M Resource Management Emerging Trends

FDOT | 2043 FASP FLORIDA AVIATION SYSTEM PLAN

Appendix M

Resource Management Emerging Trends

Resource management has held a range of meanings over the years in aviation, as the focus of airports often follows emerging environmental trends. The emerging trends around airport resources can be organized into several categories:

- Resource use reduction: the ability to reduce the amount of resources used at an airport, resulting in reduced environmental impacts and generally lower costs at an airport.
- Adaptation: the ability to respond to changing conditions successfully.
- Living resources: addressing human and wildlife considerations.

Background

When discussing emerging trends of resource use, understanding the context of national and global targets to reduce carbon emissions is important, as the targets directly relate to many of the resources (energy, aviation fuel, large scale construction projects) and day-to-day use of materials at an airport, such as use of goods and services, waste management, and water quality. All these elements are also connected to the financial resilience of organizations, which is vital as airports in the region continue to grow and need to accommodate growth in a sustainable manner.

Resource Use

The aviation industry has been making efforts to reduce emissions and become more sustainable over the past two decades. In 2018, the U.S. aviation sector carried about 32 percent more passengers than in the year 2000, yet due to increasingly more efficient fuel, emissions and fuel use has remained constant.

In November 2021, U.S. Transportation Secretary, Pete Buttigieg, released the United States Aviation Climate Action Plan. This plan outlines guidelines aimed at achieving net zero greenhouse gas emissions from the U.S. aviation sector by 2050. The plan aims to decrease emissions through various actions, including developing new and more efficient aircraft and engine technology, producing and using sustainable aviation fuels (SAF), and carbon offsetting.

Associated with the U.S. Department of Transportation (DOT) move, the Federal Aviation Administration (FAA) released its Aviation Climate Action Plan to set the aviation industry on a path to achieve net zero greenhouse gas emissions by 2050. Airports Council International (ACI) also signed a net zero goal for 2050 for airports. The establishment of these net zero goals means that airports have a significant role to play in helping the aviation industry achieve these goals. While 2050 seems far in the future, to meet this goal, there is a trend toward airports preparing net zero plans to help mitigate the effects of climate change. Emerging trends relative to climate change are detailed in sections below.

Greenhouse Gas Emissions (GHG) Emissions Inventories and Climate Action Planning

Inventories of GHG emissions create the basis for understanding the amount of emissions at an airport and the relative control (also referred to as "scope") of the GHG emissions. Understanding the baseline emissions at an airport is important in order to target reductions and develop a climate action plan.

Once an airport understands its baseline emissions, the Airport Carbon Accreditation program (ACA) through the ACI provides a certified framework to target and reduce emissions that an airport owns and controls.

Sometimes airports do not want to utilize the ACA certification process, so they create separate climate action plans to identify reductions (climate change mitigation) and methods to adapt to an already changing climate. Others conduct climate action plans as part of a broader effort.

Reductions tend to focus first on those emissions entirely within an airport's total control (such as airport-owned fleet vehicles) or partially within their control (such as energy used from the grid). Emissions that are not directly within an airport's control include the actual aircraft emissions. Aircraft emission reductions, while associated with airports, are controlled more directly by the airlines. Programs to target aircraft emissions are typically focused on the introduction of more efficient technology, electrification of ground power and preconditioned air to support reduced aircraft idling, the introduction of SAF, and offsetting programs.

Reductions – Energy Efficiency, Renewables, Electrification

In 2014, about 22 percent of global energy production was creating and using renewable resources. Of this 22 percent, hydropower contributed 74 percent, wind contributed 13 percent, bioenergy contributed 8 percent, solar contributed 3 percent, and geothermal contributed 1 percent. According to the International Civil Aviation Organization (ICAO), the renewable energy options available to airports depends on how airports use energy, and which renewable alternatives are feasible solutions. Typically, airports purchase power from the national grid, which typically generates power using fossil fuels; however, airports can develop on-site power generation sources, which in rare instances produce more energy than needed to run the airport. In those instances, the airport authority generally would be able to sell the excess power back to the grid, generating income and supplying clean energy off-site.

> **Solar photovoltaic (PV)** panels are the most popular source of clean energy produced by U.S. airports. Aside from solar glare, which can be mitigated through strategic placement of solar panels, solar is compatible with airports because the modular system allows for more flexibility when designing solar installations. Solar can be easily deployed at most sites, provided there is a stable base and optimal sunlight. Some solar PV systems can

also self-adjust by tilting to optimize sun exposure. However, unlike other clean energy sources, solar can only produce energy during daylight hours.

Wind power is typically located in areas that receive stronger winds, such as flat plains, ridgetops, coastal locations, and other areas where wind flows uninterrupted. While successful wind farms generate large amounts of electricity, wind power is most efficient when the wind is strong and consistent, so wind power is only a feasible option in specific locations.

Geothermal Power: Solar and wind power are cost effective alternatives to traditional fossil fuel produced energy; however, they are limited by their ability to generate power only when the wind is blowing or during daylight hours. For this reason, geothermal power can be a beneficial alternative. Geothermal power uses heat from the earth to generate power. Ground source heat pumps, a heat pump that uses geothermal technology to heat and cool buildings, is a popular way airports are beginning to incorporate geothermal power into their designs.

