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Institute for Aviation and the Environment

Mitigating Aviation Carbon Dioxide Emissions: An Analysis for Europe

Lynnette Dray, Antony Evans, Tom G. Reynolds & Andreas Schäfer

Institute for Aviation and the Environment, University of Cambridge

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Air Transport in Europe

- Intra-European RPK growth of ~3%/year forecast (Airbus, Boeing)
- Several EU emissions targets which affect aviation
  - Emissions trading scheme sets cap on CO_2 from included sectors
    - Aviation in EU ETS from 2012
    - Cap for aviation allowances = 97% of average 2004-2006 emissions
  - UK target – reduce 2050 aviation emissions to below 2005 levels
- Strong political pressure to reduce negative externalities of aviation

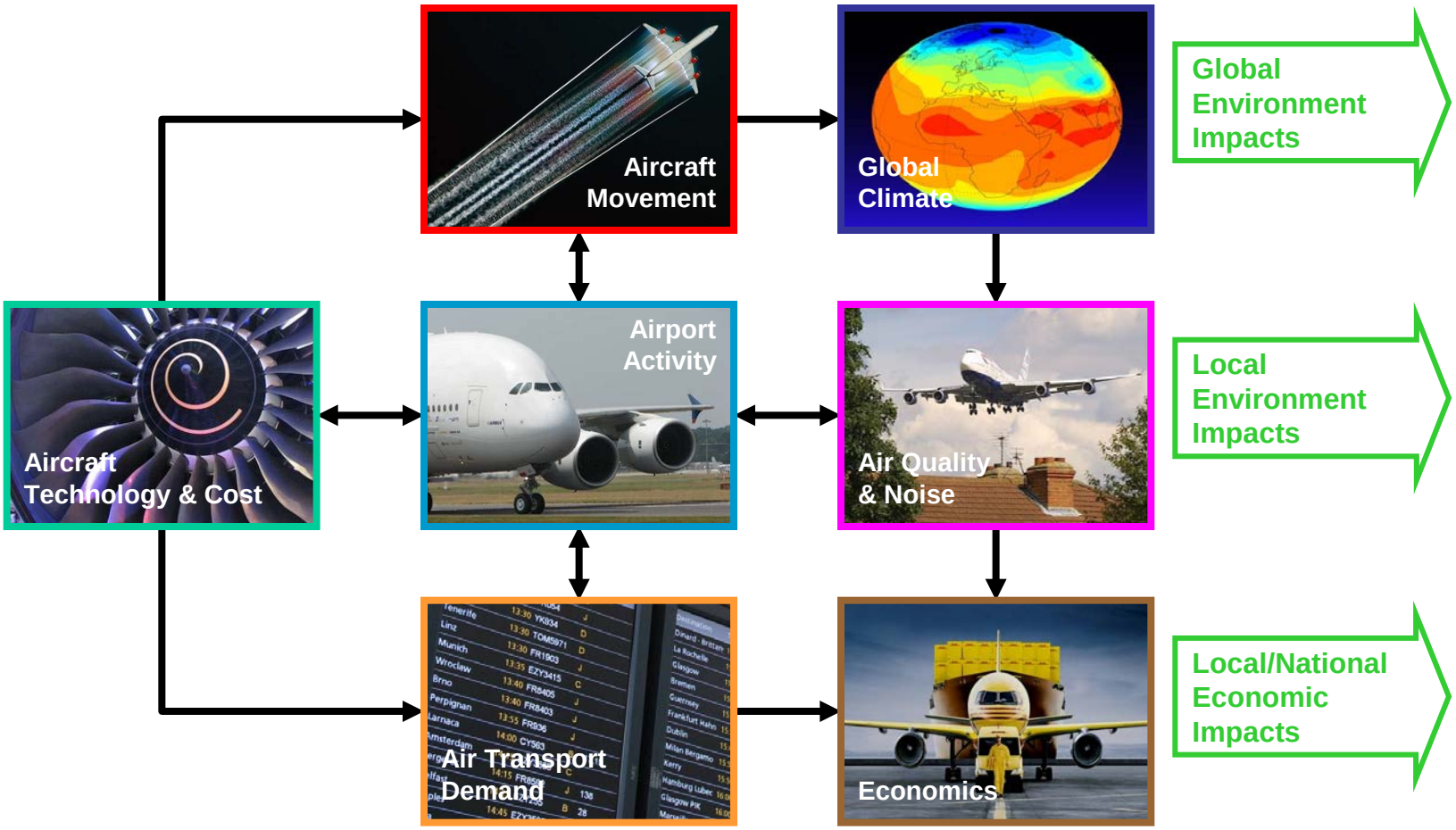
Possible Mitigation Measures

- Economic – e.g. EU ETS
- Technological – e.g. retrofits, biofuels
- Operational – e.g. improved air traffic control
- Most likely/effective scenarios involve a combination of measures
  - Effects not necessarily additive
  - Impact depends on future oil price, carbon price, GDP etc.
- Useful to model non-additive and feedback effects...

