RISK INSIGHTS

Jamaica Civil Aviation Authority's Digital Risk Management Newsletter
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NATURAL HAZARDS
Drought and High Temperatures

The Impact on Aviation

Source: AdobeStock

An exploration of the profound effects of drought and high temperatures on the aviation industry and the innovative strategies being implemented to mitigate these challenges.

INSIDE

1. Drought and its implications for aviation
2. Case Study: Water Management (Kansai Int'd Airport)
3. ANSP Strategies for Navigating Extreme Weather
4. Did You Know?

NATURAL HAZARDS

Drought and High Temperatures

Let's explore...

Source: Adobe Stock

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Natural Hazards and Aviation

The Relevance of Understanding the Impact of Natural Hazards on Aviation

Research Planning & Risk Assessment

Aviation is an essential pillar of global connectivity and economic development, facilitating the rapid movement of people and goods across the world. the industry, is however, increasingly vulnerable to natural hazards such as drought, high temperatures, hurricanes, and severe thunderstorms. These extreme weather events pose significant challenges to the infrastructure, and operations that promotes the safe, secure and efficient delivery of aviation services. Understanding the impact of these natural hazards on aviation is crucial for developing effective mitigation strategies, ensuring safety, resilience, and operational continuity.

THE GROWING THREAT OF NATURAL HAZARDS

Climate change has ushered in an era of escalating frequency and intensity in natural hazards. Climate change has been a critical factor in this escalation. According to the Intergovernmental Panel on Climate Change (IPCC), rising global temperatures are linked to more severe and frequent weather events, including heatwaves, droughts, and intense storms (ICAO). These phenomena can disrupt aviation operations in multiple ways:

1. OPERATIONAL DISRUPTIONS:

Heatwaves: High temperatures can reduce air density and increase the prevalence of turbulence, and affecting aircraft performance in takeoff, and landing. Extreme heat can also lead to airport tarmac damage, causing operational delays (ICAO).

Droughts: Prolonged droughts can result in water shortages, impacting airport operations, firefighting capabilities, and cooling systems (ICAO).

Severe Storms: Thunderstorms, hurricanes, and other severe weather events can cause flight cancellations, diversions, and significant delays. They also pose risks to aircraft during takeoff, flight, and landing phases (ICAO).

2. INFRASTRUCTURE VULNERABILITY:

Airports and related infrastructure are highly susceptible to damage from extreme weather. Flooding from heavy rainfall or storm surges can inundate runways, terminals, and support facilities, leading to costly repairs and prolonged downtime (ICAO).

High winds and severe storms can cause structural damage to airport buildings, communication towers, and other critical infrastructure (ICAO).

3. SAFETY CONCERNS:

Turbulence associated with thunderstorms and jet streams can pose significant risks to passenger and crew safety. Clear-air turbulence, which is

difficult to detect, can cause injuries and necessitate emergency responses (ICAO).

Dehydration and heat-related illnesses among passengers and crew can increase during prolonged exposure to high temperatures, particularly in aircraft on the ground (ICAO).

MITIGATION AND ADAPTATION STRATEGIES

The aviation industry must adopt comprehensive mitigation and adaptation strategies. These include technological advancements, procedural adjustments, and collaborative efforts across the industry.

Technological innovations are critical in addressing the challenges posed by extreme weather in aviation. Improved meteorological services and tools now enable more accurate predictions of extreme weather events, allowing for better preparedness and response planning (ICAO). Furthermore, innovations in aircraft materials and design have enhanced resilience to extreme temperatures and reducing the impact of turbulence (ICAO). These advancements ensure that the aviation industry can maintain safety and operational efficiency despite increasingly severe weather conditions.

Operational Adjustments: Dynamic flight planning involves adjusting flight paths and schedules in response to real-time weather data, which helps minimise disruptions and maintain safety (ICAO). Reinforcing runways, improving drainage systems, and investing in resilient infrastructure can also mitigate the impact of severe weather on airport operations (ICAO). These operational adjustments are crucial in maintaining safety and continuity in the face of adverse weather conditions.

Collaboration among airlines, airports, air navigation service providers (ANSPs), and meteorological agencies is vital for sharing information and resources to manage weather-related challenges effectively (ICAO). Moreover, governments and aviation authorities must implement and enforce regulations that support climate resilience and ensure industry adherence to best practices in managing natural hazards (ICAO). These collaborative efforts are essential for a coordinated and efficient response to extreme weather events.

GOALS AND INSIGHTS FOR READERS

This issue of the Research, Planning and Risk Assessment Department Risk Insights Newsletter provides readers with information on the impact of natural hazards on aviation. Articles, case studies, and technological reviews, deliver an understanding of:

1. **The Science Behind Climate Change and Weather Extremes**: Understanding the underlying factors driving the increase in natural hazards and the specific effects on aviation.
2. **Real-World Case Studies:** Learning from past events and the experiences of industry in managing extreme weather conditions.
3. **Innovative Solutions and Best Practices:** Exploring the latest advancements in technology and procedural strategies that enhance the resilience of aviation operations.
4. **Policy and Regulatory Perspectives:** Examining the role of regulatory bodies and international organisations in promoting climate resilience within the aviation sector.

By delving into these topics, readers will be equipped with the knowledge to better anticipate and respond to the challenges posed by natural hazards, ultimately contributing to a safer and more resilient aviation industry.

Source: AdobeStock

Climate Trends: Drought and High Temperatures and the Implications for Aviation

Drought and high temperatures are significant natural hazards that are becoming increasingly common and more severe due to climate change.

Drought is a prolonged period of deficient rainfall leading to a significant water shortage. High temperatures, often associated with drought, exacerbate the impacts on various sectors, including aviation. The aviation industry is a critical sector for global connectivity and economic growth and is particularly vulnerable to these climatic extremes. As droughts become more frequent and severe, understanding their implications on aviation operations, infrastructure, and safety is essential for developing effective mitigation and adaptation strategies.

The aviation industry relies heavily on water for various operations, from maintaining airport infrastructure to ensuring the safety and comfort of passengers and flight crew. Both drought and high temperatures significantly impact the industry, affecting far more than just airports and airlines. The effects extend to ground handling services, aviation fuel suppliers, aircraft manufacturers, Maintenance, Repair, and Overhaul (MRO) services, pilots, air traffic controllers, regulatory bodies and related enabling services.

Prolonged droughts and heat waves can strain essential water resources, leading to significant operational disruptions. While the immediate implications of drought, such as water shortages and increased temperatures, are apparent, the ripple effects extend across various industry stakeholders. Understanding these impacts is, therefore, crucial for developing comprehensive strategies to enhance resilience and ensure seamless operations despite the challenges posed by drought conditions.

