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FAR Part 139 Certificated Airports Shifting Towards Environmentally-Friendly Practices

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FAR PART 139 CERTIFICATED AIRPORTS SHIFTING TOWARDS
ENVIRONMENTALLY-FRIENDLY PRACTICES

by

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A.A.S., Southern Illinois University, 2009

B.S., Southern Illinois University, 2009

A Research Paper

Submitted in Partial Fulfillment of the Requirements for the
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RESEARCH PAPER APPROVAL

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Timothy Allan Bannon

A Research Paper Submitted in Partial

Fulfillment of the Requirements

for the Degree of

Master of Public Administration

in the field of Aviation

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TITLE: FAR Part 139 Certificated Airports Shifting Towards Environmentally-Friendly Practices

MAJOR PROFESSOR: Dr. Jose R. Ruiz

While the aviation industry has grown dramatically in the past 100 years, it has done so with minimal environmental awareness. Leaders in the industry must become more conscious of environmentally-friendly practices available for airport use. This research provides a discussion of technology and sustainable practices available for use at U.S. airports. This research also provides funding information available to airports for sustainable projects. The methodology used in this research study was a review of literature that examined environmental reports, federal regulations, periodicals, political statements, and professional articles related to the topic. Environmental sustainability and climate change as it relates to airport sustainability is also defined. The Federal Aviation Administration (FAA) issues operating certificates and provides regulatory oversight for all Federal Aviation Regulation (FAR) Part 139 airports. FAR Part 139 certificated airports are the largest and busiest air carrier service airports in the United States. Several industry leading airports recognize the need to pursue environmental conservation initiatives, and are doing so on a voluntary basis. These environmental initiatives include the utilization of alternative energy, sustainable building design, retrofitting energy efficient technology to existing facilities, water conservation, recycling programs, and construction waste management. Motivators, priorities, and barriers to airport sustainable practices are identified to provide insight to

current and future environmental trends at airports. The results of this research study identify a need for official publications that can be utilized by airports wishing to invest in sustainable initiatives. Further research is necessary by the federal government to create a user-friendly guide for airport sustainability that can be utilized by large and small airports alike.

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CHAPTER 1

INTRODUCTION

Overview

While the aviation industry has grown dramatically in the past 100 years, it has done so with minimal environmental considerations. The Federal Aviation Administration (FAA) forecasts that the commercial aviation industry will continue growing an average of 3.6% per year over the next 20 years (FAA Forecast 2011-2031, p. 33). With a growing number of passengers, airports must continue to expand air traffic capacity and facilities. As this expansion of facilities takes place, leaders in the industry must become more conscious of environmentally-friendly practices available for airport use. Furthermore, industry leaders should be aware of funding opportunities to improve air quality and become energy efficient. This research focuses on Federal Aviation Regulation (FAR) Part 139 certificated airports. Air quality, emissions reduction, energy efficiency and other ground based environmental initiatives are the primary topics presented in this research. In the form of literature review, these topics outline the technologies and new practices in existence to aid current airport infrastructures and operations in becoming more environmentally-friendly.

Aviation growth in the past century has resulted in a vast network of airports that have positive economic impact in the areas that surround them. In 2010, the U.S. Department of Transportation's Bureau of Transportation Statistics reported that 786.7 million scheduled passengers traveled on U.S. airlines and on foreign airlines serving the United States (Research and Innovative Technology Administration, 2011). Considering the current number of passengers using the air transportation system, airports exist as some of the most publicly visible users of energy.

Problem Statement

FAR Part 139 certificated airports are responsible for hosting all commercial service aircraft in the United States. “Although there is no doubt that the presence of an airport has great positive impacts on a surrounding community from an economic standpoint, the presence of an airport, much like any large industrial complex, unfortunately impacts the community and surrounding natural environment in what many consider a negative manner” (Wells & Young, 2004, p. 354). The aviation industry must focus on more sustainable development and environmentally friendly practices.

Purpose Statement

The purpose of this study is to identify and define a need for sustainable practices at FAR Part 139 certificated airports, outline current aviation industry practices, and provide funding information to airports that desire to undertake environmental projects in the future.