On-site energy production can be cost-effective in the long run but often requires upfront capital costs. In addition to considering alternative power generation sources, airport authorities should also design infrastructure in ways and with materials that promote energy efficiency. The incorporation of LED area lights and conversion of vehicle fleets to electric or hybrid vehicles can make parking garages and parking lots more efficient. A recent study by ARUP Laboratories, a national non-profit and academic reference laboratory, shows that operating buildings more efficiently can save up to 6 percent annually on electricity bills.

Electric aircraft are the upcoming clean alternative to traditional aircraft. While there are sustainable alternatives to fuel, and fuel has become more efficient in recent years, traditional aircraft use a lot of fuel and contribute substantial emissions. Electric aircraft, however, will use electricity in place of fuel and result in zero emissions. The electric motors in electric aircraft are 95 percent efficient compared to combustion engines used in traditional aviation, which are 18 to 23 percent efficient.

An electric motor loses less energy to heat than a combustion engine, which also makes electric motors more reliable, easier to maintain, and less expensive to operate. Due to a decreased risk of mechanical failure, electric aircraft are safer than traditional aircraft as well. The improved efficiency of the motor also means electric planes are much quieter, which people residing near an airport might appreciate, and because of the lower operating costs, tickets on electric planes will likely be less expensive.

Despite these advantages, electric motors use a much heavier battery than traditional planes do. The batteries used in electric aviation can potentially be toxic, rupture easily,

short-circuit, or catch fire. In addition to the batteries, electric planes currently only have a range of less than 250 miles and a maximum capacity of up to 6 passengers, making electric planes impractical for a large percentage of passengers.

Low Carbon Pavements

Traditional Portland cement has a large carbon footprint. As the industry moves toward reducing carbon footprints, the embodied carbon relative to construction projects is an important piece of the carbon reduction puzzle. FAA's research arm, the Airport Technology Research & Development Branch (ATR), helps advance innovative technologies and best practices that improve the resilience and sustainability of airports. Recently, the FAA identified low carbon pavement as one of their areas of research priority. ATR is working with research partners to address the impact of recycled materials in pavement, which can lower energy and emissions by approximately 20 percent.

Additionally, the FAA has released a draft Engineering Brief in 2022 to address sustainability in cement, including blended cements that reduce the carbon footprint when compared to the traditional Portland cements.[1] The brief provides interim guidance for the specifications of cement with consideration to lower carbon options. Blended cements are generally acceptable to use in place of Portland cement and can be more economical and can increase strength. Some low carbon options can use the captured carbon dioxide, effectively sequestering it in the cement and these options are starting to show up in airport projects. In 2022, construction of the first low carbon cement runway in the United States began at Indianapolis International Airport.

Carbon Offsetting and Carbon Removal

Carbon reductions, such as energy efficiency and renewable energy transition are vital to meeting the aviation industry's goals. However, while direct carbon reductions are still a critical piece of the overall net-zero strategy, large-scale reductions will need to be supplemented with active carbon offsets or carbon removal from the atmosphere. Carbon offsets refer to a fee paid to offset GHG emissions, where the fees are typically directed to programs that reduce GHG emissions. Programs such as the Good Traveler provide carbon offsets for the miles that individuals fly, and some airports choose to offset their employee travel or other carbon footprints through this or similar programs.

Carbon removal is the direct removal of carbon from the atmosphere, storing (sequestering) it for some period of time. There are two types of carbon removal, technological, such as direct air capture, and nature-based pathways, such as soil carbon sequestration. The various carbon removal pathways are rapidly evolving and will play a vital part in the overall climate mitigation strategy for the aviation industry. The most recent version of the Intergovernmental Panel on Climate Change (IPCC) report highlights the need for carbon removal to limit the rise in global

[1] https://www.faa.gov/sites/faa.gov/files/2022-09/draft_EB_XXX_Cement_Specs.pdf

temperatures. However, carbon removal at airports could be an important piece of airports' net zero goals. Currently, the Airport Cooperative Research Program (ACRP) is funding a study on carbon removal at airports that will likely be released in 2024.

Waste Reduction / Diversion

Many airport authorities are taking action to achieve zero waste in the coming years. To accomplish this, the aim is to reduce waste generation and increase waste diversion from landfills through reuse, composting, and recycling.

The U.S. Environmental Protection Agency (EPA) estimates that the largest contributor to landfills is food waste, contributing to 24 percent of all landfilled material and 22 percent of the amount of combusted energy. Of the 63 million tons of food waste produced by commercial, institutional, and residential sectors, only 32 percent was diverted from waste. Food waste can be repurposed or diverted by producing animal feed and bio-based materials, biochemical processing, or anaerobic digestion. Food waste can also be composted, donated, used in land application, sewer, and wastewater treatment. The Florida Department of Agriculture and Consumer Services released the Florida Food Recovery Resource Guide, which outlines ways to assist and lists organizations that have indicated interest in participating in Florida's Food Recovery Program.