Ground handling services, for instance, may face water restrictions that affect aircraft cleaning, de-icing, and cooling systems for ground support equipment. Aviation fuel suppliers could see disruptions in biofuel production due to reduced agricultural yields from water shortages, impacting fuel availability and costs. MRO services depend on substantial water use for cleaning and cooling systems, with drought conditions potentially hindering these critical maintenance operations. Pilots and air traffic controllers must navigate operational challenges such as reduced aircraft performance and altered flight paths due to high temperatures and weather-related disruptions. Passengers also experience indirect effects through potential flight delays, cancellations, and increased ticket prices due to higher operational costs for airlines. Reduced availability of amenities, such as cooling systems and water services at airports, can further impact passenger comfort and experience. Regulatory bodies play a pivotal role in establishing guidelines and ensuring compliance with water usage restrictions.

Causes of Drought

The causes of drought are multifaceted, encompassing both natural climatic variability like reduced rainfall and elevated temperatures, and increasingly influenced by human activities such as deforestation, over-extraction of water resources, and poor water management. Globally, regions such as California, Australia, and parts of Africa and Asia are particularly prone to severe droughts, with historical data indicating increasing frequency and intensity due to climate change. Future projections suggest that these trends will continue, posing significant risks to various sectors, including aviation (ICAO).

Causes of High Temperatures

High temperatures also result from both natural and human-induced factors. Natural causes include variations in solar radiation, ocean currents, and atmospheric conditions. However, human activities have a significant impact on global temperatures. Greenhouse gas emissions from burning fossil fuels, industrial processes, deforestation, and urbanisation contribute to the greenhouse effect, trapping heat in the Earth's atmosphere and leading to elevated temperatures. These high temperatures often accompany drought conditions, exacerbating their impacts and presenting additional challenges for the aviation industry (NASA).

Climate Trends

Climate trends significantly impact the aviation industry, influencing everything from flight operations to infrastructure resilience. As global temperatures rise, weather patterns become more unpredictable.

1. Global Temperature Increase

One of the most prominent climate trends affecting aviation **is the increase in average global temperatures.** According to NASA, the past decade has been the warmest on record, with significant implications for aviation. Higher temperatures reduce air density, which in turn affects aircraft performance, requiring longer takeoff distances and reducing payload capacity. This phenomenon, known as "density altitude," poses operational challenges, particularly at airports in already warm regions.

Jet Stream

Jet stream is a band of strong winds that flows high in the atmosphere. Changes in the jet stream can cause drought in some areas by bringing in dry air from other parts of the world.

Source: AdobeStock

2. Precipitation Patterns
Precipitation patterns are also changing, with both more intense rainfall events and prolonged droughts becoming more common. Increased precipitation can lead to flooding, damaging airport infrastructure, runways, and disrupting operations. For instance, storm drainage systems may become overwhelmed, leading to potential water pollution issues and ground transport disruptions. Conversely, drought conditions result in water scarcity, affecting essential airport services like cooling systems, firefighting capabilities, and landscaping.

3. Rising Sea Levels
Rising sea levels pose another critical threat to aviation, particularly for coastal airports. The National Oceanic and Atmospheric Administration (NOAA) projects that sea levels could rise by several feet by the end of the century. Coastal airports, such as those in Miami and San Francisco, are at risk of flooding and erosion, which could disrupt operations and require costly mitigation measures. Protecting these airports involves building sea walls, improving drainage systems, and possibly relocating critical infrastructure.

Impacts on Aviation

Drought develops gradually, beginning slowly and intensifying over time. The initial effects are often experienced by those who depend heavily on yearly rainfall, such as farmers practicing dryland grazing or rural inhabitants who rely on wells tapping into low-yield rock formations. As droughts persist, their impacts grow more severe; reservoir storage diminishes, and groundwater levels drop.

Water Scarcity
Water scarcity is one of the most immediate effects of drought on aviation. Airports require substantial amounts of water for cooling systems, firefighting, sanitation, and landscaping. During drought conditions, water restrictions can severely impact these operations. For instance, cooling systems that regulate temperatures within airport terminals and control towers may become less effective, leading to discomfort and operational inefficiencies.

Aircraft Performance
Drought conditions can affect aircraft performance. High temperatures, associated with drought, reduce air density. Reduced air density affects lift and requires longer takeoff distances. This can limit the payload capacity of an aircraft, leading to operational adjustments and potential economic losses for airlines (ICAO).

Wildfires
Drought conditions often lead to increased frequency and severity of wildfires, which can pose significant threats to aviation. Wildfires near airports can disrupt operations, reduce visibility, and increase the risk of damage to infrastructure. Moreover, dust storms, a common consequence of prolonged drought, can significantly affect visibility and air quality, leading to flight delays and cancellations (CDC).

Economic Fallout
Economically, the disruptions caused by drought-related conditions can be substantial. Delays, cancellations, and the need for rerouting flights to avoid affected areas can lead to increased operational costs and revenue losses for airlines. These indirect impacts underscore the importance of comprehensive planning and preparedness to mitigate the effects of drought on aviation (ICAO).

Mitigation and Adaptation Strategies

Climate change is a reality that the world must face. Mimimising emissions to global warming, are essential mitigation strategies. The impact of climate change varies by geographical location and will require that we also safeguard ourselves and our communities. Success in managing climate change will rely on a mix of the strategies outlined below..

MITIGATION STRATEGIES **Cause Reduction**	**ADAPTATION STRATEGIES** **Impact Management**
Reducing Carbon Footprint • Fuel Efficiency Improvements: Implementing more fuel-efficient aircraft designs and engines to reduce CO_2 emissions. • Alternative Fuels: Investing in and transitioning to sustainable aviation fuels (SAFs) that produce fewer emissions compared to traditional jet fuels. • Operational Efficiency: Optimising flight paths, reducing idling times, and improving air traffic management to lower fuel consumption and emissions.	**Water Management** • Water-Efficient Fixtures: Installing low-flow faucets, toilets, and other water-efficient fixtures in airport facilities. • Recycled Water Use: Utilising reclaimed or recycled water for non-potable purposes such as irrigation, dust control, and certain maintenance activities. • Drought-Tolerant Landscaping: Implementing landscaping practices that require minimal water, such as using native plants and xeriscaping. • Rainwater Harvesting: Collecting and storing rainwater for use in various airport operations.
Renewable Energy Integration • Solar Power: Solar power at airports to reduce reliance on fossil fuels. • Wind Energy: To harness wind energy for the airport's energy needs. • Electric Ground Support Equipment: Replacing conventional ground support equipment with electric-powered alternatives to cut down on fuel usage and emissions.	**Infrastructure Improvements** • Enhanced Cooling Systems: Upgrading HVAC systems to be more efficient and less water-dependent. • Improved Runway Materials: Using materials that are more resistant to heat-related damage, ensuring runways can withstand higher temperatures without deteriorating. • Drainage Systems: Improving stormwater drainage systems to handle extreme precipitation events.
Carbon Offsetting and Sequestration • Participating in carbon offsetting initiatives where emissions are balanced by funding projects that reduce or absorb an equivalent amount of CO_2. • Supporting or initiating tree-planting projects to absorb CO_2 from the atmosphere	**Operational Adjustments** • Load Management: Implementing weight restrictions during high-temperature periods to ensure safe takeoff and landing operations. • Alternative Fuels: Exploring and using biofuels and other sustainable fuels that are less susceptible to supply disruptions caused by drought.

