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European Union Aviation Safety Agency

ARISE+
Funded by the European Union and implemented by the European Union Aviation Safety Agency

The importance of working with risk management at airport level and initiate adaptation measures for both existing and new infrastructures

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18th-19th December 2019

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Introduction

- Preliminary information on risks
- Risks and adaptation: how to consider and working with them
- Examples of checklists and tables to be used for adaptation and risk management purposes

Basic definitions

- **Risk:** is a combination of the chance or probability of an event occurring, and the impact or consequence associated with this event.
- **Risk assessment:** the structured analysis of hazards and impacts to provide information for decision. The process is usually proceeded by identifying hazards that could have an impact, assessing the likelihoods and severities of impacts, and assessing the significance of the risk.
- **Vulnerability:** The degree to which a system is susceptible to, and unable to cope with the adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude and rate of climate change and variation to which a system is exposed, its sensitivity and its adaptive capacity.

Why consider risks?

- → Climate change is underway and can’t be stopped.
- → Actions to mitigate GHG emissions are pivotal to avoid the worst, but not enough. Indeed, some changes produced already their effects with inevitable consequences.
- → Therefore, if the vulnerabilities and risks are not managed, climate change will increasingly affect project performance and the investments made in these projects.

Why consider risks?

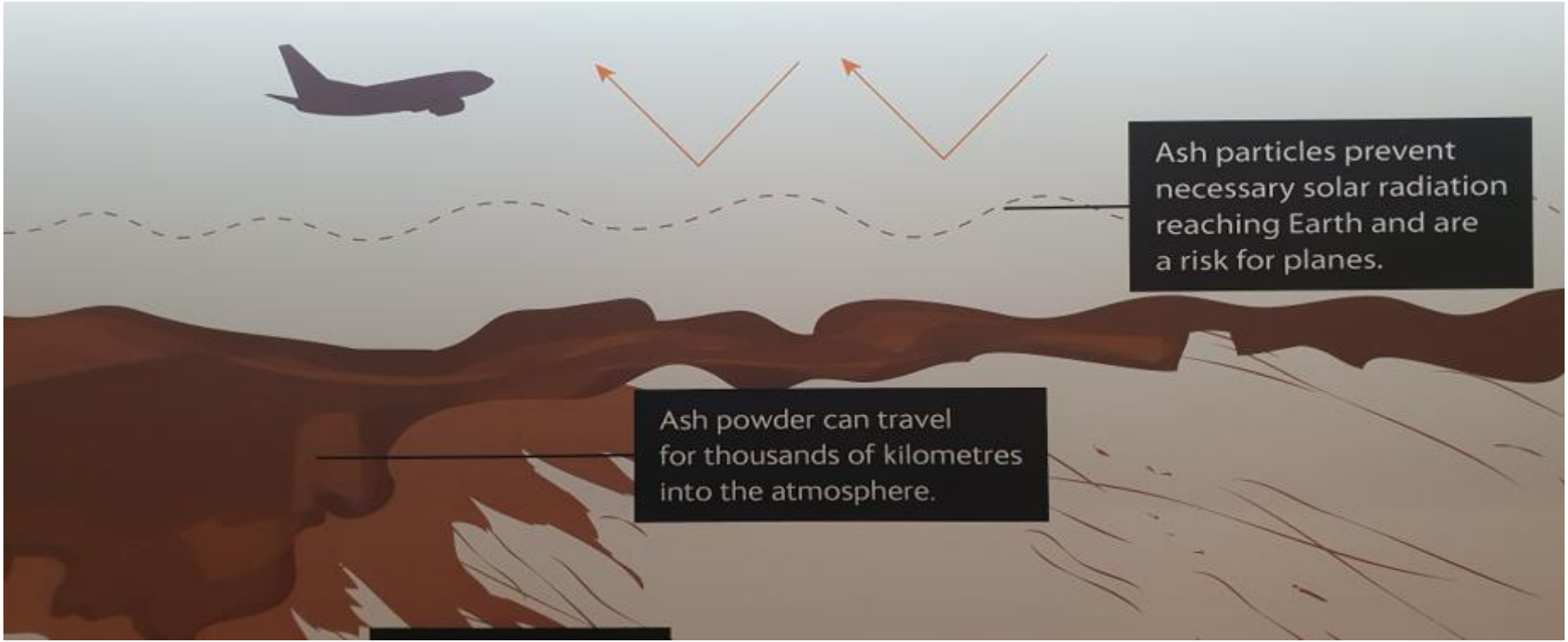
Considering the **growth of the aviation sector in the region**, and considering the strong vulnerability of the region towards the extreme events, taking into account the geographical location of the ASEAN region and therefore the potential climate risks affecting this area, these aspects should be considered by the aviation stakeholders and especially at the airport level:

- → **Sensitivity** as the identification of climate factors which could affect the functioning of the planning/ project/action/ type;
- → **Exposure** as the climate factors which are relevant to the **location** of the specific object;

Why consider risks?

