Unclutter Your Processes: Simplifying Climate Risk Management at Airports

Tuesday, October 7, 2019
2:00-3:30 PM ET
Purpose
To discuss ACRP Research Report 188: Using Existing Airport Management Systems to Manage Climate Risk.

Learning Objectives
At the end of this webinar, you will be able to:
• Describe the function of an airport’s existing risk management systems
• Apply a self-assessment for climate risks at your airport
• Discuss how to gain support for climate change mitigation plans
• Incorporate climate change throughout existing airport management processes
All Attendees Are Muted
Questions and Answers

- Please type your questions into your webinar control panel.
- We will read your questions out loud, and answer as many as time allows.
Can’t locate the *GoToWebinar* Control Panel?
American Association of Airport Executives (AAAE)

1.0 Continuing Education Units (CEUs) are available to Accredited Airport Executives (A.A.E.)

Report your CEUs: [www.aaae.org/ceu](http://www.aaae.org/ceu)
Panelists Presentations


After the webinar, you will receive a follow-up email containing a link to the recording
Today’s Speakers

- Patti Clark, *Embry-Riddle University*
- Cassie Bhat, *ICF*
- Lauren Seydewitz, *Gresham Smith*
- Scott Morrissey, *Denver International Airport*
Panel Chair for ACRP 02-74 Project that supported ACRP Report 188

Served on numerous ACRP Panels since 2009

Former Airport Manager

Developed a Masters level Aviation Based Sustainability Degree

Committed researcher on airport process improvements/metrics
Five Ways to Get Involved!

1. Join the ACRP IdeaHub community
2. Volunteer for a project panel
3. Prepare a research proposal
4. Answer an ACRP survey
5. Apply the research results

Visit us online: www.trb.org/ACRP
Today’s Speakers

Amanda Vargo, Cassie Bhat, and Tommy Hendrickson from ICF

Lauren Seydewitz from Gresham Smith

and Scott Morrissey from Denver International Airport

Presenting

ACRP Report 188: Using Existing Airport Management Systems to Manage Climate Risk
Cassandra Bhat, ICF – Senior Managing Consultant, Climate Resilience

Lauren Seydewitz, Gresham Smith – Senior Associate, Director of Sustainability

Scott Morrissey, Denver International Airport – Senior Director, Sustainability
ACRP REPORT 188 PANEL

- Patti Clark, Embry-Riddle Aeronautical University–Worldwide, Hahira, GA (Chair)
- Peter Adams, NYC Mayor’s Office of Recovery and Resiliency, New York, NY
- Chris M. S. Baglin, PPC, D DSA Company, McLean, VA
- Scott Morrissey, Denver International Airport, CO
- Akiya N. Simms, Hartsfield–Jackson Atlanta International Airport, GA
- R. Burr Stewart, Burrst, Seattle, WA
- Thomas Cuddy, FAA Liaison
- Andrea L. Schwartz Freeburg, FAA Liaison
- Christopher J. Oswald, Airports Council International–North America Liaison
- Justin M. Towles, American Association of Airport Executives Liaison
All airports should be thinking about managing climate risks

“Managing climate risks” is possible within existing processes (and probably a lot easier than you think)

Resources are available to help (ACRP Report 188)
BACKGROUND
Problem: Climate change poses risks to airports

Opportunity: Airports have existing management systems to address risk, uncertainty, and extreme weather (but few currently consider climate risks)

Goal: Help airports incorporate these climate risks into their existing management processes

Resulting Products:

- **Handbook**: Using Existing Airport Management Systems to Manage Climate Risk
- **Quick Start Guide**
BENEFITS OF INTEGRATING INTO EXISTING SYSTEMS

- Enhance climate resilience without overhauling existing planning and management processes
- Increase likelihood of success through existing systems than through a new program or process
- Discuss climate risks and associated actions within the context of other airport priorities
WHY SHOULD AIRPORTS MANAGE CLIMATE RISK?