Research Questions

- What technologies currently exist within the aviation industry to aid airports in becoming more environmentally-friendly?
- What options are currently available to fund environmental projects at FAR Part 139 certificated airports?

This research will address these and other issues present with respect to airport sustainability.

Research Methodology

The methodology used in this research study was a review of literature that examined environmental reports, federal regulations, periodicals, political statements, and professional articles related to the topic. The information gained is then presented in an objective manner to discuss the details of the review. Finally, the findings of the study, along with conclusions are presented.

CHAPTER 2

LITERATURE REVIEW

Part 139 Certificated Airports

In 1912, there were only 20 recognized landing facilities in the United States, all of which were privately owned and operated (Wells & Young, 2004). Since that time, airports have grown in number and now play a crucial role in the U.S. aviation industry. There are currently 550 FAR Part 139 certificated airports accommodating all air carrier operations in the United States (FAA, 2011a). According to FAR 139.1, any airport located in United States serving scheduled air carrier operations in aircraft designed for more than nine passenger seats but less than 31 passenger seats must be issued an operating certificate by the FAA (FAA, 2011b). Airport operating certificates serve to ensure the highest level of safety in air transportation. To obtain an operating certificate, an airport must agree to operational and safety standards outlined in FAR Part 139. The FAA provides safety oversight at commercial service airports with annual inspections to ensure compliance with FAR Part 139 (FAA, 2011b).

Environmental Sustainability

Sustainability is defined as relating to, or being a method of harvesting or using a resource so that the resource is not depleted or permanently damaged (Marriam-Webster, 2012). The U.S. Environmental Protection Agency (EPA) defines *Climate Change* as any distinct change in measures of climate lasting for a long period of time, meaning major changes in temperature, rainfall, snow, or wind patterns lasting for decades or longer (2009). According to the EPA, the primary driver of climate change is the increase in carbon dioxide, and other greenhouse gas emissions to the atmosphere (2009). The U.S. stands as a major producer of carbon dioxide emissions. “Total

energy related carbon dioxide emissions from the U.S. totals at 5,746 million metric tons (MMT). “Compared to a global production of 24,405 MMT, the U.S. produces 24 percent of the world total” (Shulk, 2007, p. 19). According to Shulk (2007), carbon dioxide emissions from the transportation sector are the largest source of energy related carbon dioxide emissions, accounting for 33% of the U.S. total. Ground based aviation specific carbon dioxide emissions information is not available.

Airport Sustainability

Leaders in both aviation and the United States Senate support environmentally-friendly practices in the aviation industry. In the letter to the Aviation Community released along with the *NextGen Implementation Plan* (NextGen), Federal Aviation Administration (FAA) Administrator J. Randolph Babbitt emphasizes “We have...been working hard at our nation’s airports to reduce delays and improve the environment with NextGen initiatives that help curb fuel burn and emissions by improving surface efficiencies” (FAA, 2011c, p. 1). Through the implementation of the NextGen, the FAA is striving to promote environmentally-friendly practices by reducing ground based emissions at airports. In order for future environmental legislation to be signed into law, leaders in our present political system must support an environmentally-friendly legislative agenda. United States Senator, Democratic Assistant Majority Leader Richard Durbin (IL) acknowledges a need for environmentally sustainable aviation practices. Durbin (2011) stated “Airports, while huge economic generators for cities around the country, have a real environmental impact on the area around them” (p.1). With strong governmental leadership supporting sustainable practices in aviation, the industry has a strong opportunity to become increasingly environmentally-conscious.

In response to airport environmental sustainability becoming a major focus area in aviation, the Airports Going Green Conference has become an annual event that is held to promote airport sustainability. “The Airports Going Green conference is the aviation industry's leading sustainability forum, bringing sustainability leaders and innovators together from all over the U.S. and around the world” (American Association of Airport Executives, 2011, p.1)

Methods of Implementing Sustainable Initiatives

Several methods exist for implementing environmentally sustainable initiatives, none of which are considered a standard for the aviation industry. Cedric Curtis (2012), vice president-aviation for Reynolds Smith & Hills Inc., describes how some airports are moving boldly, while others take a more incremental approach (p.24). Which approach is correct, comprehensive or incremental? There's no right answer, of course, because it depends so much on the airport, the project, the sustainability goals, and the budget (Curtis, 2012, p.26). Airports vary greatly in size, organizational structure, available funding and potential environmental projects. Depending on all factors present, sustainability must be achieved on a case by case basis.

