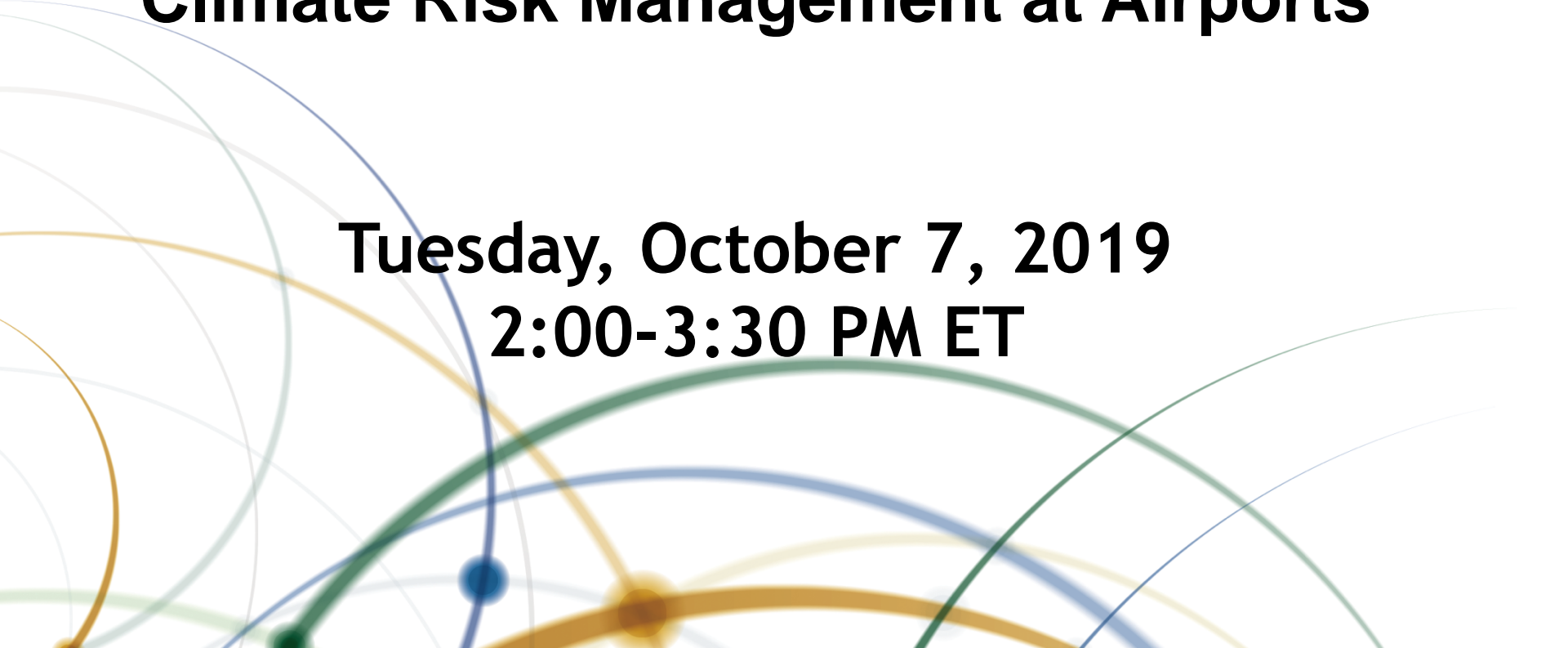


TRANSPORTATION RESEARCH BOARD

Unclutter Your Processes: Simplifying Climate Risk Management at Airports

**Tuesday, October 7, 2019
2:00-3:30 PM ET**




Purpose

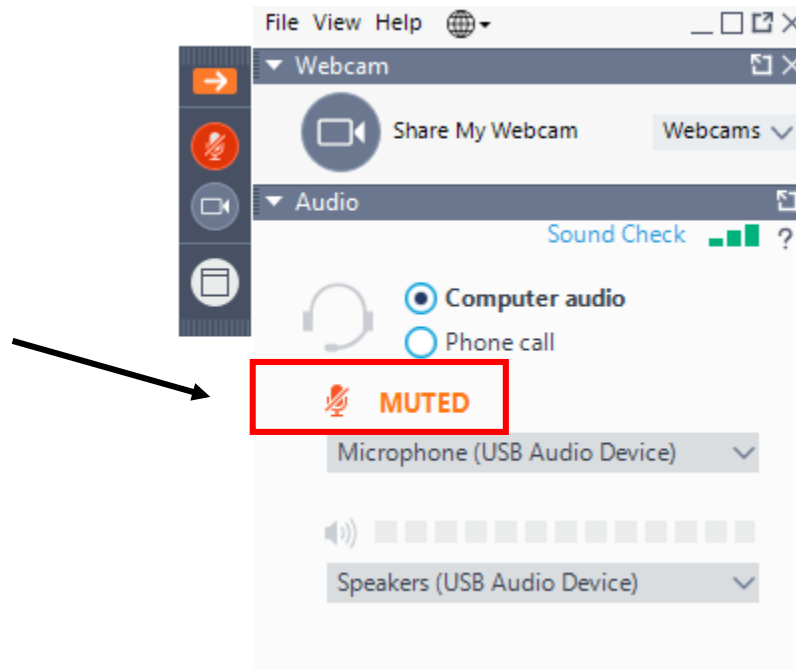
To discuss ACRP [Research Report 188](#): Using Existing Airport Management Systems to Manage Climate Risk.

Learning Objectives

At the end of this webinar, you will be able to:

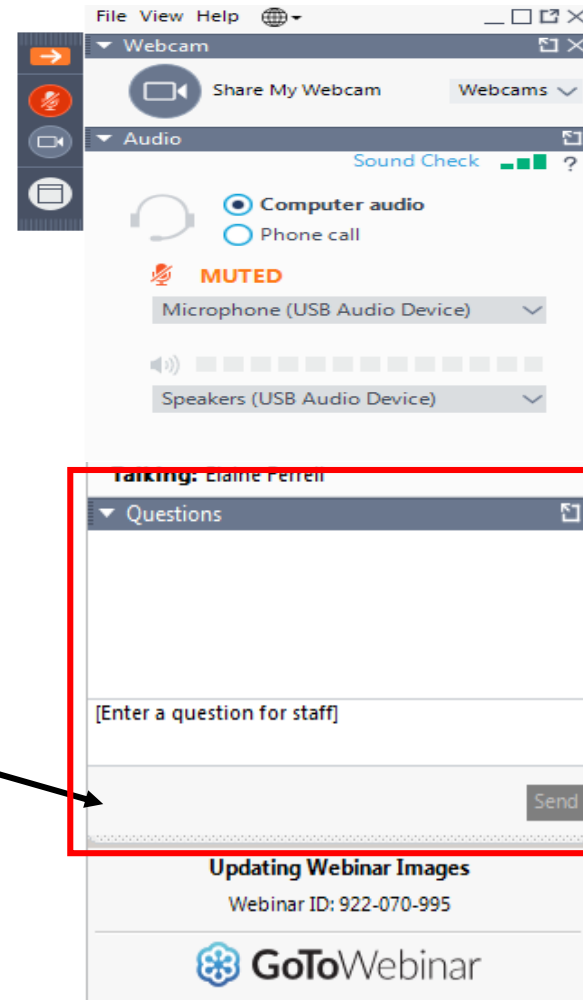
- Describe the function of an airport's existing risk management systems
 - Apply a self-assessment for climate risks at your airport
 - Discuss how to gain support for climate change mitigation plans
 - Incorporate climate change throughout existing airport management processes
- 

All Attendees Are Muted

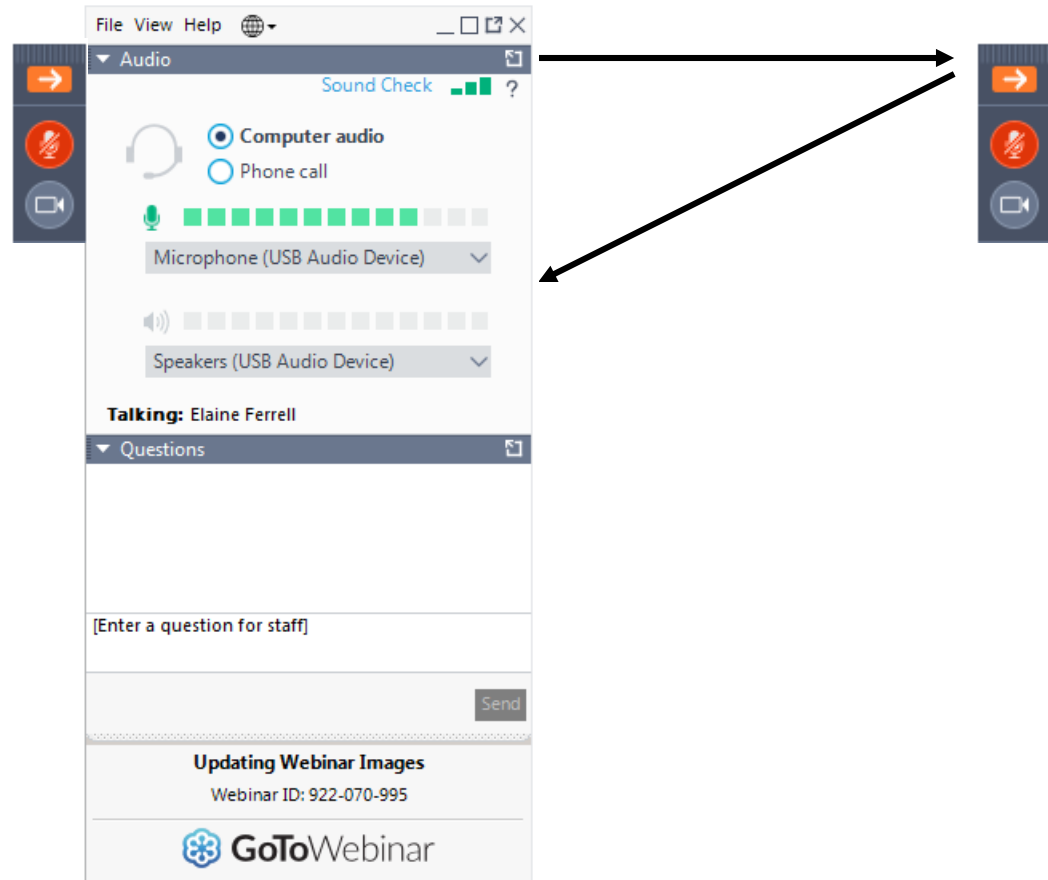


Questions and Answers

- 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



Panelists Presentations

<http://onlinepubs.trb.org/onlinepubs/webinars/191007.pdf>

*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*

ACRP Webinar

Unclutter Your Processes – Simplifying
Climate Risk Management at Airports

October 8, 2019



ACRP AIRPORT
COOPERATIVE
RESEARCH
PROGRAM

Patti Clark

Embry-Riddle Aeronautical University

- ✈ 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!



