The Impact of Climate Change on Aviation

Moderator:
- **Thomas Roetger**, Assistant Director, Environment, Technology, IATA

Panelists:
- **Jonathon Counsell**, Group Head of Sustainability, International Airlines Group (IAG) and IATA ENCOM Chair
- **Ülkü Özeren**, Environmental and Sustainability Director, Istanbul New Airport
- **Andrew Watt**, Head of Environment, EUROCONTROL
- **Paul Williams**, Professor of Atmospheric Science, Reading University
The Impact of Climate Change on Aviation

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Thomas Roetger, IATA

4 April 2019
Aviation and climate change

Not only: Aviation impact on climate change

But also: Climate change impact on aviation
Climate change impacts on aviation

- Rising sea levels and storm surges threaten coastal airports
- Shifting wind patterns modify optimal flight routes and fuel consumption
- Warmer air imposes take-off weight restrictions
- Stronger jet-stream wind shears increase clear-air turbulence
- More extreme weather causes disruptions and delays

Puempel & Williams (2016)
ICAO Environmental Report
Climate change impacts on aviation

- Over the last years
  - Changes in weather behaviour observed
  - Including increased frequency and intensity of weather events with adverse effect on aviation
  - Strong regional differences

- Impacts:
  - Operational – e.g. route changes, flight times
  - Disruptions – e.g. thunderstorms, heavy snowfall
  - Disasters – e.g. hurricanes
  - Route network changes in the longer term
Stakeholders need to work together

Scientifically robust understanding and risk assessment is essential. Aviation, meteorology and insurance need to work together.

**Science**

**Airports**

- Need resilience against local disruptions
- Already facing infrastructural challenges from traffic growth

**ATM**

- Need flexibility to operational changes

**Airlines**

- Vulnerable to operational disruptions
- Depending on airports and ATM
- Need to ensure customers’ satisfaction
The Impact of Climate Change on Aviation

Jonathon Counsell
Group Head of Sustainability, International Airlines Group (IAG) and IATA ENCOM Chair
The Impact of Climate Change on Aviation

Jonathon Counsell
IATA Safety & Flight Operations Conference
Barcelona, 4 April 2019
Impacts on Aircraft Operators

Precipitation changes:
- Disruptions to operations (e.g. airfield flooding, ground subsidence)
- Reduction in airport throughput
- Inundation of transport access (passengers and staff)
- Loss of local utilities provision (e.g. power)

Sea-level rise:
- Loss of airport capacity
- Impacts on en-route capacity due to lack of ground capacity
- Loss of ground transport access

Temperature changes:
- Changes in aircraft performance

Wind changes:
- Convective weather: disruptions to operations
- Convective weather: route extensions
- Jet stream: potential increase in en-route turbulence
- Crosswinds: reduction in capacity

Extreme events:
- Disruptions to operations
- Disruption to ground transport access
- Disruption to supply of utilities

Source: Eurocontrol European Aviation in 2040 Challenges of Growth Annex 2: Adapting Aviation to Changing Climate
Climate Physical Challenges and Opportunities

Description and potential impact

**Extreme weather impact on operating costs**

For example, increased frequency of high winds, fog events, storms, turbulence, sustained extreme heat events or stronger jet stream would increase operating costs by increasing delays, fuel burn and requiring additional cooling and maintenance costs.

Drought-induced water scarcity at outstations could increase fuel cost with increased potable water carriage.

How we manage it

IAG climate strategy and our support for strong global action to tackle climate change.

Partnerships to find solutions to mitigate operational disruption.

- Example is project with partners in NATS and Heathrow Airport to implement innovative technology, the ‘Time Based Spacing’ system, enabling landing rates at Heathrow to be maintained in the event of strong winds. This has reduced delays, fuel burn and emissions and avoided extra costs due to disrupted operations.
Climate Physical Challenges and Opportunities

**Description and potential impact**

**Destinations becoming unattractive for visitors**

For example, extreme weather events and physical impacts of climate change such as flooding, drought, forest fires, heat waves, algae blooms, coral bleaching, rising sea levels and reduced snow cover in ski destinations could make certain destinations less desirable and impact customer demand.

