



ROYAL COMMISSION ON ENVIRONMENTAL POLLUTION

**“THE ENVIRONMENTAL EFFECTS OF CIVIL
AIRCRAFT IN FLIGHT” (2002)**

“I thought it was a rather thin report and they had not done as much work as they might have. This report is not the fruits of many years research. It’s a gallop around the course”

- Alistair Darling



STARTING POINT FOR RCEP REPORT

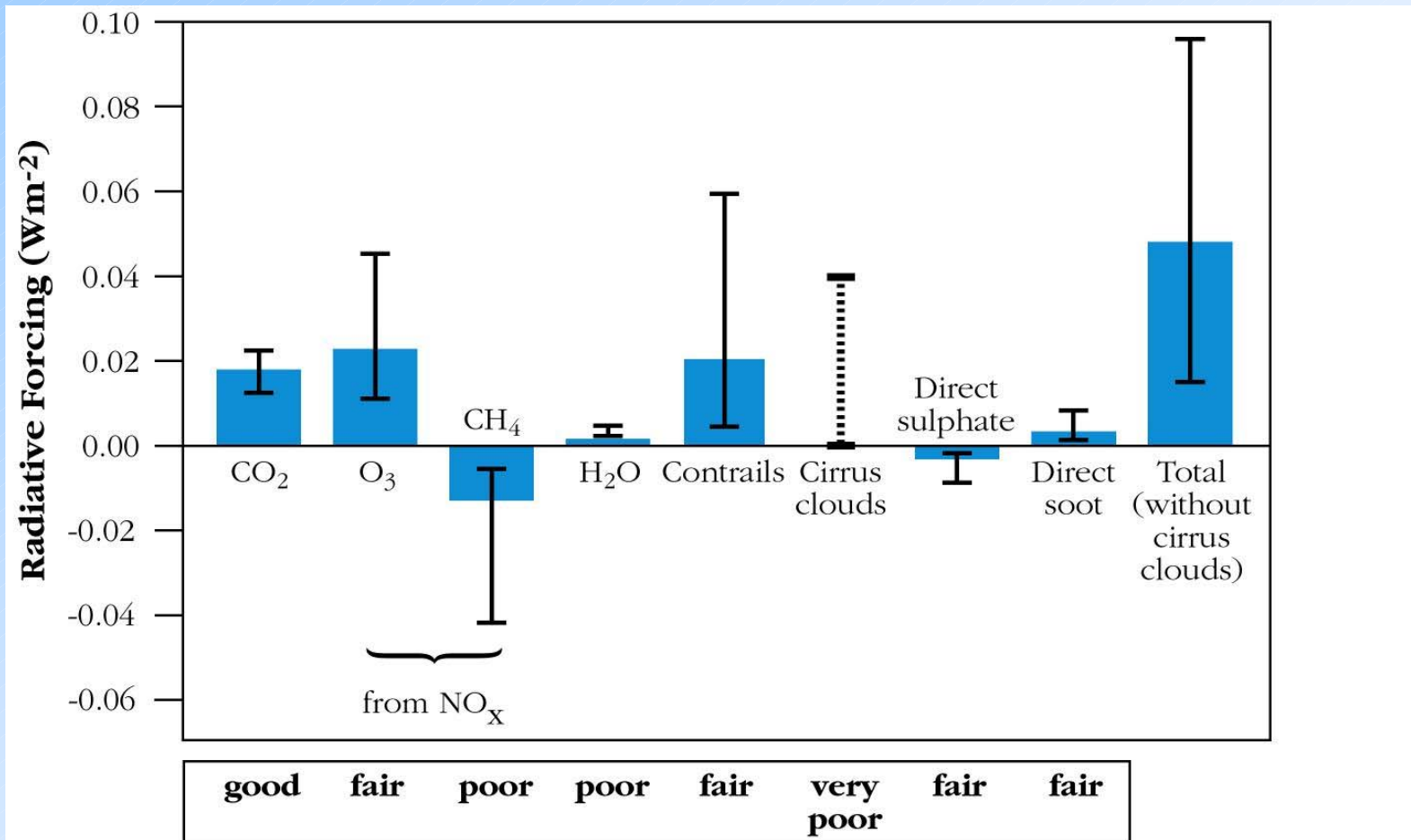
- **It is a property of aircraft that they fly...**