Mitigation and Adaptation Strategies

The aviation industry, in particular, is focusing on developing more fuel-efficient aircraft, adopting sustainable aviation fuels (SAFs , and optimising flight operations to minimise fuel burn and emissions. Collectively, these efforts contribute to the pursuit of the global objective of limiting temperature rise and stabilising the climate system, which is essential for maintaining operational resilience, ensuring passenger safety, and sustaining economic growth

MITIGATION STRATEGIES Cause Reduction	ADAPTATION STRATEGIES Impact Management
Policy and Regulatory Measures • Stricter Emission Standards: Implementing and adhering to stricter emission regulations and standards set by international aviation bodies like ICAO. • Carbon Pricing: Introducing carbon pricing mechanisms to encourage the reduction of emissions.	**Technological Advancements** • Advanced Weather Forecasting: Utilising more accurate and advanced meteorological forecasting tools to better anticipate and respond to extreme weather conditions. • Cooling Technologies: Developing and using advanced cooling technologies for aircraft and ground equipment to maintain operational efficiency during high temperatures. • Remote Monitoring: Implementing remote sensing and monitoring technologies to detect and respond to heat and water stress in real time.
Technological Innovations • Hybrid and Electric Aircraft: Researching and developing hybrid and fully electric aircraft to reduce reliance on fossil fuels. • Advanced Materials: Using lightweight, durable materials in aircraft manufacturing to improve fuel efficiency. • Climate-Resilient Infrastructure: Developing infrastructure that can withstand extreme weather conditions, ensuring operational continuity.	
Collaboration and Awareness • Industry Collaboration: Collaborating with other industries and sectors to develop comprehensive climate mitigation strategies. • Public Awareness Campaigns: Educating passengers and the general public about the importance of reducing carbon footprints and supporting sustainable aviation initiatives.	

REGULATORY APPROACHES

Regulatory Bodies Tackle Natural Hazards: Drought and High Temperatures

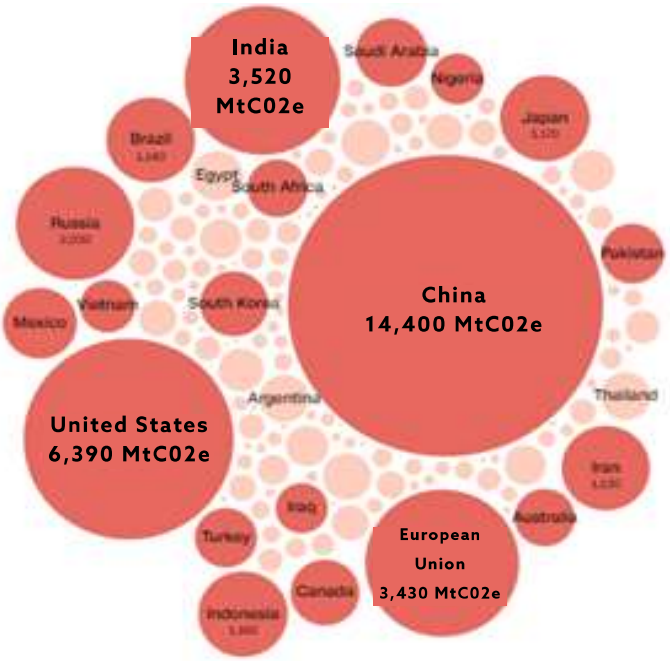
Data Driven.Systematic.Collaborative

Rootcause & Source Identification

"Global warming of 1.1°C above pre-industrial levels has been caused by over a century of burning fossil fuels and unequal, unsustainable energy and land use. This has led to an increase in the frequency and intensity of extreme weather events, which have caused dangerous impacts on nature and people worldwide (United Nations, 2024). Understanding the producers of greenhouse gas (GHG) emissions requires a multi-faceted approach. By examining emissions from various perspectives, such as country and sector, specific areas for targeted interventions and policymaking can be identified. This comprehensive view is critical for developing effective strategies to combat climate change and mitigate its effects, such as drought and high temperatures.

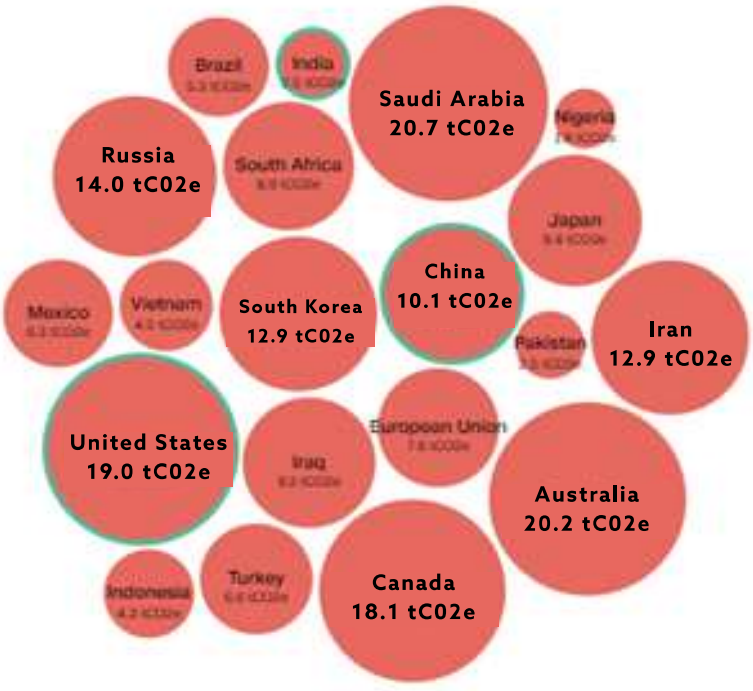
The world is heading toward nearly 3 degrees of global warming, even if current climate policies are achieved (United Nations). There is therefore mounting pressure to rapidly scale up climate targets. The aviation sector, though it currently contributes only 4% to global greenhouse gas emissions, must play its part in mitigating and adapting to climate change problems including drought and high temperatures.

