Assessing adaptation challenges and increasing resilience at Heathrow airport [1]

Image from Climate Adapt about this case study [2]

Autor:

In 2011, as all other large infrastructure providers in UK, Heathrow Airport Limited (HAL) was asked by the UK government to submit a climate change adaptation report (also called adaptation strategy). The report included a climate adaptation risk analysis matrix, which has been regularly monitored since then. Besides rain (and consequent flooding) and temperature, fog and changing wind directions were identified as the weather conditions deserving more attention today and also in the future. Weather conditions are not expected to impact significantly operations in the short (2020) and medium (2040) term; therefore, one of the conclusions of the adaptation report is that as far as near-term changes are concerned, HAL's resilience plans are fit for purpose. In 2013, the UK government invited HAL to submit a progress report, which was published in July 2016; in accordance with it, all the short-term actions foreseen in 2011 have been implemented.

Case Study Description

Challenges:

The preparation of the adaptation report considered assets owned by HAL and involved a comprehensive risk assessment of climate related risks to the direct and indirect operations of Heathrow. The adopted approach was quantitative (where possible) incorporating climate modelling, literature review, and concerted consultation with HAL external partners. In particular climate modelling was undertaken for two time periods: the short term (i.e. now to 2020) and the medium to longer term (i.e. 2020 to the 2050s) considering high, medium and low emissions scenarios. Key uncertainties identified relate to the modelling of future climate change, future development of assets at Heathrow, indirect risks from third parties, as well as critical threshold levels for specific assets. The assessment addresses uncertainties by adopting a precautionary approach and classifying the uncertainty of risks identified. In the worst case scenario, the risk assessment has identified 34 risks in the short and medium to longer term. The main relevant climate variability refers to projected longer term changes to temperature and precipitation extremes, and uncertainties in prevailing wind conditions in the future. The latter are of particular concern, because the airport’s two runways are parallel and there is no crosswind runway.

Objectives:

The objective of the HAL adaptation report is to comply with the requirements of the UK Government, following the 2008 Climate Change Act. Since its submission in 2011, the implementation of the adaptation strategy is following good-practice principles such as: no-regrets, synergies, precautionary principle, flexibility, integration, knowledge-based, proportionality or sustainability. A successful adaptation of Heathrow would be measured by the airport ability to keep meeting its statutory functions and stakeholder needs, and fulfilling its organisational priorities.

Solutions:

Three classes of priority adaptation responses have been identified in the adaptation report: "action", "prepare" and "watching brief" responses:

- Action: identifies response which is required in the short term, either to manage short term risks (classified as high) or because the solution to longer term risks needs to begin in the short term because of long planning or implementation cycles.

- Prepare: identifies need for additional research and/or development prior to confirming any risk management actions.
- Watching brief: risks are relevant in longer term and require an on-going watching brief to monitor science evolution and effects of climate change.

The first two classes have been delivered within the first three years (2012-2014). At the request of the Civil Aviation Authority (CAA), an operational resilience plan was prepared and submitted in 2014. The key points related to the operational resilience include the following:

- To have risk assessments for the infrastructure under its control and for all the services it offers at the airport, with clear management procedures and clear communication plans in place for remedying and dealing with the impact of the loss of infrastructure or service.
- The process should include dissemination of information to passengers and some provision of passenger welfare if the airlines are slow to organise this.
- All plans should be underpinned by robust business continuity models.
- Allocation of capacity during disruption should be given the utmost focus, as at high-density airports such as Heathrow delays cannot be easily absorbed.

Heathrow has implemented a number of new technologies and processes in order to provide higher capacity and to increase its resilience to weather disruption. These measures provide adaptation responses under the "action" class identified in the adaptation report, which address challenges such as heavy rainfall events, changes to groundwater levels and increasing variability of snowfall:

