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# Status Report on Sustainable Airports in the United States: Case Study of Chicago O'Hare International Airport

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STATUS REPORT ON SUSTAINABLE AIRPORTS IN THE UNITED STATES: CASE  
STUDY OF CHICAGO O'HARE INTERNATIONAL AIRPORT

By

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B.S., Southern Illinois University, 2009

A Research Paper

Submitted in Partial Fulfillment of the Requirements for the  
Master of Public Administration.

Department of Political Science

in the Graduate School

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Master of Public Administration  
in the field of Political Science.

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TITLE: STATUS REPORT ON SUSTAINABLE AIRPORTS IN THE UNITED STATES: CASE STUDY OF CHICAGO O'HARE INTERNATIONAL AIRPORT

MAJOR PROFESSOR: Dr. David NewMyer

Sustainable policies affect the future of the environment. Airports across the country are focusing on sustainable airport planning to create a sustainable future for aviation by concentrating on the economic, social, and environmental impacts of aviation. Research is conducted through a literature review of sustainable airport planning and conducting a case study of Chicago O'Hare International Airport. Trends relating to sustainable airport planning are described, as well as current and future trends at Chicago O'Hare International Airport. Sources include the City of Chicago's Department of Aviation and the Federal Aviation Administration, along with other books and scholarly articles. Chicago O'Hare International Airport is a leader in sustainable airport planning through the O'Hare Modernization Program and the Sustainable Airport Manual. Economics play a key role in sustainable airport planning.

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## CHAPTER 1 - INTRODUCTION

### **Statement of Purpose**

Sustainable policies established at an airport can affect the quality of life for the future. Stressing sustainability in airport planning can make a major impact on the environment through airport operations and maintenance (Luther, 2007). The purpose of this research is to describe sustainable airport planning initiatives. It will also provide a case study of Chicago O'Hare International Airport as a leader in sustainable airport planning, specifically through the development of the Sustainable Airport Manual. (The National Leader in Sustainable Initiatives, 2010)

### **Background**

The World Commission on Environment and Development (WCED), better known as the Brundtland Commission was assembled by the United Nations in 1983 in order to address issues regarding humanity's impact on the environment and use of natural resources. Sustainable development was discussed during the commission and is meant to support and improve the quality of life. (Moffat, 1996)

The United Nations Conference on Environment and Development (UNCED) was held in 1992 in order to further define and understand sustainable development after the Brundtland Commission. UNCED characterized sustainable development as "the right to development must be fulfilled so as to equitably meet developmental and environmental needs of present and future generations." (Muschett, pg 6) Balancing the needs of people is important in sustainable development and environmental preservation. UNCED further states the necessity of environmental protection as part of sustainable development. (Muschett, pg 6)

Sustainability is relevant to operations and maintenance aspects at an airport, which are essential in a globalized society. However, air transportation causes negative impacts on the environment and on humans. The air transportation system is considered a cause of air pollutants, especially carbon dioxide. (Janic, pg 4) Emissions from air transportation have continuously increased over time, accounting for about 4% of carbon emissions from developed countries. (Safe Guarding Our Atmosphere, 2011)

Prioritizing the quality of life for those using and living near the airport is increasingly difficult because of advocates for economic growth. (Boons, Van Buuren, & Teisman, 2010) There are discrepancies between the economic value of and ecological impacts of an airport. Sustainable aviation has become a balance between the interest of the citizens in terms of sustainability and airport growth. (Boons, Van Buuren, & Teisman, 2010)

Demand for air transportation and airport capacity continues to rise, but is impacted by environmental limits, such as land use compatibility. According the Federal Aviation Administration's (FAA) 2011 forecast, one billion passengers are to be flown in 2021 and aviation growth over the next five years will average 3.7 percent per year. (FAA Aerospace Forecast Fiscal Years 2011 - 2031, 2011) The available seat miles, which are the FAA's way of measuring how busy the airline industry is, will increase 4.5 percent in 2011. (FAA Aerospace Forecast Fiscal Years 2011 - 2031, 2011)