Many institutions are combatting waste by limiting their reliance on plastic and other non-recyclable and non-compostable materials by introducing alternative packaging and recycling solutions. For example, Delta Airlines has made efforts to remove single-use plastic items from their aircraft and lounges, eliminating an expected 30,000 pounds of plastic waste annually. Similarly, Ryanair plans to rely solely on biodegradable cups, wooden cutlery, and paper packaging by 2023. Many airports have also seen success with the implementation of liquid waste receptacles near the security checkpoint, which allows passengers to keep their empty bottles through the terminal and in turn reduces the amount of plastic waste.

In addition to material changes, recycling programs within organizations can be upgraded in ways that minimize, divert, or reuse waste. The recycling rate at Geneva Airport increased from 49 percent to 53 percent between 2016 and 2017 when the airport introduced a new waste sorting center. Vancouver International Airport was able to achieve 51 percent diversion in 2017 through an improved airport supplemented recycling program, which included the installment of a centralized sorting center as well. Portland International Jetport, in collaboration with Inland Technologies, developed a recycling program that recaptures and reuses aircraft de-icing fluid, making it the first airport in the United States to use 100 percent recycled aircraft de-icing fluid.

On average, 85 to 90 percent of aircraft can be recycled or repurposed at the end of their useful life. The Aircraft Fleet Recycling Association (AFRA), in coordination with 72 companies, established best practices for aircraft disposal and recycling. AFRA recycles over 150 aircraft annually (amounting to 30,000 tons of aluminum from aircraft).

Water Quality

Per and poly-fluoroalkyl substances (PFAS) are an emerging concern for airports relative to groundwater contamination. PFAS are a family of thousands of compounds used in a variety of materials and industrial processes around the globe since the 1940s. PFAS are considered emerging contaminants that are stable and break down slowly in the environment. Because they do not break down easily, PFAS can accumulate in the environment over time and become concentrated in the food chain, entering humans through the ingestion of food and water containing PFAS. There is evidence that exposure to certain PFAS chemicals can lead to significant adverse human health effects.

PFAS have water-repellant, stain-resistant, non-stick and surfactant properties and can be found at airports, most notably from the use of Aqueous Film Forming Foam (AFFF). Examples of products and processes at airports in which PFAS can be found include: AFFF; aircraft hydraulic fluids; paper tableware products such as paper cups, paper plates, and coffee cups; food packaging such as microwavable popcorn bags and fast-food wrappers; stain- and water-repellent fabrics; nonstick products; polishes; waxes; paints; sealants; varnishes; and cleaning products.

For decades, AFFF containing PFAS has been used at airports for extinguishing fires, fire and emergency response training, and fire equipment calibration purposes. The use of AFFF containing PFAS has been required by FAA extinguishing agent regulations to meet Part 139 certification requirements. Airports face several challenges in addressing the presence of PFAS. First, airports need to identify and appropriately respond to the legacy presence that may exist due to historical activities. Second, airports need to reduce the use of PFAS chemicals currently required by the FAA. The Department of Defense is expected to authorize a non-fluorinated foam in early 2023, at which point airports will be able to use that to replace AFFF. The EPA is currently reviewing comments on a proposed rule that would designate PFAS as a hazardous material under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), which is also known as Superfund. If this designation passes, there would be implications for the analysis of impacts during the National Environmental Policy Act (NEPA) process, as well as additional requirements around the release and cleanup of these contaminants.

Supply Chain Considerations

Since the COVID-19 pandemic, there have been supply chain issues across the nation and worldwide. While this challenge varies by location and needs, the trend has been requiring airports to build in additional lead time for orders of parts needed for operations, particularly those limited to airport operations that may have limited options from distributors. Challenges include:

- Increased lead time to obtain parts necessary for operations.
- Increasing costs relative to inflation and the constrained supply chain.
- Requirement to order more than needed earlier than needed to account for the supply chain issues, resulting in additional upfront costs and storage space requirements.

Adaptation

As the industry has seen, particularly with the COVID-19 pandemic, adaptation, or the ability to respond to changing conditions successfully, is vital. Risks can touch any aspect of an airport; financial, social, or environmental. Many often touch several of these categories. Several emerging components of risk evaluation include:

- Emergence of Environmental, Social, Governance (ESG) reporting to identify, track and mitigate actions to decrease risk.
- Adaptation planning including:
  - Climate Change.
  - Design.
  - Durability.
- Certifications to assist with resource management and adaptation.

Environmental Social Governance (ESG)

Medium to large hub airports have been receiving requests for additional information around ESG actions prior to receiving a bond rating. Bond agencies are requiring documentation around airports' environmental and social programs, and commitment to these programs from a structural/governance standpoint to prove to bond rating agencies that the airports are appropriately identifying and mitigating risks.

Many airports have large capital improvement programs, and while ESG reporting is not required, the trends around needing to document these risks appropriately for bond ratings is pushing airports to complete formalized ESG reports. While a certain format is not required currently, many are aligning with the Global Reporting Initiative (GRI) structure to help identify and address those areas that are the greatest risk to an airport.