- One way Heathrow is mitigating the impact of changes to wind is through time-based separation (TBS) procedures, which were introduced in March 2015. TBS uses real-time wind data to calculate the optimum safe time between arriving aircraft, allowing separation distances to be reduced to maintain the landing rate. TBS brings additional operational benefits in addition to providing future climate resilience to Heathrow.
- New wake vortex separation rules (RECAT-EU). Another measure under consideration is reducing separations among aircrafts (and therefore increasing airport capacity) under certain particular crosswind conditions, in which the vortex is blown away.
- Airfield flow management through Demand Capacity Balancing (DCB). DCB is able to predict the behaviour of flights and the effects of any actions taken by the airport to change the outcomes. In this way, the actual capacity of the airport can be estimated in advance with higher accuracy, taking into account the expected conditions of a wide range of variables, such as global winds or local weather, and the contingency measures to be adopted by the airport. Airfield flow is subsequently managed taking into account these conditions. DCB is expected to be implemented in 2018-2019.
- Changes to low visibility procedures (LVP) to increase resilience to the impact of fog, through enhanced Instrument Landing Systems (eILS).
- A GBP 37 million investment to improve resilience to snow (following lessons learnt in the 2010 snow event), including additional equipment, new processes for weather forecasting, enhanced command and control structure and a detailed Passenger Welfare Plan.

These measures do not only have an effect in gaining resilience to weather disruption. As the climate change projections for Heathrow suggests higher variability in the future (e.g. for rain and snowfall), the measures implemented are also increasing medium and long-term climate resilience to the airport.

Heathrow’s climate change risk assessment also examines how more extreme temperatures might affect the airport pavements in terms of deformation, bearing capacity and durability, although the risk from the effects of extreme temperature is low in the near to medium term. In the longer term (in 50 years or more) there may be more significant temperature increases, and a need to introduce alternative materials and performance requirements in pavement composition.

Using best available information on future climatic effects and applying a comprehensive risk assessment that took a precautionary worse case approach to future climate change risks, the adaptation report concluded that:

- Heathrow has comprehensive control measures and contingency plans for managing climate related risks, and these are considered sufficient to manage climate change risks in the shorter term (e.g. to 2020).
- It is not feasible at this time to conduct a detailed assessment of climate projections beyond the 2050s since this time scale falls outside typical airport planning cycles and the climate science becomes increasingly uncertain in the longer term.
- Climate risks in the short term are predominantly low, and where risks are more significant these are already being managed through existing mitigation and resilience programmes.
- Assuming no changes to existing control measures, the risks associated with climate change impacts in the medium to longer term are predicted to worsen.
- Assuming the adaptation report is implemented and continually evolved will ensure that residual risks are appropriately managed.
- Key adaptation responses identified in the short term generally build on existing actions planned by the business.
- Delivery of the adaptation actions will be assured through clear ownership across Heathrow's business units together with a requirement for on-going reporting of progress at senior health, safety and environment (HS&E) performance management fora.
- Regular review (5 yearly comprehensive and mid-point reviews) of the climate risk assessment will ensure continuous updating of the adaption report in line with best available information on climate science, risk thresholds and business and infrastructure planning cycles.

Short-term actions undertaken thus far have mainly addressed current climate variability, and they are opening the way for a more comprehensive, long-term approach to the challenges of climate change. Since 2011, adaptation to climate change has been mainstreamed in the main planning instruments of the airport. This includes the annual strategic capital business plan, which now is dedicating a specific section to resilience investments, the airport management system, which is following ISO14001:2015 guidance, including climate change adaptation, the annual operational resilience plan and a corporate risk process including the regular review of the 34 risks initially identified at the 2011 Adaptation Report.

Importance and relevance of the adaptation:
IMPL_AS_CCA;

Additional Details
Stakeholder engagement:
The preparation of the adaptation report and its implementation is following a collaborative approach, with participation of professionals from the different technical services and companies involved in HAL operations.

Key external partners and regulators consulted through the preparation of the adaptation report included the Environment Agency, National Air Traffic Services (NATS), London Borough of Hillingdon, Transport for London (TfL), surface transport operators, and key Heathrow airlines. Interdependencies have been identified where others' actions are likely to impact on Heathrow's ability to manage its own climate change risks. These relate primarily to provision of key utilities, aircraft fuel infrastructure, surface access services and infrastructure and airline operations.

The HAL climate adaptation report was submitted to the UK government and published after approval in May 2011. The information from the report was used in the National Adaptation Plan. Following the 2008 Climate Change Act, the UK government asked HAL and other organizations to submit a progress report by 2016. These updates should feed the next national risk assessment of risks from climate change, due to be published no later than 2017.

Success and limiting factors:

This preparation of the adaptation report has been well received across the airport. Success factors include the involvement of professionals from the various services and companies involved in HAL operations; other success factors are related to the availability of well-developed climate change scenarios, and to the already deep reliance of operations and management on weather information. The actions identified offer a good benchmark for monitoring progress in delivering results.