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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*

ACRP Research Report 188

Using Existing Airport Management Systems to Manage Climate Risk

ICF

in association with
Gresham Smith
Faith Group, LLC



PRESENTERS



✈ Cassandra Bhat, ICF – Senior Managing Consultant, Climate Resilience



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

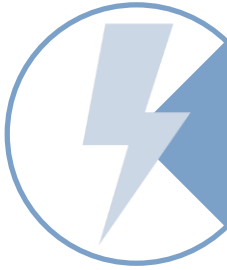


✈ Scott Morrissey, Denver International Airport – Senior Director, Sustainability

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
- ✈ Molly Laster, U.S. Government Accountability Office Liaison, Washington, DC
- ✈ Christopher J. Oswald, Airports Council International–North America Liaison
- ✈ Justin M. Towles, American Association of Airport Executives Liaison

TODAY'S PRESENTATION



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



Image courtesy of City of Dallas

PROJECT 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

CLIMATE RISKS TO PLANNING AND OPERATIONS

✈ **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



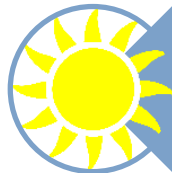
Temperature

- 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

The Washington Post

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

The Dallas Morning News

NEWS > WEATHER

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

MANAGING CLIMATE RISKS THROUGH EXISTING SYSTEMS

✈ Most situations don't require major changes to existing processes

- Review assumptions
- Monitor for changes

Strategic Planning

Master Planning

Enterprise Risk Management

Safety Management

Capital Planning

Asset Management

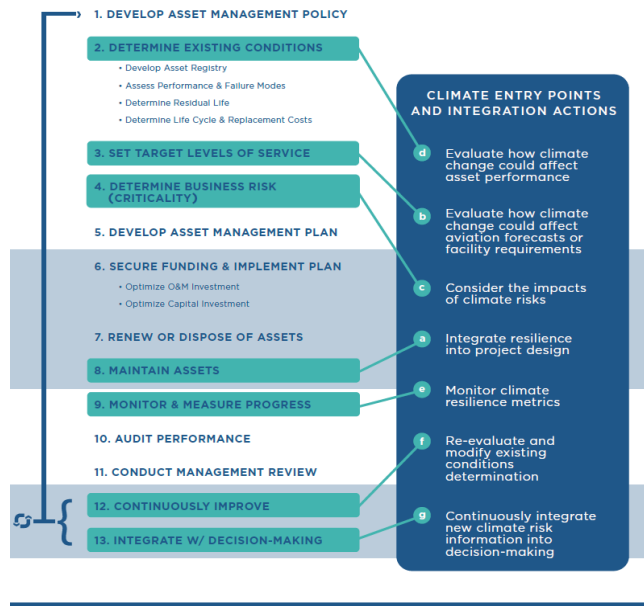
Emergency Management

HANDBOOK PROVIDES RESOURCES TO HELP

✈ Simple processes

✈ Examples

✈ Supporting resources (e.g., checklists, tools, outside information)



WHAT WE NEED TO KNOW ABOUT RISK

Recent trends show that the frequency and the type of extreme weather events are changing, with impacts across industries and societies worldwide. New and different hazards pose a risk to ["how they live"](#), in both the near- and the long-term, but there are changes we can make today to manage these risks over time.

Potential Near-term Risks

- More frequent heavy rain events (up to 3 times more events with more than 2 inches of rain in 24 hours within the next 20-30 years) could lead to:
- More frequent drainage system failures and
- Higher risk of environmental contamination.
- Increases in heatwaves (up to 25 days per year above 95 degrees Fahrenheit - could lead to:
- Reduced efficiency of outdoor staff due to heat stress, frequent breaks, and
- Risks to elderly travelers.
- Increased risk of pavement rutting and shoving.

Benefits of Taking Action

- Save on maintenance costs for drainage system maintenance, pavement repair, and other weather-related costs
- Avoid costly violations in drainage design for planned runway extension project
- Maintain compliance with environmental regulations
- Improve safety and security for staff and passengers

Recent Trends and Observed Impacts

- Runways were flooded from heavy downpours four times in the past five years, and resulted in:
- 27 cancelled flights,
- \$20,000 in clean-up costs per event (\$80,000 total), and
- \$40,000 in lost revenues per event (\$160,000 total).
- Number of emergency response calls for workers in heat distress has doubled from the current 5-year period from the previous period.
- Observed 10% increase in cooling costs over past 5 years.

HOW OTHER AIRPORTS ARE ADDRESSING CLIMATE RISK

Airports of all sizes are starting to manage their climate risks, including airports in Boston, Istanbul, San Diego, Philadelphia, New York, and Toronto.

FOR EXAMPLE:

- Manitowishippi Regional Airport in Boston, Massachusetts, assessed flood risks. From this, the airport set a new design flood elevation for infrastructure and began a process to systematically floodproof critical assets.
- In Canada, Toronto Pearson International Airport accounted for increased frequency and intensity of marooned storms in a hydrologic analysis for a new culvert and in evaluating the potential impacts of a new precipitation nowcasting tool on water quality.
- In Tokyo, Narita International Airport, the world's largest, built in water and power efficiency is expected to save around US\$ 8.5 million annually and create less dependence on water supply.

Where to Go from Here?

- Create airport policy to require all new infrastructure designs to incorporate future precipitation projections.
- When emergency management plan is due for update this spring, ensure extreme heat is adequately captured.
- Follow the ACRP Handbook to integrate climate risks into the asset management system.
- Continue to track and analyze flood frequency and frequency of heat-related issues.
- Distribute climate change projection information to all departments.

	Tracking Frequency	Strategic planning	Master Planning	Enterprise Risk Management	Safety Management	Asset Management	Capital Planning	Emergency Management
Data Point								
Asset Performance								
Extent and cause of damages to infrastructure and facilities, including photos	For each event					✓		
Duration of damage or closure (i.e., how long was asset out of service)	For each event					✓		
Pavement condition (such as occurrences of buckling, rutting, and cracking on runways and other paved surfaces)	Annually					✓		
Facility condition	Annually					✓		
Expected life vs. actual life of assets	Annually					✓		
Frequency of storm drain overflows or blowouts	Annually					✓		
Frequency of water-ponding	Annually					✓		
Causes of weather-related flight delays (e.g., runway not long enough during a high-heat event)	For each event					✓		✓
Causes for repairs (make sure staff can categorize damage as related to heat, flooding, freeze/thaw, etc.)	For each event					✓		
Type and severity of weather event that caused damage (preferably by specific event/date)	For each event			✓		✓		✓
Changes in remaining service life	Annually					✓		

HANDBOOK APPLIES TO ALL AIRPORTS

LOWER Risk Airport

HIGHER 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.

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?

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

- » 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 design guidelines for existing infrastructure
- » Use failure codes to conduct a maintenance needs assessment or a criticality assessment
- » Develop a process to conduct life-cycle cost

Airport Perspective: Climate Change at Denver International Airport

✈ **DEN has less obvious climate risks than other airports, but faces similar challenges as many U.S. airports**

- Average annual days above 95⁰ will increase from about 15 currently to 40 by mid-century¹
- Shift from snow to rain events and earlier snowmelt increasing stormwater flows²
- Increasing risk of drought and wildfires³
- Changes in wind patterns³

¹NOAA. 2019. Climate Explorer.