Climate change could also make certain destinations more attractive or accessible to visitors, for example a longer summer season.

**How we manage it**

Ongoing lobbying and engagement in projects and initiatives designed to reduce the industry’s impact on climate change.

Teams dedicated to assessing and understanding changes in customer demand and managing network developments to respond to such changes.

Strategy to ensure aircraft and crew flexibility means we are prepared and able to respond to shifting demand profiles.
<table>
<thead>
<tr>
<th>Risk</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wind changes and Turbulence</td>
<td>Systems capability to better predict weather conditions to avoid eg CD-M, Boeing Winds, eWAS Time based separation at Heathrow</td>
</tr>
<tr>
<td>Turbulence</td>
<td>More difficult to predict – more real time sharing of information from pilots and met weather systems Revised seat belt policies?</td>
</tr>
<tr>
<td>Water distressed destinations</td>
<td>Avoid water pick-up but has fuel penalty</td>
</tr>
<tr>
<td>Longer term - Destination changes</td>
<td>More flexible fleet ownership models?</td>
</tr>
<tr>
<td></td>
<td>More flexible bi-lateral arrangements?</td>
</tr>
<tr>
<td>Potential Future Collaboration</td>
<td>ICAO Working Group 2 Industry associations – IATA, A4E, Sustainable Aviation</td>
</tr>
</tbody>
</table>
The Impact of Climate Change on Aviation

Ülkü Özeren
Environmental and Sustainability Director, Istanbul New Airport
ISTANBUL AIRPORT
CLIMATE CHANGE ACTION PLAN

IATA Safety and Flight Operations Conference
Session: Impact of Climate Change on Aviation
04 April 2019

Ülkü Özeren
Environmental and Sustainability Director
Potential Risks To Airports

Physical Risks
- Damage From Water (Flooding, Severe Storms, Sea Level Rise)
- Damage Resulting from Temperature Changes (Runway Buckling, Material Deformation)

Business Risks
- Flight Delays, Airport Closures and Related Costs
- Temperature Change impact to Cooling and Heating
- Risk to Contractual, Regulatory and Other Legal Compliance
- Changes in Flora and Fauna (Invasive Species)

Security Risks
- Threats to life and safety (Storms, Lightning, Security Scanner Interruption)

Financial Risks
- Unplanned expenditures
- Impaired performance on a contract
- Decrease in demand for tourism travels

Methodology and Outline

ADAPTATION

Asset Inventory Identification ➔ Modeling Site Specific Climate Change ➔ Vulnerability and Risk Assessment (Incl. Economic Analysis) ➔ Disaster Planning and Management

MITIGATION

GHG Inventory ➔ Reduction Strategy ➔ Stakeholder Participation ➔ Roadmap to Neutrality

| 7600 ha | Project Area |
| 2      | Terminal Buildings |
| 6      | Runways |
| 3      | ATC Towers |
| 200    | MPPA |
| 1      | Fuel Jetty |
| 56 km  | Phase 1 Stormwater Channel |
| 3M m²  | Phase 1 Building Construction Area |
**IGA Infrastructure Vulnerability and Risk Assessment (Summary)**

<table>
<thead>
<tr>
<th>Impact Parameter</th>
<th>Vulnerability</th>
<th>Adaptation</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRECIPITATION</td>
<td>Reduction in sight</td>
<td>Early warning systems</td>
</tr>
<tr>
<td></td>
<td>Flood damage</td>
<td>Barriers</td>
</tr>
<tr>
<td>WIND</td>
<td>Sea level rise</td>
<td>Routine maintenance</td>
</tr>
<tr>
<td></td>
<td>Disconnection</td>
<td>Anchoring</td>
</tr>
<tr>
<td>HUMIDITY</td>
<td>Collapse</td>
<td>Portable pumps</td>
</tr>
<tr>
<td></td>
<td>Rupture of equipment</td>
<td>Insulation</td>
</tr>
<tr>
<td>TEMPERATURE</td>
<td>Insulation damage</td>
<td>Equipment replacement</td>
</tr>
<tr>
<td></td>
<td>Operational delay</td>
<td>Extra air conditioning</td>
</tr>
</tbody>
</table>