The ESG reports are similar to, but not necessarily the same as, sustainability management plans, as ESG reports use sustainability categories, but are focused with the additional lens of risk mitigation. Climate change is part of the ESG focus (i.e., sea level risk, inundation, heat, extreme

weather events, etc.), as are social considerations, such as having a sustainable work force and appropriate stakeholder engagement programs.

Climate Change Planning

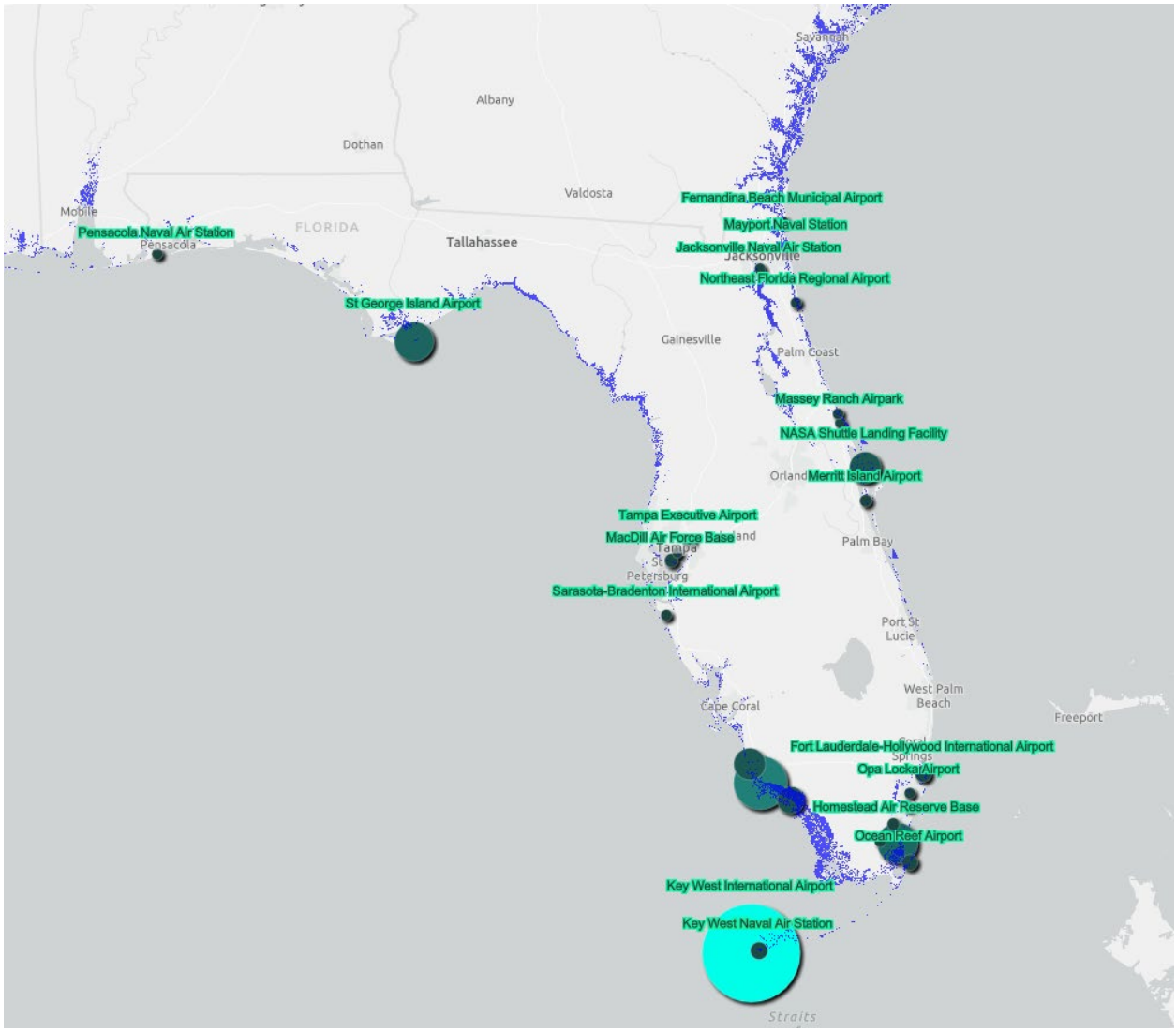
One of the aspects that ESG reports focus on is quantifying the risks and opportunities around climate change. The world is already experiencing shifts associated with a changing climate. Climate modelers expect additional impacts relative to increased extreme events, temperatures, and sea level rise, among others. Data around climate change is evolving rapidly, and it has become vital that airports address, plan for, and adapt to these changes. There are several tools that combine multiple data sources to help evaluate risks to airports. The Climate Mapping for Resilience and Adaptation (CMRA) Tool provides information on past, present, and future climate conditions, to better understand the risks associated with certain areas. Using this tool, airports can screen for climate hazards such as extreme heat, drought, wildfire, flooding, and coastal inundation for existing conditions, projected conditions in 2050, and projected conditions in 2090.

Sea Level Rise: Using the CMRA Tool, all airports in Florida were mapped relative to coastal inundation, which identifies the percent of each airport area that is projected to be impacted by global sea level rise. The information is included in **Figures 1, 2, and 3** for all Florida airports for the 2050 projected timeframe. The blue shading and dots near each airport representative sea level rise impacts as well as the area expected to be inundated by water in the future (2050) timeframe.