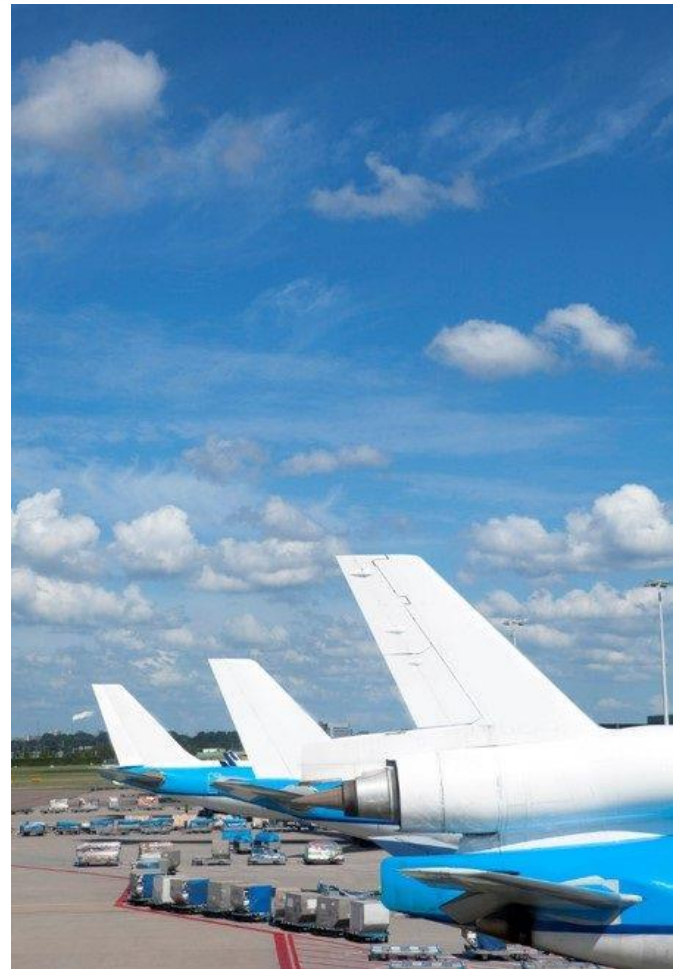
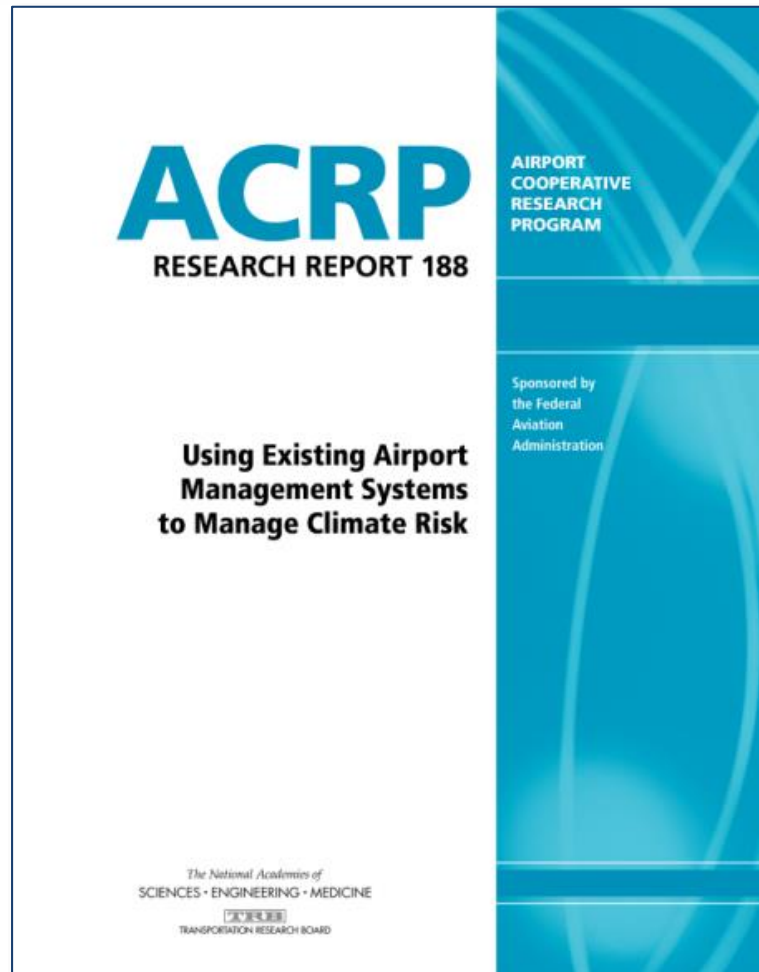
²Denver Environmental Health. 2014. City and County of Denver Climate Adaptation Plan.

³USGCRP. 2017. National Climate Assessment: Southwest.

Climate Change at Denver International Airport

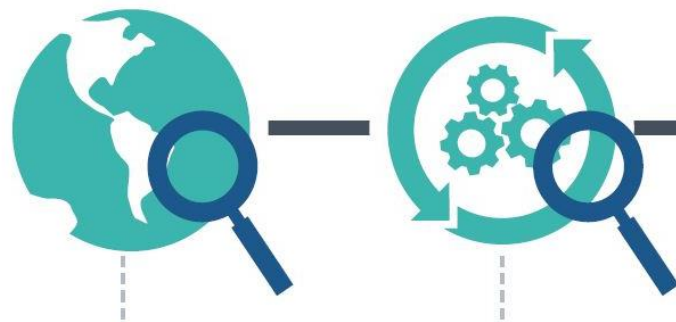
- ✈ **These climate change considerations will create risks for DEN throughout airport planning and operations**
 - Worker safety from extreme heat exposure
 - Increasing energy demands from cooling loads
 - Stormwater management and runoff pollution
 - Forecasting demand from tourism changes
 - Long-term infrastructure decision making
- ✈ **DEN is working with individual management teams in planning and operations to consider and integrate these considerations into existing practices**

HANDBOOK



HANDBOOK OVERVIEW

SELF-ASSESSMENT



IDENTIFY
CLIMATE HAZARDS

IDENTIFY RELEVANT
MANAGEMENT SYSTEM(S)

INTEGRATION



BUILD SUPPORT

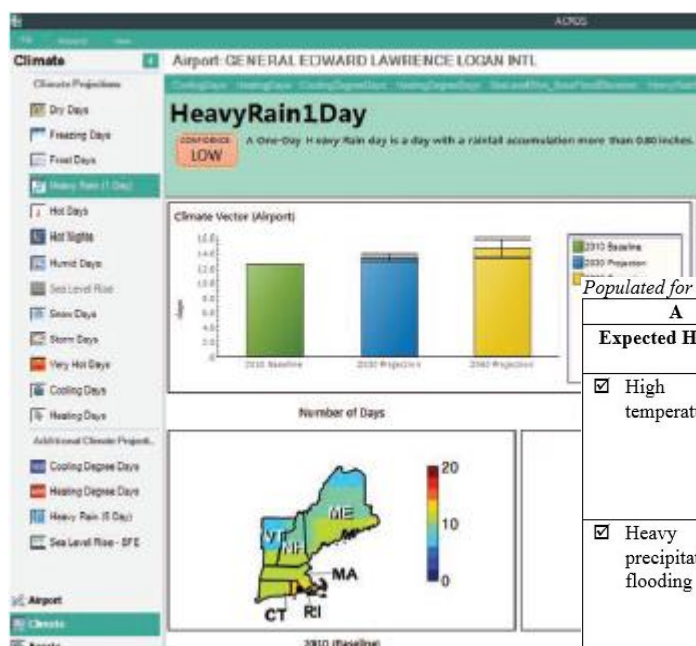
TAKE ACTION TO INTEGRATE
CLIMATE RISKS

SELF-ASSESSMENT



✈ 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?



Populated for BOS based on default ACROS tool results.

A	B	C	D	E
Expected Hazards	Expected Timing	Physical Risks	Business and Operational Risks	Safety and Security Risks
<input checked="" type="checkbox"/> High temperatures	2030s: 1.5-9.4 "Hot Days" 2060s: 3.7-22.4 "Hot Days" by 2060	High – Failure of building envelope Moderate – Loss of pavement integrity Low – Reduced vegetation and increased erosion	High – Increased HVAC demand and duration High – Reduced throughput capacity Low – Increase in number of endangered species	Low – Potential for drawing in smoke through outdoor air handling systems
<input checked="" type="checkbox"/> Heavy precipitation and flooding	2030s: Increase in 1-day heavy rain event from 12.6 to 13-14 inches 2060s: Increase to 14.4-16.6 inches	High – Building moisture damage; mold Moderate – Pavement heave Low – External facility damage due to flooding	High – Reduced throughput capacity Moderate – Change in tourism and seasonal enplanements Low – Reduced level of service	Moderate – Outbreak of contagious disease Low – Decreased food resources

WHICH MANAGEMENT SYSTEMS SHOULD I START WITH?



