Paper 30

POTENTIAL ADAPTATION to IMPACTS of CLIMATE CHANGE on AIR TRAFFIC MANAGEMENT

Watt, Burbidge and Melrose

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Some Preamble

• This is only a scoping study – it’s a start and not a destination – looks at European impacts from a global phenomenon

• State-of-the Art has advanced in last two years

• Climate Adaptation’ should be considered as a societal cost, business threat, strategic challenge, investment necessity, operational influence parameter, planning issue

• It will not be mitigated by aircraft (or any man-made) emissions reduction – so emission reduction is not relevant
Aim:
To **Scope** the environmental constraints which *may* impact the ability to meet demand

For the first time
A focus on Climate Adaption

It is a small study – a start only
EUROCONTROL CoG 2010 work to be published 2011.

3 Case Studies

Aim:
To make risks more tangible and specific (as far as possible)

- Flooding at airports
- Increased storminess
- Demand Changes
Perturbations hurt.....

and can hurt more with poor planning
During 15/9-2/10 closure runways 24, 19R & 19L for take-off. Resulted in 30-70% runway capacity loss at 1 airport affecting the total ECAC ATM system.
E.g. Adaptation to More Extreme Weather
### Projected impacts of climate change

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<th>Global temperature change (relative to pre-industrial level)</th>
<th>0°C</th>
<th>1°C</th>
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<td>Falling crop yields in many areas, particularly developing regions</td>
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<td>Possible rising yields in some high latitude regions</td>
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<td>Falling yields in many developed regions</td>
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<td><strong>Water</strong></td>
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<td>Small mountain glaciers disappear – water supplies threatened in several areas</td>
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<td>Significant decreases in water availability in many areas, including Mediterranean and Southern Africa</td>
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<td>Sea level rise threatens major cities</td>
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<td><strong>Ecosystems</strong></td>
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<td>Extensive Damage to Coral Reefs</td>
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<td>Rising number of species face extinction</td>
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<td><strong>Extreme weather events</strong></td>
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<td>Rising intensity of storms, forest fires, droughts, flooding and heat waves</td>
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<td><strong>Risk of abrupt and major irreversible changes</strong></td>
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<td>Increasing risk of dangerous feedbacks and abrupt, large-scale shifts in the climate system</td>
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Source: Stern Review

Typical current predictions
The Main ‘Challenges of Growth’ Update
Environmental Technical Report Study (2009-2010)

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EUROCONTROL – MET-OFFICE(UK) – OMEGA
Manchester Metropolitan University
Weather-driven operational impacts

- Potential reduction in turbine performance (Noise, Runway-length, control recovery performance) from now
- Sea defence damage and local flooding e.g. river overload combined with increased tides (from mid century)
- Increased severe events (Freezing rain? Tornados? Convection?)
- Alterations to the Jet-stream (variable)
- Possible reduction in lo-viz events
- Reduction or increase in de-icing

Implied Strategic Safety Issues

- combinations
- severe local events
- system-wide perturbations
- infrastructure failure
- reduced predictability
Main study – Risk-Threats identified

- **Climate-driven risks (demand shifts and infrastructure planning)**
  - Visitor tolerance of high temperatures (*seasonal or geographical shift*)
  - Winter sports
  - Water scarcity

- **Investment and Insurance risks**
  - Will aviation be investable?
  - Can we prove that we understand the threats and can offer effective response?
  - Are we investing correctly?
  - Are we insurable?
Main study – trend types identified
Main study: example threat – Impacts identified

Sea-level rise affecting coastal and low-lying airports

• Potential loss of runway capacity
• Potential loss of ground-transport access routes
• Likely flood defence costs
• Potential global knock-on effects from a single runway loss
Sea-Level Rise/flooding - very long term

- Up to 34 coastal/low-lying airports at risk
- Primarily sea-level rise (thermal expansion and gravity effects)
- Storm surges and flooding
Case Study Findings
(to make more tangible)

Due for Publication July 2011

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Manchester Metropolitan University
Sea level rise at 3 coastal airports studied

• Significant flooding risk around 2099
• Some increased flooding risk by mid-century
• Risk to ground transport access was confirmed
• ‘Pointless for one part of the global integrated transport system to become fully protected against this risk, if another vital part does not’

Robust and commonly agreed information is not readily available
Temperature related tourism demand displacement for one European State……

• Significant change in demand unlikely to be felt before 2030
• Significant changes likely around or soon after 2030
• By 2050 high-summer demand reduction of up to 40%

• robust and commonly agreed information is not readily available
Increased storminess risk – Maastricht Upper Airspace

- June 2010 – 28% of ECAC flow management delay due to weather
- Convective Available Potential Energy (CAPE) is a useful indicator
- **Summer:** increase of around 3-4 days in the potential for significant storminess by 2020, potentially falling below present day levels by 2050.
- **Spring-Autumn:** increase of around 1-3 days 2020 with the potential for significant storminess by 2050.

- **Some information is available for present risk not future**
Where are we now?

- Science is uncertain … but consensus is growing; some effects may be starting today

- Adaptation becoming recognised as a business threat – especially weather/climate sensitive industries

- Adaptation should not be prioritised above other urgent activities – e.g. emissions reduction

- Climate Change widely handled as an ‘environmental issue’ – but implications are operational – all need to take ownership

- Very little aviation specific research exists – **more structured research is needed**

- Some planned ATM improvements are aligned with Adaptation needs
Things are starting to move……..

- Adaptation Session in Spring 2010 ICAO Colloquium on Aviation and Climate Change
- 2010 September EASA held an event on this topic - presentations on their web (and associated ICAO notification)
- Several Governments have broad spectrum studies on climate adaptation: e.g.
  - Norway - studying for several years now; includes aviation
  - UK Government requires aviation adaptation plans
- EC funded research – e.g. ‘WEATHER’ & ‘EWENT’
- European Transport Conference (Glasgow - Oct 11 to 13 2010)
- SESAR ‘Environmental Regulation and Risk’ Work-Package (16.3.7)
Strategic Mitigation……

- Improve Understanding of this Topic – specific multi-disciplinary and global research
- Consider hard and soft infrastructure and its design (SESAR already starting)
- Improve information flows; System Wide Information Management
- Improve forecasting/predictive and planning capabilities – Dynamic Management
- Improve resilience to perturbation that cannot be avoided
- Improve system flexibility
- Others?

Signposts may not be enough
• This risk to mobility is a societal issue – aviation cannot solve this alone or even fund the research alone – present mitigation funding is a fraction of preventative funding

• Other climate/weather sensitive industries are more advanced than aviation – why?

• Even if aviation tries to ignore the issue; governments, banks and insurance companies won’t

• Starting to talk about mitigation is good – But greater understanding is needed for this to be effective

At present we just don’t know......

Maybe we should find out?
Thank You