Image courtesy of City of Dallas
Airports make climate-related assumptions in planning and operations:

- Maintenance needs
- Infrastructure design and investment
- Emergency and irregular operations planning

Climate change will affect these assumptions – historical events are not indicative of the future
EXAMPLE CLIMATE CHANGE IMPACTS ON AIRPORTS

Temperature
- Increase rate of pavement deterioration
- Increase cost associated with worker safety

Precipitation
- Increase stress to drainage infrastructure
- Reduce useful life expectancies of infrastructure

Drought
- Negatively affect facility development
- Increase operational costs

Winter Weather
- Adjust winter operations
- Adjust equipment needs

Sea level rise
- Increase extent of storm surge
- Threaten critical infrastructure
CLIMATE IMPACTS IN THE NEWS

It’s so hot in Phoenix that airplanes can’t fly

Parking garage at Dallas Love Field floods after heavy storms sweep North Texas
The airport recorded 3.62 inches of rain through Wednesday afternoon, more than the area averages in the entire month of April, according to the National Weather Service.

Airports At Water’s Edge Battle Rising Sea Levels
BENEFITS OF ADDRESSING CLIMATE RISKS AT AIRPORTS

- Save on maintenance costs
- Improve safety and security
- Avoid being caught unprepared
- Avoid underestimating infrastructure sizing requirements
- Maintain compliance
- Improve reliability and customer service
- Maintain continuity of operations
- Improve ability to recover
Most situations don’t require major changes to existing processes

- Review assumptions
- Monitor for changes

MANAGING CLIMATE RISKS THROUGH EXISTING SYSTEMS

- Strategic Planning
- Master Planning
- Enterprise Risk Management
- Safety Management
- Capital Planning
- Asset Management
- Emergency Management
HANDBOOK PROVIDES RESOURCES TO HELP

- Simple processes
- Examples
- Supporting resources (e.g., checklists, tools, outside information)
HANDBOOK APPLIES TO ALL AIRPORTS

LOWER
Risk Airport

WHY SHOULD I START?

Although climate change may not pose immediate risks, changes in the frequency or severity of extreme weather events should be tracked and monitored so that the airport is prepared to act when necessary.

WHAT ARE MY CLIMATE HAZARDS AND RISKS?

- Flooding from heavy precipitation
- HVAC/chiller demands and maintenance needs due to high temperatures
- Persistence of pests due to high temperatures

HIGHER
Risk Airport

For some airports, such as many coastal airports, climate change already poses immediate threats. Actions need to be taken to prepare for and harden infrastructure against sea level rise and more frequent and severe weather events.

WHAT ARE MY CLIMATE HAZARDS AND RISKS?

- Sea level rise
- Storm surge
- Flooding from heavy precipitation
- HVAC demands due to high temperatures
- Damage from high winds

WHICH MANAGEMENT SYSTEM(S) SHOULD I START WITH?

- Asset Management
- Emergency Management

- Capital Planning
- Emergency Management
- Asset Management

WHAT INTEGRATION STRATEGIES CAN I USE?

ASSET MANAGEMENT
- Preventive maintenance
- Track costs and impacts associated with different extreme weather impacts (e.g., HVAC system demands)
- Track occurrence of irregular maintenance needs

CAPITAL PLANNING
- Set floodproofing guidelines for existing infrastructure
- Use failure codes to conduct a maintenance needs assessment or a criticality assessment
- Develop a process to conduct lifecycle cost analysis
DEN has less obvious climate risks than other airports, but faces similar challenges as many U.S. airports

- Average annual days above 95° will increase from about 15 currently to 40 by mid-century\(^1\)
- Shift from snow to rain events and earlier snowmelt increasing stormwater flows\(^2\)
- Increasing risk of drought and wildfires\(^3\)
- Changes in wind patterns\(^3\)

\(^1\)NOAA. 2019. Climate Explorer.
\(^2\)Denver Environmental Health. 2014. City and County of Denver Climate Adaptation Plan.
\(^3\)USGCRP. 2017. National Climate Assessment: Southwest.
Climate Change at Denver International Airport

These climate change considerations will create risks for DEN throughout airport planning and operations:

- Worker safety from extreme heat exposure
- Increasing energy demands from cooling loads
- Stormwater management and runoff pollution
- Forecasting demand from tourism changes
- Long-term infrastructure decision making

DEN is working with individual management teams in planning and operations to consider and integrate these considerations into existing practices.
HANDBOOK OVERVIEW

SELF-ASSESSMENT

IDENTIFY CLIMATE HAZARDS

IDENTIFY RELEVANT MANAGEMENT SYSTEM(S)

BUILD SUPPORT

INTEGRATION

TAKE ACTION TO INTEGRATE CLIMATE RISKS
Step-by-step guidance for identifying:

- What are my relevant climate hazards?
- What are my expected climate risks from these hazards?
- Which management systems should I use to manage my climate risks?
Consider the severity of climate risks at the airport, and which management systems can address those risks.