**Air Navigation and Service Buildings**

- VIP Terminals
- Admin Buildings
- Transportation
- Operational Buildings
- Air Navigation and Service Buildings

**Air Navigation and Service Buildings**

- Fuel Farm and Jetty
- Infrastructure (Seweraga, ICT Network, Energy Transfer)

**Transportation**

**VIP Terminals**

**Admin Buildings**

**Operational Buildings**

**Air Navigation and Service Buildings**

- Fuel Farm and Jetty
- Infrastructure (Seweraga, ICT Network, Energy Transfer)
Disaster Risk Reduction and Management

DRR: Reducing exposure to hazard and reducing the vulnerability of communities and contributing to sustainable development.

Reduce Exposure

Reduce Vulnerability

Increase Resilience

Prepare, Respond and Recover

Transfer and Share Risks

Cooperation with AFAD* of Turkey: Early Warning and Weather Forecast Systems, Response and Evacuation, Recovery

*AFAD: Emergency and Disaster Presidency of Turkey
Monitoring
Plan and
Next Steps

MONITORING

Climate Change Modeling and Physical Change

Infrastructure vulnerability and risk assessment

Disaster risk reduction and management

GHG Inventory and Reduction Strategy

Assessing the need for investment for adaptation

Further Community and Stakeholder Engagement

Raising Awareness – micro and macro level

Communication and Collaboration with Peers

NEXT STEPS

IDENTIFICATION OF OPTIONS:
NO-REGRET
LOW REGRET
WIN
## Sample of Airports’ Initiatives for Climate Change Adaptation

<table>
<thead>
<tr>
<th>REGION</th>
<th>STATE</th>
<th>AIRPORT</th>
<th>TYPE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
</table>
| North America | USA     | Philadelphia             | Assessment Infrastructure Upgrade | ▪ Vulnerability assessment conducted  
▪ Integrated climate change issues into strategic planning and operational activities  
▪ Electrical substations upgraded |
|           |         | Seattle-Tacoma           | Integration to master planning | ▪ Workshops for vulnerability identification and integrate adaptation planning into airport master plan |
|           |         | JFK                      | Design Guideline Infrastructure Upgrade | ▪ Adopted design guidelines for climate resilience  
▪ Installation of tide gates |
|           |         | San Francisco            | Assessment Design Guideline   | ▪ Vulnerability assessment conducted  
▪ Developed resilience planning, design, and construction guideline |
|           |         | Oakland                  | Assessment                   | ▪ Conducted vulnerability assessment, resilience study, especially, against rising tides |
| Canada    |         | Toronto Pearson          | Assessment                   | ▪ Conducted vulnerability assessment for selected storm water infrastructure |
|           |         | Churchill                | Assessment                   | ▪ Conducted vulnerability assessment with 30-year projected trend in climate conditions |
| Europe    |         | Birmingham               | Assessment                   | ▪ Conducted vulnerability assessment |
|           | UK      | Gatwick                  | Assessment                   | ▪ Conducted vulnerability assessment |
|           |         | Glasgow                  | Assessment                   | ▪ Conducted vulnerability assessment |
|           |         | Heathrow                 | Assessment                   | ▪ Conducted vulnerability assessment |
|           |         | Manchester               | Assessment                   | ▪ Conducted vulnerability assessment |
|           |         | Stansted                 | Assessment                   | ▪ Conducted vulnerability assessment |
| Norway    |         | Avinor                   | Assessment Guideline Integration into master planning | ▪ Conducted risk analysis  
▪ Airport design handbook includes specific requirement for future climate factors  
▪ Standards for buildings including climate adaptation  
▪ Integrated adaptation planning into airport master plan |
| Denmark   |         | Copenhagen               | Assessment                   | ▪ Conducted vulnerability assessment and developed first emergency plan for extreme rainfall events |
| Asia Pacific |        | Mackay                   | Assessment                   | ▪ Undertook an internal risk screening assessment process and produced risk register |
|           | Korea   | Korea Airport Corp       | Strategy                     | ▪ Participating in a government-wide adaptation strategy task force |
|           | China   | Hong Kong                | Coordination                 | ▪ Coordination with national authority, and airport stakeholders |
The Impact of Climate Change on Aviation