REGULATORY APPROACHES



Total greenhouse gas emissions in 2022 (World)
Source: CNN

Most of the world's planet-heating pollution comes from just a few countries.
The top 20 global polluters is dominated by China (30%), India, the United States and the European Union. These regions were responsible for 83% of emissions in 2022. What these countries do to respond to the climate crisis has an outsized impact on the rest of the world.



Source: CNN

Per capita greenhouse gas emissions for the top 20 emitters in 2022 (World)
Source: CNN

While China is the biggest emitter overall, the average American is responsible for nearly twice as much climate pollution as the average person in China. And in densely populated India, one of the world's biggest climate polluters, per capita emissions are significantly below the global average.

Regulatory Responses to Climate Change

The Intergovernmental Panel on Climate Change (IPCC)

The IPCC was set up by the World Meteorological Organization (WMO) and United Nations Environment Programme, offers objective scientific information on climate change. It promotes "climate-resilient development," combining climate adaptation with emission reduction for broader benefits.

The United Nations

The problem of climate change is global and requires a global response. There are several instruments developed under the leadership of the United Nations to manage climate change.

1. United Nations Framework Convention on Climate Change (UNFCCC) (1992)

In 1992, the United Nations held the "Earth Summit," which led to the creation of the UNFCCC. This Convention, aims to prevent dangerous human interference with the climate system.

2. Kyoto Protocol (1997)

The Kyoto Protocol is an international treaty that extends the 1992 UNFCCC and was adopted in 1997. It commits the parties to reduce greenhouse gas emissions, based on the scientific consensus that global warming is occurring and that human-made CO_2 emissions are driving it.

3. Paris Agreement (2015)

The Paris Agreement (2015) is a legally binding international treaty that aims to limit global warming to below 2°C, with efforts to keep it to 1.5°C.

Source: AdobeStock

The Aviation Industry's Response

As climate change intensifies, natural hazards such as drought and high temperatures increasingly threaten aviation operations. Regulatory bodies worldwide are stepping up efforts to address these challenges, ensuring safety, continuity, and resilience. "ICAO recognizes that innovation is key to achieving this goal, and the ICAO stocktaking process and complementary innovation focused seminars held in 2020 and 2021, unlocked and showcased many revolutionary and innovative solutions being developed inside and outside the sector. These solutions have the potential to transform the industry in a way and at a pace never seen before" (ICAO, 2022).

The 41st ICAO Assembly adopted a long-term global aspirational goal (LTAG) for international aviation of net-zero carbon emissions by 2050 in support of the UNFCCC Paris Agreement's temperature goal.

The International Civil Aviation Organization (ICAO) has therefore developed a comprehensive strategy to combat climate change, focusing on several key areas. These strategies aim to reduce the aviation sector's carbon footprint and promote sustainability.

REGULATORY APPROACHES

1. Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) (2016)

The aviation industry has made commitments to addressing climate change. One prominent example is the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA), which was established by the International Civil Aviation Organization (ICAO). CORSIA is the main global market-based measure aimed at stabilising CO_2 emissions at 2020 levels. Under CORSIA, airlines are required to offset any increase in CO_2 emissions above 2020 levels through the purchase of eligible emission units from carbon reduction projects worldwide.

The COSIA Pilot Phase in which Jamaica participated, ran from 2021 to 2023. As of January 2024, 126 States (including Jamaica) began the mandatory First Phase.

2. Technological Innovations

- Advancements in Aircraft Technology: Encouraging the development and adoption of more fuel-efficient aircraft and engines. This includes research and development in aerodynamics, lightweight materials, and more efficient propulsion systems. Additionally, companies like Eviation Aircraft are developing fully electric aircraft such as the Alice, which are designed for short-haul flights and produce zero emissions during operation.

- Promotion and Use of Sustainable Aviation Fuels (SAF): ICAO promotes the development and deployment of sustainable aviation fuels, which can significantly reduce the carbon footprint of aviation. These fuels are derived from renewable sources and have a lower life-cycle carbon intensity compared to conventional jet fuel.

3. Operational Improvements

- Air Traffic Management (ATM) Enhancements: Implementing more efficient air traffic management and operational procedures to reduce fuel burn and emissions. This includes initiatives like the Single European Sky and NextGen in the United States, which aim to optimise flight routes and reduce delays.

- Continuous Descent Operations (CDO) and Continuous Climb Operations (CCO): These procedures help aircraft reduce fuel consumption and emissions by optimizing the descent and climb phases of flight.

ICAO Guidance on Climate Change Risk Assessment and Adaptation Planning

In addition to these global efforts, ICAO released specific guidance on Climate Change Risk Assessment and Adaptation Planning. This guidance provides a framework for aviation organisations to assess and manage the risks posed by climate change, ensuring resilience and continuity in operations.

FAA Guidelines on Airport Resilience

The FAA Guidelines on Airport Resilience provide a framework for enhancing the ability of airports to withstand and recover from the impacts of climate change and extreme weather events. These guidelines focus on ensuring that critical airport infrastructure, such as runways, terminals, and other facilities, remains operational during and after climate-related disruptions.

US Aviation Climate Action Plan

This action plan outlines strategies for reducing the environmental impact of the aviation industry while supporting its growth. The plan focuses on achieving net-zero greenhouse gas emissions by 2050 inline with measures advanced by ICAO and the United Nations.

Source: AdobeStock

REGULATORY APPROACHES

AVIATION REGULATIONS

ICAO Standards and Recommended Practices (SARPs) cover a wide range of areas to ensure that international aviation operates safely, securely, and in an environmentally responsible manner.

Key SARPs related to environmental protection and sustainability specific to CO_2 emissions.

Annex 16 (Volume II) - Environmental Protection

- Emissions Certification Standards: Sets standards for the certification of aircraft engine emissions, including limits on hydrocarbons (HC), carbon monoxide (CO), oxides of nitrogen (NOx), and smoke.
- Market-Based Measures (MBMs): Provides guidelines for implementing MBMs, such as the Carbon.

Annex 8 - Airworthiness of Aircraft

- Aircraft Design and Manufacturing Standards: Ensures that aircraft are designed and manufactured to meet environmental standards, including those related to noise and emissions.
- Continuous Monitoring: Recommends procedures for continuous monitoring and reporting of aircraft emissions during operation.

Annex 6 - Operation of Aircraft

- Operational Measures to Reduce Emissions: Includes standards and practices for operational measures to reduce fuel consumption and emissions, such as efficient flight planning, reduced engine taxiing, and continuous descent operations.
- Environmental Management Systems: Recommends that operators implement environmental management systems to systematically manage and reduce their environmental impact.

Global Temperatures

According to an ongoing temperature analysis led by scientists at NASA's Goddard Institute for Space Studies (GISS), the average global temperature on Earth has increased by at least 1.1° Celsius (1.9° Fahrenheit) since 1880. The majority of the warming has occurred since 1975, at a rate of roughly 0.15 to 0.20°C per decade(NASA, 2020).