Consider the time horizon of each management system:
- Planning horizon
- Implementation horizon

Identify management systems due for a regular update.

Example starting points:
- Use a management system to monitor climate risks over time
- Consider climate change in the design of new infrastructure
- Learn from extreme weather events
CLIMATE ENTRY POINTS AND INTEGRATION ACTIONS - These describe the climate-related risk assessment steps, or climate entry points, along with the corresponding suggested action(s) during that step.

CLIMATE ENTRY POINTS AND INTEGRATION ACTIONS:
- Identify threats and opportunities from climate change
- Identify strategic issues, strategies, and long-term objectives related to managing climate risk
- Monitor climate resilience performance measures
- Re-evaluate and modify your climate risk management objectives over time
- Continuously integrate new climate risk information into decision-making

TYPICAL STEPS followed to complete the development of a system, implement the system, verify the system is meeting objectives by monitoring and measuring progress, and communicating outcomes to integrate system revisions.
STRATEGIC PLANNING PROCESS

1. UNDERSTAND THE ORGANIZATION
2. DEVELOP MISSION, VISION AND VALUE STATEMENT
3. SCAN THE ENVIRONMENT AND PREDICT DEVELOPMENTS (SWOT ANALYSIS)
4. IDENTIFY STRATEGIC ISSUES, STRATEGIES & LONG-TERM OBJECTIVES
5. FORMULATE SHORT-TERM OBJECTIVES AND CREATE ACTION PLANS
6. SECURE FUNDING & IMPLEMENT PLAN
7. MONITOR & MEASURE PROGRESS
8. COMMUNICATE PROGRESS TO ORGANIZATION
9. EVALUATE PLAN IMPLEMENTATION
10. CONDUCT MANAGEMENT REVIEW
11. CONTINUOUSLY IMPROVE
12. INTEGRATE W/ DECISION-MAKING

CLIMATE ENTRY POINTS AND INTEGRATION ACTIONS
a. Identify threats and opportunities from climate change
b. Identify strategic issues, strategies, and long-term objectives related to managing climate risk
c. Monitor climate resilience performance measures
d. Re-evaluate and modify your climate risk management objectives over time
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## STRATEGIC PLANNING

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BUILDING SUPPORT FOR ADDRESSING CLIMATE RISKS

- Identify a champion
- Define roles and responsibilities
- Make the case to executive management
- Build support across airport departments
- Coordinate with external stakeholders
- Communicate effectively
BUILDING SUPPORT FOR ADDRESSING CLIMATE RISKS

- Identify a champion
  - Drive climate change integration
  - Gather support
- Define roles and responsibilities
- Make the case to executive management
- Build support across airport departments
- Coordinate with external stakeholders
- Communicate effectively
BUILDING SUPPORT FOR ADDRESSING CLIMATE RISKS

- Identify a champion
- Define roles and responsibilities
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BUILDING SUPPORT FOR ADDRESSING CLIMATE RISKS

- Identify a champion
- Define roles and responsibilities
- Make the case to executive management
  - Help inform airport priorities
- Build support across airport departments
- Coordinate with external stakeholders
- Communicate effectively

Potential Short-term Risks
- Intensifying heavy rain events (e.g. 20-year events now occur every 2 years)
- Increased frequency and severity of storms
- More frequent and severe heat waves
- Higher risk of coastal flooding
- Increased public awareness and demand for action
- Increased public demand for sustainability
- Higher costs for water and energy services
- More frequent and severe heat waves
- Increased public awareness and demand for action
- Increased public demand for sustainability
- Higher costs for water and energy services

Benefits of Taking Action
- Use an assessment method for drainage system resilience, performance, and other weather-related costs
- Reduce costs and emissions by changing design for planned major renovation project
- Mitigate climate change and environmental effects
- Reduce costs and emissions by changing design for planned major renovation project
- Mitigate climate change and environmental effects
- Reduce costs and emissions by changing design for planned major renovation project
- Mitigate climate change and environmental effects