Durability: Preparing for sea level rise, increasingly intense storms, changes in average temperatures, and changes in biodiversity have become a priority for large institutions around the world. Transportation authorities should consider these potential impacts when beginning the master planning process, although some authorities choose to develop separate resilience management plans. ACI recommends that airport sponsors specifically:

- Conduct risk assessments of aircraft operations and infrastructure based on potential climate impacts.
- Develop and incorporate actions according to the risk assessment early on.
- Develop effective communication channels with all airport stakeholders and local emergency management officials as part of their adaption planning process.

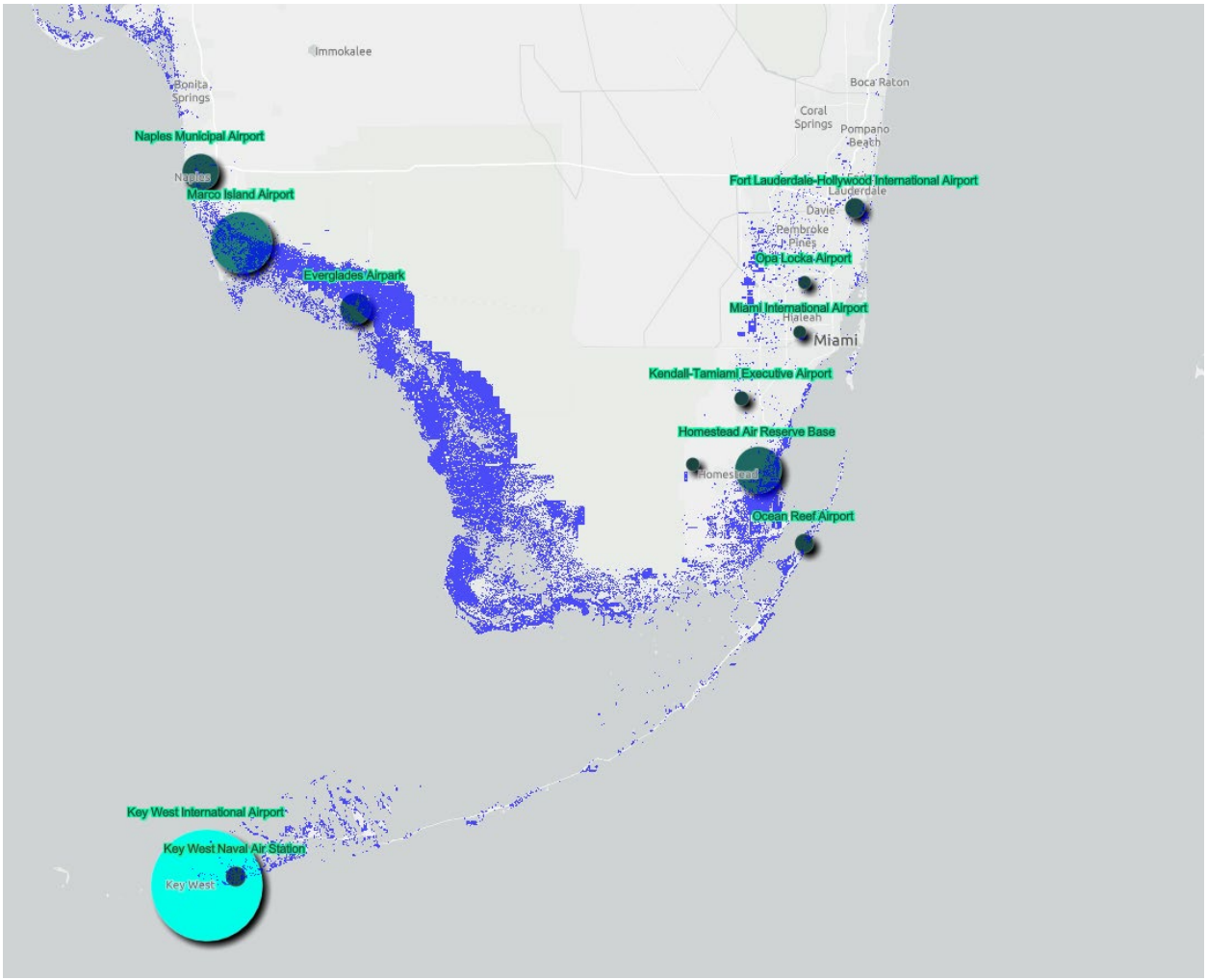
Figure 1. Statewide Future Inundation Levels (2050)



Note: Blue shading represents sea level rise. The size of the dot near each airport is representative of the amount of area an airport is expected to be inundated by water in the future (2050) timeframe – i.e., a larger dot represents higher area of impact. Source: Climate Mapping for Resilience and Adaptation, https://resilience.climate.gov/, accessed 2022.