- ✈ **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

THEN WHAT? TAKING ACTION ON CLIMATE RISK



MANAGEMENT SYSTEMS



Strategic Planning

Master Planning

Enterprise Risk
Management

Safety Management

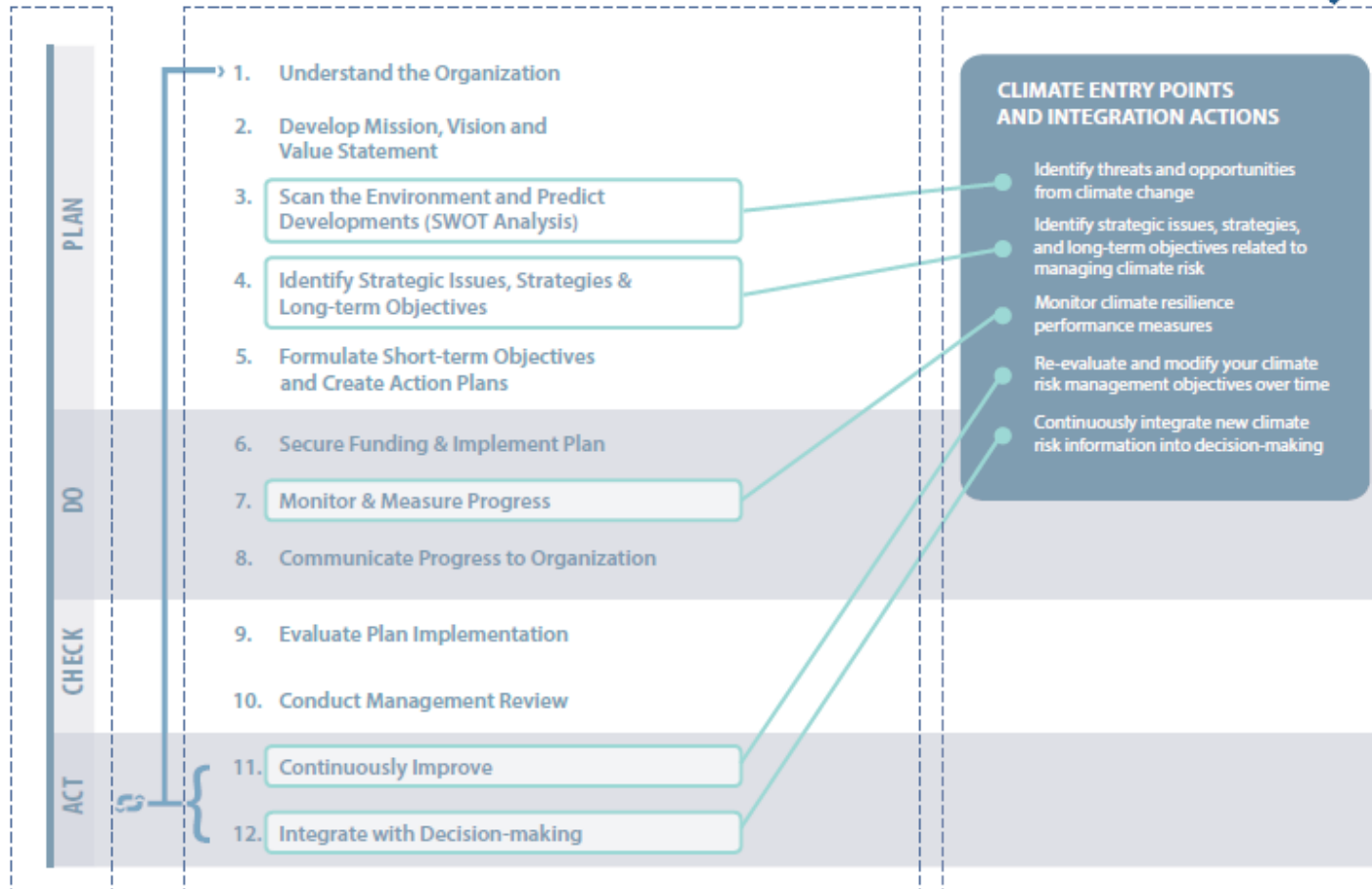
Capital Planning

Asset Management

Emergency
Management

HOW TO READ YOUR FLOWCHART

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

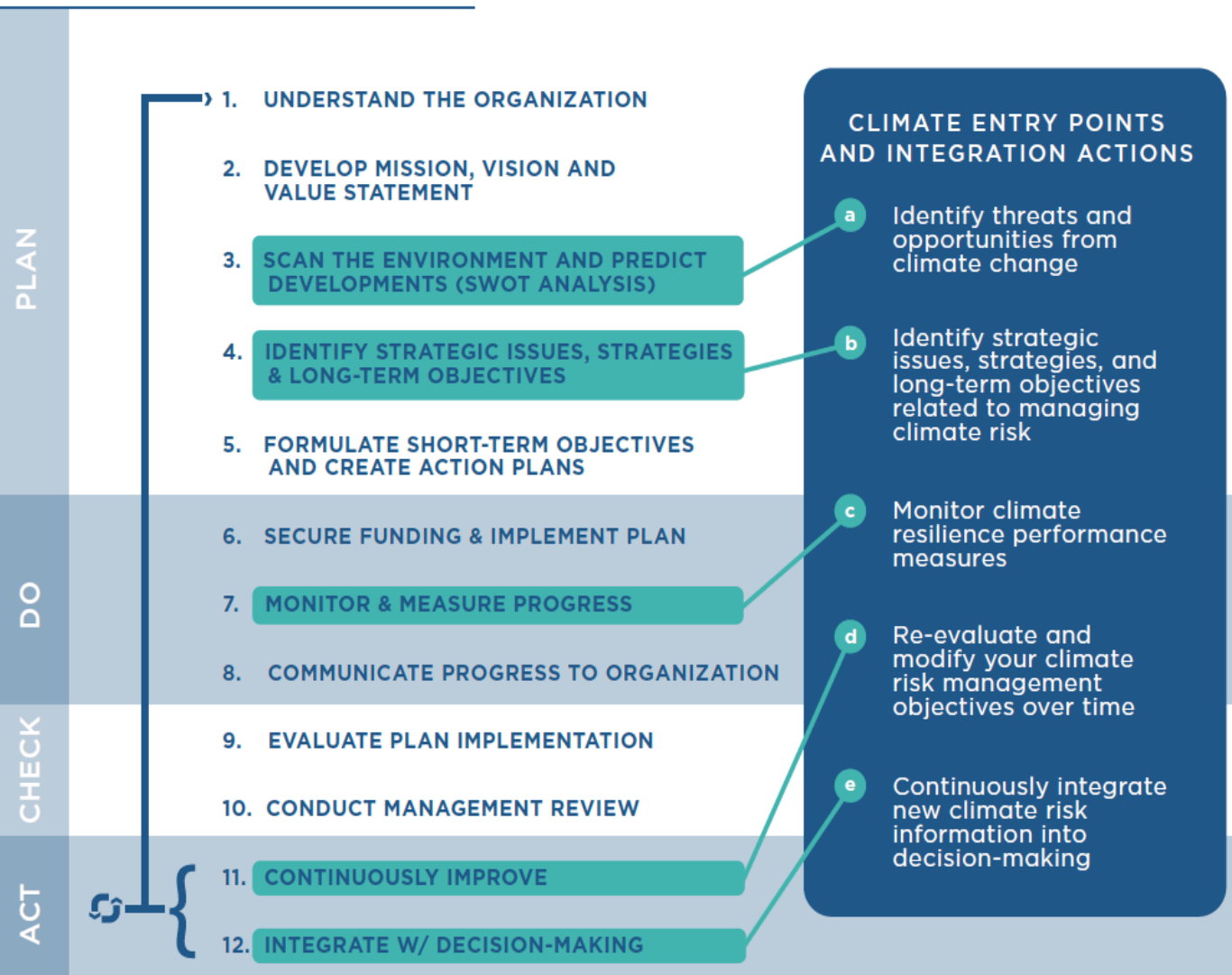


4 Steps of the Plan-Do-Check-Act Cycle

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



STRATEGIC PLANNING



Climate Entry Points	Climate Integration Actions	Example Integration Strategies
Scan the environment and predict developments (SWOT analysis)	Identify threats and opportunities from climate change	<ul style="list-style-type: none"> ● Evaluate hazards identified in the self-assessment ● Prioritize climate risks to existing planning and operations
Identify strategic issues, strategies, and long-term objectives	Identify strategic issues, strategies, and long-term objectives related to managing climate risk	<ul style="list-style-type: none"> ● Evaluate all threats and opportunities (including those related to climate change) to identify strategic issues, strategies, and long-term objectives
Monitor and measure	Monitor climate resilience performance measures	<ul style="list-style-type: none"> ● Set and monitor performance measures for a climate risk management or climate resilience strategic objective
Continuously improve	Re-evaluate and modify your climate risk management objectives over time	<ul style="list-style-type: none"> ● Continuously improve management of climate risks
Integrate with decision-making	Continuously integrate new climate risk information into decision-making	<ul style="list-style-type: none"> ● Periodically review data on performance measures to understand and improve performance ● Refine strategic issues, strategies, and objectives as needed to ensure objectives are being met

STRATEGIC PLANNING



Climate Entry Points	Climate Integration Actions	Example Integration Strategies
Scan the environment and predict developments (SWOT analysis)	Identify threats and opportunities from climate change	<ul style="list-style-type: none"> ● Evaluate hazards identified in the self-assessment ● Prioritize climate risks to existing planning and operations
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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**
- ✈ 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
 - Help inform airport priorities
- ✈ Build support across airport departments
- ✈ Coordinate with external stakeholders
- ✈ Communicate effectively

WHAT WE NEED TO KNOW ABOUT RISK

Recent trends show that the frequency and the type of extreme weather events are changing, with impacts across industries and societies worldwide. New and different hazards pose a risk to [Easter Test Here](#), in both the near- and the long-term, but there are changes we can make today to manage these risks over time.

Potential Near-term Risks

- More frequent heavy rain events (up to 3 times more events with more than 2 inches of rain in 24 hours within the next 20-30 years) could lead to
 - More frequent drainage system failures and
 - Higher risk of environmental contamination.
- Increase in heat waves (up to 25 days per year above 95 degrees Fahrenheit) – could lead to
 - Reduced efficiency of outdoor staff due to need for more, frequent breaks, and
 - Risks to elderly travelers.
- Increased risk of pavement rutting and shoving.

Benefits of Taking Action

- Save on maintenance costs for drainage system maintenance, pavement repair, and other weather-related costs
- Avoid costly mistakes in drainage design for planned runway extension project
- Maintain compliance with environmental regulations
- Improve safety and security for staff and passengers

Recent Trends and Observed Impacts

- Runways were flooding from heavy downpours four times in the past five years, and resulted in
 - 27 canceled flights.
 - \$20,000 in clean-up costs per event (\$80,000 total), and
 - \$40,000 in lost revenues per event (\$160,000 total).
- Number of emergency response calls for workers in heat distress has doubled from the current 5-year period from the previous period.
- Observed 10% increase in cooling costs over past 5 years.

HOW OTHER AIRPORTS ARE ADDRESSING CLIMATE RISK

Airports of all sizes are starting to manage their climate risks, including airports in Boston, Istanbul, San Diego, Philadelphia, New York, and Toronto.

