

Fuel efficiency of commercial aircraft

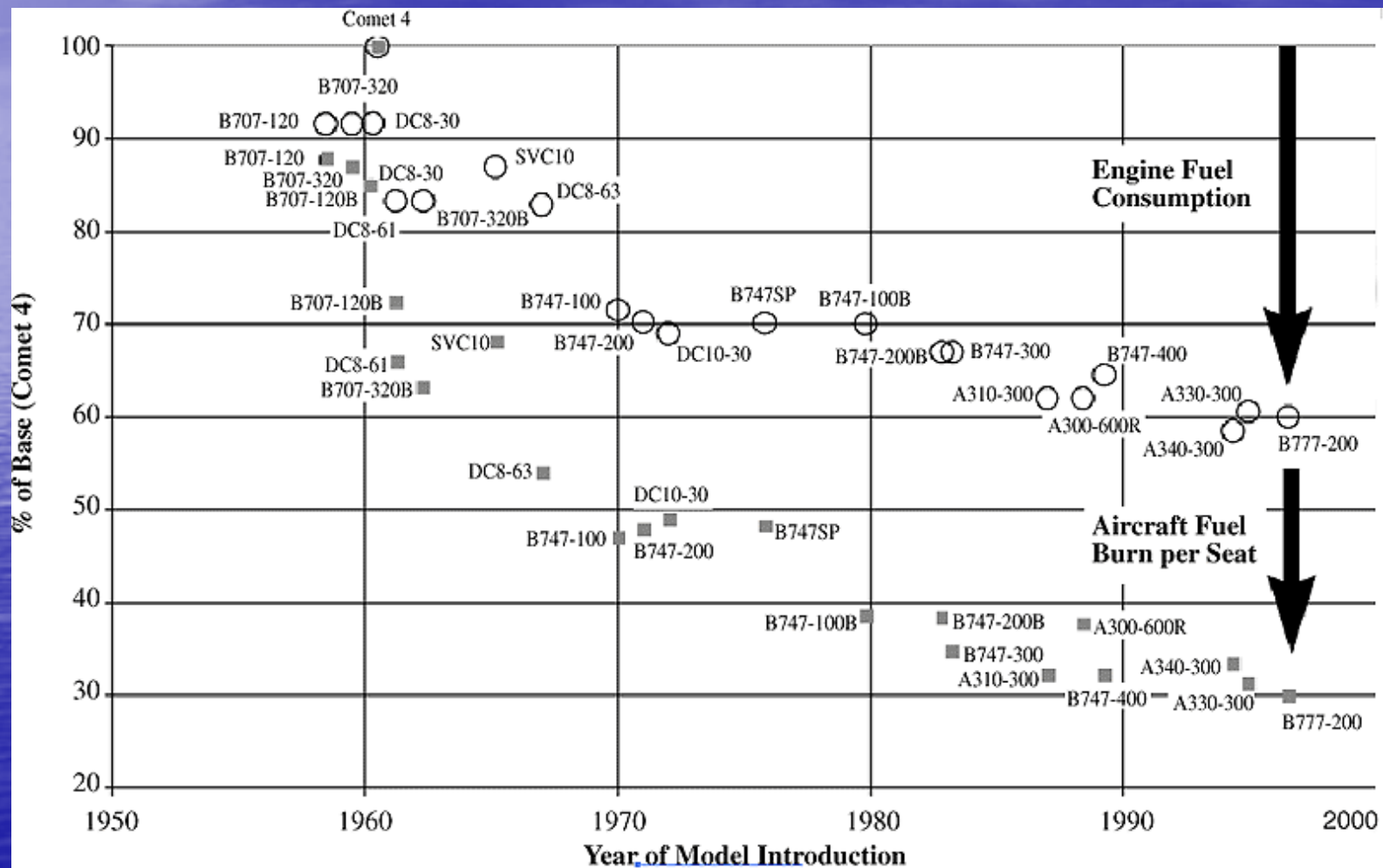
An overview of historical and future trends