Chicago O'Hare International (ORD) is a leading example of sustainable airport planning. ORD has not only strived for a sustainable future through the O'Hare Modernization Program, but has created a living document that will continue to grow and change, labeled the Sustainable Airport Manual, that has become a significant example for the future of sustainability. For example, ORD has created the "Bike to Work Plan,"

which encourages employees to commute to work by bicycle, year-round, which will assist in decreasing the amount of carbon emissions released while driving. This program allows indoor bike storage, bike racks, and showers for employees. (Bike to Work at O'Hare International Airport, 2010)

### **Significance of Problem**

Airports currently follow certain environmental impact and analysis standards, including impact studies and soundproofing for the surrounding communities. Even with regulations being enforced by the Federal Aviation Administration (FAA) and local communities, these airports are still producing pollution and waste caused by harmful chemicals, such as paint, and lack of recycling programs, according to Roger Yu. (Yu, 2008) Since 1970, an emphasis on impact analysis and mitigation methods has been placed on airports around the nation by the FAA and Environmental Protection Agency, which require environmental impact analysis for federally funded projects.

Adopting sustainable measures is a slow process and goes beyond the minimum environmental requirements. Airports have embraced ideas ranging from low-flush toilets and reusing coffee grounds to hybrid taxis and wind turbines. (Yu, 2008) Sustainability saves on energy costs and gives customers an encouraging impression of the airport. (Yu, 2008) The push to greater sustainability is caused by multiple factors including economic impacts, social concern, and how airports effect the environment. (Hewitt, 2007) Various airports throughout the United States are focusing on environmental concerns, and ways to create a “green” culture while cutting costs at the same time.

Creating a sustainable environment has been an important focus at the City of Chicago's Department of Aviation, specifically at O'Hare International Airport. Initiatives at O'Hare include specific green projects in the O'Hare Modernization Program (OMP) and the Sustainable Airport Manual.

### **Research Questions**

What are the current trends in sustainable airport planning in the United States? What are the current and future sustainable airport plans at Chicago O'Hare International Airport?

### **Definitions**

The term sustainability can be traced back to the 1987 Brundtland Declaration, created to address environmental concerns. The Brundtland Declaration focused on the implications of sustainable development in terms of policy making and action. (Moffatt, pg. 3) The Brundtland Commission was created in order to address environmental deterioration and depletion of natural resources. Sustainable development was defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." (Report of the World Commission on Environment and Development, 1987) In other words, sustainability is based on the concept of individuals working together to decrease consumption of resources in order to maintain a healthy environment. For example, recycling materials help in combating resource depletion by recovering materials that are made into marketable products. (Recycling, 2010)

Multiple types of sustainability are represented in airport planning. There are four types of sustainable development, including, human, economic, social, and environmental. (Basiago, 1998) Each is needed to maintain life. Human sustainability is

the basic need of humans to maintain a healthy lifestyle so that individuals can invest in human capital. Economic sustainability consists of ensuring a specific amount of capital exists for a particular amount of time. Resources that are consumed need to be preserved, and must be regenerated for consumption. Social sustainability consists of communities that need to effectively work together. (Sustainability, 2010) Without this many societies would be destroyed. Airports need to pay attention to the social welfare of individuals when operating. Finally, environmental sustainability involves the Earth's natural resources that humans need for economic growth. If humans do not pay attention to impacts on the environment, natural resources will be depleted. (Sustainability, 2010)

According to the Airport Cooperative Research Program, airport sustainability is defined as “practices that ensure: protection of the environment, including conservation of natural resources.” (Airport Cooperative Research Program, 2008) It also involves social progress that recognizes the need of not only airport officials, but also the public and ensures “maintenance of high and stable levels of economic growth and employment. (Airport Cooperative Research Program, 2008)

Sustainable airport planning provides guidance regarding the best environmentally friendly practices that will reduce the negative impact airports have on the environment. Social responsibility, as well as design and construction practices, including renewable energy are included in sustainable planning.

