{\Delta t} \left(\sum_{\text{day}} 10^{L/10} + 10 \sum_{\text{night}} 10^{L/10} \right) \right]$$

Noise Reduction - The Challenge

High pressure on aircraft noise:

- regulation
- “QC” system,
- landing fees, night time operation,
- public uproar, airports extension...

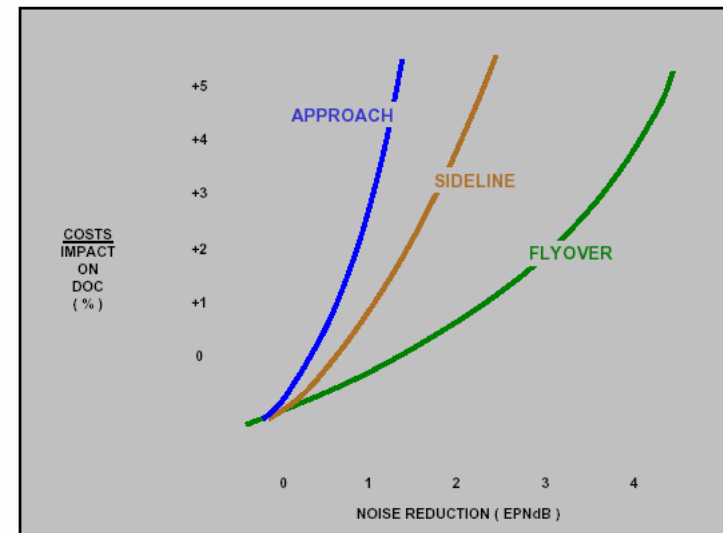
Noise issue might be limiting the foreseen traffic growth (tripling by 2020)

Pushing further existing technologies has strong negative operating cost impact

Thus: Strong demand for cost friendly low noise technologies



IMPACT OF FURTHER NOISE REDUCTION
USING AVAILABLE TECHNOLOGY (ICAO Study)

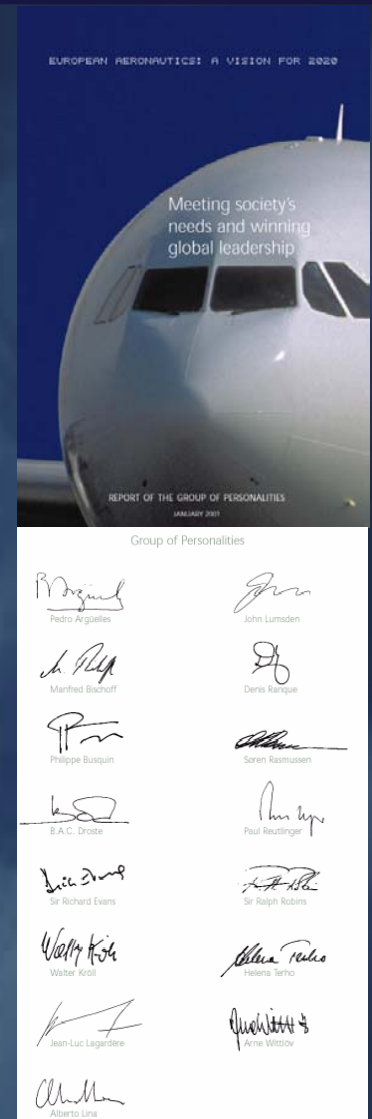


Reference Data - ANDES Study

Vision 2020

The challenge has been transformed in the
Vision 2020 Goals:

- *Reduce CO2 by 50%*
- *Reduce NOx by 80%*
- ***Reduce perceived noise by half***
- ***Eliminate noise nuisance outside airport boundaries***
- *Substantial cuts in operating costs*
- Five-fold reduction in accident rate
- Drastic reduction in the impact of human error
- 99% of flights within 15 minutes of timetable
- New standards of quality and effectiveness
- Halve the time to market
- Improve synergies between civil and military research