- **Potential impact** as a consequence of: if the type of intervention is sensitive to a particular climate factor and the specific location is exposed to it, then there is a potential impact;
- **Vulnerability** which takes into account the resources and capabilities of the project's management to adapt their project successfully (financially, practically, whether they have the expertise etc.) offsetting the potential impact.

Risks and exposure to volcanic eruptions



What are the consequences of including adaptation in aviation planning activities?

The need to develop:

1) Sensitivity analysis
2) Assess exposure to baseline/observed climate assess vulnerability to future climate
3) Vulnerability analysis for each climate
4) Risk assessment in terms of consequences, probability, risk matrix
5) Identification of adaptation options
6) Appraisal of adaptation options (i.e. cost benefit analysis-CBA)
7) Integration of adaptation action plan into project development cycle (something for now and not for later)

1) Vulnerability studies and climate risk information should be considered and analyzed

To analyze what is existing, including any potential impact as well as the resources and capability to adapt, giving a financial indication of whether the project is vulnerable.

A list of non exhaustive climate risks to be considered could be the following:

1) Average air temperature change (annual/seasonal/monthly)
2) Extreme air temperature change (frequency and magnitude)
3) Average rainfall change (annual/seasonal/monthly)

1) Vulnerability studies and climate risk information should be considered and analysed

4) Extreme rainfall change (frequency and magnitude)
5) Average wind speed change (annual/seasonal/monthly)
6) Extreme wind speed change (frequency and magnitude)
7) Humidity
8) Solar radiation
9) Sea level rise plus local land movement
10) Sea/water temperature
11) Water availability

2) Location exposure

To analyze the climate risks of the location, which could be identified as low, medium and high sensitivity as per existing models.

General points to control:

1) Have you conducted a climate risk and vulnerability assessment?
2) In the analysis are included aspects related to institutional/social and demographic factors?
3) Other aspects not directly related to climate risks have been considered? Some examples: credit/financial insurance risks, legal risks like change in policy regulation, reputational risks.

2) Location exposure

Network

1) Have you included considered vulnerabilities of the site access and utility connections (outside the boundary of the project/action/asset)?
2) Does the assessment take into account worsening impacts on ecological systems as a result of climate change done and/or adaptation efforts in the planning?

Suggestion…

Therefore, a detailed analysis of specific climate risk should be developed and for each potential impact, it should be discussed how it could affect each of the relevant planning/project aspects in terms of inputs, outputs and network infrastructure.

Risk identification checklist

Risk register: climate related risks to assets/infrastructure/projects				
Category	Climate vulnerabilities, sensitiveness and critical threshold	Climate related risks	Risk scores Likelihood: 1=low, 2=moderate, 3=significant, 4= very significant	Reference doc
1. Temperature related issues				
a				
2.Precipation related issues				
a				
Extreme risk management actors	Proposed potential risk management actors	Owners	Due date	comments

Risks analysis and adaptation in the aviation sector as a matter of common sense

It should be considered as a good practice to consider future climate changes when planning **new infrastructure projects**. It should be regarded as a good practice to see how existing systems and processes can be integrated into the adaptation planning. For example, adaptation can be integrated into the maintenance and or renovation of the runways in the airport (not only EIA). This will be more cost-effective as the maximum utility of the existing infrastructure will be reached and a building site has to be established anyway. Existing weather or infrastructure information tools can be used as a cost-effective method as well.

Illustrative examples of adaptation options by project category

Project Category	Climate variable and climate related hazards	Geographical vulnerability	Climate change impacts	Adaptation option
Transport Infrastructure	-Change in temperature -Change in precipitation -Extreme events -Increased sea level rise and storm surges -Increased in drought and wildfire -Increase in wind speed and storms	-Low lying areas -Flood prone areas -Coastal zones -River beds -Vulcanic zone -Flat land and delta region	-May impact airport pavement -May impact critical transport infrastructure -May impact coastal infrastructure -May result in damage to infrastructure and infrastructure failures	-Subsurface conditions -Material specifications -Drainage and erosion -Protective engineering structures -Maintenance planning and early warning -Increased maintenance -Alignment airport/aviation infrastructure with transport master plan -Environmental Management

Challenges to consider

Budget constraints

- → The main difficulty in adaptation as per transport/infrastructure sector is the small budget given to reduce climate change vulnerability.
- → However, it is a common mistake thinking that adaptation entails costly and large-scale interventions. Indeed, there is a wide variety of different measures like for example insuring against high-impact, low profitability risk (through pre-financing mechanisms to smooth out cash flow) and/or putting in place monitoring and contingency plans.