Culberson and Reznar (2012) report:

Initially, sustainability concepts may be incorporated into new development projects, such as a new building, to reduce pollutants released to the air or water in compliance with local or state regulations. From this experience, an airport's interpretation of sustainability may broaden—sustainability is fundamentally about changing the way we make decision, from the day to day routine decisions to the long-term visionary decision that promote future airport growth (p.27).

Environmentally Sustainable development programs are a good starting point while placing priority on sustainable practices. Culberson et al. (2012) state that a sustainable development program may include goals designed to drive planning, design and construction decisions, such as minimizing environmental impacts and maximizing community benefits while doing so in a fiscally responsible manner. However, sustainable management programs are a much more inclusive step in a sustainable existence.

Culberson et al. explain how sustainability management programs expand the integration of sustainability into all aspects of an organization so sustainable decision-making becomes the cultural norm (p.28). This all inclusive approach changes the internal focus of the organization, which further instills a sustainable mindset within the organization. "Sustainability efforts need visible leadership support and implementation by engaged and empowered airport staff (Culberson et al., 2012, p.28).

An additional method of sustainable initiative implementation is currently being researched by the FAA via the Sustainable Master Plan Pilot Program. This program focuses on an overall approach to planning airports with a major focus on sustainability.

The American Association of Airport Executives (2011) explains the FAA's

Sustainable Master Plan Pilot Program:

This program is evaluating ways to make sustainability a core objective at every airport by funding long-range planning documents at 10 airports around the country. These documents, called Sustainable Master Plans and Sustainable Management Plans, will include initiatives for reducing environmental impacts and achieving economic benefits while increasing integration with local communities. The program will end in late 2012. The industry leaders will use lessons learned to develop national program guidance on airport sustainability (p. 1).

Current Industry Practices

For the good of the environment, important to recognize new innovations and developments concerning environmentally-friendly practices that are being implemented by businesses and agencies throughout the United States. Airports are voluntarily pursuing environmental initiatives, but at an overall slow pace. Graham (2011) explains that “following various developments such as the publication of the Brundtland report in 1987 and the Earth Summit in Rio de Janeiro in 1992 there has been an increasing awareness and commitment to the principles of sustainable development in many industries, the aviation sector being no exception” (p.226).

Select airports within the industry are transitioning from traditional airport operating methods toward more environmentally-friendly ones. Airports that adopt environmentally-friendly technologies are often viewed as being environmentally responsible. Palm Beach International Airport (PBI), Denver International Airport (DEN), Boston Logan International Airport (BOS), and Chicago O’Hare International Airport (ORD) are prime examples of “model green airports”. These airports are voluntarily leading the industry in the right direction with regard to airport sustainability. Focusing on sustainable practices that include alternative energy generation and energy efficiency are key components to minimizing negative effects on the environment.

Terminal Design

Airport terminal design is applicable when airports are constructed or expanded to meet the demand of air travelers. Select airports domestically and internationally are adopting green methods into new terminal building construction. For instance, Singapore’s Changi Airport (WSSS) opened recently with a small number of green

initiatives. One example of what SIN has done to become a sustainable airport is strategically installing windows to maximize natural lighting. Loo (2008) describes how the terminal is designed to run on lower energy costs compared to Changi's older terminals, mainly via natural lighting from the 919 skylights and by positioning air-conditioners nearer to the floor-level (para. 5).

Alternative Energy

Due to the general design of airports; buildings, runways and taxiways usually cover a relatively small portion of airport property. An airport's general design leaves a considerable amount of empty space for non-aeronautical use. For instance, Columbia Metropolitan Airport's (CAE) Airport Operations Area (AOA) consists of approximately 2,700 acres (1,092 Hectares). Twenty-two percent of that area is impervious (non-penetrable by fluids) – 2,106 acres (852 Hectares) are available (for alternative use) (Columbia Metropolitan Airport, 2011, p. 6).