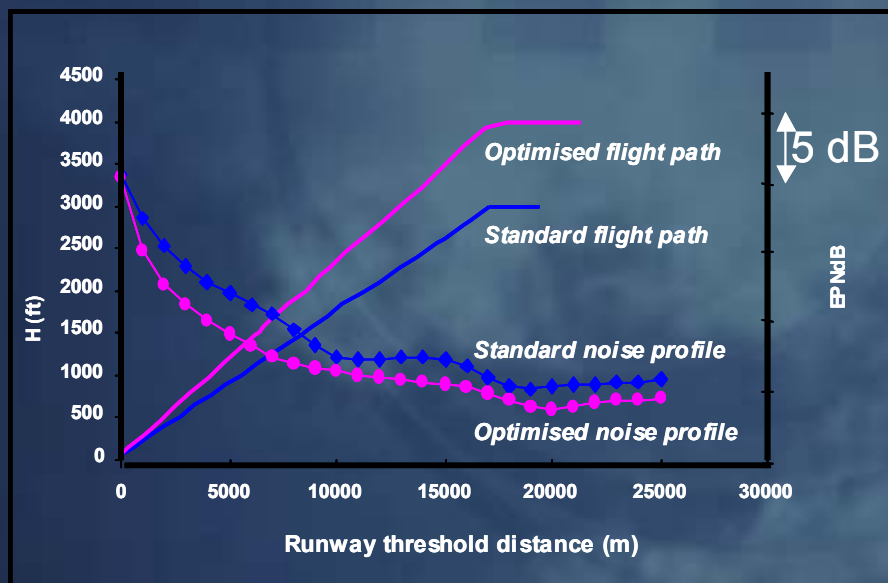
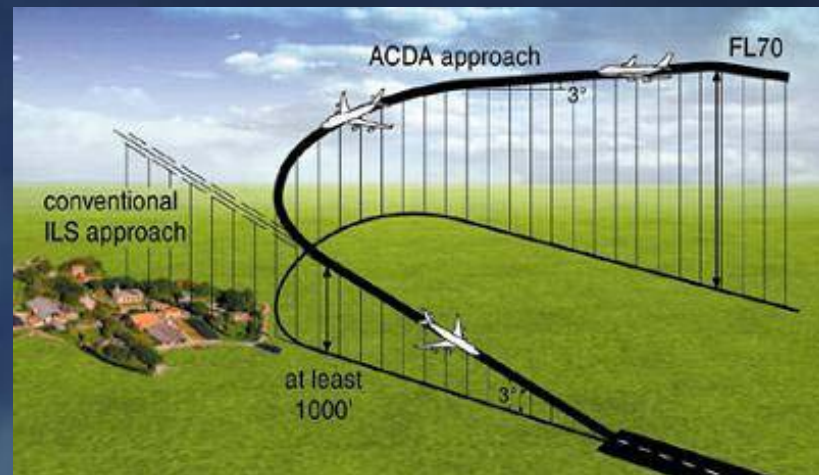


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Noise abatement procedures

Approach



Parameters to be optimised

- Increased ILS glide interception altitude
- Delaying stabilisation of landing configuration
- Flap setting
- Increased ILS glide slope
- Continuous descent approach

Aircraft Operation

Noise abatement procedures require:

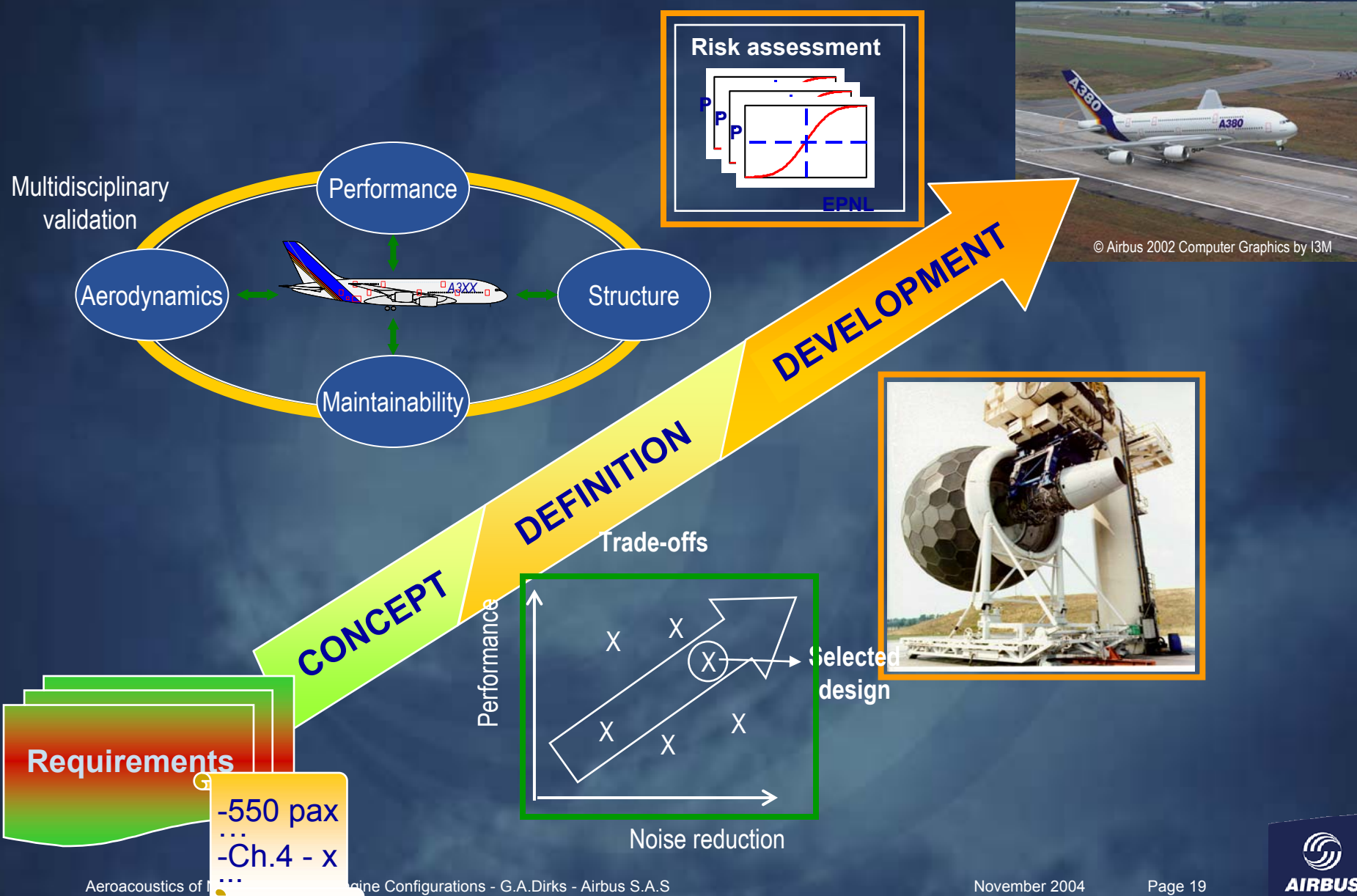
- New functionalities such as A380 FMS handling thrust management for low noise
- New aircraft capabilities, i.e.: High lift systems enabling steeper trajectories without increased component noise
- ATC / ATM handling the new procedures