The FAA provides guidance on environmental planning documents, including Environmental Assessments (EA), Environmental Impact Statements (EIS), and Environmental Management Systems (EMS). These documents are mandated by the FAA when there is a possibility for significant impact on the environment at an airport,

and are mandatory for federal funding. (Wells & Young, p. 407) EAs provide likely effects of a proposed project on the environment. An EIS provides a comprehensive overview of areas of the environment that will be impacted. (Wells & Young, p. 407) An EMS refers to the management of an airport's environmental programs. (AC 150/5050-8 Environmental Management Systems for Airport Sponsors, 2007)

There are key differences between sustainable airport planning and environmental documents provided by the FAA. Sustainable airport planning is not mandatory by the FAA. However, it provides comprehensive guidance on how airport officials can effectively reduce the overall impact on the environment. (City of Chicago, 2010) This goes beyond infrastructure changes as described in documents like the Environmental Impact Statements. FAA documents tend to focus more on efficiency of the planning process rather than the effectiveness of sustainable planning. (City of Chicago, 2010)

## CHAPTER 2 - METHODOLOGY

In order to obtain a better understanding of the research concerning sustainable airport, I conduct a literature review. This includes the O'Hare Modernization Program and the Sustainable Airport Manual implemented at Chicago O'Hare International Airport. The review includes documents from the Chicago Department of Aviation as well as various scholarly articles and books related to sustainability and airport planning. I also review studies regarding sustainable development from other airports. I research the current and future sustainable airport plans at Chicago O'Hare International Airport.

## CHAPTER 3 – FEDERAL AVIATION ADMINISTRATION DOCUMENTS RELATED TO SUSTAINABILITY

The Federal Aviation Administration provides multiple documents geared toward environmental airport planning issues. Advisory Circular (AC) 150 series addresses noise concerns, as well as Environmental Management Systems. Advisory Circulars are used by airport management and other aviation operations to provide an understanding of federal regulations and procedures from the FAA. (Wells & Young, p. 21) The FAA publishes advisory circulars in order to provide guidelines on various aviation issues, ranging from airport compliance to aircraft worthiness.

AC 150/5020 provides guidance for noise control and compatibility planning for airports. It also provides guidance for noise exposure maps and noise compatibility programs. The goal of AC 150/5020 is to reduce noncompatible land uses around the airport and prevent additional noncompatible land uses. Land use planning consists of ensuring the area surrounding the airport is used the best way possible while limiting the negative impacts of the airport. (Wells & Young, p. 375) This program is not mandatory for airport to complete. However, airports are encouraged to create a Noise Control and Compatibility plan. This AC implements parts of the Aviation Safety and Noise Abatement Act of 1979. It creates a system of measurement that will determine the exposure to noise of individuals surrounding the airport. Submission of Noise Exposure Maps, noise units and analytical techniques for assessments, compatible land identification, and procedures for FAA approval are outlined in the AC.

AC 150/5050-8 provides guidance for the development of Environmental Management Systems, or EMS. An EMS allows an airport to take a strategic approach to

environmental issues by identifying goals, completing them, looking at the progress, and making continual improvements based on progress. (AC 150/5050-8 Environmental Management Systems for Airport Sponsors, 2007) This AC includes standards given by the Environmental Protection Agency and the International Organization for Standardization. (AC 150/5050-8 Environmental Management Systems Airport Sponsors, 2007) Airports create an EMS in order to receive federal funding for projects, such as runway expansion. EMS must be kept current and up to date. (AC 150/5050-8 Environmental Management Systems for Airport Sponsors, 2007) This AC is geared toward large and medium hub airports that create an EMS. A large hub airport accounts for at least one percent of the total annual passenger enplanements in the United States, while a medium hub airport accounts for at least 0.25 percent but less than one percent of the total annual passenger enplanements. (Administration, Airport Categories, 2010) An EMS helps organize environmental projects with the objectives of the airport, and calls for continued improvement. (FAA, AC 150/5050-8 Environmental Management Systems for Airport Sponsors, 2007) As a result, airports may see cost reductions and significant savings. (FAA, AC 150/5050-8 Environmental Management Systems for Airport Sponsors, 2007) Reducing consumption, complying with federal environmental laws, and process control are the main functions of an EMS. (FAA, AC 150/5050-8 Environmental Management Systems for Airport Sponsors, 2007) Process control is a tool designed to create stable and consistent operations, such as recycling and waste disposal, while providing feedback in order to correct the process. (Linstrom & Asbjornsen, 1996) Enhanced environmental management techniques, such as waste and emissions plans, are a direct result of process control.