Resiliency planning begins by identifying risks to operations and infrastructure. Many institutions have taken steps to proactively plan for natural events such as hurricanes and floods. Large airports, for example, can be equipped with resources to act as an Emergency Operations Center (EOC). Toronto Lester B. Pearson International Airport learned a lesson from an extremely cold three-day period in January 2014 that caused delays and cancellations.

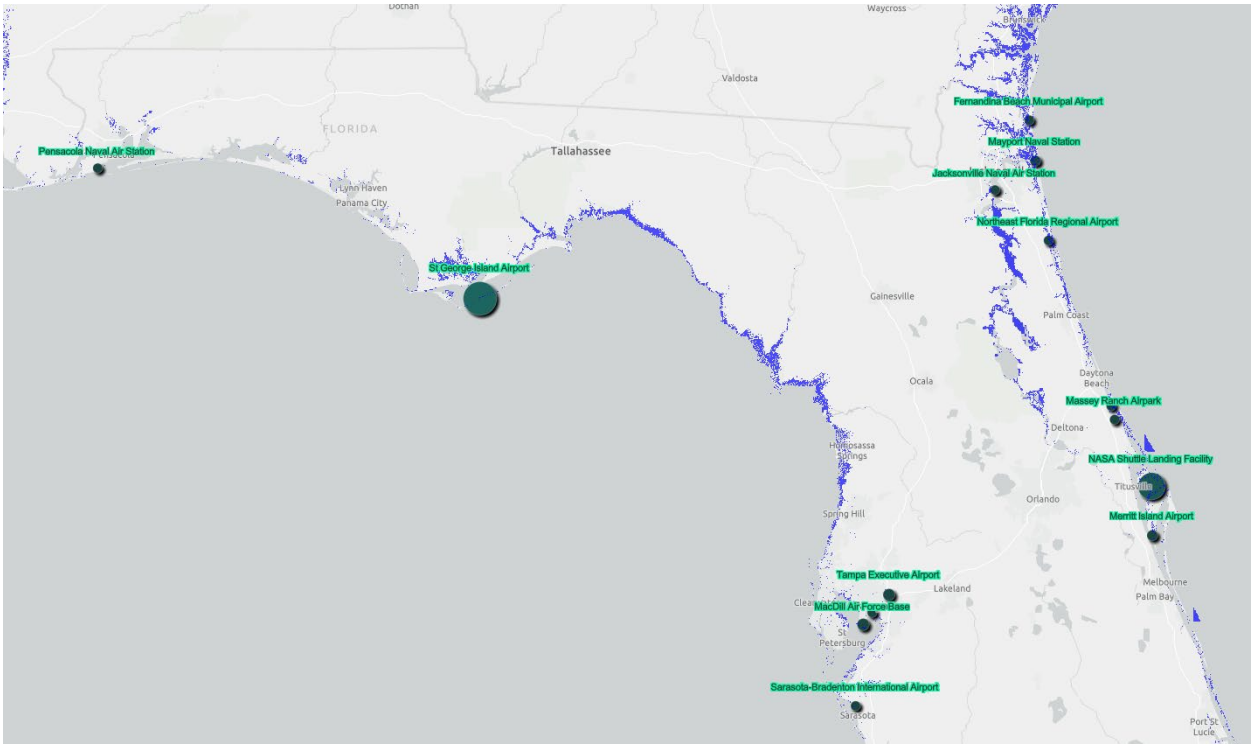
Figure 2. Southern Florida – Future Inundation Levels (2050)



Note: Blue shading represents sea level rise. The size of the dot near each airport is representative of the amount of area an airport is expected to be inundated by water in the future (2050) timeframe – i.e., a larger dot represents higher area of impact.
Source: Climate Mapping for Resilience and Adaptation, https://resilience.climate.gov/, accessed 2022.

As a response, the Greater Toronto Airports Authority (GTAA) created a list of recommendations, including improving communication within the airport authority and designing a passenger facing app and website to communicate necessary protocols for passengers. New Mexico City International Airport, on the other hand, is planning ahead. The airport is located on a drained lakebed and is prone to droughts, earthquakes, and flash flooding. When designing their new terminal building, engineers used a 2- to 3-meter-thick layer of tezontle, a volcanic material common in Mexico, that can provide ground water replenishment in addition to the storm water drainage facilities.

Figure 3. Central/Northern Florida – Future Inundation Levels (2050)



Note: Blue shading represents sea level rise. The size of the dot near each airport is representative of the amount of area an airport is expected to be inundated by water in the future (2050) timeframe – i.e., a larger dot represents higher area of impact.
Source: Climate Mapping for Resilience and Adaptation, https://resilience.climate.gov/, accessed 2022.

The United Nations Environment Program (UNEP) has issued a report, *A Practical Guide to Climate-resilient Buildings and Communities*, which recommends ways in which buildings and community spaces can be constructed to withstand and adapt to anticipated future environmental changes. Specific recommendations in this guide include using structural designs which can help reduce heat during a heatwave by using heavy materials which capture solar heat.

Certifications: Sustainability certifications are important for the implementation of sustainability. Because third parties verified them, certifications are a way to close the loop between the planning of a project and the implementation. Additionally, certification can help address the idea of continuous improvement in many ways, as many certifications require annual checks or additional information to keep the certification.