Source: AdobeStock

California - Water Management Strategies

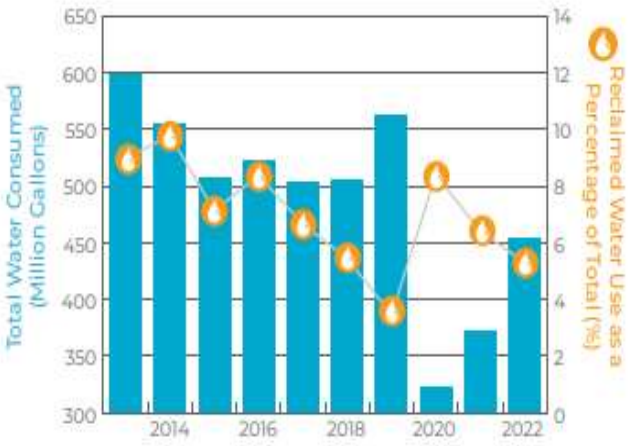
California has experienced severe droughts that significantly impacted major airports like Los Angeles International Airport (LAX) and San Francisco International Airport (SFO). In June 2021 in California, the U.S. Drought Monitor reported that almost 95 percent of the state experienced severe to exceptional drought conditions. Airport Operators, are said to be well prepared, owing to years of conservation efforts. Operators implemented a combination of measures to mitigate the effects of drought, such as installing water-efficient fixtures, developing drought-tolerant landscaping, and using recycled water for non-potable purposes

Source: AdobeStock

100 MILLION GALLONS LESS WATER CONSUMED BY LAWA 2022 vs. 2019

Aggressive water conservation efforts at Los Angeles International Airport (LAX) are part of the sustainability action plan adopted by Los Angeles World Airports (LAWA) in 2019.

In 2022, LAWA substantially completed the Recycled Water Extension Program, connecting LAX to Los Angeles Department of Water and Power (LADWP) Conveyance Pipeline Project. LAWA reduced the volume of water consumed in 2022 compared to 2019 by over 100 million gallons and significantly increased the amount of reclaimed water used for activities such as irrigation and dust mitigation during construction. In 2022, 24 million gallons of reclaimed water was used at LAX (LAWA, 2022).



LAX Reclaimed Water Use as a Percentage of Total Water Use
Source: Los Angeles World Airports (LAWA), 2022

CASE STUDY
EUROPE

THE 2023 EUROPEAN HEATWAVE

The summer of 2023 brought an unprecedented heatwave to Europe, setting record temperatures and causing widespread disruption across the continent This extreme weather event offered critical insights into the growing challenges posed by climate change.

Starting on 10 July 2023, the record-breaking **Cerberus anticyclone**, the named most significant heatwave of the period, affected many European countries, with the effects felt most severely in parts of Southeast and Southwest Europe such as Cyprus, Greece, Italy, and Spain.

The UK experienced one of its busiest days for fire and rescue services since World War II, dealing with numerous wildfires and property damage. In London alone, 41 properties were destroyed by fire, with significant losses reported in other regions (GOV.UK). Here, we explore the lessons learnt from this heatwave and the steps needed to mitigate and adapt to future events.


Source: AdobeStock

Record-Breaking Temperatures

In July 2023, several European countries experienced the highest temperatures on record. Southern Europe, including Spain, Italy, and Greece, saw temperatures soar above 45°C (113°F). Major cities like Rome and Athens reported multiple consecutive days of extreme heat, overwhelming public health systems and infrastructure.

Public Health Crisis

The heatwave had a severe impact on public health. Hospitals across Europe saw a significant increase in heat-related illnesses, including heat strokes, dehydration, and respiratory issues. In some regions, the mortality rate rose due to the prolonged exposure to extreme heat, highlighting the vulnerability of elderly populations and those with pre-existing health conditions. In Europe 70,000 people were killed by heatwave in 2023.


Source: AdobeStock

Infrastructure and Energy Demand

The extreme temperatures strained infrastructure and energy supplies. Power grids were pushed to their limits as air conditioning usage spiked, leading to occasional blackouts. Transportation systems, including railways and roads, suffered from the heat, causing disruptions and delays. In some areas, asphalt on roads melted, and rail tracks

CASE STUDY EUROPE

buckled, leading to significant safety concerns.

Agricultural Impact

Agriculture was also severely affected by the heatwave. Crops across Europe experienced drought conditions, reducing yields and impacting food supply chains. Farmers faced significant economic losses, and the scarcity of water resources became a critical issue in many regions.

Air Travel

The extreme heat disrupted flights, leading to increased delays and operational challenges. In some cases passengers were bumped to enable a safe takeoff. Aircraft require lift to fly safely and efficently. Cricially, lift depends on the temperature of the surrounding air. As the air warms up, it expands; the number of molecules available to push the aircraft up is reduced. Planes get 1% less lift with every 5.4 degrees Fahrenheit (3 degrees Celsius) of temperature rise. Extreme heat makes it harder for planes to take off.

RESPONSE MEASURES

European governments and organisations took various measures to mitigate the heatwave's impacts. In the UK, the Met Office provided early warnings that allowed the government to launch public advice campaigns on managing heat-related health risks. The collaboration between national and local authorities, emergency services, and public health agencies was crucial in managing the crisis effectively.

The 2023 European heatwave was a stark reminder of the urgent need to address climate change and its impacts. The lessons learnt from this heatwave should serve as a catalyst for action, driving the development of more resilient and sustainable communities across the continent.

Lessons Learnt

Early Warning Systems and Forecasting

Enhanced meteorological tools and communication strategies are essential for timely and effective public response.

Inter Agency Collaboration

Coordinated efforts among emergency services, health agencies, and local authorities can significantly improve crisis management.

Improving Infrastructure resilience

There is a need to upgrade infrastructure to withstand extreme temperatures. This includes reinforcing power grids, improving cooling systems in public buildings, and developing heat-resistant materials for roads and railways.

Enhancing Public Health Systems

Governments must invest in healthcare infrastructure and ensure adequate training for healthcare providers to handle heat-related illnesses.

Source:Climate Smart Health, euronews, British Red Cross

Osaka's Kansai International Airport's Water Management

Sustainable Water Management Systems

Kansai International Airport (KIX), located on an artificial island in Osaka Bay, Japan, is renowned for its innovative approach to water management. Built to handle the heavy rainfall and tidal surges characteristic of the region, KIX has implemented state-of-the-art water management systems that balance sustainability with operational continuity.