Land use compatibility is a key component in identifying areas on an airfield capable of being used for non-aeronautical purposes. Close attention must be paid to navigational aids, signage, lighting, wildlife areas, and safety areas while identifying potential areas for installing equipment for alternative energy capabilities. By utilizing selected available space with solar or wind energy, airports can readily decrease the use of fossil fuels and reduce the current carbon emissions footprint they impose on the local and global environment. Taking into account the sunlight hitting the earth's surface every day contains around 7,000 times more energy than the fossil fuels that humanity consumes annually, solar energy is a realistic option for decreasing dependence on fossil fuels (Goodall, 2008). One important incentive that appeals to

airports is lower operational costs associated with energy consumption and return on investment. Winegard (2010) believes that through prudent, energy efficient investments, airports can readily reduce operating costs from 10 to 30 percent annually” (p.19). To date, Denver International has installed 9,200 solar panels to decrease energy costs. Fresno Yosemite Airport (FAT) has also installed 11,700 solar panels to reduce energy costs (Yu, 2008, p. 1). For Part 139 certificated airports with greater land area and compatible airport layouts, solar energy may prove to be a viable alternative to fossil fuels. Even though an adequate amount of land may be available at large airports, the absence of an immediate return on investment can be challenging. “Because of the precarious situation of airlines, airports require quick return on investment. Sometimes the return on investment on these (environmental) projects is not quick enough for the airport” (Yu, 2008, p. 1). Although the payback period may take a considerable amount of time with solar panels, this option may suit FAR Part 139 certificated airports with the necessary land area and financial latitude that allows them to utilize solar energy.

Geothermal energy is another viable option for new energy projects at airports. In 2012, Maine’s Portland International Jetport (PWM) procured funding to install a geothermal system to support heating and cooling in within their terminal expansion project.

Dolan (2012) describes the geothermal system:

The geothermal system built at Portland Jetport is Maine’s largest, with nearly 23 miles of high-density polyethylene piping and 120 ground wells that reach up to 500 feet deep. The system moves up to 475 gallons of water per minute with a 125-horsepower pump. Under normal operation, it takes approximately 30 minutes for water to complete a round trip to the farthest well. The energy efficiencies provided by the geothermal

system outside the terminal are complemented by the use of low-energy radiant-heated flooring inside (p. 46).

Another type of alternative energy that can be utilized at airports is wind power. Wind energy must be analyzed on an individual site basis, requiring research and up-front investment. Those airports that find their geographical location potentially beneficial for wind power generation are beginning to explore options. For instance, according to Hammel (2009), Boston Logan Airport installed 20 wind turbines that will offset about 3% of the buildings annual energy needs (para. 2). The implementation of such an energy system would have long term benefits for sites with alternative energy potential. Boston Logan Airport (BOS) ranks as the 19th busiest airport in the U.S. based on enplanements (FAA, 2010b). Twenty turbines resulted in a three percent energy savings, having a real impact on overall energy consumption. Installing a similarly sized system at smaller Part 139 certificated airports could have a larger effect on utility costs associated with alternative energy generation.

Light-Emitting Diode Technology

As facility and airfield lighting technology has advanced, high efficiency options are now available for utilization. Dan Mann, Executive Director of Columbia Metropolitan Airport stated "Until recently, airports have not widely focused on energy efficient lighting on airfields or in airport facilities" (D. Mann, personal communication, November 2, 2011). A transition from conventional incandescent bulbs to high-efficiency, light-emitting diode (LED) luminaires, can drastically reduce the cost of day to day operations. "In a three month study conducted by Spofford and Thorndike, it was determined that LED luminaires were the obvious choice for energy efficiency and improved illumination" (Winegard, 2010). At Palm Beach International Airport (PBI),

LED lighting has been installed on their arrival and departure roadways. “The recent installation of 695 79W LED luminaires will provide the airport with an annual energy savings of \$34,000 and an annual lighting maintenance savings of more than \$27,000” (Winegard, 2010, p. 19). Not only does this represent a significant cost savings to the airport resulting from lower energy usage, but also improves visibility on the roadways due to brighter light output. This type of lighting can be retrofitted to existing infrastructure easily, and can be used in indoor and outdoor environments.