Several example certifications include:

- LEED – a framework for building energy efficient, healthy, and cost-saving buildings.
- Envision – a sustainability framework developed for Infrastructure.
- Fitwel – building certification based on health
- TRUE – a framework based on progress toward zero waste.
- ACA – the airport certification for GHG emission reductions.

These certifications focus on creating an adaptable environment, both the build environment and human aspects, such as health. Both aspects are important from the resource management side, with lower associated costs of energy use, materials, as well as a focus on human health and wellness, which has had particular attention since the start of the COVID-19 pandemic.

Living Resources

There are two topic areas that generally fall under the umbrella of living resources: 1) diversity, equity, and inclusion and 2) wildlife management. Each are discussed here for consideration.

Diversity, Equity, and Inclusion

Diversity, equity, and inclusion has become a spotlight for airports in recent years. Environmental justice is defined as the right to a safe, healthy, productive, and sustainable environment for all, where environment includes the ecological, physical, social, political, aesthetic, and economic environment.

Historically, planning for commercial and transportation development focused on the costs to develop and the convenience of the location instead of the impacts to the people and resources of the community. In the past, decisions were made to locate infrastructure in areas where disadvantaged individuals lived. This lack of racial equity has become a major concern.

While environmental justice has long been evaluated in NEPA documents, recently the trend has identified the need to go beyond traditional analysis to make sure fair treatment of people of all races, cultures, and income levels, and ensure that no group of people shoulders a disproportionate share of the impacts relative to a project or the airport in general.

Additionally, airports contribute to the economy, environment, and physical health of individuals in their local communities. Airports have the potential to impact the conditions of surrounding communities, both positively and negatively. Positive impacts may include job creation, partnerships with community organizations, and educational opportunities. Support of a sustainable workforce is a recent addition to most ESG reports, as sustainable workforce is a vital part of risk management in a post COVID-19 world with limits in available labor. Negative impacts could

include decreases in air quality, water quality, noise disturbances, increased surface traffic, and displacement of residences. The recent understanding of PFAS contamination described earlier in this document is another emerging trend relative to equity.

An airport is responsible for being a good steward of its local community. Airports can use environmental justice screening to identify areas that may require additional consideration, analysis, or outreach. Planning for future development projects and changes in operations requires a review of environmental justice to ensure that no negative impacts are anticipated to further exacerbate any socioeconomic issues in disadvantaged communities. Recently, tools have been developed to further analysis of environmental justice. The EPA offers the Environmental Justice Screening and Mapping Tool (EJScreen) that gives access to census data. The EJScreen tool identifies population indicators, including people of color, low-income, linguistically isolated, less than high school education, under the age of 5 and over the age of 64. EJScreen also examines environmental factors, including air quality standards, cancer risks, and the proximity to National Scale Air Toxics Assessment factors such as hazardous waste, wastewater, traffic, Superfunds, and Risk Management Plans.

Wildlife Management

Establishing a wildlife management plan is essential in airport planning. Bird and mammal strikes have the potential to cause severe accidents. The associated costs from wildlife strikes in the U.S. aviation industry average $550 million and contribute to over 500,000 hours of aircraft down time annually. While improper landscaping can attract these animals to airports, a wildlife management plan can prevent or significantly reduce the occurrence of these hazards.

Recognizing attractants near airports as well as limiting the creation of new attractants near airports is essential to wildlife strike mitigation. The FAA has found that the largest contributors to wildlife strikes are gulls, waterfowl, raptors, and deer. Putrescible-waste operations, wastewater treatment facilities, wetlands, and dredge spoil containment areas are commonly located near airports and tend to attract these species. Additionally, animals are attracted to areas that are similar to their natural habitats and can support their essential needs to survive – for this reason, proper landscaping in and around airports is important in preventing animal strikes. Many airport authorities have been successful in reducing the number of reported animal strikes through habitat mitigation: avoiding plants that provide food and shelter to regional wildlife species and instead creating an environment that is unappealing to local wildlife.

The FAA has several resources to assist in wildlife mitigation including:

- Advisory Circular (AC) 150/5200-32, *Reporting Wildlife Aircraft Strikes*.
- AC150/5200-34, *Construction of Establishment of Landfills near Public Access Airports.*
- AC 150/5200-36, *Qualifications for Wildlife Biologist Conducting Wildlife Hazard Assessments and Training Curriculums for Airport Personnel Involved in Controlling Wildlife Hazards on Airports.*

- AC 150/5200-38, *Protocol for the Conduct and Review of Wildlife Hazard Assessments, and Wildlife Hazard Management Plans.*
- AC 150/5220-25, *Airport Avian Radar Systems.*
- 14 CFR 139 Section 139,337.
- National Wildlife Strike Database.

Funding and Financing

In 2022, funding became available for additional areas of resource management and sustainability elements.

Bipartisan Infrastructure Law (BIL): The recent Bipartisan Infrastructure Law placed additional focus and funding on sustainability related elements. As part of the funding application, both carbon reduction/energy efficiency and equity elements were included as prioritization for proposed projects to compete for funding.