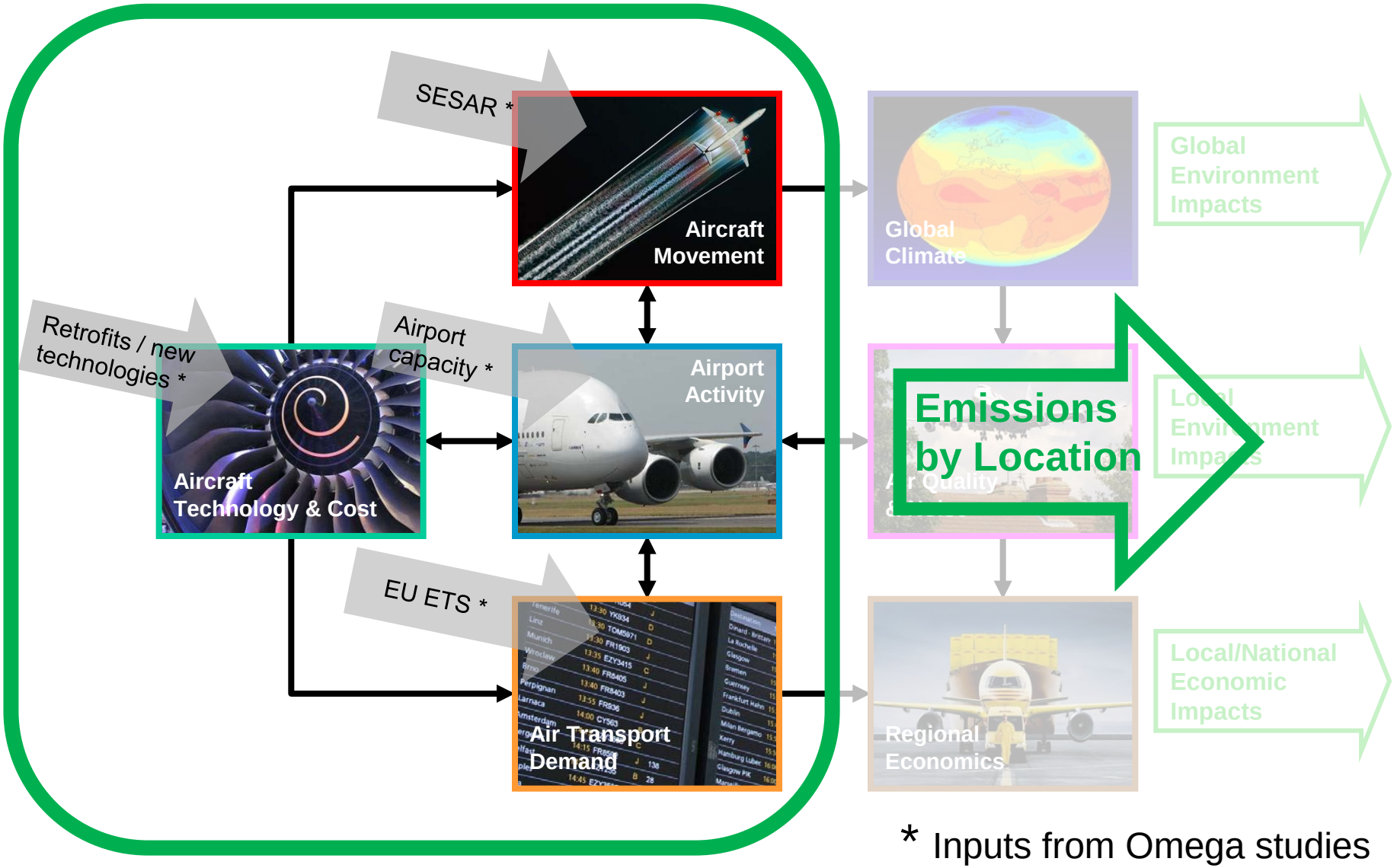
Aviation Integrated Modelling

- Goal: Develop integrated assessment tool for aviation, environment & economic interactions at local & global levels, now and into the future
  - Assess policies to strike appropriate balances between economic benefits and environmental impact mitigation
  - Independent & transparent tool for mediating between stakeholders
- Duration: 3-year “Phase 1” initiated in October 2006
- Funding from: EPSRC Engineering and Physical Sciences Research Council; NATURAL ENVIRONMENT RESEARCH COUNCIL
- UK Omega project input for this study (e.g. Marginal abatement costs)