Recent Trends and Observed Impacts
- More frequent and severe heat waves observed across the nation
- Increased frequency and severity of storms
- More frequent and severe heat waves
- Increased public awareness and demand for action
- Increased public demand for sustainability
- Higher costs for water and energy services
- More frequent and severe heat waves
- Increased public awareness and demand for action
- Increased public demand for sustainability
- Higher costs for water and energy services

WHERE TO GO FROM HERE
- Create an action plan to implement new infrastructure changes to align with future climate projections.
- Work with stakeholders to develop a comprehensive climate adaptation plan.
- Engage with the public to increase awareness and understanding of climate change impacts.
- Collaborate with other airports and stakeholders to share best practices and lessons learned.
- Develop a comprehensive climate action plan that addresses both short- and long-term impacts.
BUILDING SUPPORT FOR ADDRESSING CLIMATE RISKS

- Identify a champion
- Define roles and responsibilities
- Make the case to executive management
- Build support across airport departments
- Coordinate with external stakeholders
- Communicate effectively
BUILDING SUPPORT FOR ADDRESSING CLIMATE RISKS

- Identify a champion
- Define roles and responsibilities
- Make the case to executive management
- Build support across airport departments
- Coordinate with external stakeholders
  - Address indirect risks
  - Share data or lessons learned
- Communicate effectively
BUILDING SUPPORT FOR ADDRESSING CLIMATE RISKS

- Identify a champion
- Define roles and responsibilities
- Make the case to executive management
- Build support across airport departments
- Coordinate with external stakeholders

**Communicate effectively**

- Focus on risks, not causes
- Keep it positive
- Focus on why it matters to your audience
Identify data metrics – use existing or create new performance/data metrics to gauge impacts of climate risks

Use event expense codes – track costs related to climate risk events or impacts

Use existing (or create new) annual processes to review data

Identify a tipping point – determine a point in your data tracking where action is needed
EXAMPLE STARTING POINTS

- Use asset management (or other) systems to monitor climate risks over time
- Consider climate change in the design of new infrastructure
- Learn from extreme weather events
Laying the groundwork for conversations with department leads on specific projects that have climate implications

- Using team lead language to think through climate considerations the effect on those projects
- Specific projects considering climate change: de-icing infrastructure, retention pond design

Airports better off integrating climate change into existing systems and speaking the language of teams in place

- DEN strives to integrate sustainability/climate change values with the teams they are working with
- More successful meeting teams where they are comfortable working
Most integration actions are not to change the existing process; simply to recognize when it's time to revisit assumptions.

Integrating at early entry points can have “trickle down” effects.

Not all entry points are necessary.
Practical guidance, checklists, examples, and other resources for each integration action

Glossy template for engaging airport executives

Detailed list of climate risk data metrics to monitor

Detailed list of climate data resources
QUICK START GUIDE

- Condensed, visual version of the handbook
- Highlights key processes and resources
IN CONCLUSION

All airports should be thinking about managing climate risks

“Managing climate risks” is possible within existing processes (and probably a lot easier than you think)

Resources are available to help (ACRP Report 188)
Handbook and Quick Start Guide:
http://www.trb.org/Main/Blurbs/178312.aspx

Cassandra Bhat
Cassandra.Bhat@icf.com
Appendix – Management System Flow Charts and Integration Strategies
STRATEGIC PLANNING PROCESS

1. UNDERSTAND THE ORGANIZATION
2. DEVELOP MISSION, VISION AND VALUE STATEMENT
3. SCAN THE ENVIRONMENT AND PREDICT DEVELOPMENTS (SWOT ANALYSIS)
4. IDENTIFY STRATEGIC ISSUES, STRATEGIES & LONG-TERM OBJECTIVES
5. FORMULATE SHORT-TERM OBJECTIVES AND CREATE ACTION PLANS

CLIMATE ENTRY POINTS AND INTEGRATION ACTIONS

a. Identify threats and opportunities from climate change
b. Identify strategic issues, strategies, and long-term objectives related to managing climate risk
c. Monitor climate resilience performance measures
d. Re-evaluate and modify your climate risk management objectives over time
e. Continuously integrate new climate risk information into decision-making