Inflation Reduction Act (IRA): The Inflation Reduction act includes sustainability and climate mitigation funding associated with SAF. SAF provides emissions reductions from aircraft emissions. However, due to the current cost differential between conventional jet fuel and SAF, as well as low availability, the IRA provides a tax credit to help boost production and use of SAF, along with grant funding to assist with the development of fuels and low emissions technology.

Additional Sustainability Funding: BIL and IRA are important emerging pieces of the funding availability for resource management. The implementation of sustainability measures is also eligible for federal funding in several additional grant programs and is anticipated to be used for the FAA Airport Climate Challenge going forward. These programs include VALE, Zero Emissions Vehicle and Infrastructure Program, and Section 512, briefly described below. Grant funding opportunities and availability change often and, with an increased focus on climate change, additional focus on electrification, emissions reduction projects, and resilience-based projects is anticipated.

Funding sources that have been available for a longer time and have been used by various airports include:

Voluntary Low Emissions Program (VALE): VALE is an FAA-sponsored program that improves air quality and requires air quality credits for future airport development by funding projects such as low- emission vehicles, refueling and recharging stations, and gate electrification. These grants help airports meet state air quality responsibilities under the Clean Air Act. Only commercial service airports located within a maintenance or non-attainment area relative to the National Ambient Air Quality Standards (NAAQS) are eligible for this funding.

Airport Zero Emissions Vehicle and Infrastructure Program (ZEV): The ZEV program targets improved air quality by use of zero emissions technologies at airports. The program

allows airports to use AIP funds to purchase ZEVs or construct/modify infrastructure to support ZEVs. FAA gives priority for projects that have the most air quality benefits and high cost-effectiveness.

Section 512 (FAA's Energy Efficiency of Airport Power Sources): This program is an AIP-discretionary program where an airport is eligible for a grant up to a certain percentage of a project that focuses on energy efficiency. These funds are awarded by region and scored against other discretionary projects.

How does this affect Florida Airports?

As seen in the information above, Florida airports are at risk for infrastructure and resilience concerns. For example, many airports are at risk relative to future inundation. Since most projects have a lifespan between 25 and 50 years, modeling data for 2050 is appropriate for planning for an adapting to climate change. Buildings and other infrastructure should be taking into account these types of future modeling now, so that current capital projects are not at risk in the future. As transition to electrification occurs, with substantial need to increase electric use and hookups to support buildings, electric vehicles, aircraft, electric ground service equipment (eGSE), etc., consider airport wide electrification planning and coordination with utilities and potential links to renewable sources and on-site storage options. This helps to reduce single point failure and increases resilience to the system. Consider evaluating on a project-by-project basis or combining several of the associated risk and resource management concerns detailed above by conducting a comprehensive ESG report to assess risk and vulnerability of Florida airports.

Additionally, there are human factors to consider. Airports serve their communities, providing connection to the broader world and economic benefits to their communities. As a result, they need to be cognizant of both the potential negative impacts on communities, and the positive ones. As projects proceed, airports should consider using more proactive stakeholder engagement and tools to identify equity challenges, and work to address them. As an employer, look for ways to enhance equity within FDOT through employee resources and training. Creating a sustainable workforce is vital to airports continuing to thrive. These challenges could also be addressed in sustainability or ESG planning and report development.

Ways that the FDOT AO Can Assist

The FDOT AO cannot directly assist airports in conducting risk assessments, equity screening, or communication with each airports' stakeholders. However, the FDOT AO office can support airports through the facilitation of evolving data, resources, and communication. Below are several recommendations to assist the Florida airports in analyzing their risks, mitigating them, and moving forward to be a more resilient system as a whole.

- **Communication:** For risk and resilience, as well as social equity, the field is evolving rapidly, and airports can and should learn from each other. The FDOT AO may provide an avenue to help facilitate and further some of these discussions. Additionally, for topics such as PFAS where the regulatory context is also changing rapidly, the FDOT AO can assist airports in staying on top of these changing regulations.

- **Resource Sharing:** As stated above, many resources now exist to help assess risks around climate change and social equity. The modeling is increasingly easy to use by the layperson, and many airports could conduct similar risk assessments to what is included from a system perspective in this document. As additional tools are developed, the FDOT AO can help facilitate the dissemination of that type of information.

- **Funding:** While several of the federal funding sources were identified above, the FDOT AO can assist airports in providing funding for the planning for and mitigation of risks such as climate change, electrification and energy transition, infrastructure improvements, PFAS strategy, and equity analysis. This would be beneficial to airports especially when the installation of such infrastructure is not eligible for funding from other traditional sources like the FAA AIP.

Conclusion

In conclusion, there are several trends around risk evaluation – social, environmental, and financial, that could affect the long-term resilience of airports in the Florida system. Each of these trends (equity, climate change, PFAS), provide an opportunity for airports to decrease their footprint, mitigate impacts on the environment and their communities, and support nationwide (and in some cases, international) goals around these issues. Recent funding sources on the federal level have raised many of these challenges to the forefront of airports nationwide. The Florida state aviation system can benefit from the FDOT AO looking for innovative ways of addressing these challenges to increase the adaptability and resilience of the entire system of airports in the State of Florida.