Paul Williams
Professor of Atmospheric Science, Reading University
Impacts of Climate Change on Aviation

An update on the latest scientific research

Professor Paul D. Williams, Ph.D.

University of Reading, UK
AVIATION

CLIMATE
A changing climate scenario may render some of today’s aerodrome, airspace and airframe design and operation standards inadequate in the years or decades to come. Using past climatological records alone as an indicator of future climate at an airport, say, may be insufficient given the (current) rate at which the world’s climate is changing (warming).
Williams (2016) states that the jet stream will be 15% stronger due to climate change. This increase leads to a higher chance of westbound flights taking more than 7 hours, increasing by 80%. The map shows a flight path from New York to London, highlighting the impact on flight times.
Flight reaches 801 mph as a furious jet stream packs record-breaking speeds

The “jet stream” is a river of air in the upper atmosphere. It cruises west to east, and helps move weather systems across the country.

A “jet streak” is a narrow but intense maximum in jet stream speeds. Notice the jet streak stretching from the Great Lakes to New England.
How the wrong type of wind is to blame for slower flights from Britain to the US

Flights from London to New York are taking eight hours - about half an hour longer than usual - because of unusually powerful headwinds caused by the jet stream
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The Impact of Climate Change on Aviation

Andrew Watt
Head of Environment, EUROCONTROL
Adapting Aviation to a Changing Climate

IATA Safety & Flight Operations Operations Conference

Andrew Watt
Head of Environment
4th April 2019
EUROCONTROL’s WORK ON CLIMATE ADAPTATION
EMISSIONS FORECAST 2017-2040
Based on Traffic Forecast in Challenges of Growth 2018
EUROCONTROL Challenges of Growth 2018
Climate Adaptation Survey

- Follow up to 2013 survey: what do we think now and what climate adaptation action are we taking?
- 90 responses

% of organisations that expect climate change to affect them between now and 2050

- Already experiencing: 48%
- By about 2020: 9%
- By about 2030: 26%
- By about 2050: 17%

33% of organisations consider their current position as critical
3: 45%
EUROCONTROL Challenges of Growth 2018
So, are we ready?

% of organisations that consider adaptation actions to reduce the impacts of climate change may be necessary now or in the future:
- Yes: 86%
- No: 14%

% of organisations that have begun planning for adaptation to climate change impact:
- Yes: 52%
- No: 48%
EUROCONTROL Challenges of Growth 2018
Potential Impacts to be managed by ANSPs

Precipitation change
- Disruptions to operations (e.g. airfield flooding, ground subsidence)
- Reduction in airport throughput
- Inundation of transport access (passengers and staff)
- Loss of local utilities provision (e.g. power)

Sea-level rise
- Loss of airport capacity
- Impacts on en-route capacity due to lack of ground capacity
- Loss of ground transport access

Temperature change
- Changes in aircraft performance
- Changes in noise impacts due to changes in aircraft performance

Wind changes
- Convective weather: disruptions to operations
- Convective weather: route extensions

Extreme events
- Disruptions to operations
- Disruption to ground transport access
- Disruption to supply of utilities
Weather Impact in Europe is Increasing Minutes of Delay