6. SECURE FUNDING & IMPLEMENT PLAN
7. MONITOR & MEASURE PROGRESS
8. COMMUNICATE PROGRESS TO ORGANIZATION
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| **Integrate with decision-making** | Continuously integrate new climate risk information into decision-making | • Periodically review data on performance measures to understand and improve your performance  
• Refine strategic issues, strategies, and objectives as needed to ensure objectives are being met |
MASTER PLANNING PROCESS

1. UNDERSTAND THE ORGANIZATION

2. CONDUCT EXISTING CONDITIONS SURVEY
   • Assess Aviation Forecasts
   • Assess Facility Requirements
   • Conduct Aeronautical Obstruction Survey

3. ASSESS LEVEL OF SERVICE REQUIREMENTS

4. DEVELOP AND EVALUATE ALTERNATIVES
   • Assess Financial Feasibility
   • Assess Environmental Impacts of Alternatives
   • Develop Airport Layout Plan

5. DEVELOP MASTER PLAN

6. SECURE FUNDING & IMPLEMENT PLAN

7. MONITOR & MEASURE PROGRESS

8. EVALUATE PLAN IMPLEMENTATION

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CLIMATE ENTRY POINTS AND INTEGRATION ACTIONS

a. Evaluate how climate change could affect aviation forecasts or facility requirements

b. Consider impact of climate change through environmental analyses

c. Consider whether infrastructure changes are needed to accommodate climate change

d. Monitor climate resilience performance measures

e. Re-evaluate and modify your climate risk management objectives over time

f. Continuously integrate new climate risk information into decision-making
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<td>Evaluate how climate change could affect aviation forecasts or facility requirements</td>
<td>• Understand existing organization/facility</td>
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<tr>
<td></td>
<td></td>
<td>• Evaluate hazards identified in the self-assessment</td>
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<tr>
<td></td>
<td></td>
<td>• Incorporate climate information into level of service forecasts</td>
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<td></td>
<td>• Prioritize climate risks to existing infrastructure and aviation forecasts</td>
</tr>
<tr>
<td>Develop and evaluate alternatives – assess environmental impact of analysis</td>
<td>Consider impact of climate change through environmental analyses</td>
<td>• Draw from climate hazard data collected in the self-assessment or other sources</td>
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<tr>
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<td>• Consider any climate implications determined during the existing conditions survey</td>
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<tr>
<td>Develop and evaluate alternatives – develop airport layout plan</td>
<td>Consider whether infrastructure changes are needed to accommodate climate change</td>
<td>• Assess the time horizon of your identified climate hazards</td>
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<tr>
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<td>• Incorporate climate change considerations into design requirements</td>
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<td>• Refine existing conditions survey, environmental analysis, and airport layout plan as needed</td>
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ENTERPRISE RISK MANAGEMENT PROCESS

1. DEVELOP ENTERPRISE RISK MANAGEMENT POLICY
   - Develop ERM Strategy (Risk Philosophy)
   - Develop Governance Structure (Framework)