Flooding

- Flooding considered in its widest aspects therefore related to threat of landslides and rock fall represents the most common climate impacts. Indeed, more extreme precipitation events will occur, challenging the existing infrastructure and its drainage capacity (increase of 25-30%).
- Infrastructure located in urbanized areas are the ones exposed to highest risks and this implies that urban proliferation could increase climate impacts. Problems must be solved identifying areas, which can be flooded during extreme precipitation events.

Social and cultural factors

- Adaptation includes inherent and social factors that must be considered. Indeed, engaging in adaptation means changing societal and political ideals.

Therefore, the difference, the risk culture, determined by the level of the society's welfare system, should be evaluated while making decisions based on risks.

- In addition, social factors that will be affected by a changing climate having a knock-on effect to the transport network should be weighted. For example, the number of tourists might rise and fall according to climate and transport networks stress projections will have to take those numbers into considerations.

Lack and gaps

It is important to consider the medium/long term planning according to existing climate change implication models. Indeed, early planning reduces both risks and costs. Unfortunately, the level of willingness among implementers is a trigging one due to the lack of awareness. In additional, a more climate related research is required, more economic analysis should be developed to grasp the negative effect of climate change.

How to deal with challenges…

Example of initial mapping of the vulnerable sector, location and project category

Project category	Sector specific risks	Location specific risks
Airport capacity expansion and rehabilitation	Flood	Sea level rise
	Increased climate variability	Extreme weather events
	Temperature increase	
	Extreme weather events	

Adaptation option checklist Adaptation type	Description/examples
Building adaptative capacity	
Research and analysis	-It is useful to reduce uncertainties prior to investing in risk management measures -develop better understanding of the relationships between climate-related factors and the performance of assets -develop in depth-climate change risk assessment -develop higher resolution data on future climate variability and climate change -Undertake cost-benefit analysis of risk management measures incorporating uncertainty analysis
Data collection and monitoring	-Monitor impacts of climate related factors on performance of existing assets -Monitor new developemnt in climate change science
Changing or developing standards, codes, risk registers	-Amend standards, codes of practice to ensure they are resilient to/take account of changing climatic conditions -Incorporate climate resilience into contracts and procurement processes -Consider climate related risks and management in environmental and social impact assessmengts -incorporate climate related risks into risk registers
Awareness raising and organisation development Work in partnership	-Undertake training, staff development and capacity building programme -Identify climate change champions-best practices to showcase -Staff attend conferences and events on climate change -Work with all stakeholders to understand climate change risks and develop co- ordinated adaptation measures_ governments, regulators, external infrastructure providers, communities, -Partnership work helps to avoid conflict between different organisation adaptation strategies

Delivering adaptation actions	
Transfer: spread/share risks	-Diversify asset types and technologies -Trasnfer risks through contracts with suppliers and contractors
Treat: avoid negative impacts	-Consider climate resilience as part of site selection process for a new ramp -Implement climate resilient design standardrs for new deviations, new activites, new assets -Implement changes to management regimes or operating rules for existing assets -Implement engineering and technical solutions to build robustness rules against climate change for existing assets as part of routine refurbishment or upgrades -Integrate climate related risks into contingency and disatser plans for new activites and existing assets
Tolerate: accept risks	-Accept risks where they can't be managed abd where cost-benefit analysis indicate that it is not worthwhile to make changes to existing assets
Terminate: bear loss	-Bear losses where they can't be avoided-loss of coastal areas to dea level rise
Exploit opportunities	-Identify and develop new actions that are favored by future climate change conditions

Conclusions

- → Despite it is not possible to eliminate the risks related to climate change, you can work on sensitizing the development of an adaptive capacity in your region. This implies that thanks to this exercise, your system will be able to abject to climate change effects, to moderate potential damages and to take advantages of opportunities and/or consequences that otherwise cannot be avoided or reduced.
- → Although one solution does not fit for all, regional guidelines on this topic will help aviation world to cope with this new theme.

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