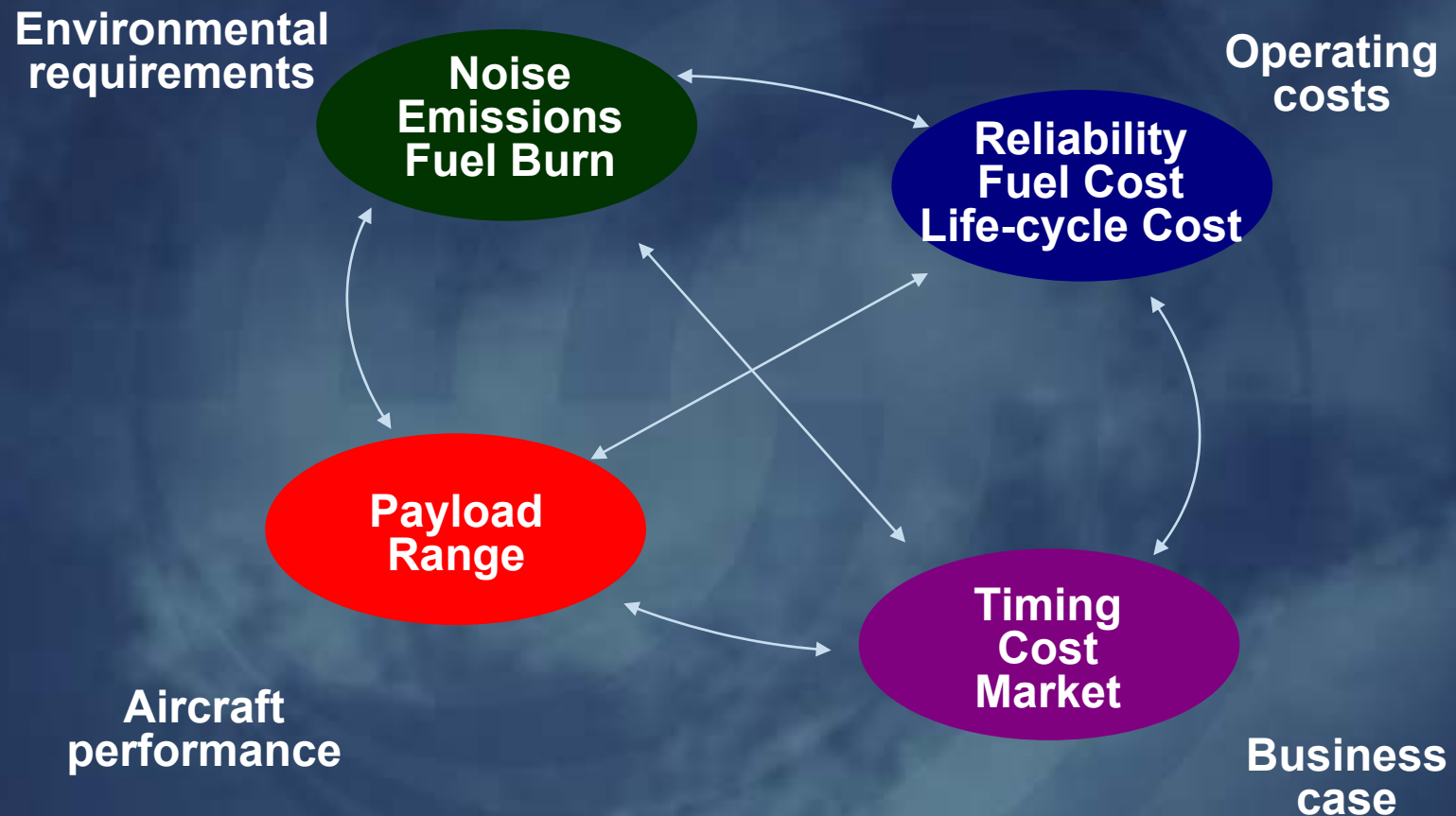
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Noise: An integral part of the design process