2. IDENTIFY RISKS
   - Conduct Risk Assessment
   - Develop Risk Register
   - Conduct Risk Control Assessment

3. DEVELOP RISK RESPONSE PLANS (MITIGATION STRATEGIES)

4. DEVELOP IMPLEMENTATION PLAN

5. SECURE FUNDING & IMPLEMENT PLAN
   - Avoid, Modify, Transfer & Retain Risk

6. PROVIDE ERM TRAINING

7. MONITOR & MEASURE PROGRESS

8. REPORT PROGRESS

9. CONDUCT MANAGEMENT REVIEW

10. CONTINUOUSLY IMPROVE

11. INTEGRATE W/ DECISION-MAKING

CLIMATE ENTRY POINTS AND INTEGRATION ACTIONS

a. Identify threats from climate change
b. Incorporate climate risks into existing mitigation strategies, or develop new strategies
c. Identify funding sources for climate risk management activities
d. Update training protocols
e. Monitor climate risk related performance indicators
f. Re-evaluate climate risk data and mitigation strategies over time
g. Continuously integrate new climate risk information into decision-making
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<td>Identify risks</td>
<td>Identify threats from climate change</td>
<td>- Incorporate self-assessment results into the risk assessment</td>
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<td>- Prioritize climate risks in the risk register</td>
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<td>- Develop methods for incorporating uncertainty into climate risk assessments</td>
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<tr>
<td>Develop risk response plans</td>
<td>Incorporate climate risks into existing mitigation strategies, or develop new strategies</td>
<td>- Share risk information to coordinate mitigation efforts</td>
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<td>plans (mitigation strategies)</td>
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<td>- Seek low-cost options for mitigating climate risks in the short-term</td>
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<td>- Identify insurance plans and provides that address climate risks</td>
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<td>- Develop a Business Continuity Plan (BCP) or Continuity of Operations Plan (COOP)</td>
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<tr>
<td>Secure funding and implement plan</td>
<td>Identify funding sources for climate risk management activities</td>
<td>- Seek funding sources from federal, state, and local resources for climate risk management</td>
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<tr>
<td>Provide enterprise risk management</td>
<td>Update training protocols</td>
<td>- Update your training protocols to include the identified climate risks, risk assessment results, and modified or</td>
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<tr>
<td>training</td>
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<td>new mitigation strategies</td>
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<tr>
<td>Monitor and measure progress</td>
<td>Monitor climate risk related performance indicators</td>
<td>- Monitor and measure service disruptions, personnel and stakeholder safety, and financial costs related to</td>
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<td>identified climate hazards and risks</td>
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<tr>
<td>Continuously improve</td>
<td>Re-evaluate climate risk data and mitigation strategies over time</td>
<td>- Re-evaluate how climate hazards and risks are being incorporated into your enterprise risk management process</td>
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<td>- Continuously coordinate with risk management personnel to overcome potential barriers</td>
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2. DESIGN SMS
   - Obtain Management Commitment
   - Appoint an SMS Champion
   - Select SMS Model Structure
   - Build on Existing Practices and Operations
   - Conduct Gap Analysis/Internal Safety Assessment

3. IDENTIFY RISKS/HAZARDS

4. DEFINE AND DOCUMENT SMS
   - Set Objectives
   - Develop Standard Operating Procedures

5. DEVELOP SMS IMPLEMENTATION PLAN

6. IMPLEMENT PLAN
   - Develop and Implement SMS Processes
   - Appoint SMS Manager

7. PROVIDE SMS TRAINING

8. MONITOR & MEASURE PROGRESS

9. CONDUCT SMS ASSESSMENT

10. CONDUCT MANAGEMENT REVIEW

11. CONTINUOUSLY IMPROVE

12. INTEGRATE W/ DECISION-MAKING

CLIMATE ENTRY POINTS AND INTEGRATION ACTIONS

- **a** Include risks from climate change and extreme weather events in risk/hazard identification
- **b** Incorporate climate change into SMS procedure trainings
- **c** Identify climate change as a safety risk
- **d** Monitor weather trends and climate-related metrics
- **e** Re-evaluate and modify climate-related safety risks
- **f** Continuously integrate new climate risk information into risk assessment
### SAFETY MANAGEMENT

<table>
<thead>
<tr>
<th>Climate Entry Points</th>
<th>Climate Integration Actions</th>
<th>Example Integration Strategies</th>
</tr>
</thead>
</table>
| **Identify risks/hazards** | Include risks from climate change and extreme weather events in risk/hazard identification | • Evaluate whether SMS is effectively accounting for projected changes in weather-related safety risks  
• Establish a policy to review weather frequency assumptions |
| **Provide SMS training** | Incorporate climate change into SMS procedure trainings | • Update training to include climate hazard information  
• Update training to include reviewing recent weather trends |
| **Design SMS** | Identify climate change as a safety risk | • Establish a policy to identify climate change as a safety risk |
| **Monitor and measure progress** | Monitor weather trends and climate-related metrics | • Monitor recent weather trends that may affect worker or passenger safety |
| **Continuously improve** | Re-evaluate and modify climate-related safety risks | • Continuously improve management of climate-related safety risks |
| **Integrate with decision-making** | Continuously integrate new climate risk information into risk assessment | • Periodically review data on climate hazard risks and recent weather trends  
• Refine identified risks and hazards or SMS trainings as needed to ensure SMS objectives are met |
CAPITAL PLANNING PROCESS

1. DEVELOP AIRPORT CAPITAL PLANNING POLICY
   - Set Financial Metrics
   - Determine Operating Budget Forecast
   - Determine Revenue Projections
   - Determine Potential Funding Sources