The main limiting factors are due to the uncertainty in long-term climate models. Whilst there are some commonalities in terms of barriers to adaptation (i.e. scientific uncertainty), others are very much determined by an organisation's own situation. For Heathrow Airport the main barriers to successful adaptation are summarised below:

- Scientific uncertainty, regarding the pace and scale of climate change and particularly scientific uncertainty surrounding some variables not currently able to be modelled in a probabilistic fashion i.e. prevailing wind direction.
- Financial uncertainties and resource constraints. The airport has to balance the need to invest in adaptation with other business investment priorities. Furthermore as a regulated company its return is regulated by the Civil Aviation Authority (CAA) in 5 year cycles that do not necessarily match the long term timescale challenges posed by climate change.
- Uncertainty regarding future aviation industry developments: demand projections, destination trends, aviation technology changes and future development plans at the airport in the medium and longer term.
- Space constraints. Heathrow's footprint is comparatively compact when compared to other major hub airports around the world. Space constraints on the site do limit the storage of supplies onsite, and limit the ability of HAL to expand some infrastructure and assets which would improve adaptive capacity at the airport.
- Runway capacity constraints. Heathrow is among the most congested airports in the world and the lack of spare capacity means that unlike many other British or European airport, HAL has very little room to manoeuvre when disruption occurs.
- Permitting constraints. Heathrow's activities are constrained by numerous permitting constraints reflecting the airport's proximity to residential areas i.e. the night flight quota, Cranford Agreement, air quality and noise footprint limits. Some of these permitting constraints may affect the adaptation options available to the airport.
- Interdependencies. As a landlord of many other organisations based at Heathrow, HAL is limited in how directly it can shape the adaptation undertaken by other organisations. Not all adaptation decisions will be taken in-house by HAL and the airport operator will be affected by the degree to which other bodies at the airport choose to adapt to climate change. Furthermore HAL relies on external, offsite third party organisations for some of its essential services i.e. fuel, staff transport, power, potable water and should climate change negatively impact these services then the adaptive capacity at Heathrow could be impaired.
- Other legislative requirements. HAL's adaptation response will need to be balanced with other regulatory requirements. Primary amongst these is the need to maintain airfield and aviation safety.

Budget, funding and additional benefits:
Any adaptation action following the strategy must be subject to a cost-benefit analysis.

Legal aspects:
The main legal framework of this review is the Climate Change Adaptation Acts (2008), which provides a so-called Adaptation Reporting Power to the UK Government. Based on this, the government requested HAL, among many other infrastructures mangers, to provide an adaptation report by 2011, and to regularly update it.

The Climate Change Act (2008) created a legal framework for increasing the UK's ability to respond and adapt to the consequences of climate change. An essential component of the Act and the Adapting to Climate Change (ACC) cross-Government programme is to lay before Parliament risk assessments of the threats and

opportunities posed to the UK by the physical impacts of climate change on a five-yearly basis, with the first national risk assessment to be presented in January 2012. Organisations whose assets and functions are felt to be of national importance have been directed by Government to assess their vulnerability to the consequences of climate change.

DEFRA identified the operators of Heathrow Airport as being of particular importance in adapting the UK to the changing climate, because of its importance to the national economy and to global transportation of people and cargo. Heathrow (amongst other UK strategically important airports) is considered within the ACC programme as a priority reporting authority and is part of the first tranche of organisations required to input into the National Climate Change Risk Assessment.

Implementation time:
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Websites:
http://www.heathrow.com/company/community-and-environment/responsible-he... [4]

Sources:
Heathrow Airport Limited (HAL) and Civil Aviation Authority (CAA)

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What is climate change?

What is the adaptation to CC?

What I can do?

Participate in AdapteCCa

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Divulgative resources search engine

Interactive climate change adaptation dossier

Experiences of adaptation (multimedia resources)

Virtual classroom

Tools

Viewer of Climate Change Scenarios

Case Studies

Documentary search engine

Other

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Links

[1] https://adaptecca.es/en/assessing-adaptation-challenges-and-increasing-resilience-heathrow-airport
[2] https://adaptecca.es/sites/default/files/lhr-1.jpg
[3] mailto:Katherine_Rolfe@heathrow.com
[4] http://www.heathrow.com/company/community-and-environment/responsible-heathrow/reducing-environmental-impacts/climate-change