Water Management Challenges

Kansai International Airport was constructed in the early 1990s; it faced unique challenges due to its location. The artificial island sits 5 kilometers offshore, subjecting it to the risks of typhoons, tidal surges, and heavy rainfall. Furthermore, the island's gradual subsidence—sinking by an average of 7 centimeters annually — required the airport to adopt adaptive water management strategies from the start.

Kansai Int'l Airport has taken a proactive approach to its environmental challenges. The airport has implemented a "triple water system", recycling up to 66.1% of its water by 2015, up from 43.8% in 2009. Despite increased passenger traffic and aircraft movements, this has significantly reduced potable water usage at the airport during periods of scarcity (Infrastructures, 2018)

Source: AdobeStock

CASE STUDY
KANSAI INTL.

Innovative Water Management Solutions

Rainwater Harvesting	KIX employs an advanced rainwater filtration system that captures and reuses rainwater as recycled water. This has reduced the airport's reliance on Osaka's city water supply. Harvested rainwater is used for landscaping, fire suppression, and cooling systems. This approach significantly reduces the airport's freshwater demand
Water Recycling & Reuse	The KIX airport's greywater recycling system treats water from sinks, showers, and other non-potable sources, which is then reused to flush toilets, vehicle washing and for irrigation. This system reduces the airport's reliance on external water sources and ensures a steady supply of water even during droughts or disruptions to the local water supply. The airport has ambitious targets to reduce city water usage by 2% per passenger annually.
Consumption and Monitoring	KIX has deployed low-flow fixtures to aid in the overall reduction in water consumption. These fixtures have significantly restricted water usage compared to standardfixtures. KIX has established a real-time environmental monitoring system deploys automated systems to monitor water consumption and leak detection, optimising usage across its facilities

In the face of increasing climate risks, Kansai International Airport continues to enhance its water management infrastructure. Kansai International Airport's innovative water management practices provide a blueprint for airports aiming to build resilience against climate change and natural hazards. Through a combination of engineering ingenuity, proactive planning, and environmental stewardship, KIX has positioned itself as a leader in sustainable airport operations.

Rainwater Harvesting

Rainwater harvesting involves collecting rainwater from rooftops, land surfaces, or rock catchments. The water is then stored in tanks or reservoirs for later use. Rooftop rainwater harvesting is particularly common in urban areas, where water is collected from roofs and directed into storage containers through a system of gutters and pipes.

Source: AdobeStock

Water Harvesting

The Jamaica Civil Aviation Authority

The Jamaica Civil Aviation Authority (JCAA) plays a crucial role in combating climate change by implementing sustainable aviation practices, enforcing regulations to reduce carbon emissions, and promoting the adoption of green technologies across the aviation industry. Through these efforts, the JCAA helps ensure that the aviation sector contributes to global climate goals.

In 2012, the Facilities Management Department at the Jamaica Civil Aviation Authority (JCAA) embarked on an innovative project to enhance sustainability and resource efficiency. The Team developed a water harvesting system at the head office with capacity to capture and store over 50,000 gallons of rainwater, ensuring a reliable backup supply for non-potable purposes.

This innovative system primarily harvests water from one of its buildings with an aluminum zinc roof, chosen for its optimal rainwater collection properties. As rain falls, it is channeled through strategically placed gutters into a sophisticated filtration system that directs the clean water into large storage tanks. This harvested water is then used for watering gardens, maintaining lawns, and various cleaning activties, reducing the reliance on the main water supply.

One of the standout features of this system is its resilience and efficiency. Although Jamaica experiences its rainy season only five months a year—May, June, and September to November—the system is designed to maximise water collection during these periods. Remarkably, during a typical two-week rainfall, enough water can be harvested to fill all the tanks, showcasing the system's effectiveness.

The JCAA's commitment to sustainability doesn't stop at rainwater harvesting. The water management process is designed to ensure that water tanks are never left empty, reflecting their dedication to maintaining continuous operations. If water levels fall below a certain threshold, the tanks are refilled using either the main water supply or by procuring water from a water trucking company, ensuring that the Authority's critical functions are never compromised. This backup supply is vital, as a lack of water could force a suspension of operations, directly impacting the resilience and operational continuity of the Air Traffic Services and the overall safety of air traffic management services.

This initiative not only underscores the Authority's forward-thinking approach to resource management but also serves as a model for other organisations aiming to enhance their sustainability practices. By leveraging natural resources and integrating innovative technologies, the JCAA is making significant strides towards a more sustainable future.

Gutters installed on the building direct water to a filtration system, which then transfers it to storage tanks.
Source: RPRA

Storage tanks for backup water supply.
Source: RPRA

Source: AdobeStock

Heat-Resistant Aircraft Materials

As aircraft operate at high speeds and altitudes, they encounter extreme temperatures. These temperatures can affect both the structural integrity and performance of the aircraft.

Heat-resistant materials are essential for ensuring safety, reliability, and efficiency. These materials are designed to withstand high temperatures and thermal stresses, thereby protecting critical components from heat damage.

Source: Adobe Stock

Carbon neutral is a state where the net amount of carbon dioxide emissions produced is equal to the amount removed or offset, resulting in no net increase in atmospheric CO_2 levels.

As of December 2023, 66 Indian airports are operating on 100% green energy. Major airports such as Delhi, Mumbai, Hyderabad, and Bengaluru have achieved Level 4+ Airports International Council (ACI) Accreditation and have become carbon neutral. These efforts are part of India's initiative to achieve carbon neutrality and net zero carbon emissions at airports across the country.

Source: Adobe Stock

ANSPs Strategies for Navigating Extreme Weather

As the aviation industry grapples with the increasing frequency and severity of extreme weather events due to climate change, Air Navigation Service Providers (ANSPs) play a pivotal role in ensuring flight safety and operational efficiency. The implementation of advanced technologies and strategic measures is crucial for mitigating the impact of extreme weather on air traffic management (ATM). Here, we delve into the key strategies adopted by ANSPs to navigate these challenges effectively.

Advanced Weather Forecasting and Monitoring
The cornerstone of managing extreme weather lies in accurate and timely weather forecasting. ANSPs are harnessing state-of-the-art meteorological tools and real-time data to predict and monitor adverse weather conditions. For instance, the Philippines' PAGASA (Philippine Atmospheric, Geophysical, and Astronomical Services Administration) has significantly enhanced its forecasting capabilities by installing S-Band Doppler radar systems. The latest installation was inaugurated in Northern Samar in April 2023, marking the 19th such radar in the country (Philippine Information Agency) (PAGASA). These radar systems provide detailed information on precipitation, wind speed, and storm intensity, which are critical for making informed decisions in air traffic management.

Integration of Weather Data into ATM Systems
To optimise flight routes and schedules, some ANSPs integrate accurate weather data into their air traffic management systems. Collaborative Decision Making (CDM) processes involve sharing information between airlines, airports, and ANSPs to make real-time adjustments based on weather conditions. System Wide Information Management (SWIM) further facilitates the seamless exchange of information, including weather data, among aviation stakeholders. This enhanced situational awareness enables more efficient and safer flight operations during extreme weather events.