RCEP CONCLUSIONS 1

- **The analysis in the 1999 IPCC Report is sound.**
- **Research since then has, if anything, revealed even greater uncertainty.**
- **Total contribution of aircraft to radiative forcing is at least 2.7 times that of carbon dioxide emissions alone.**

RADIATIVE FORCING FROM AVIATION EFFECTS IN 1992





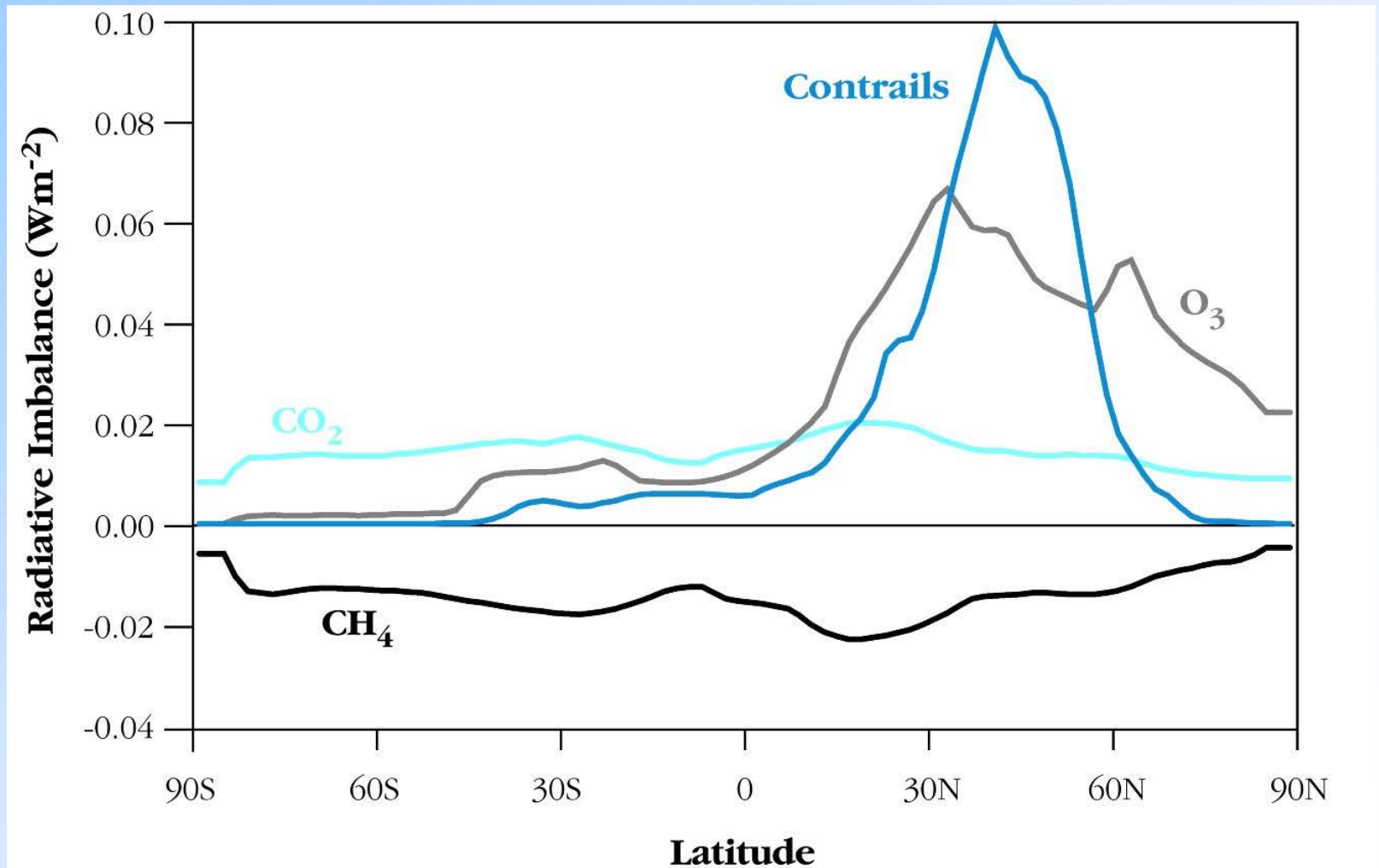
CONTRAIL AND CIRRUS CLOUD

- Jet engine emissions can cause Condensation Trails (Contrails), like seeing one's breath on a cold day
- If the air is moist, they can persist and spread into cirrus cloud
- There is increasing indication that aviation-induced cirrus will be a significant contributor to global warming.
- Modern weather forecasting techniques could be used to route aircraft away from the most sensitive areas, minimising climate impact