AIM Policy Assessment



AIM Policy Assessment

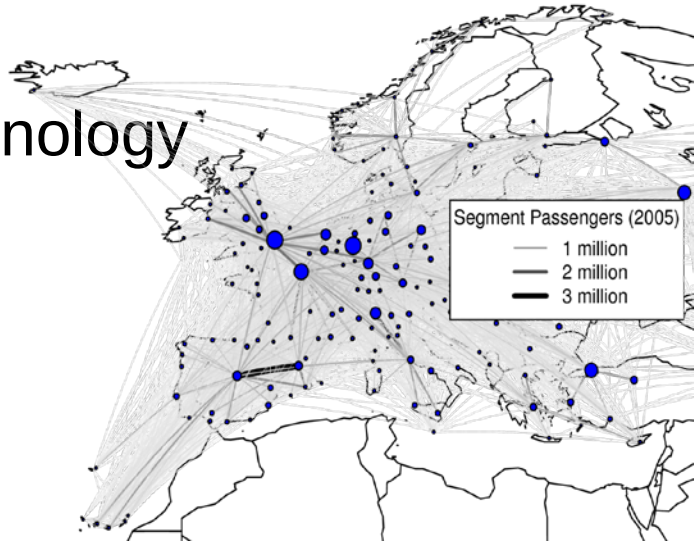


* Inputs from Omega studies

3 x 3 Scenarios

Mitigation Scenarios

- "Base" – no measures, incremental technology
- "Technology" – optional retrofits, new technology, operational measures
- "Abatement" – as above plus ETS



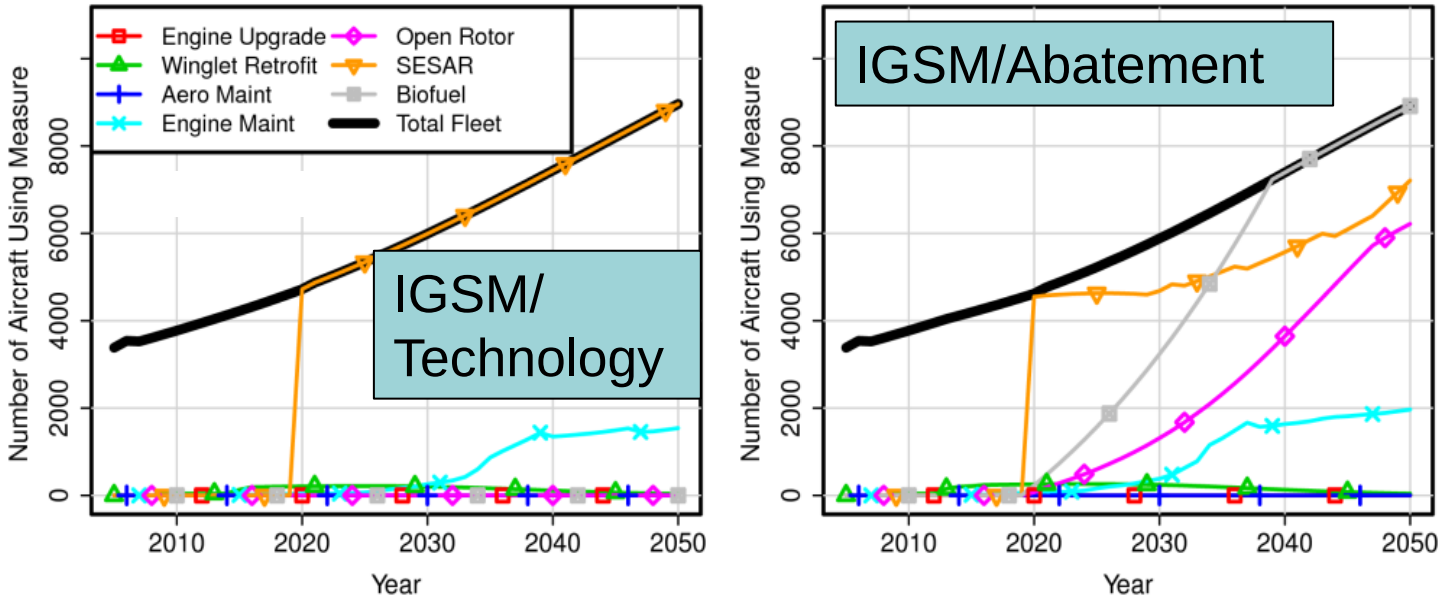
Background scenarios, 2005-2050

	2020 oil price, $(2005)/bbl	2020 carbon price, $(2005)/tCO$_2$	Average GDP/cap growth rate, Western Europe
IGSM*	88.8	23.0	2.8%
MERGE*	71.7	33.7	1.7%
MiniCAM*	62.3	28.5	1.0%