In 2010, the FAA developed a pilot program to support Sustainable Airport Master Plans. The objective of this project is to produce planning documents that focus primarily on sustainability. (Airport Sustainable Master Plan Pilot Program, 2010) Ten airports from around the nation have been chosen to develop a Sustainable Master Plan or Sustainable Management Plan, which are aimed to reduce negative impacts on the environment while benefiting from the economic benefits of sustainability. (Airport Sustainable Master Plan Pilot Program, 2010) Airports that are updating their Master Plan are eligible to complete a Sustainable Master Plan that would include a chapter that focuses on sustainability. Those airport officials that are interested in sustainability but do not need to update the Master Plan may create a Sustainable Management Plan as a stand-alone document. (Airport Sustainable Master Plan Pilot Program, 2010)

The FAA provides guidance for creating the Sustainable Master Plan and the Sustainable Management plan. Each document should contain a sustainable policy or mission statement including how the document will be communicated to airport employees. (Airport Sustainable Master Plan Pilot Program, 2010) Definitions of sustainable categories are required, such as environmental resources that may include noise, water, and air quality. (Airport Sustainable Master Plan Pilot Program, 2010) An inventory of each defined sustainable category is to be conducted, such as an emissions inventory or environmental resource usage. (Airport Sustainable Master Plan Pilot Program, 2010) Water consumption is an example of environmental resource usage. The document establishes measurable goals for each sustainable category in order to minimize impact and identifies initiatives that will assist in reaching each goal. (Airport

Sustainable Master Plan Pilot Program, 2010) For example, a goal is to reduce energy consumption and initiatives include turning off lights and changing air filters regularly.

Sustainable Master Plans are tailored to AC 150/5070 regarding Airport Master Plans, which describes elements included in an Airport Master Plan. (Airport Sustainable Master Plan Pilot Program, 2010) Elements include inventory, activity forecasts, demand/capacity analysis, facilities requirements, design alternatives, and financial plans. (Wells & Young, p. 374)

Airports participating in the pilot program include Denver International Airport, CO; Fresno Yosemite International Airport, CA; Hartsfield-Jackson Atlanta International Airport, GA; Nashville International Airport, TN; Newark Liberty International Airport, NY; Newport News/Williamsburg International Airport, VA; Newton City-County Airport, KS; Outagamie County Regional Airport, WI; Renton Municipal Airport, WA; and Teterboro Airport, NJ. (Airport Sustainability, 2010)

## CHAPTER 4 – OTHER DOCUMENTS AFFECTING SUSTAINABLE AIRPORT PLANNING

The General Accounting Office (GAO) released a study regarding sustainable aviation in September 2010, titled: Aviation and the Environment. The purpose of this study was to look at environmental impacts caused by the aviation industry in order for airports to focus on these issues when working towards sustainable airport planning. Four key areas were addressed, including noise reduction, water pollution, air pollution and emission reduction, and the implementation of sustainable practices. (Aviation and the Environment, 2010)

The GAO took into account voluntary actions taken by pilots such as operation procedures that are designed to lower noise levels. The GAO also reviewed several environmental requirements at the federal and state levels, which include water and air pollution. (Aviation and the Environment, 2010) The study noted that airports have started to create strategies that address environmental issues. Larger airports have more of an impact on the environment, but also take greater steps in sustainability, such as emissions reduction. However, the study noted that airports are beginning to be more concerned about sustainable practices, including EMS. (Aviation and the Environment, 2010)

The GAO conducted this study because of forecast growth in the aviation industry creating a greater need for airport growth. Subsequently, airports will create more damaging effects to the environment. (Aviation and the Environment, 2010) The study looked at strategies that airports use to decrease the impact on the environments. Federal

laws and regulations were reviewed, as well as various local governments and airports. However, the GAO did not offer any recommendations to improve sustainable practices.