FOR EXAMPLE:

- In **Massport** (Boston Logan International Airport) in Boston, Massachusetts, assessed flood risks. From this, Massport set a new design flood elevation for infrastructure and began a process to systematically floodproof critical assets.
- In **Canada**, **Toronto Pearson International Airport** accounted for increased frequency and intensity of microburst storms in a hydraulic analysis for a new culvert and is evaluating the potential impacts of a new precipitation mix on deicing fluid use and water quality.
- In **Turkey**, **Istanbul New Airport**, the world's largest, built-in water and power efficiency is expected to save around USD 0.5 million annually and create less dependence on local supplies.

Where to Go from Here?

- Create airport policy to require all new infrastructure designs to incorporate future precipitation projections.
- When emergency management plan is due for update this spring, ensure extreme heat is adequately captured.
- Follow the ACRP Handbook to integrate climate risks into the asset management system.
- Continue to track and analyze flood frequency and frequency of heat-related issues.
- Distribute climate change projection information to all departments.

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

CROSS-CUTTING ADAPTIVE MANAGEMENT STRATEGIES



- ✈ **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

Airport Perspective: Mitigating Climate Risks at Denver International

- ✈ **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

LESSONS LEARNED

- ✈ 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

HANDBOOK RESOURCES

- ✈ 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

WHAT WE NEED TO KNOW ABOUT RISK

Recent trends show that the frequency and type of extreme weather events are changing, with impacts across industries and societies worldwide. New and different hazards pose a risk to both in the near- and long-term, but there are changes we can make today to manage these risks over time.

Potential Near-term Risks

Benefits of Taking Action

Recent Trends and Observed Impacts

HOW OTHER AIRPORTS ARE ADDRESSING CLIMATE RISK

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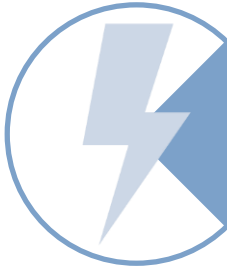
Where to Go from Here?

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)

FOR ADDITIONAL INFORMATION

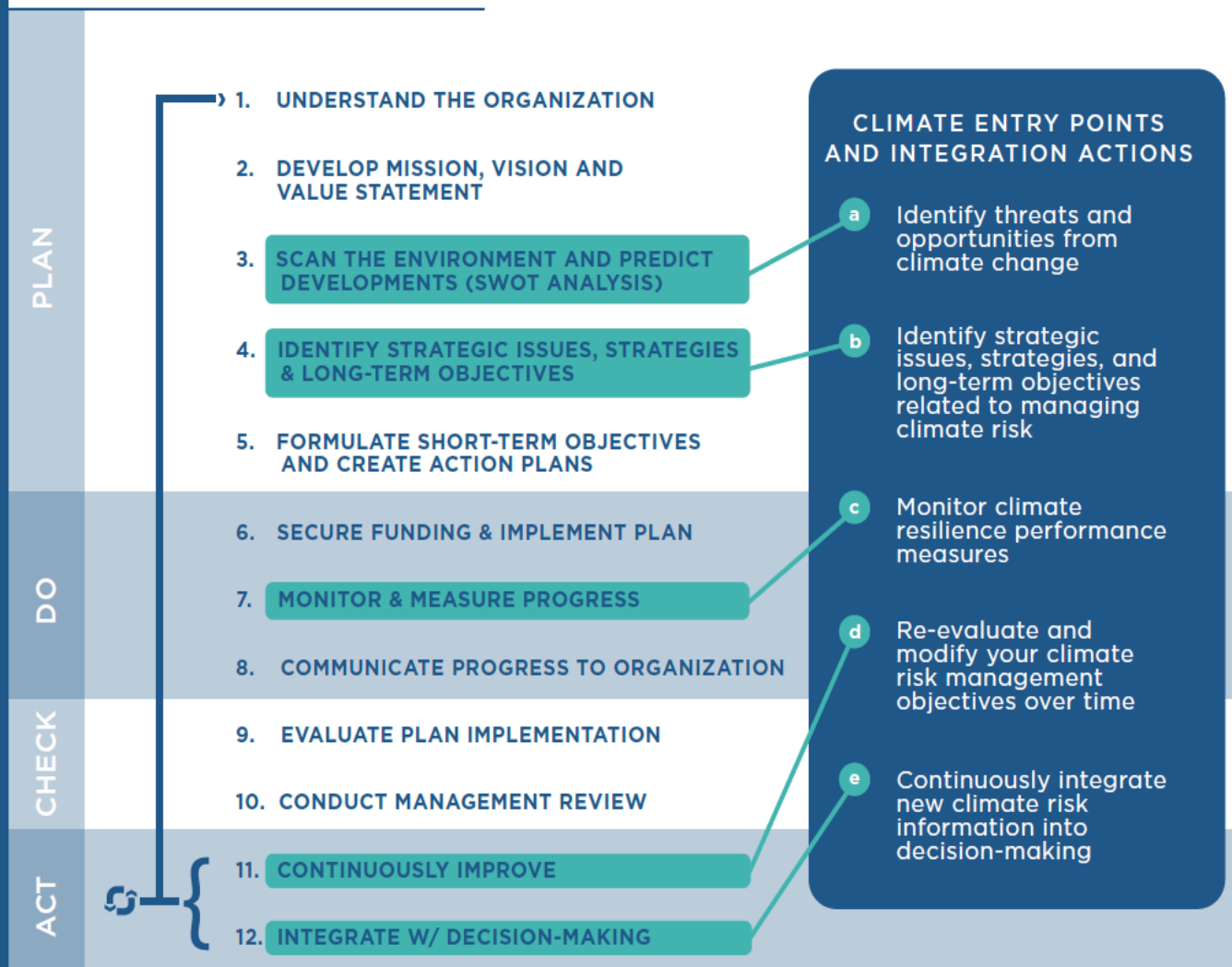


Handbook and
Quick Start Guide:
<http://www.trb.org/Main/Blurbs/178312.aspx>

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Appendix – Management System Flow Charts and Integration Strategies

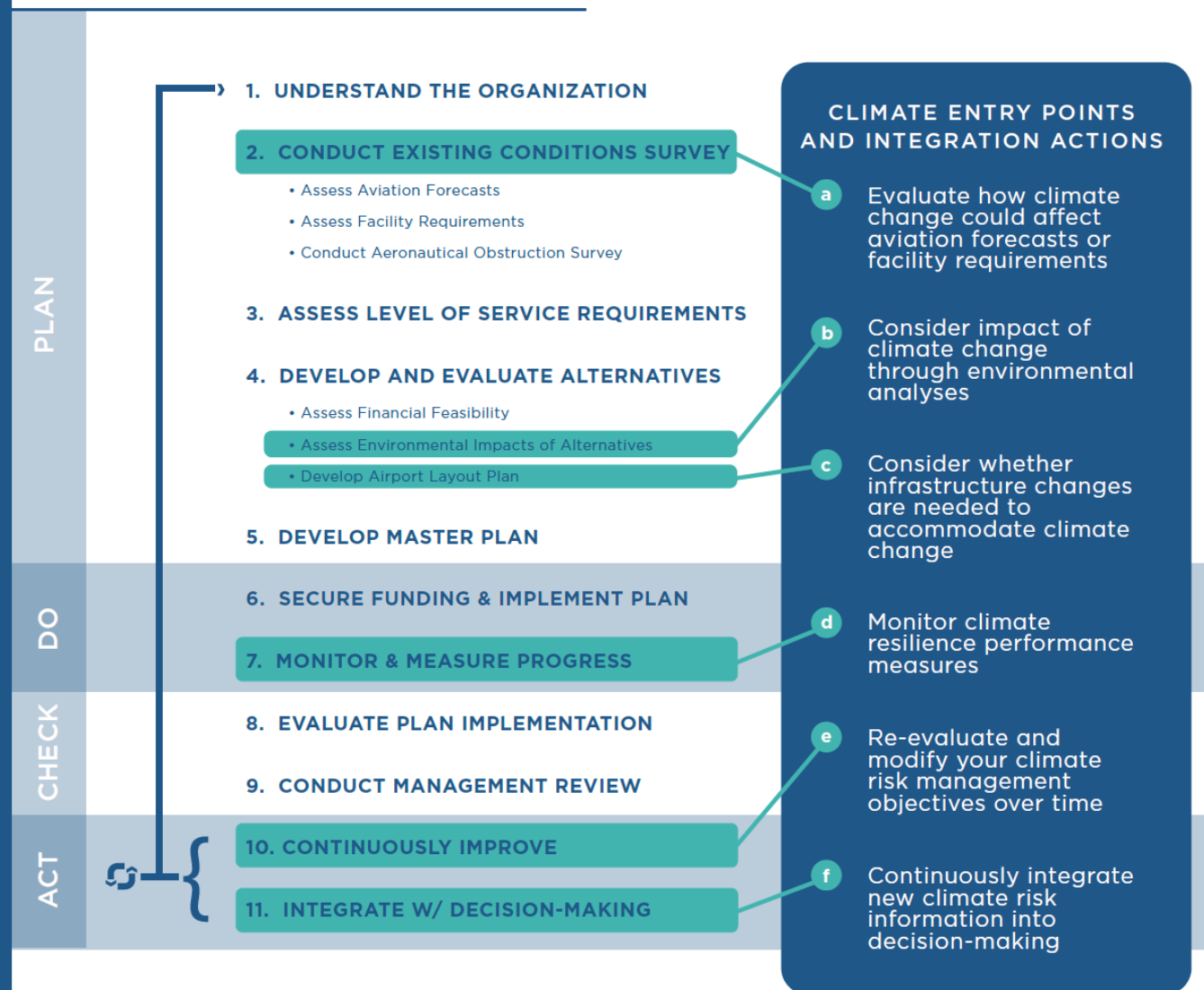
STRATEGIC PLANNING PROCESS



STRATEGIC PLANNING

Climate Entry Points	Climate Integration Actions	Example Integration Strategies
Scan the environment and predict developments (SWOT analysis)	Identify threats and opportunities from climate change	<ul style="list-style-type: none"> • Evaluate hazards identified in the self-assessment • Prioritize climate risks to existing planning and operations
Identify strategic issues, strategies, and long-term objectives	Identify strategic issues, strategies, and long-term objectives related to managing climate risk	<ul style="list-style-type: none"> • Evaluate all threats and opportunities (including those related to climate change) to identify strategic issues, strategies, and long-term objectives
Monitor and measure progress	Monitor climate resilience performance measures	<ul style="list-style-type: none"> • Set and monitor performance measures for climate risk management or climate resilience strategic objective
Continuously improve	Re-evaluate and modify your climate risk management objectives over time	<ul style="list-style-type: none"> • Continuously improve management of climate risks
Integrate with decision-making	Continuously integrate new climate risk information into decision-making	<ul style="list-style-type: none"> • 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