* US CCSP Scenarios, 2007

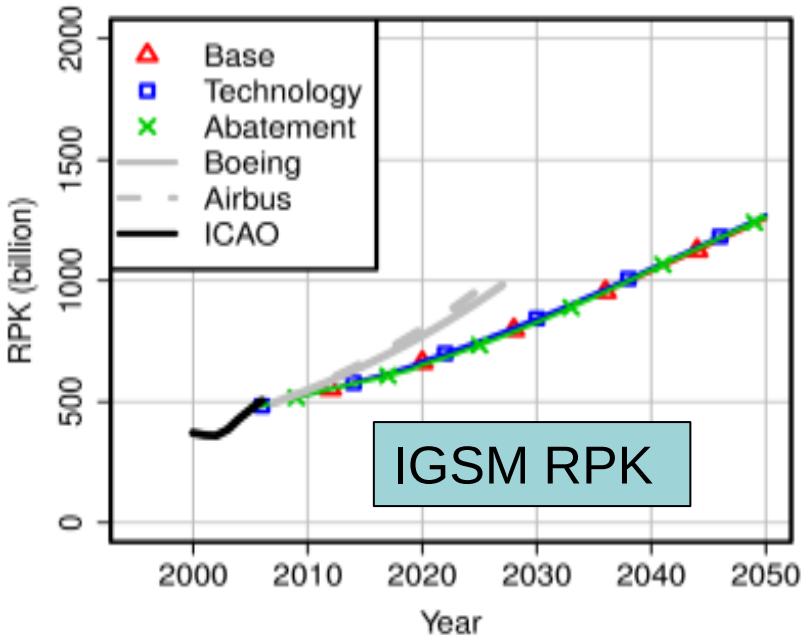
Results – Measure uptake

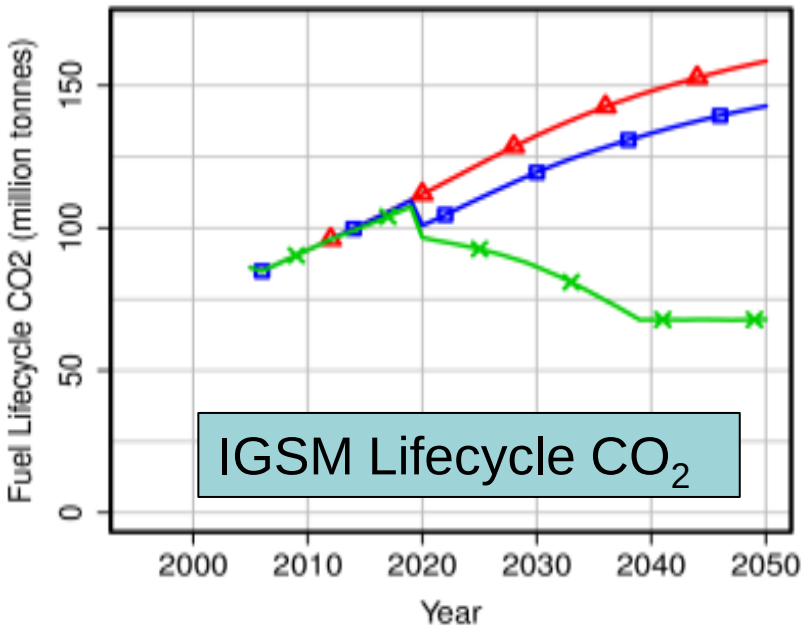
- Base case – zero uptake by definition



- Carbon price prompts airline uptake of biofuels etc.
- Scenario also has an effect:
  - MERGE lower oil price → no open rotors
  - MiniCAM low oil price, low growth → low measure adoption without ETS

Results – RPK and CO_2





- Small demand response
- Potentially large emissions reduction *if* biofuels, SESAR, technologies and high carbon/oil prices
  - Over half this reduction is from biofuels
- Demand response slightly larger, RPK growth lower, abatement slightly lower in MERGE, MiniCAM scenarios

Conclusions

- Complex interactions - uptake of one mitigation measure can lower future uptake of other measures
- Depending on the scenario and assumptions, reductions in **airborne** CO_2 over reference case seem possible by 2050
  - Up to 10% (“Technology” with no ETS)
  - 15-25% (“Abatement” including ETS)
- Strongest reduction for this study in model **lifecycle** aviation emissions is from ETS + SESAR + biofuels
  - Lifecycle CO_2 emissions below 2005 levels in 2050
  - Requires central-high oil and carbon prices
- Optimistic biofuel scenario - major challenges
  - Noise, local and airborne emissions similar to base case
  - Cellulosic biomass fuel requires land area ~ England by 2050!