The Sustainable Aviation Guidance Alliance (SAGA) will have an impact of future sustainably airport planning. SAGA assists airport operators in sustainable airport planning as an effort to consolidate and compile sustainable airport planning guidelines and practices. (Sustainable Aviation Resources, 2011) SAGA released a resource guidebook for sustainable airport planning, as well as created a database of various airport practices. The guidebook provides airports with a guide comprised of three sections, including how airports define sustainability; planning, implementation, improving and maintaining a sustainability program; and sustainable airport examples. (Sustainable Aviation Resources, 2011) The Sustainable Database is a resource for airports that includes a compilation of various sustainable airport planning practices that allows the airport to search and implement practices. (Sustainability Database, 2011) This includes various policies and practices such as waste reduction and low emitting materials. (Sustainability Database, 2011)

The Airport Cooperative Research Program (ACRP) is an applied research program that creates solutions to problems faced by airport officials. The program is managed by the Transportation Research Board (TRB). In 2008 the ACRP Synthesis 10: Airport Sustainability Practices was published. The purpose of the study is to tell airport officials about current sustainability practices. (Airport Cooperative Research Program, 2008) Information in the study was obtained through literature and a web-based survey. This study looked at the implementation of sustainable practice, barriers in implementing sustainable airport planning, future drivers for sustainable airport planning,

environmental sustainability performance at airports, and social sustainability performance at airports. (Airport Cooperative Research Program, 2008)

Environmental sustainability performance includes water quality, air quality, materials, and waste. (Airport Cooperative Research Program, 2008) Social sustainability performance includes public awareness, indoor environmental quality, as well as employee and passenger well-being. (Airport Cooperative Research Program, 2008) According to the ACRP, existing drivers for sustainable airport planning are global trends, customers, and international regulations, while future trends are being driven by State and local regulations, customers, and economic incentives such as rebates. (Airport Cooperative Research Program, 2008) However, according to the ACRP, lack of funding is a barrier to the implementation of sustainable airport planning. (Airport Cooperative Research Program, 2008) Overall, the ACRP found that airports are taking initiative that fit within sustainable airport planning, with the emphasis being placed on environmental issues, such as air quality. (Program, 2008)

## CHAPTER 5 – CASE STUDY: CHICAGO O’HARE INTERNATIONAL AIRPORT

O’Hare is currently working on a project, labeled the O’Hare Modernization Program, or OMP, which is managed by the Chicago Department of Aviation. The O’Hare Modernization Act was signed by Governor Rod Blagojevich in August of 2003. (Chicago, 2010) The law recognizes that the state of Illinois depends on efficiency at ORD because the airport enhances the economic welfare of the state by providing more jobs and business. (Chicago, 2010) The projects included in the program are all based off of the Sustainable Airport Manual (SAM).

### **Sustainable Airport Manual**

The Sustainable Airport Manual (SAM) was developed by the City of Chicago’s Department of Aviation in order to integrate sustainable airport planning into all functions of an airport. The City of Chicago created the SAM in order to promote the best possible environmental, social, and fiscally responsible practices and to enhance the quality of life in the city. It is built as a living document, meaning it will change over time as sustainability continues to grow and develop, and incorporates new technologies, best practices, lessons learned, and design and sustainable initiatives. (Sustainable Airport Manual, 2010)

The SAM started off as the Sustainable Design Manual (SDM), which was part of the 2003 O’Hare Modernization Program. As it matured, it was renamed the SAM. Chicago was the first city to develop sustainable guidance for airport planning. Version 1.0 of the SAM was initially released in 2009 and included a variety of sustainable airport planning initiatives and case studies related to them. Version 2.0 of the SAM was released on November 15, 2010.

The creation of the SAM has resulted in construction efficiency, specifically in terms of cost saving; reduction in the use of natural resources; and the use of best available practices. (Sustainable Airport Manual, 2010) ORD has been able to cut costs in a variety of ways using the SAM. For example, ORD recovered and reused 95 percent of concrete, asphalt, and on site dirt, saving nearly \$3 million. (Sustainable Airport Initiatives, 2010) Managing excess materials and soil on site has saved ORD \$100 million. (Sustainable Airport Initiatives, 2010) Chapters included in the SAM include Administrative Procedures, Design and Construction, Planning, Operations and Maintenance, and Concessions and Tenants. (Sustainable Airport Manual, 2010)