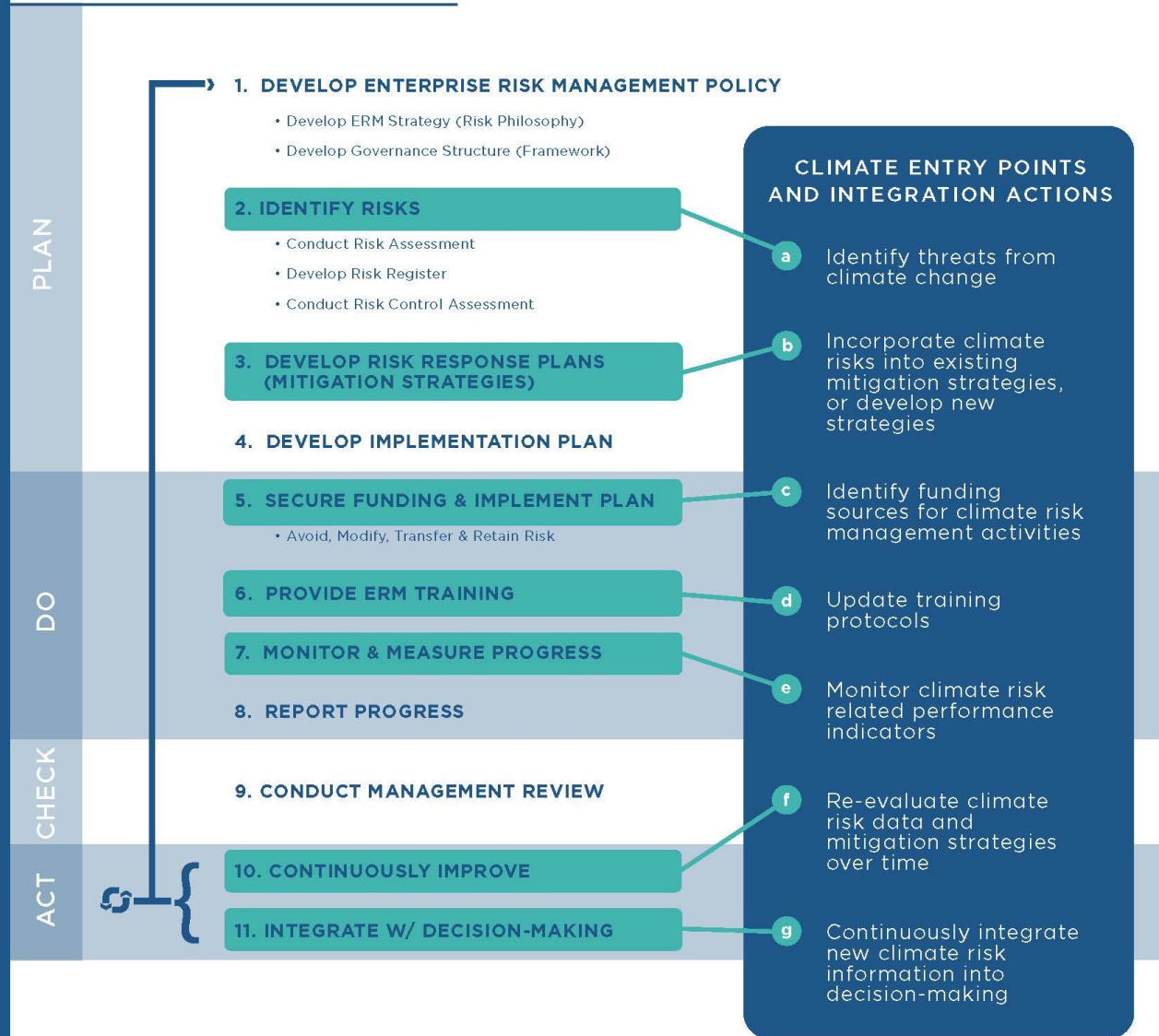
MASTER PLANNING PROCESS



MASTER PLANNING

Climate Entry Points	Climate Integration Actions	Example Integration Strategies
Conduct existing conditions survey	Evaluate how climate change could affect aviation forecasts or facility requirements	<ul style="list-style-type: none"> • Understand existing organization/facility • Evaluate hazards identified in the self-assessment • Incorporate climate information into level of service forecasts • Prioritize climate risks to existing infrastructure and aviation forecasts
Develop and evaluate alternatives – assess environmental impact of analysis	Consider impact of climate change through environmental analyses	<ul style="list-style-type: none"> • Draw from climate hazard data collected in the self-assessment or other sources • Consider any climate implications determined during the existing conditions survey
Develop and evaluate alternatives – develop airport layout plan	Consider whether infrastructure changes are needed to accommodate climate change	<ul style="list-style-type: none"> • Assess the time horizon of your identified climate hazards • Incorporate climate change considerations into design requirements
Monitor and measure progress	Monitor climate resilience performance measures	<ul style="list-style-type: none"> • Set and monitor performance measures for climate risk management objective
Continuously improve	Re-evaluate and modify your climate risk management objectives over time	<ul style="list-style-type: none"> • Continuously improve management of climate risks
Integrate with decision-making	Continuously integrate new climate risk information into decision-making	<ul style="list-style-type: none"> • Periodically review data on performance measures • Refine existing conditions survey, environmental analysis, and airport layout plan as needed