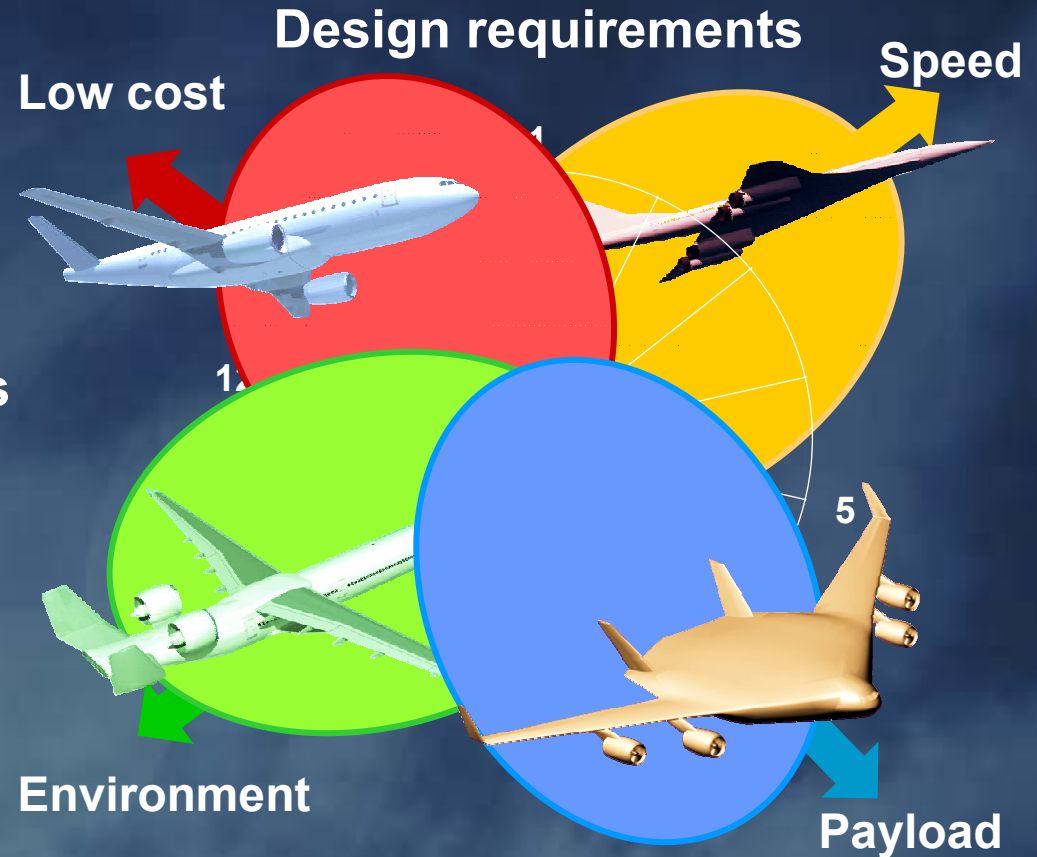


Aircraft noise needs to be balanced with other aircraft design requirements



Unlocking today's constraints: aero performance

Future capabilities : driven by a family of concepts tailored to fit specific sets of requirements



The idea is to select concepts to explore the most relevant capabilities and meet the widest range of challenges

Important: these are not intended to be future Airbus products but extreme configurations to develop our capabilities

Low noise configurations

Airbus recognize a need to investigate these configurations in order to reach 10 dB noise reduction per aircraft operation