Deployment of Remote Sensing and Surveillance Technologies
Remote sensing technologies like LIDAR (Light Detection and Ranging) and infrared cameras are invaluable for detecting and analysing atmospheric phenomena such as turbulence and volcanic ash. Hong Kong International and Singapore Changi have integrated LIDAR systems to measure wind profiles and detect clear-air turbulence, which is crucial for takeoffs and landings. LIDAR systems measure wind profiles and detect clear-air turbulence, providing data crucial for flight path adjustments. Infrared cameras, deployed at airports and onboard aircraft, help in detecting volcanic ash clouds, ensuring safe flight operations by preventing encounters with hazardous conditions.

ANSPs STRATEGIES

Enhanced Communication and Data & Information Exchange

Effective communication and data and information exchange among aviation stakeholders are essential for managing extreme weather scenarios. Digital NOTAMs (Notice to Airmen) provide timely updates on weather conditions and operational constraints, aiding pilots and air traffic controllers in making informed decisions. Aeronautical Information Management Service Providers disseminate essential weather information and alerts to all aviation participants, enhancing preparedness and response.

Infrastructure Resilience and Adaptation

Investing in resilient infrastructure and adapting operational procedures to withstand extreme weather is critical. ANSPs across the world are fortifying on-airport and off-airport facilities to withstand high winds, flooding, and extreme temperatures, ensuring continuous operations during adverse weather conditions. ANSPs and airports are also investing in heat-resistant materials for runways and taxiways, Advanced cooling technologies for aircraft and ground support equipment are also being developed to maintain operational efficiency during extreme heat. Sustainable technologies are also being implemented to curtail the impact of ANSP aviation activities on the climate.

Source: Adobe Stock

Jamaica's Journey to Climate Change Resilience, Adaptation, and Decarbonisation

Source: Adobe Stock

Jamaica is pioneering efforts to enhance climate resilience and reduce carbon emissions through innovative projects and strategic policies.

"This new solar-at-gate solution will replace carbon intensive sources of energy for parked aircraft with more sustainable renewable options. The importance of this flagship project for the aviation sector in Jamaica, and for other Small Island Developing States in the Caribbean, is hard to overestimate."

— Deputy Director General Regulatory Affiars (Mr. Rohan Campbell)

NMIA Solar-at-Gate Project

In the aviation sector, there are exciting developments that contribute to Jamaica's sustainability goals shared by the community of Small Island Developing States (SIDs). In 2018, the JCAA collaborated with the International Civil Aviation Organization (ICAO) and the Airports Authority to implement the Solar-at-the-Gate Project. The pilot project replaced fuel-powered ground units with solar energy, significantly reducing climate-change-inducing carbon emissions while aircraft are parked at the gate. The "solar-at-gate" project is a scalable, practical solution that other countries can adopt to reduce emissions at airports, with guidance and documentation provided by Jamaica's pilot project. Similar projects have been implemented at the Sangster International Airport, and in Douala, Cameroon, and Mombass, Kenya.

Source: Uniting Aviation

Mr. Rohan Campbell (Deputy Director General - Jamaica Civil Aviation Authority - JCAA), and Ms. Jane Hupe (Deputy Director, Environment, ICAO) at the launch of the pilot project at the Norman Manley International Airport (NMIA).

Aviation accounts for 2.5% of global CO_2 emissions. But it has contributed around 4% to global warming to date. There are other impacting emissions from aviation which include Nitrogen Oxide (NOx), water vapour and particles.

Renewable energy technologies such as solar, wind, and hydroelectric power are essential for combating climate change. Denmark leads the world in wind energy production, with wind power supplying over 40% of the country's electricity needs.

Titanium alloys, known for their high strength-to-weight ratio and excellent corrosion resistance, can withstand temperatures up to 600°C (1112°F). These properties make them ideal for use in engine components, airframes, and landing gear.

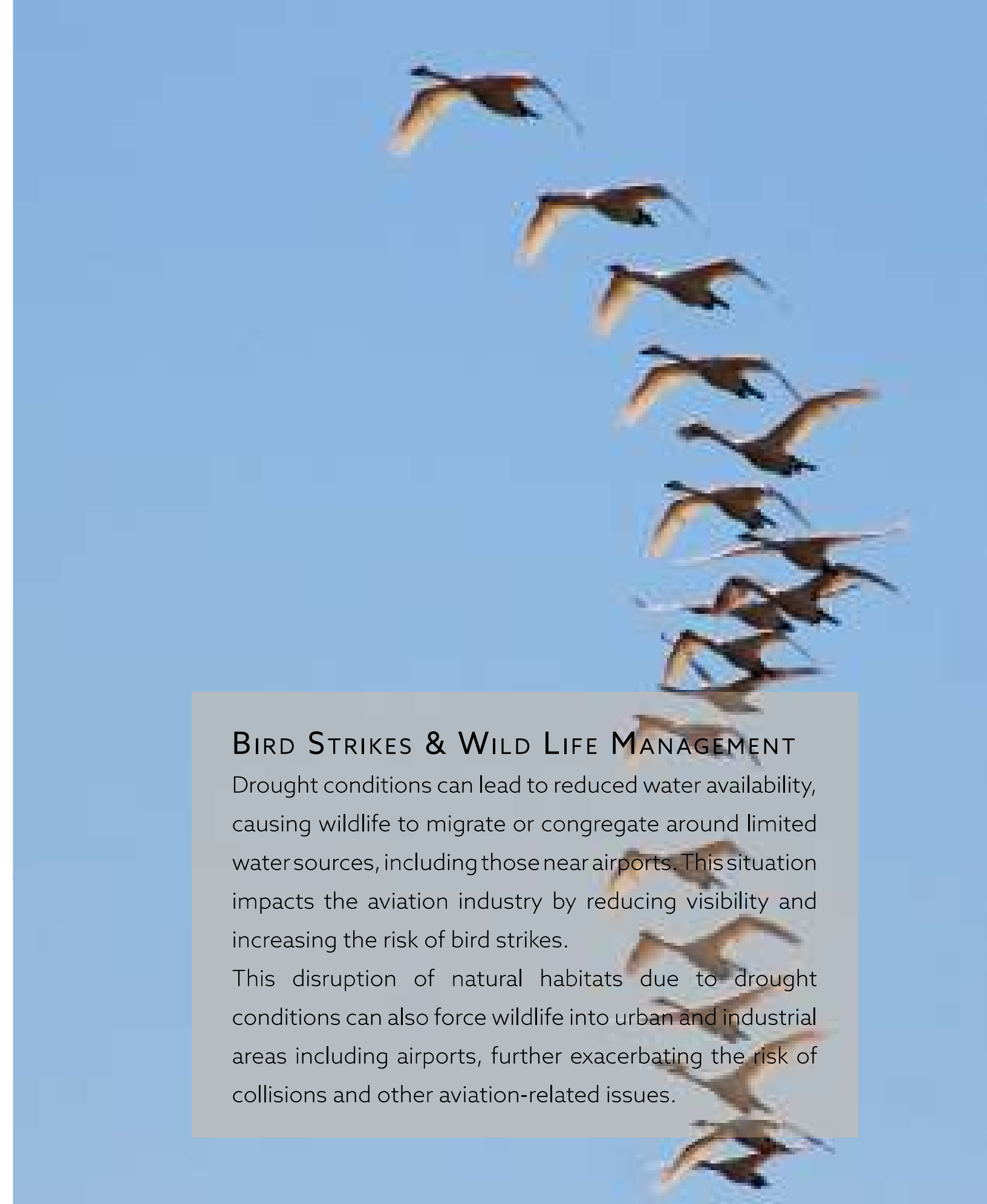
High temperatures affect aircraft performance by reducing air density. The need for longer takeoff distances at high temperatures is a significant consideration for airports in hot regions like Dubai and Phoenix.