Runways and taxiways are also good candidates for a LED lighting retrofit. Small hub FAR Part 139 certificated airports such as Columbia Metropolitan Airport (CAE) are investing in LED lighting for their airfield surfaces. As a part of the Runway 11/29 rehabilitation project in 2009, CAE elected to switch all runway lights to LEDs. “This airport was the second to install LED lighting in the runway environment domestically” (D. Mann, personal communication, November 2, 2011). Not only has the lighting decreased energy consumption, it has also increased the visibility of the runway environment during Instrument Meteorological Conditions (IMC), resulting in enhanced safety. “During the installation of the LED lighting on Runway 11/29, contractors had to reduce the brightness of the bulbs due to their intensity” (D. Mann, personal communication, November 2, 2011).

Boston Logan International Airport (BOS) is another airport utilizing LED luminaires by installing nearly 2,000 within their parking garage. “It is estimated that the 2,000 retrofit LED luminaires will use approximately 50 percent less electricity than is currently used and will save the Massachusetts Port Authority approximately \$263,000 in energy costs this year alone, not including the maintenance savings from ongoing

replacement of the high intensity discharge bulbs, which cost \$150 for each fixture” (Winegard, 2010, p. 19). According to Winegard, an energy management program will be joined together with the new LED lighting to provide motion-controlled lighting throughout each level of the garage (p.19). The use of motion controlled lighting at Part 139 certificated airports, especially during evening hours in low traffic areas of the facilities (offices, closets, storage rooms, bathrooms, parking garages, generator rooms, and hallways) can reduce environmental impact via a reduction in energy consumption.

Sustainable Construction Management

Construction is ongoing in the aviation industry as airports continue to update their facilities. It is recommended by the City of Chicago Sustainable Airport Manual (SAM) (2009) that airports undertaking construction projects develop and implement a construction waste management plan. The SAM suggests a waste management plan should identify the materials to be diverted from disposal and indicate whether the materials will be sorted on-site (2009). The SAM is currently being used as an environmental guideline for the multi-billion dollar O’Hare Modernization Program (OMP). The City of Chicago’s SAM is regarded a leading edge document in the aviation industry. “The City of Chicago has been a leader amongst airports in taking steps to make O’Hare more efficient and environmentally-friendly” (Durbin, 2001, para. 1). The plan recognizes when it is necessary to recycle and/or salvage non-hazardous construction and demolition debris. Recyclable materials should be redirected back into the manufacturing process. To facilitate the airport’s recycling objectives, the SAM recommends that specific sites are designated for the segregated collection and

labeling of recycled materials and track the recycling efforts throughout the construction process (Chicago Department of Aviation, 2009).

During the construction of Metropolitan Oakland International Airport's (OAK) \$300 million terminal in 2004, the airport implemented their own Materials Management Program (MMP) (Port of Oakland, 2006, para. 3). Their guidelines are similar to the guidelines presented in the City of Chicago SAM. The MMP has designated three on-airport sites for material stockpiling and recycling, allowing for the reduction of disposal and material purchasing costs and reduction of truck emissions associated with landfill disposal of waste. By following the OAK MMP it is expected that over 500,000 cubic yards of construction materials will be reused and more than \$5 million will be saved (Port of Oakland, 2006, para. 4).

Throughout the construction projects of new facilities, runways, or taxiways, airports should consider creating stockpiles of the excavated soil. Storing excavated soil allows the utilization of the displaced soil for later use and a reduction of the transportation and disposal costs, which would otherwise be incurred. The ORD modernization effort demonstrated this environmentally conservative practice during construction of Runways 10C-28C and the extension of 10L. All existing stockpiles, totaling 1.8 million cubic yards (1.38 million cubic meters) of soil, were relocated to a designated area on the airport property (Chicago Department of Aviation, 2009).

Aggregates can be stockpiled on-site including, asphalt, crushed concrete, gravel and sand for later use as demonstrated by Boston Logan International Airport (BOS).

Boston Logan was the first airport in the nation to use environmentally-friendly asphalt

developed by Aggregate Industries Northeast Region (Chicago Department of Aviation, 2009). Environmentally-friendly practices have been an ongoing trend at Boston Logan.