2. MANAGE FINANCIAL PLAN
   - Conduct Existing Conditions Survey
   - Conduct Facility Needs Assessment
   - Analyze Alternatives
   - Analyze Life-cycle Cost/Business Viability
     - Generate Project Request List

3. MANAGE CAPITAL PLAN
   - Evaluate Project
   - Run Financial Model Scenarios
   - Compare to Current Contracts and Commitments
   - Rank Project

4. ANALYZE PROGRAMMING CRITERIA
   - Design project
   - Construct project
   - Monitor & measure progress
   - Operate project

5. DEVELOP AIRPORT CAPITAL PLAN WITH FUNDING SOURCES IDENTIFIED
   - Secure funding & implement plan
   - Define scope, schedule, funding source & operating impact of project

6. DESIGN PROJECT
   - Construct project
   - Monitor & measure progress
   - Operate project

7. CONSTRUCT PROJECT
   - Monitor & measure progress
   - Operate project

8. MONITOR & MEASURE PROGRESS
   - Operate project

9. OPERATE PROJECT
   - Closeout and evaluate project
   - Conduct management review

10. CONFIRM AND EVALUATE PROJECT
    - Continuously improve
    - Integrate w/ decision-making
### CAPITAL PLANNING

<table>
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<tr>
<th>Climate Entry Points</th>
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<th>Example Integration Strategies</th>
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</thead>
<tbody>
<tr>
<td><strong>Design project</strong></td>
<td>Integrate climate change projection data into design practices</td>
<td>• Establish tiers of analysis&lt;br&gt;• Plan for uncertainty with flexible design practices</td>
</tr>
<tr>
<td><strong>Evaluate project</strong></td>
<td>Screen projects for climate risks</td>
<td>• Downscale climate risks to specific projects&lt;br&gt;• Select and apply evaluation criteria</td>
</tr>
<tr>
<td><strong>Rank project</strong></td>
<td>Include climate risk management as a criterion for project ranking</td>
<td>• Collaborate with stakeholders to develop a rating system</td>
</tr>
<tr>
<td><strong>Manage capital plan</strong></td>
<td>Consider climate risk management needs in development of project request list</td>
<td>• Identify facilities, assets, or infrastructure vulnerable to climate risks&lt;br&gt;• Generate project request list</td>
</tr>
<tr>
<td><strong>Secure funding and implement plan</strong></td>
<td>Allocate funding for climate risk management projects</td>
<td>• State and local resources&lt;br&gt;• Resilience bonds</td>
</tr>
<tr>
<td><strong>Develop airport capital planning policy</strong></td>
<td>Incorporate climate risk management as an overarching guideline</td>
<td>• Create a general climate risk guiding policy</td>
</tr>
<tr>
<td><strong>Closeout and evaluate project</strong></td>
<td>Review climate risk management efforts and identify opportunities for improvement</td>
<td>• Create a review protocol specific to climate risk management</td>
</tr>
<tr>
<td><strong>Monitor and measure progress</strong></td>
<td>Monitor the performance of climate risk management projects</td>
<td>• Measure the historical and post-investment service disruptions for a given event threshold</td>
</tr>
<tr>
<td><strong>Continuously improve</strong></td>
<td>Re-evaluate climate risk data and design protocols over time</td>
<td>• Incorporate new climate change data into design protocols</td>
</tr>
<tr>
<td><strong>Integrate with decision-making</strong></td>
<td>Continuously integrate new climate risk information into decision-making</td>
<td>• Continuously integrate new climate risk analysis into decision-making to ensure all process steps consider climate change</td>
</tr>
</tbody>
</table>
ASSET MANAGEMENT PROCESS

1. DEVELOP ASSET MANAGEMENT POLICY

2. DETERMINE EXISTING CONDITIONS
   - Develop Asset Registry
   - Assess Performance & Failure Modes
   - Determine Residual Life
   - Determine Life Cycle & Replacement Costs