RADIATIVE IMBALANCE AT THE TROPOPAUSE AS A FUNCTION OF LATITUDE





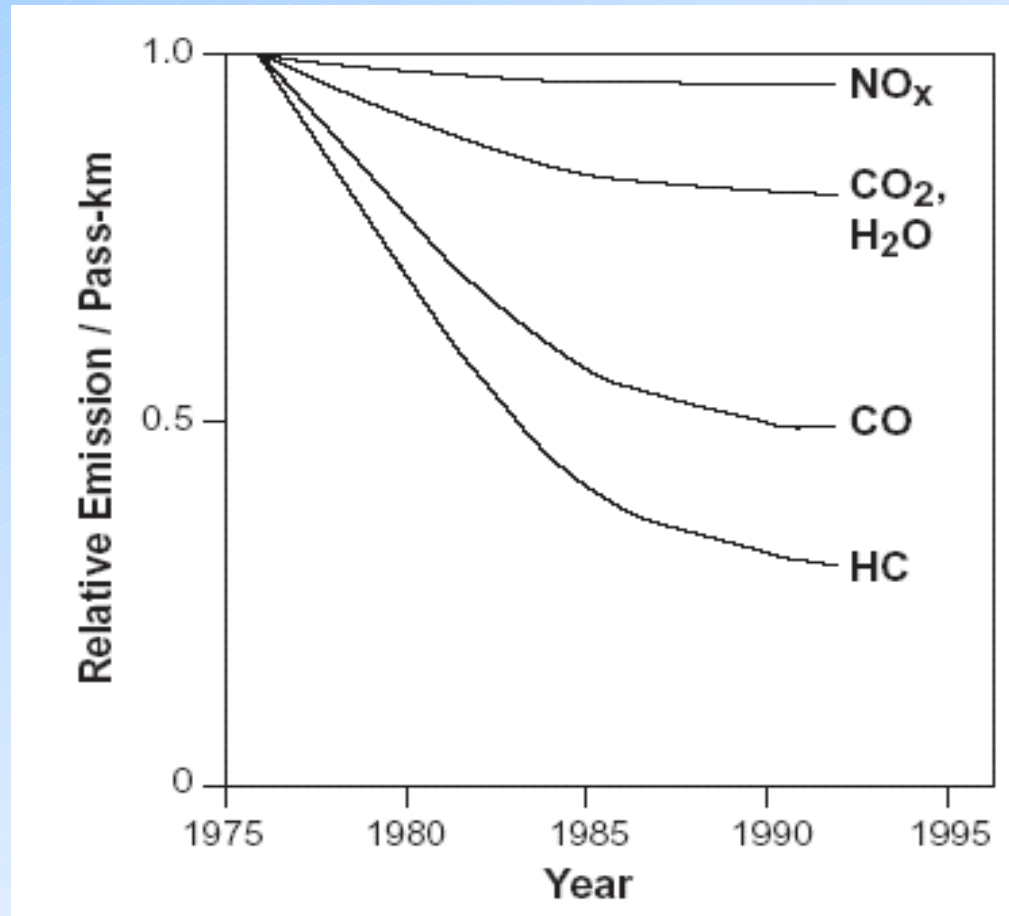
RCEP CONCLUSIONS 2

- **Even the industry's own most optimistic targets for technological advance will not offset projected growth.**
- **Short-haul flights (less than about 2000 km; i.e. 1000 nautical miles) are disproportionately damaging.**