Many parties have contributed to the creation of the SAM, including airport executives, industry leaders, and environmental experts from around the world. Airports that have participated in the SAM include Paris-Charles de Gaulle, San Francisco, Los Angeles, San Diego, Reno-Tahoe, Portland, Oakland, Seattle-Tacoma, Dallas-Fort Worth, Denver, Detroit, Boston-Logan, Atlanta-Hartsfield, St. Louis, Minneapolis-St. Paul, Baltimore-Washington, and Metropolitan Washington Airports Authority. (Sustainable Airport Manual, 2010)

As a result of the SAM, a rating system and a green airplane certification award system were developed. The SAM uses the Leadership in Energy and Environmental Design (LEED) rating system as a basis, along with lessons learned from the original SDM and the availability of new technologies. (Sustainable Airport Manual, 2010) LEED is a green building certification system that provides verification that a building was designed using sustainable processes, such as water efficiency and emissions reductions. (U.S. Green Building Council, 2010) The manual is designed so that it can be applied to

any airport's environment. The practices described in the SAM can reduce the environmental impact of the airport while creating financial, operational and social benefits.

Using the sustainable airport planning practices can reduce operational costs and increase productivity. For example, using on site recycling and reusing construction waste can reduce transportation costs. (Sustainable Airport Manual, 2010)

The SAM provides guidance for sustainable elements in airport planning. Information in the SAM is drawn from documents powered by the FAA, the U.S. Environmental Protection Agency, Illinois Environmental Protection Agency, the U.S. Department of Agriculture, and the Illinois Department of Transportation.

The SAM checklist uses an approach to incorporate sustainable practices into airport design. A project is tracked by using a checklist in order to decide the number of applicable credits that are in the SAM. The checklist is completed by the designer of the project. (Sustainable Airport Manual, 2010) Points are achieved by meeting requirements outlined in the SAM and checklists, such as using local and regional materials, low emitting materials, and clean fuel in construction vehicles. (Sustainable Airport Manual, 2010) Each design team must demonstrate how the credits will be achieved. The SAM Green Airplane Rating System is outlined in the SAM and uses a five tiered approach to rating projects using "Green Airplane Certification" symbols. (Sustainable Airport Manual, 2010) The Green Airport Rating System can be seen in Table 1.

Administrative procedures provide green meeting practices and are intended to guide meetings towards a green standard. This will help reduce the negative impact on

the environment, while educating people about sustainable meetings. This chapter provides examples of how to host a green meeting. (Sustainable Airport Manual, 2010) Meeting hosts are asked to consider sharing meeting materials, digitizing materials and distributing presentations via email, or placing a single large poster on the wall for multiple people to view. If handouts are necessary hosts are asked to use local products, double sided pamphlets, recycled material, or vegetable based inks. It is also suggested that presenters avoid travel plans for participants, by using video or phone conferencing. (Sustainable Airport Manual, 2010) The reduction of paper used is an important task when hosting a green meeting. A guideline for reduction is outlined in the SAM and includes identifying a process for essential copies, promoting centralized review rooms for documents, and providing recycling. Airports can eliminate a vast amount of waste by following the administrative procedures outlined in the SAM. (Sustainable Airport Manual, 2010)

The Planning chapter of the SAM is designed to look at planning of the airport's physical environment in terms of design and construction, and its impact on the environment. It outlines the procedures for the airport's compliance with federal, state, and local standards, while looking at planning as a process that establishes goals for projects. (Sustainable Airport Manual, 2010) Planning begins at the earliest stages of development, which makes it an essential part of sustainability. This chapter creates an integrated approach and is customizable to the organization. It assists in designing the overall framework for the airport project. (Aviation, 2010) The planning process helps define sustainability goals and can be applied to the airport's master plan. One example of sustainable airport planning in the SAM is assisting the project manager in writing a

sustainable vision for the project by establishing project requirements. (Sustainable Airport Manual, 2010)

The Design and Construction chapter provides an outline of sustainable practices at an airport. It includes information on sustainable sites in order to reduce pollution from construction. (Sustainable Airport Manual, 2010) Alternative transportation and public transportation access is discussed in order to reduce pollution and land development impact from automobile use. (Sustainable Airport Manual, 2010) In relation to automobiles, alternative fuels and low emissions vehicles are also discussed. Stormwater design and quality control is part of the design and construction chapter. The design and construction chapter also discusses best construction practices and indoor environmental quality. (Sustainable Airport Manual, 2010) Using these practices will enable the airport to have a lower impact on the environment while potentially cutting costs at the airport. (Sustainable Airport Manual, 2010)