3. SET TARGET LEVELS OF SERVICE

4. DETERMINE BUSINESS RISK (CRITICALITY)

5. DEVELOP ASSET MANAGEMENT PLAN

6. SECURE FUNDING & IMPLEMENT PLAN
   - Optimize O&M Investment
   - Optimize Capital Investment

7. RENEW OR DISPOSE OF ASSETS

8. MAINTAIN ASSETS

9. MONITOR & MEASURE PROGRESS

10. AUDIT PERFORMANCE

11. CONDUCT MANAGEMENT REVIEW

12. CONTINUOUSLY IMPROVE

13. INTEGRATE W/ DECISION-MAKING

CLIMATE ENTRY POINTS AND INTEGRATION ACTIONS

- a. Integrate resilience into project design
- b. Evaluate how climate change could affect aviation forecasts or facility requirements
- c. Consider the impacts of climate risks
- d. Evaluate how climate change could affect asset performance
- e. Monitor climate resilience metrics
- f. Re-evaluate and modify existing conditions determination
- g. Continuously integrate new climate risk information into decision-making
### Climate Entry Points

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<tr>
<td>Maintain assets</td>
<td>Integrate resilience into project design</td>
<td>• Use asset rehabilitation and replacement as early opportunities for managing climate risks in the design phase of projects</td>
</tr>
</tbody>
</table>
| Set target levels of service  | Evaluate how climate change could affect aviation forecasts      | • Incorporate climate information into level of service forecasts  
• Prioritize climate risks to existing infrastructure and aviation forecasts  
• Create a plan for critical assets in advance of an event |
| Determine business risk (criticality) | Consider the impacts of climate risks                        | • Evaluate the probability and consequences of asset failure under climate change |
| Determine existing conditions  | Evaluate how climate change could affect asset performance       | • Evaluate hazards identified in the self-assessment  
• Update scheduling, prioritization, and asset condition analysis  
• Develop metrics for events that exceed thresholds  
• Use event expense codes |
| Monitor and measure progress  | Monitor climate resilience metrics                               | • Monitor and measure asset performance under increasing climate risks |
| Continuously improve          | Re-evaluate and modify existing conditions determination       | • Continuously evaluate data for changes in performance  
• Improve methodology for integrating and tracking climate risk and asset performance |
| Integrate with decision-making| Continuously integrate new climate risk information into decision-making | • Continuously integrate new climate risk information focusing specifically on critical assets |
EMERGENCY MANAGEMENT PROCESS

1. DEVELOP EMERGENCY MANAGEMENT VISION
2. MITIGATE/PLAN
   - Identify Risks
     - Conduct Risk Assessment
     - Develop Risk Register
3. ASSESS PREPAREDNESS
4. DEVELOP RISK RESPONSE PROCESSES/MITIGATION STRATEGIES
5. DEVELOP EMERGENCY MANAGEMENT PLAN
6. IMPLEMENT PLAN/RESPOND TO INCIDENTS
   - Contain Incident
   - Reduce Impact
   - Prevent Further Impact
7. EVALUATE RECOVERY
   - Assess Response Effectiveness and Timing
8. CONDUCT MANAGEMENT REVIEW
9. CONTINUOUSLY IMPROVE
10. INTEGRATE W/ DECISION-MAKING

CLIMATE ENTRY POINTS AND INTEGRATION ACTIONS

a. Review and update risk register in light of climate risks
b. Develop risk response processes or mitigation strategies for any new climate-related risks
c. Review performance during each stage of the event and integrate lessons learned into the emergency management plan
d. Re-evaluate and modify climate-related risks
e. Continuously integrate new climate risk information into risk assessment
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</table>
| Identify risks        | Review and update risk register in light of climate risks | • Consider possibility of new types of events  
• Consider increased severity of existing types of events  
• Consider changing risks associated with other risk management activities at the airport |
| Develop risk response processes/mitigation strategies | Develop risk response processes or mitigation strategies for any new climate-related risks | • Require after-action reports  
• Establish collaborative debrief sessions |
| Conduct management review | Review performance during each stage of the event and integrate lessons learned into the emergency management plan | • Identify and document lessons learned after an event  
• Evaluate airport’s emergency reserve budget |
| Continuously improve  | Re-evaluate and modify climate-related risks | • Re-evaluate incorporation of climate hazards and risks into emergency management process  
• Review recent trends and latest climate projections to determine whether extreme events are the beginning of a potential trend |
| Integrate with decision-making | Continuously integrate new climate risk information into risk assessment | • Periodically review data on climate hazard risks and recent weather trends  
• Refine your risk register to include updated climate-related risks |
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Synthesis 33: Airport Climate Adaptation and Resilience

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