The extraction and processing of materials, fuels and food contribute half of total global greenhouse gas emissions and over 90% of biodiversity loss and water stress.

Traveling one passenger-kilometer in 1990 used 2.9 megajoules (MJ) of energy. By 2019, this had more than halved to 1.3 MJ. This efficiency has come from improved design and technology.

The top 20 global climate polluters — dominated by China, India, the United States and the European Union — were responsible for 83% of emissions in 2022.

According to The Copernicus Climate Change Service (C3S) the global average surface air temperature of 17.09 degrees Celsius (62.7 degrees Fahrenheit) on July 22, 2024 was the warmest in their record books, which go back to 1940 (NASA).



Bird Strikes & Wild Life Management

Drought conditions can lead to reduced water availability, causing wildlife to migrate or congregate around limited water sources, including those near airports. This situation impacts the aviation industry by reducing visibility and increasing the risk of bird strikes.

This disruption of natural habitats due to drought conditions can also force wildlife into urban and industrial areas including airports, further exacerbating the risk of collisions and other aviation-related issues.

Source: Adobe Stock

PUZZLE CHALLENGE

JUMBLE

Unscramble the words below. One letter to each square to form five words

ILMTACE

SUGEOHNEER

AOFETRSC

YDINCAM

A SCRAMBLED WORD GAME

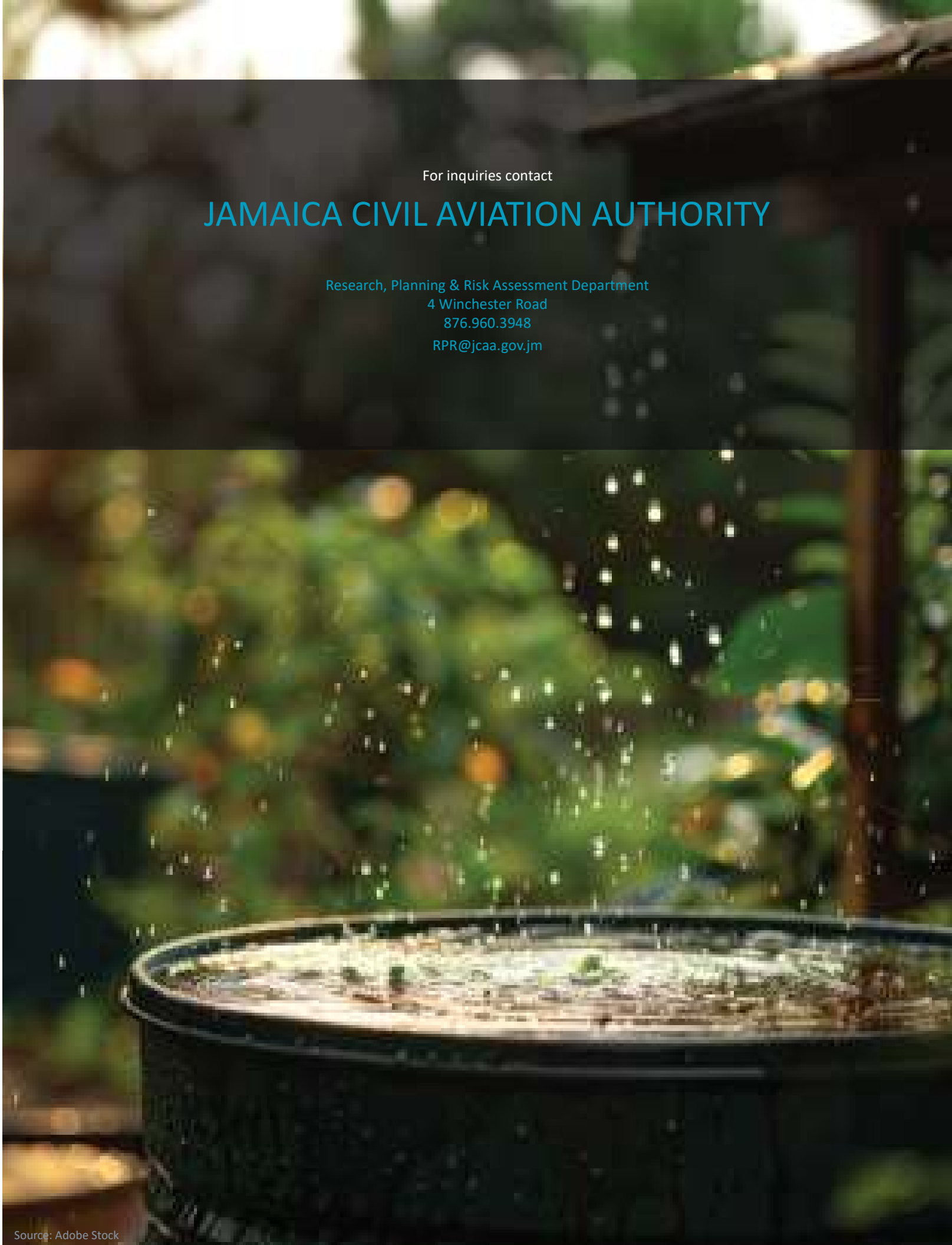
Source: justjumbleanswers.com

Now arrange the circled letters to form the answer. The cartoon above is your clue.

YOUR ANSWER WILL FIT IN THE CIRCLES BELOW

SOLUTION
APRIL 2024

The home run didn't surprise the hitter one bit. He did it without "BATTING AN EYE"



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Source: Adobe Stock