Operations and maintenance at an airport includes a variety of tasks, including routine matters and unusual circumstances, including keeping records, snow removal, and emergency preparedness. These operations must comply with regulations that protect the environment. Airports must consider the negative impacts operations have on the environment, including noise, land use, and social impacts. (Sustainable Airport Manual, 2010) The SAM provides guidelines on sustainable operations and maintenance, along with the rating system specifically for operations and maintenance. The SAM is designed to ensure sustainability at the airport by reducing the impact of day to day activities, including water and energy use, environmentally friendly products, and sustainable purchasing policies, as well as waste stream management. (Sustainable Airport Manual,

2010) Waste stream management is defined as the flow of waste products from the area of use, domestic or industrial, to the final disposal area. (Waste Stream, 2010) Forms of recycling will lessen the content of the waste stream. Information in the Operations and Maintenance chapter is applicable to tenants that do not interact with customers. Using cleaning products with a minimum of 49% biobased content is one example of sustainable operations and maintenance practices. (Sustainable Airport Manual, 2010) Biobased cleaners rely on renewable resources, such as plants, and usually do not contain toxins.

Finally, concessions and tenants include businesses that have decided to conduct business at the airport and have signed a lease agreement with the airport in order to utilize facilities. They are important to the function of the airport. (Sustainable Airport Manual, 2010) Concessions provide passengers services while waiting to travel and provide airports with significant financial benefits. They may include services ranging from car rentals, hotels, restaurants, and airlines. The Concessions and Tenants chapter in the SAM looks at all airport tenants who have direct customer interaction. Concessionaires and tenants are evaluated in terms of sustainability, energy and water efficiency, materials used, as well as company policy. An example of sustainable concessionaires includes recycling programs for food waste, such as composting. (Sustainable Airport Manual, 2010)

### **O'Hare Modernization Program**

The \$6.6 billion development at O'Hare comes at no cost to local or state taxpayers. (O'Hare Modernization Program, 2009) O'Hare currently generates 450,000 jobs and \$38 billion in economic activity for the city of Chicago and Illinois. The OMP

has created 195,000 more jobs and \$18 billion in annual economic activity. (Chicago, 2010) The project has saved airlines about \$370 million and has saved passengers about \$380 million annual. The funding for the project comes from Passenger Facility Charges, General Airport Revenue Bonds, and Airport Improvement Program funds. (Chicago, 2010)

Recycled materials have been used for many parts of OMP, including crushed concrete for backfill, asphalt grindings, steel, copper wire, and other aggregates for concrete mixers. (O'Hare Modernization Program, 2009) O'Hare houses the first LEED-certified air traffic control tower. A new passenger terminal is proposed for the west side of the airport, which will create a more efficient airport. (O'Hare Modernization Program, 2009)

The runways at O'Hare are being reconfigured to a more efficient parallel design model. At completion there will be a total of eight runways: six east-west parallel runways and two crosswind. Changing the configuration of the runways into a modern parallel design will reduce flight delays and increase capacity at the airport. (Wells & Young, p. 437) The strategic placement of parallel runways allows ORD to have more simultaneous operations.

Three major projects have been completed at ORD. As of 2008 a 3,000 foot extension to Runway 10/28 was added. (O'Hare Modernization Program, 2009) These projects were completed \$40 million under budget. (O'Hare Modernization Program, 2009) The new runway and runway extension has had a positive impact on operations at O'Hare. A third runway project is currently underway. This runway will be capable of handling Airplane Design Group VI, which includes the Boeing 747 and Airbus A380.