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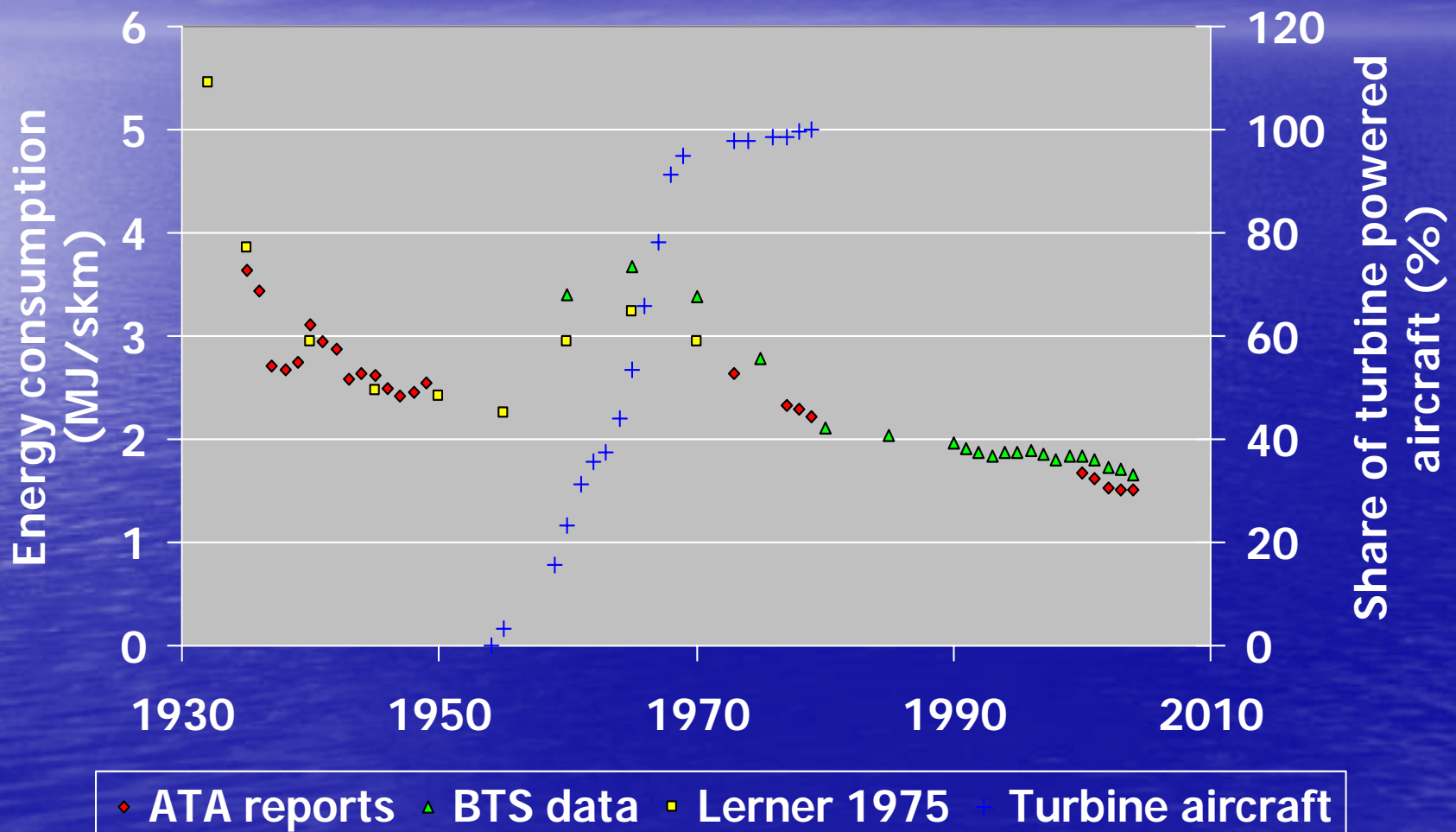
(Mis-)conceptions fuel efficiency

- Per seat-km fuel consumption is now 70% less than of early jets (IPCC)
- Continuous improvement fuel efficiency of jets (IPCC)
- Aviation industry always uses technology geared to maximum fuel efficiency (Bisignani/IATA)
- Efficiency improvement is a constant % per year (IPCC, Lee)
- In 2020 new aircraft will be 50% more efficient (Lee).

The original IPCC graph



Macro analysis



Why were jets introduced?

- Lower fuel price
- 80% higher average speed
- Slightly higher range
- Higher passenger comfort
- Lower direct operating cost
- Less vulnerable to weather conditions

(New) conceptions fuel efficiency

- Modern jet fuel consumption/seat-km is 55% less than of early jets (IPCC), but only 0-15% less than last piston-engined airliners. Macro efficiency development between 1955 and 2000: -25%
- Discontinuity in fuel efficiency of aviation due to introduction of the jet engine
- Fuel efficiency is only one of a set of design features to be considered by aircraft designers
- Efficiency improvement follows a powercurve showing gradually reduced annual improvements
- In 2040 new aircraft may be 20-25% more efficient, much less than industry proposed targets like 50% in 2020.

Discussion

- Will peak-oil petroleum prices bring the fuel cost change required for introduction of high-speed propeller/propfan and fuel savings of up to 50%?
- Is 50% saving in 30-40 years enough to compensate for air transport growth?
- Is another speed increase (supersonic, space travel) at hand and will it cause a new backward discontinuity in fuel efficiency?
- How about mitigating climate change? What technological developments are required and what economic incentives may induce these?