The selection of an airport's construction company should take into account their use of sustainable practices. Construction companies should be encouraged to utilize recycled/able materials and divert construction waste from landfills to the greatest possible extent. Boston Logan International Airport's (BOS) Terminal A redevelopment maximized green technology including alternative fuel, natural lighting, recyclables and energy conservation plans. Perhaps more importantly, 75% of construction and demolition waste was diverted from landfills (Eco-Structure Staff, 2009, para. 2).

Waste Management

At any Part 139 certificated airport, waste management is a key component of daily operations. At present, the majority of airport generated waste will be disposed of at landfills. Industry leaders must understand that there are other options for waste disposal. "Some green measures require little capital investment and are aimed more at changing business practices" (Yu, 2008, p. 1). Recycling should be a priority for Part 139 airports because it does not require a large amount of capital, but does offer a benefit to the environment. The benefit to the environment is a reduced amount of landfill waste. Hartsfield-Jackson Atlanta International Airport (ATL) launched GreenSortATL, a comprehensive recycling program. "The airport generates nearly 70 tons of paper, plastic, food and other trash daily" (Atlanta Department of Aviation, 2011, para. 2). According to the Atlanta Department of Aviation, the new system consists of singular receptacle units capable of accepting all forms of waste (para. 3). After the machine senses that new items have been deposited, an electronic sorter activates and

processes the material within the unit. The material is then taken off site at scheduled intervals to process the material. By simply discarding all trash into one of the many receptacles throughout the airport, passengers and employees alike are contributing to the recycling effort and saving landfill space (Atlanta Department of Aviation, 2011, para. 4). Hartsfield-Jackson Atlanta International Airport is identified as the busiest airport in the United States (FAA, 2010). In addition to being recognized as the United States' busiest airport, ATL is on the leading edge of implementing environmentally-friendly practices on a grand scale.

Water Reclamation

Water usage is an important topic to address when improving sustainability at Part 139 certificated airports. Fresh water is used for non-consumable applications such as irrigation of landscaping, flushing toilets, vehicle and aircraft washing, and firefighting at airports. Initiating a grey-water recycling system can be an effective addition to making the airport more environmentally-friendly. "Grey-water is any...wastewater with the exception of wastewater from toilets" (Lets Go Green, 2011, para. 1). Fresh, potable water is currently being used in large quantities at airports throughout the United States. The primary concern is the use of fresh water for applications where it is not required. If grey water was utilized for non-drinking applications, potable water would be conserved at a considerable rate. This technology is not currently utilized at any airport.

Drivers of Sustainable Practices

Based on survey data presented by the Transportation Research Board (2008) local governments have been taking action to promote environmental responsibility by

creating regulations that require environmentally-friendly initiatives. Although this has had a positive impact on the implementation of sustainable practices at airports, state and regional regulation is anticipated to disappear in the future as a driver of sustainability (as indicated in Table 1). In the future, federal regulations will be viewed as less of a driver (see Table 1). This may have a negative impact on the development of future requirements involving the adoption of sustainable practices by Part 139 certificated airports. A lack of federal regulation will result in airports not taking necessary steps in becoming more environmentally-friendly. Respondents reported that “Stakeholder Concerns and Relations” would emerge as the primary drivers of airport sustainability. These drivers coincide with various airports taking a voluntary lead in identifying sustainable practices and implementing leading edge technology in the industry today.

Table 1 Current and Future Drivers for Sustainability

Rank	Current	Future
1	State/Regional Regulations	Stakeholder Concerns/Relations
2	Airport Policy	Global Trends
3	Federal Regulations	Airport Policy
4	Corporate Responsibility	Corporate Responsibility
5	Stakeholder Concerns/Relations	Federal Regulations

(Transportation Research Board, 2008, p. 9)

As shown in Table 2, respondents also addressed survey questions concerning priorities associated with implementing sustainable practices at airports. A focus on cost effective initiatives can be seen in the top three practices. It is evident that airports are utilizing their current infrastructure and retrofitting environmental technology to

increase operating efficiency and reduce carbon emissions (see Table 2). These actions may be the result of the lower cost linked with updating existing infrastructure as compared to building new structures and buying new equipment.