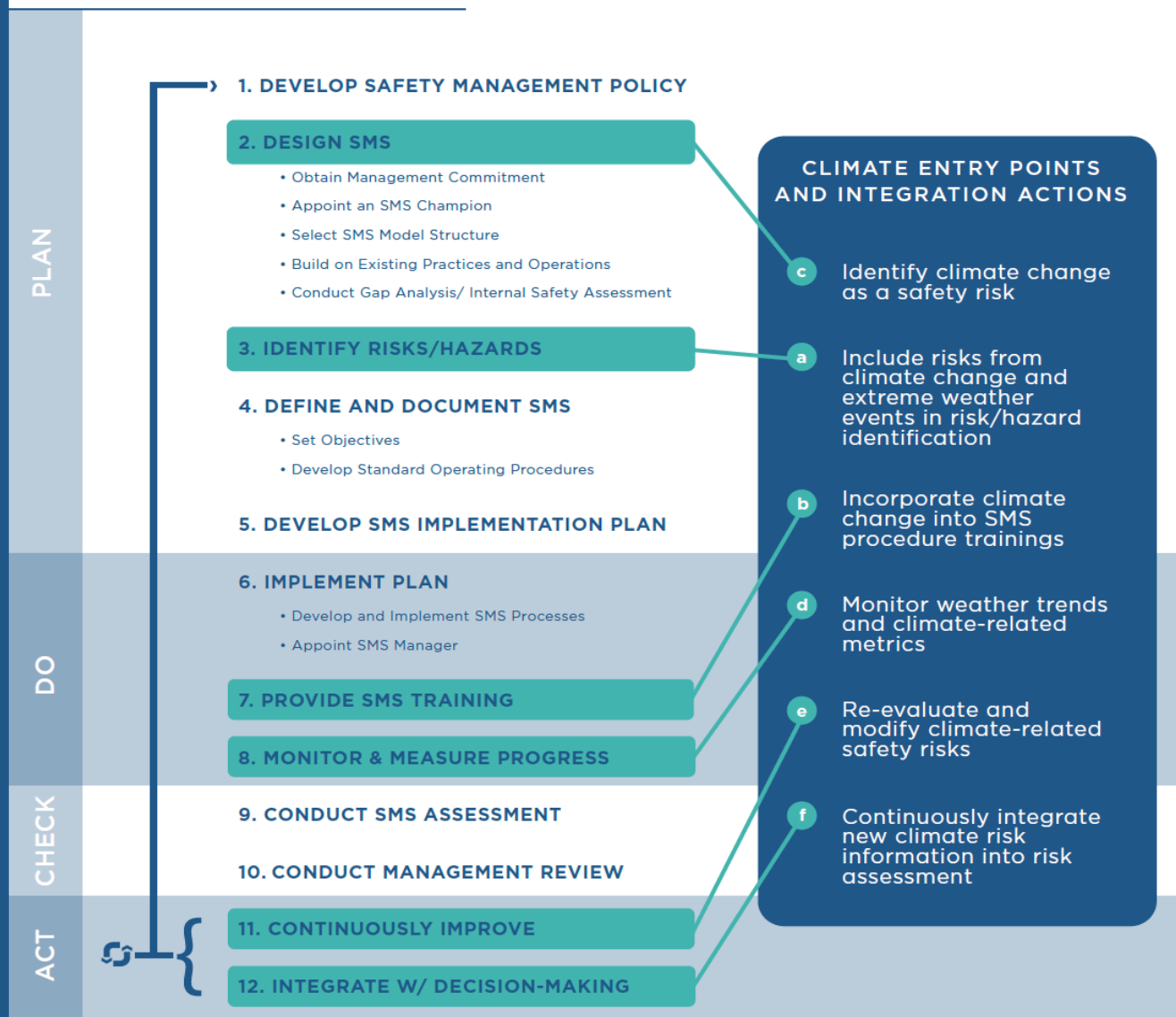
ENTERPRISE RISK MANAGEMENT PROCESS



ENTERPRISE RISK MANAGEMENT

Climate Entry Points	Climate Integration Actions	Example Integration Strategies
Identify risks	Identify threats from climate change	<ul style="list-style-type: none"> • Incorporate self-assessment results into the risk assessment • Prioritize climate risks in the risk register • Develop methods for incorporating uncertainty into climate risk assessments
Develop risk response plans (mitigation strategies)	Incorporate climate risks into existing mitigation strategies, or develop new strategies	<ul style="list-style-type: none"> • Share risk information to coordinate mitigation efforts • Seek low-cost options for mitigating climate risks in the short-term • Identify insurance plans and provides that address climate risks • Develop a Business Continuity Plan (BCP) or Continuity of Operations Plan (COOP)
Secure funding and implement plan	Identify funding sources for climate risk management activities	<ul style="list-style-type: none"> • Seek funding sources from federal, state, and local resources for climate risk management
Provide enterprise risk management training	Update training protocols	<ul style="list-style-type: none"> • Update your training protocols to include the identified climate risks, risk assessment results, and modified or new mitigation strategies
Monitor and measure progress	Monitor climate risk related performance indicators	<ul style="list-style-type: none"> • Monitor and measure service disruptions, personnel and stakeholder safety, and financial costs related to identified climate hazards and risks
Continuously improve	Re-evaluate climate risk data and mitigation strategies over time	<ul style="list-style-type: none"> • Re-evaluate how climate hazards and risks are being incorporated into your enterprise risk management process
Integrate with decision-making	Continuously integrate new climate risk information into decision-making	<ul style="list-style-type: none"> • Continuously coordinate with risk management personnel to overcome potential barriers

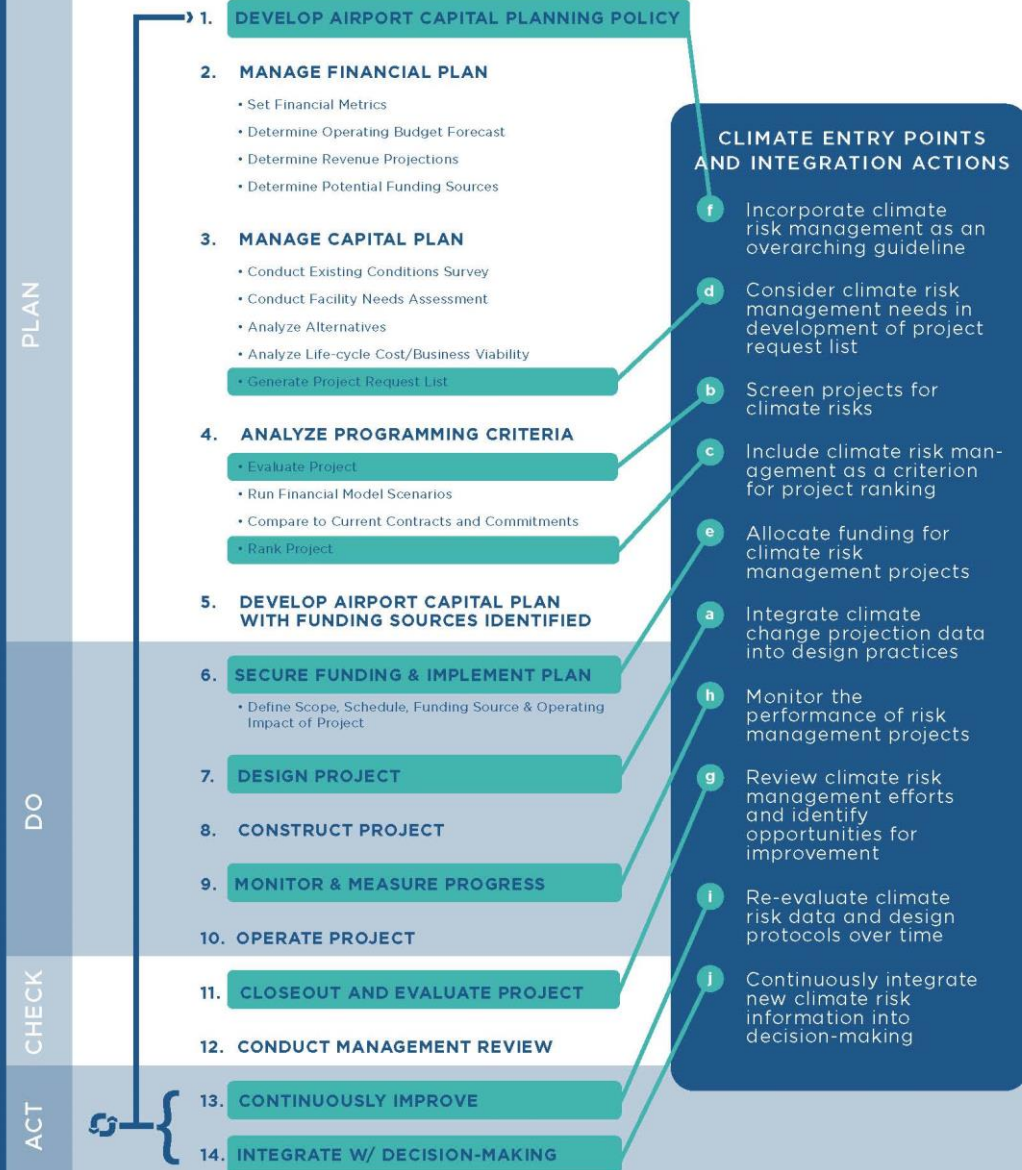
SAFETY MANAGEMENT PROCESS



SAFETY MANAGEMENT

Climate Entry Points	Climate Integration Actions	Example Integration Strategies
Identify risks/hazards	Include risks from climate change and extreme weather events in risk/hazard identification	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Update training to include climate hazard information • Update training to include reviewing recent weather trends
Design SMS	Identify climate change as a safety risk	<ul style="list-style-type: none"> • Establish a policy to identify climate change as a safety risk
Monitor and measure progress	Monitor weather trends and climate-related metrics	<ul style="list-style-type: none"> • Monitor recent weather trends that may affect worker or passenger safety
Continuously improve	Re-evaluate and modify climate-related safety risks	<ul style="list-style-type: none"> • Continuously improve management of climate-related safety risks
Integrate with decision-making	Continuously integrate new climate risk information into risk assessment	<ul style="list-style-type: none"> • 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