TECHNOLOGICAL IMPROVEMENTS SINCE 1975

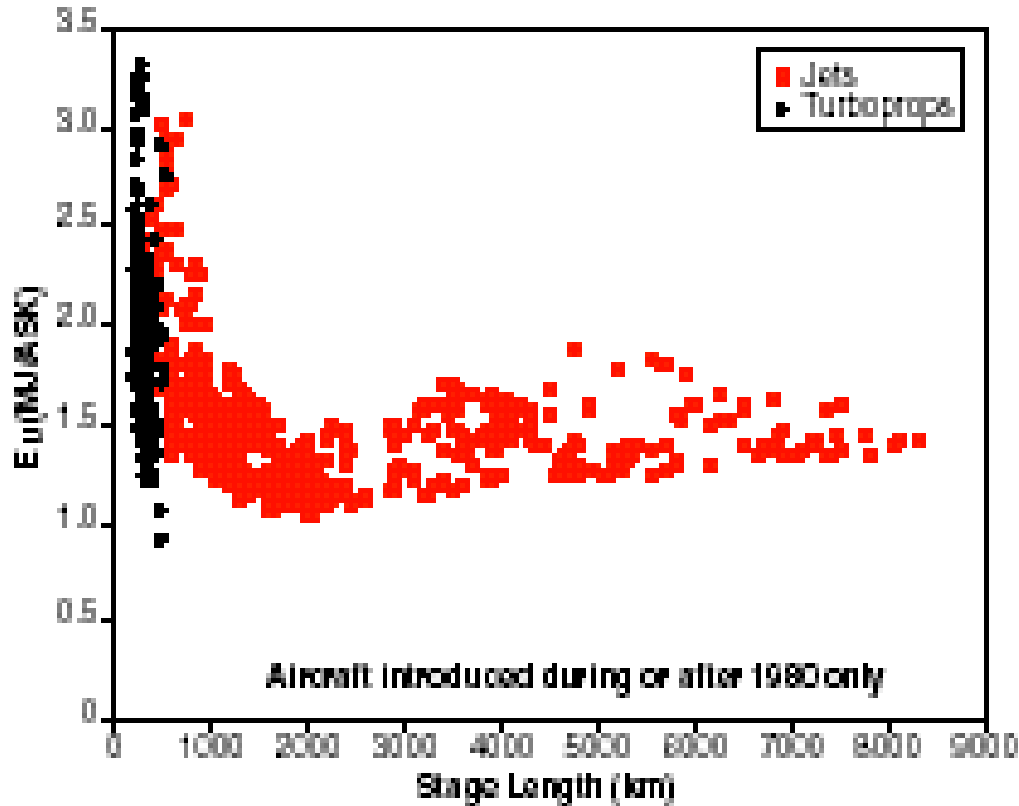
(Boeing data, courtesy of Prof. Ian Waitz)



[Fleet cruise emissions per passenger-kilometer (from DuBois at Boeing).]

EFFECT OF STAGE LENGTH ON SPECIFIC ENERGY USAGE

(Babikian, Lukachko & Waitz, J.Air Transport Management, Nov.2002)





SOME BROAD COMPARISONS

In terms of contribution to radiative forcing:

- Long-distance air travel is equivalent to 1-2 people travelling in a passenger car.
- Per passenger-km, modern high-speed rail travel is at least an order of magnitude less damaging.
- Per tonne-km, rail freight is one to two orders of magnitude less damaging than air freight.
- Marine freight is a factor of 2 or more less damaging than rail freight.



HYDROGEN AS A TRANSPORT FUEL

- **Over the whole fuel cycle, hydrogen gives benefits if it is used in fuel cells; i.e. for electric transmission for motive power.**
- **Per energy yield, hydrogen represents about a quarter the weight but about 2.5 times the volume of kerosene.**
- **Larger volume and lower weight mean that hydrogen-powered aircraft would fly at higher altitudes.**

Conclusions

- **If hydrogen does become used as a transport fuel, it will be used for surface transport.**
- **Kerosene will remain the fuel of choice for aircraft.**



“The Commission’s remedy was to try to price people off planes. I think they might have some difficulty selling that proposition.”

- Alistair Darling



AIR TRANSPORT IN CONTEXT

Contribution to global climate change of passenger flights within, to and from the UK:

YEAR	MILLION TONNES CO ₂	% OF UK	
		EMISSIONS	RADIATIVE FORCING*
2000	30	5	12
2020 ⁺	55	10-12	23-26

* Based on “multiplier” of 2.7 for aircraft emissions
+ Assuming “low” growth and significant technological advance, with 8 to 14% reduction in other sources.

SOURCE: “Aviation and the Environment: using economic instruments”, HM Treasury and department for Transport, March 2003.



AIR TRANSPORT AND ENERGY POLICY

Following the recommendations of the Royal Commission, the 2003 White Paper has confirmed the policy of achieving 60% reduction in UK carbon dioxide emissions by 2050.

The projected growth in air travel would represent not less than the remaining 40%.

...??



RCEP CONCLUSIONS 3

- **Airport capacity should not be expanded unless/until the contribution to climate change is brought into an effective policy.**
- **Technological advances alone will not offset unlimited growth.**
- **Some form of demand management will be needed.**