Priorities of Sustainable Practices

The Transportation Research Board (TRB) Airport Cooperative Research Program (ACRP) Synthesis 10 (2008), surveyed numerous airports on the topic of future sustainable practices priorities.

Table 2 Priorities of Sustainable Practices at Airports

Rank	Sustainable Practice
1	Energy conservation, efficiency, demand management, and baseline audit
2	Emission (CO ₂) Reductions
3	Clean energy production and clean fuel vehicles
4	Use of green building principles, sustainable design, and high-performance buildings
5	Green building certification using Leadership in Energy and Environmental Design (LEED), a green building rating system developed by the U.S. Green Building Council

(Transportation Research Board, 2008, p. 10)

Based on survey data, The TRB (2008) explains that U.S. airports mainly identified environmental practices as key priorities for the future, followed by social and then economic practices (p.10). Under environmental practices, airports listed numerous areas of focus for the future. The TRB outlines the major areas as; energy, green buildings, and climate change (p.1).

Barriers to Sustainable Practices

The Transportation Research Board (TRB) Airport Cooperative Research Program (ACRP) Synthesis 10 surveyed numerous airports on the topic of barriers to sustainable practices. “A lack of funding was identified as the key barrier to implementation of sustainability by 10 of the 16 U.S. respondents. A variety of other impediments received roughly equal mention: lack of staffing, lack of management support, lack of environmental culture, and limited staff understanding of sustainability” (Transportation Research Board, 2008, p.12). Table 3 depicts the results of a survey asking airports which barriers are most prominent in their experience.

Table 3 Barriers to Sustainability Practices

Airport Size	Funding	Staffing	Management	Culture & Behavior	Training/ Understanding/ Knowledge
Non-Hub (1)	100%	0%	0%	0%	0%
Small Hub (2)	50%	0%	50%	0%	0%
Medium Hub (4)	75%	0%	0%	25%	0%
Large Hub (9)	56%	33%	11%	22%	33%

(Transportation Research Board, 2008, p.12)

The TRB (2008) reports that respondents from small and medium U.S. airports cited lack of management support or an environmental culture in their organization, as particularly important barriers, whereas respondents from large airports were more likely to mention lack of funding, lack of staffing, and lack of understanding/knowledge as barriers (p.12).

Federal Funding of Environmental Projects

The main funding source of environmentally based airport projects at FAR Part 139 certificated airports is the Voluntary Airport Low Emission (VALE) program. VALE grants were created in 2004 as a result of The Vision 100–Century of Aviation Reauthorization Act.

In an FAA memorandum written by Barry Molar (2004), the VALE program is further explained:

The program...is intended to help sponsors meet their obligations under the Clean Air Act (CAA) in support of regional attainment of health-based National Ambient Air Quality Standards (NAAQS). The VALE program provides sponsors with financial and regulatory incentives to take early actions to reduce airport emissions using proven low emission technologies. Eligible Types of Low Emissions Projects include 1) facilities and infrastructure and 2) vehicles (p. 1).

The VALE program is funded through the Airport Improvement Program and Passenger Facility Charges (Alexander-Adams 2012, para. 1). Certain criteria must be met in order to be eligible for assistance through the VALE program.

Alexander-Adams (2012) further explains eligibility for VALE funding:

The VALE program is available to commercial service airports located in poor air quality areas of the country as designated by the Environmental Protection Agency. Airports can obtain VALE funding for cleaner technology that the FAA validates as being cost effective. VALE projects also receive emission reduction credits from State governments, which the airports can use to meet future environmental obligations under the Clean Air Act (para. 2).

The goal of the VALE program is to create a funding source for airports that choose to initiate sustainability projects. “In fiscal year 2011, the FAA issued VALE grants for 12 projects at 11 airports for emission-lowering projects. Since 2005, the FAA has funded 52 emission-lowering projects at 30 airports representing a total investment of \$138 million...in clean airport technology” (Alexander-Adams, 2012, para. 4). A list of

eligible airports can be found at the FAA website. The available list can change due to future air quality studies completed by the EPA.