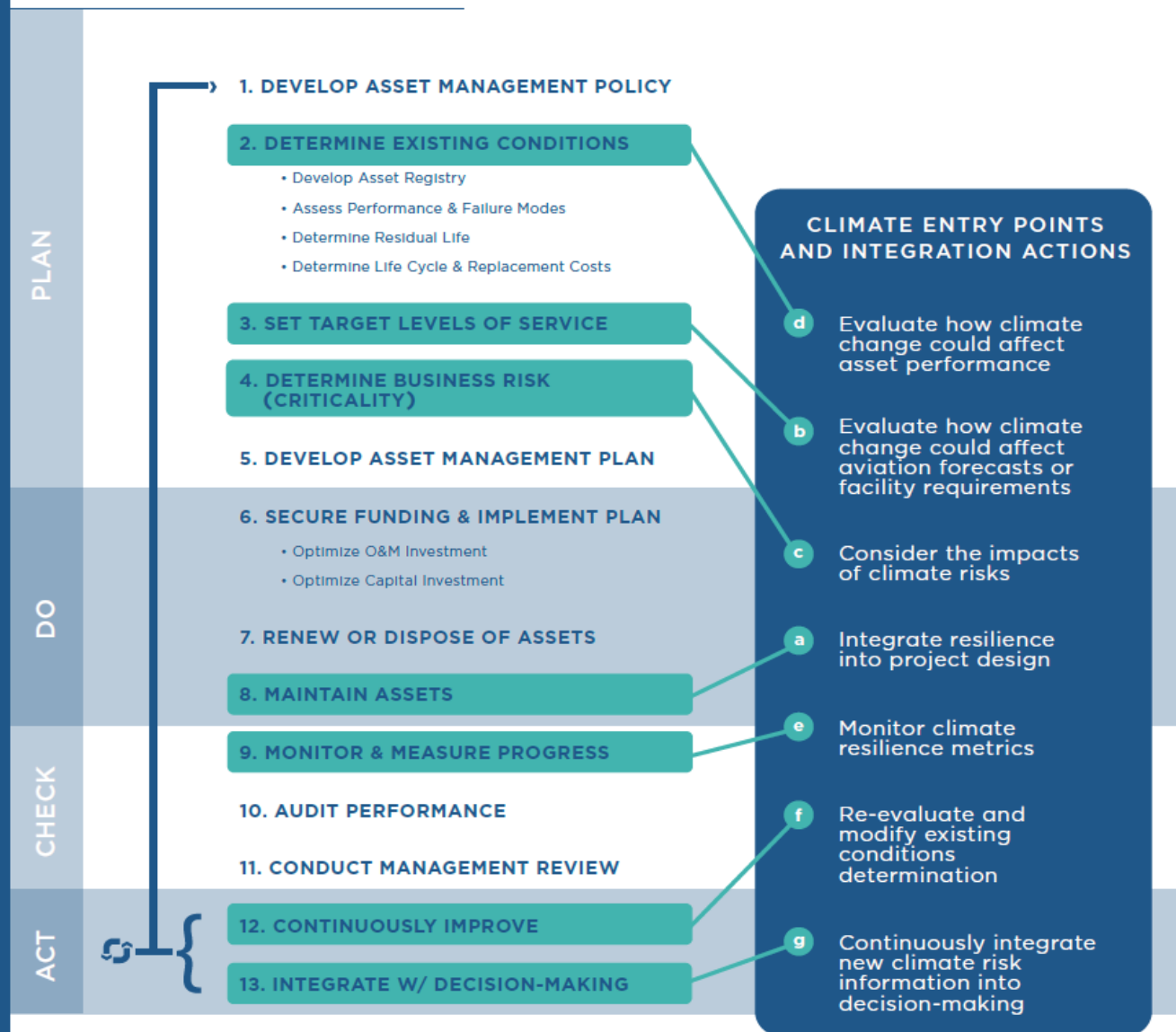
CAPITAL PLANNING PROCESS



CAPITAL PLANNING

Climate Entry Points	Climate Integration Actions	Example Integration Strategies
Design project	Integrate climate change projection data into design practices	<ul style="list-style-type: none"> Establish tiers of analysis Plan for uncertainty with flexible design practices
Evaluate project	Screen projects for climate risks	<ul style="list-style-type: none"> Downscale climate risks to specific projects Select and apply evaluation criteria
Rank project	Include climate risk management as a criterion for project ranking	<ul style="list-style-type: none"> Collaborate with stakeholders to develop a rating system
Manage capital plan	Consider climate risk management needs in development of project request list	<ul style="list-style-type: none"> Identify facilities, assets, or infrastructure vulnerable to climate risks Generate project request list
Secure funding and implement plan	Allocate funding for climate risk management projects	<ul style="list-style-type: none"> State and local resources Resilience bonds
Develop airport capital planning policy	Incorporate climate risk management as an overarching guideline	<ul style="list-style-type: none"> Create a general climate risk guiding policy
Closeout and evaluate project	Review climate risk management efforts and identify opportunities for improvement	<ul style="list-style-type: none"> Create a review protocol specific to climate risk management
Monitor and measure progress	Monitor the performance of climate risk management projects	<ul style="list-style-type: none"> Measure the historical and post-investment service disruptions for a given event threshold
Continuously improve	Re-evaluate climate risk data and design protocols over time	<ul style="list-style-type: none"> Incorporate new climate change data into design protocols
Integrate with decision-making	Continuously integrate new climate risk information into decision-making	<ul style="list-style-type: none"> Continuously integrate new climate risk analysis into decision-making to ensure all process steps consider climate change

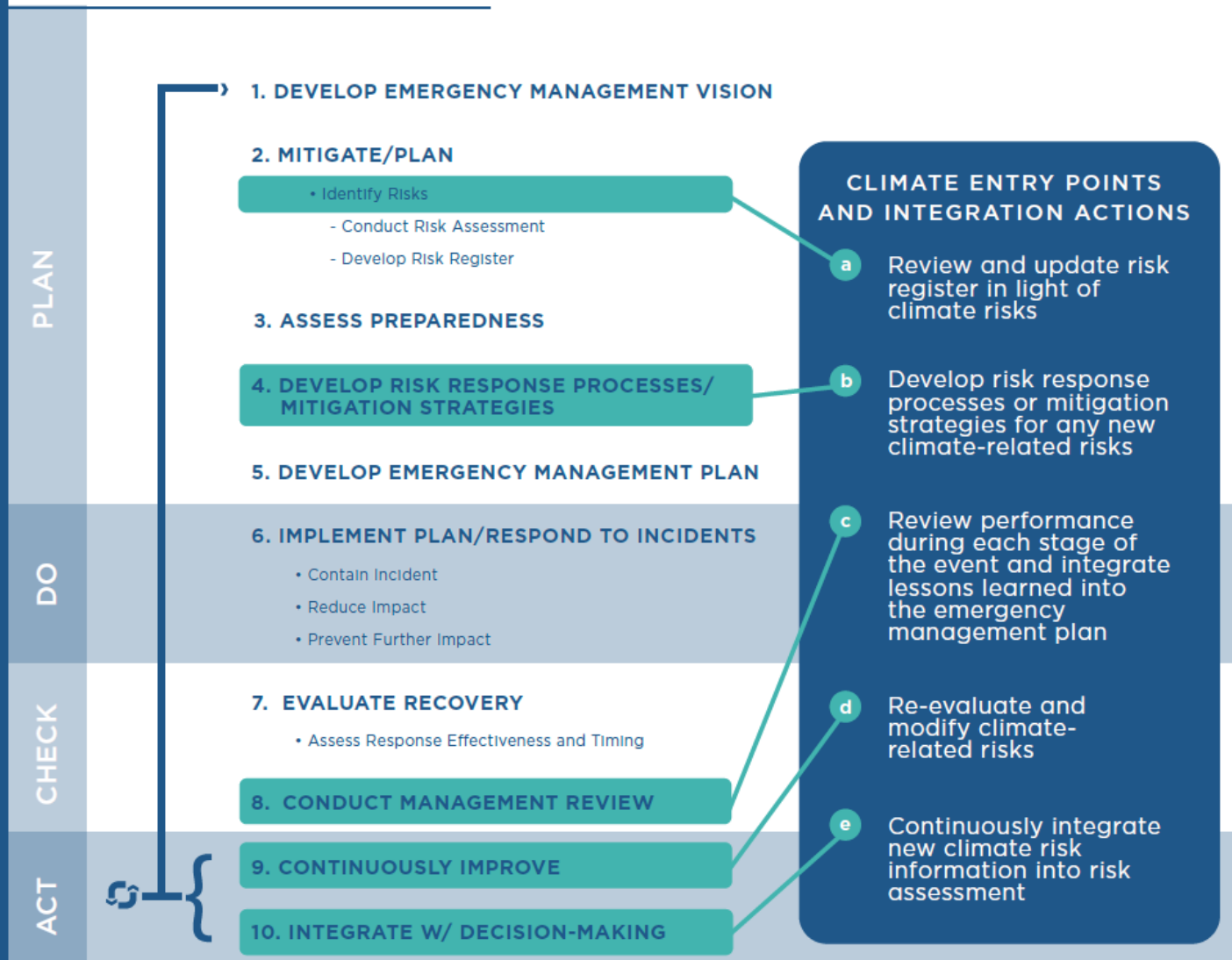
ASSET MANAGEMENT PROCESS



ASSET MANAGEMENT

Climate Entry Points	Climate Integration Actions	Example Integration Strategies
Maintain assets	Integrate resilience into project design	<ul style="list-style-type: none"> • Use asset rehabilitation and replacement as early opportunities for managing climate risks in the design phase of projects
Set target levels of service	Evaluate how climate change could affect aviation forecasts	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Evaluate the probability and consequences of asset failure under climate change
Determine existing conditions	Evaluate how climate change could affect asset performance	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Monitor and measure asset performance under increasing climate risks
Continuously improve	Re-evaluate and modify existing conditions determination	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Continuously integrate new climate risk information focusing specifically on critical assets

EMERGENCY MANAGEMENT PROCESS

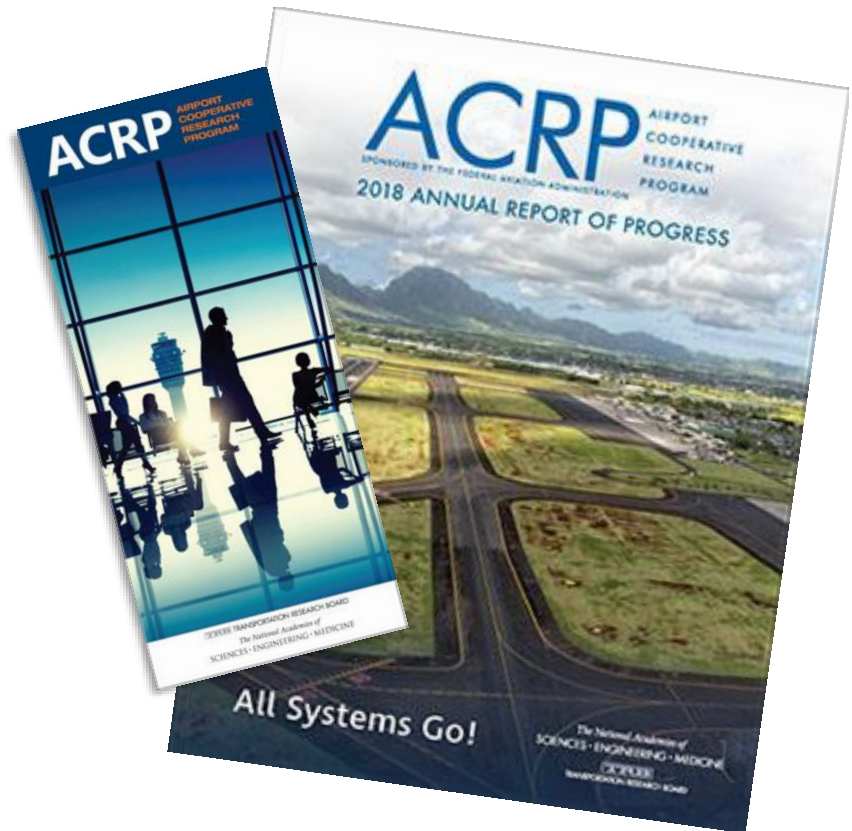


EMERGENCY MANAGEMENT

Climate Entry Points	Climate Integration Actions	Example Integration Strategies
Identify risks	Review and update risk register in light of climate risks	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Identify and document lessons learned after an event • Evaluate airport's emergency reserve budget
Continuously improve	Re-evaluate and modify climate-related risks	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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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