Environment



Masked sources

- inlet fan
- combustion
- turbine

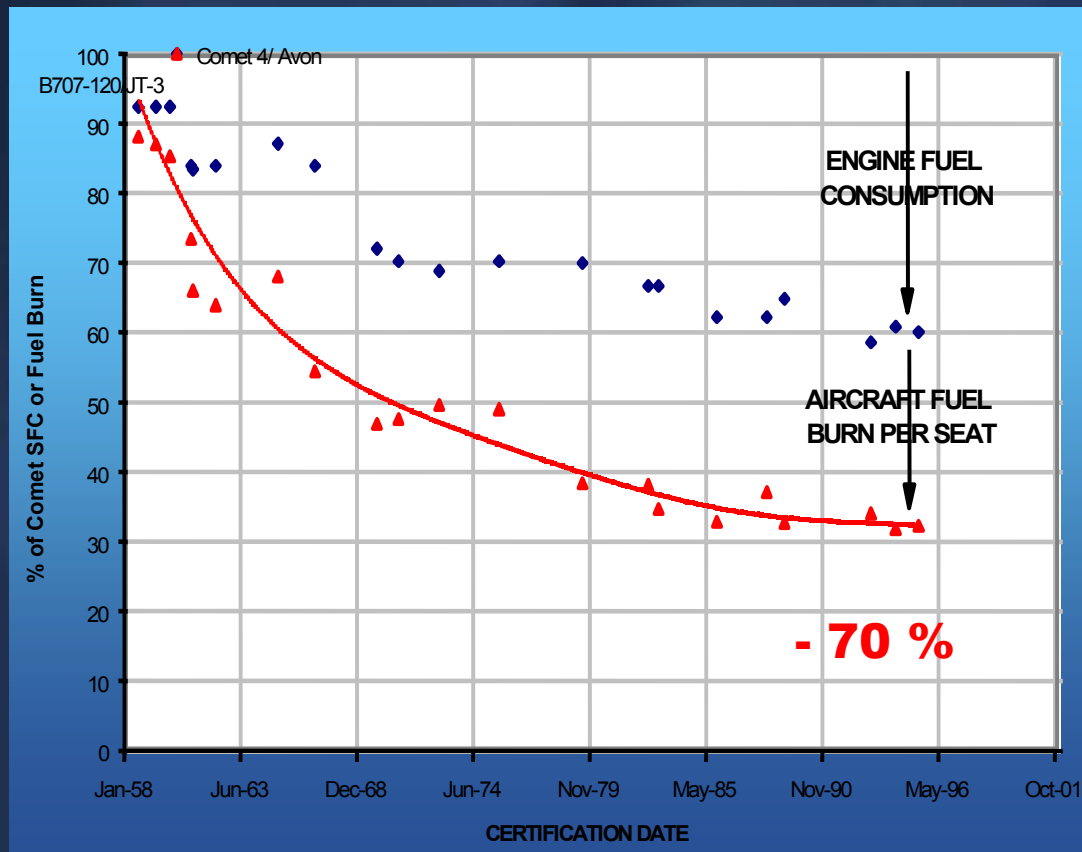
Masked sources

- inlet & aft fan
- compressor
- combustion
- turbine



Vision 2020 - Emissions

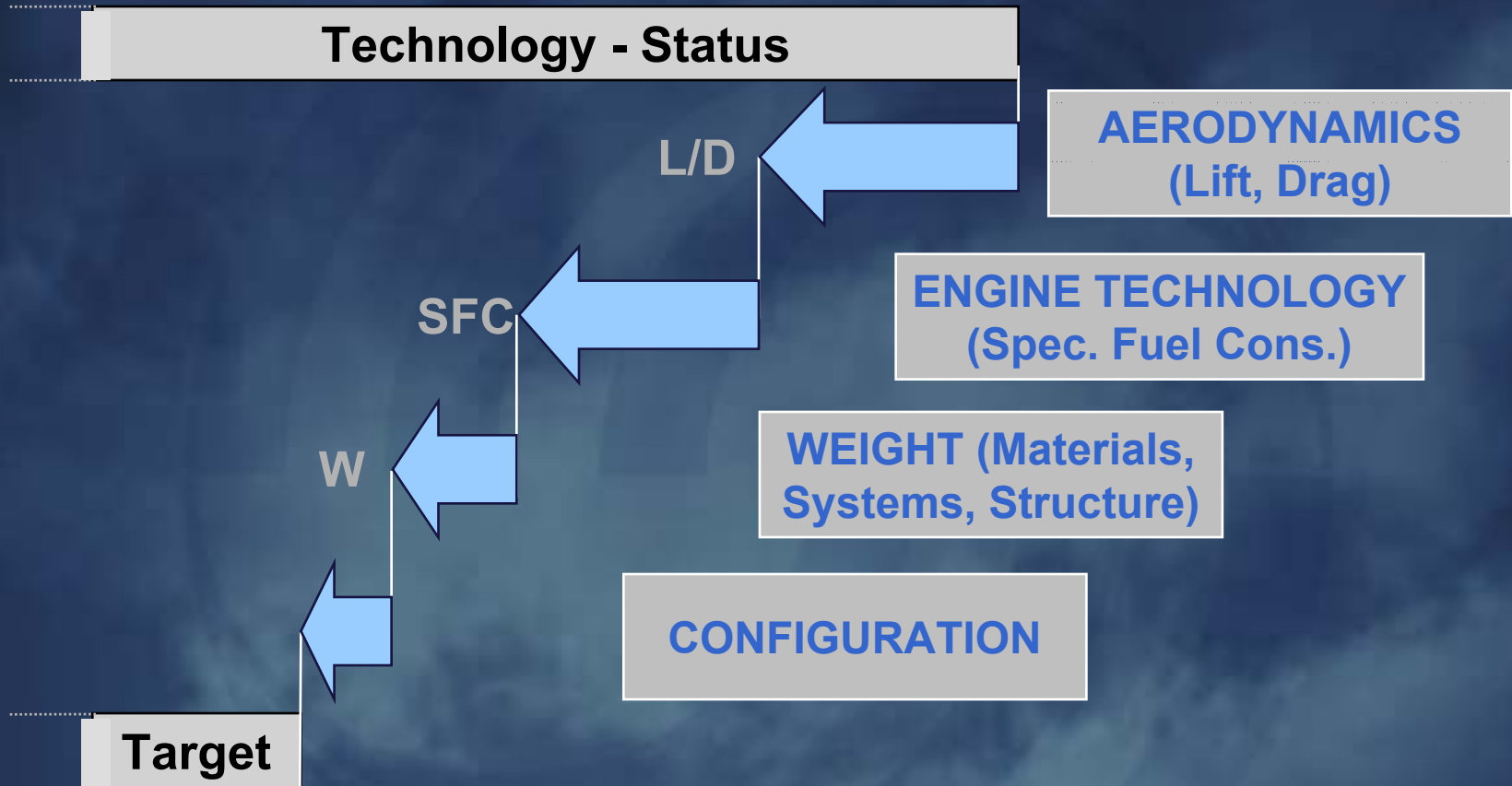
Despite much improvements,



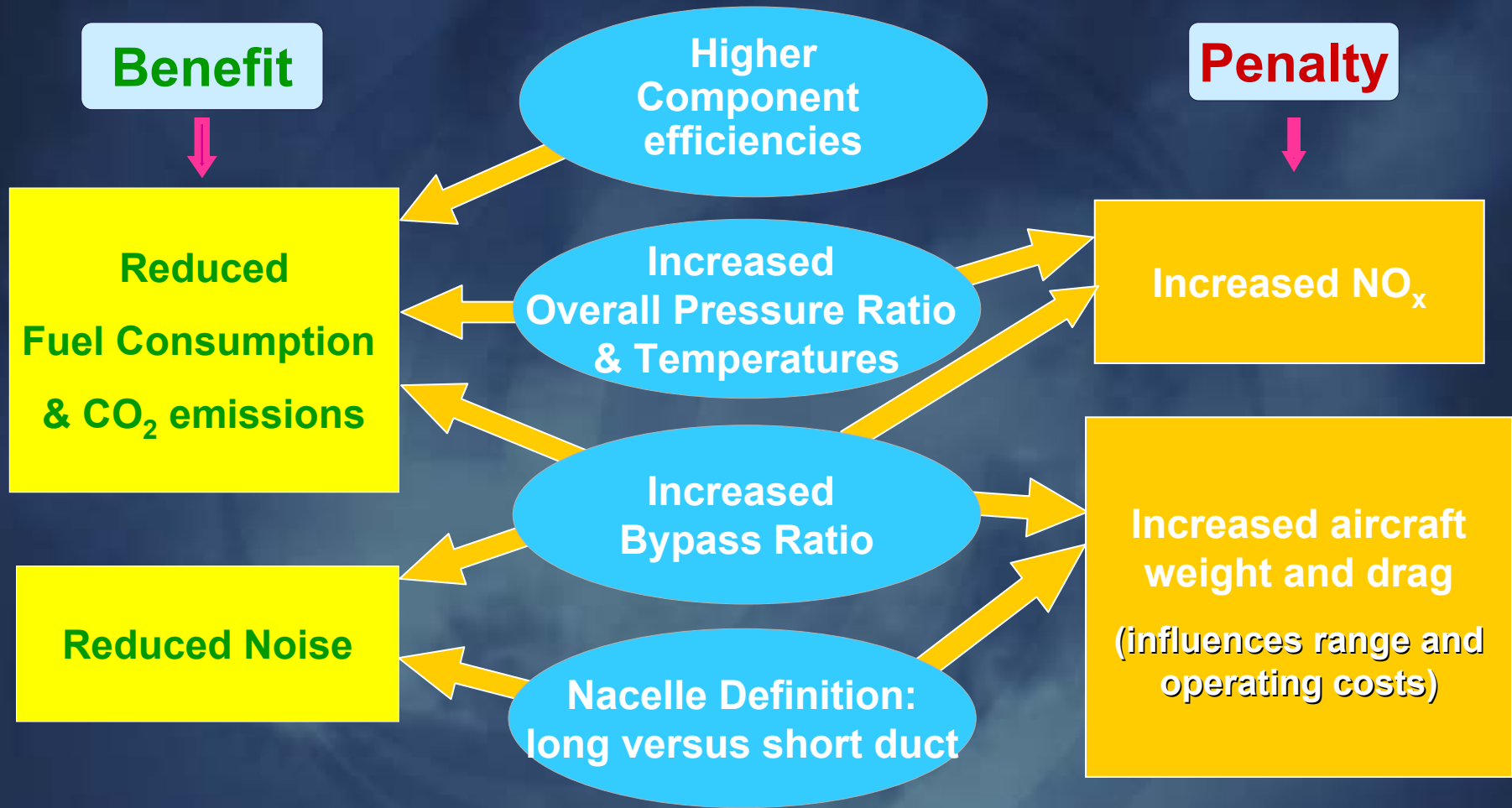
We are committed to go even further

- **Reduce CO₂ by 50%**
- **Reduce NO_x by 80%**
- *Reduce perceived noise by half*
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An Example: CO2 Reduction Potential for Conventional Aircraft



Noise & Gaseous Emissions From Engines: Friends & Foes



Low Noise Configurations & Gaseous Emissions

What is the breakdown of potential emissions reduction for these aircraft?

Are these configurations conflicting with emissions reduction targets compared to conventional configurations?

What are the possible trades offs if needed?

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