Utilizing the VALE Grant

The latest airport project awarded a VALE grant was a geothermal system at Portland International Jetport (PWM). This project was awarded \$2.5 million from the VALE program to install the new energy system in conjunction with a \$75 million terminal expansion project (Dolan, 2012, p.46). The project is anticipated to provide a substantial return on investment. Dolan explains that based on conservative estimates of current heating oil prices, the airport expects to save more than \$160,000 per year (p. 47). Within Dolan's article, the Portland International Airport Director, Paul Bradbury explains "we had to spend considerable money to do all of the research and advance testing to demonstrate the project would work as promised...VALE funds are not simply granted on the basis of a good idea" (p.46).

CHAPTER 3

FINDINGS

It is evident that a voluntary effort is being made at select airports across the country to become more environmentally-friendly. Drivers of sustainable practices in the future will include stakeholder concerns, global trends, and airport policy. Financial incentives and social responsibility should motivate airport administrators to implement sustainable practices when operating their facilities, constructing new facilities, or undertaking environmental projects, despite a lack of regulation requiring them to do so. Adopting sustainable practices in an effort to reduce climate change should be a priority for airports.

Federal funding is currently available to airports within an EPA classified poor air quality area. The VALE grants available may offer substantial benefits to airports that qualify, but may also require large financial investment by airports that wish to justify environmental projects. The VALE grant was utilized more in 2011 than in any other year since 2004 when the grant became available. The TRB (2008) reports that respondents from small and medium U.S. airports cited lack of management support or an environmental culture in their organization, as particularly important barriers, whereas respondents from large airports were more likely to mention lack of funding, lack of staffing, and lack of understanding/knowledge as barriers (p.12). Other funding options must be explored by airports that are not located in an EPA identified poor air quality area and that wish to invest in environmentally friendly initiatives.

New technologies and sustainable practices currently exist at FAR Part 139 certificated airports. Solar energy is currently being generated at certificated airports including Denver International (DEN) and Fresno Yosemite International (FAT). These

airports have installed solar panels in order to reduce their impact on the environment. Wind turbines are currently being utilized for alternative energy generation at BOS. The energy generated by these turbines produces three percent of the electricity needed to power the airport on a daily basis. Geothermal technology is currently being utilized by Portland International Jetport, which is expected to provide a large return on investment. Energy efficient lighting utilizing LEDs is installed at numerous airports including Palm Beach International and Columbia Metropolitan Airport. Palm Beach International uses LED lighting in their parking facilities, which drastically reduces operating costs. Columbia Metropolitan Airport has installed LED lighting on their main runway, resulting in efficiency, reliability, and improved safety due to their brightness.

Construction waste management has been utilized at O'Hare international airport for their large O'Hare Modernization Program. Other airports such as Metropolitan Oakland International Airport and Boston Logan International have also utilized construction waste management practices while undergoing large expansion projects. Hartsfield-Jackson Atlanta International Airport operates GreenSortATL, a comprehensive recycling program for tenants and passengers throughout the facility. These practices and technologies encompass many sustainable measures available to airports.

CHAPTER 4

CONCLUSIONS

The future of environmentally-friendly practices at airports is yet to be defined. Comprehensive standards and policies that address airport sustainability are not currently available to airports; a situation that limits progress in this effort. Airports must be leaders in environmental design and sustainable practices to secure the transportation of people and products throughout the world in an efficient way. Although project funding exists on a limited basis via the VALE Program, some airports who wish to implement sustainable initiatives are not eligible for funding due to their location in good air quality areas. More environmental regulations must be put in place for the use of alternative energies where applicable. Environmental standards must be developed by the federal government for airports follow throughout the nation. Nationwide funding for environmental projects must also be established to promote sustainable development. A goal of exceeding practiced environmental standards must be the main focus for the future of airports. Many airport facilities today remain old, inefficient and expensive to operate. While the facilities are becoming excessively costly, the expense of operation is being placed on travelers through ticket costs and facility fees. In order to reduce the economic impact on today's travelers, a reduction of environmental impact must be initiated, solidifying a future of environmentally-friendly Part 139 airports. FAR Part 139 certificated airports represent the largest and busiest transportation centers in the United States. By setting the standard in sustainability initiatives, Part 139 certificated airports can secure a cleaner environment for future generations.

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