The entire project is scheduled to be completed in 2014. (O'Hare Modernization Program, 2009)

More green initiatives done by O'Hare include Ultra Low Sulfur Diesel Fuel for vehicles, recycling of demolition materials, utilizing building and construction materials for projects from sources that are no more than 500 miles, and restricting idling vehicles. (O'Hare Modernization Program, 2009) Over 150 acres of wetlands are being replaced by 450 acres in mitigation processes. (O'Hare Modernization Program, 2009) Green roofs are being added to various buildings, which contain a vast amount of vegetations growing on top and will reduce the amount of stormwater run-off. (Sustainable Airport Manual, 2010) Dual flush toilets and high efficiency devices on faucets are being added to the terminal. These toilets use two flush buttons, usually a handle that will move in two directions. Dual flush toilets consist of two different flushes: the long flush that will use 1.6 gallons of water and the short flush that uses half of the amount of the long flush. (McGinn, 2004) Dual flush toilets reduce the amount of water usage. (McGinn, 2004)

Volatile Organic Compounds, or VOCs, are emitted from various solids and liquids, and include a variety of chemicals. VOCs are emitted from paints, cleaning supplies, pesticides, and building materials. (Volatile Organic Compounds, 2010) These emissions can cause negative health effects in humans, such as damage to the liver and the central nervous system. (Volatile Organic Compounds, 2010) In order to prevent this ORD began using low VOC emitting sealants, paints, and coatings throughout the planning process. Finally, local and regional building and construction materials are being used throughout the process. (O'Hare Modernization Program, 2009)

## CHAPTER 6 – FINDINGS AND CONCLUSION

### **Overview of Sustainable Airport Planning**

Economics is the major driving trend for the move to sustainable airports. Hewitt states according to Sue Schalk, the president of Aerofinity, “For airports, the economic side is more important than the environmental or social.” (Hewitt, 2007) Using environmentally-friendly methods when planning future projects on an airport makes good business sense. Sustainable technology can lower utility costs at an airport. However, cost-effectiveness is a key selling point when speaking with airport sponsors. In order for an airport to sell sustainability it must prove that the methods are more likely to save money in the long run. For example, replacing old heating, ventilating, and air conditioning units with more efficient systems would save airports, a significant amount of money spent on utility costs, as well as lower energy costs.

While large and medium airports have started to focus on creating sustainable environment, it is difficult for smaller airports to participate in the green trends because of the high costs involved. Cost becomes more important than how future planning is going to effect the environment. With the current recession and the decline of interest in general aviation it has become increasingly difficult for general aviation airports to focus on anything but the costs. A general aviation airport has fewer than 2,500 enplaned passengers and used by aircraft not providing commercial air carrier passenger service, such as flight training, personal transportation, and medical transport. (Wells & Young, p. 15) According the FAA, general aviation activity fell 5.6 percent in 2008. (FAA Aerospace Forecast Fiscal Years 2009-2025, 2009) While economic tends to be the big theme, it is possible to incorporate some sustainable methods in the planning of future

developments at smaller airports. Scaling down some major projects such as the use of wind turbines may be one solution, causing a reduction of energy costs, and a positive return on the investment. A major factor in considering sustainability is the economic impact.

The impact airports have on the environment is a factor in creating sustainable facilities. Environmental topics include energy conservation, air quality, water quality, material management, green buildings, and waste management. “Airports have been spending hundreds of millions in terminal facilities that are aesthetically pleasing but aren’t designed to conserve energy,” states Steven Gitlin, of AeroVironment, according to Roger. (Yu, 2008) Any time an airport begins a new federally funded project it is required by the FAA and the Environmental Protection Agency to conduct an Environmental Assessment. Airports produce environmental impact studies prior to beginning a project. This helps alleviate environmental concerns regarding a specific project. It is guidance for improving and maintaining environmental planning at an airport, and sets up some standards in improving the environment. Other initiatives are designed to develop greener facilities, for example, Chicago’s Sustainable Airport Manual. Currently the FAA has produced standards through Advisory Circular (AC) 150/5050-8 which is a guide for Environmental Management Systems. Long term environmental planning has become a major objective at airports across the country, due in some part to the increasing awareness of the public and growing trends towards a greener future. (Hewitt, 2007)

Social concerns, which include public awareness, heritage, and passenger well-being, are also encouraging the shift to greener side. Over the past several years there has

been a conversion in society's mindset towards sustainability. Public sentiment is important when considering future planning on airports because of people's heightened awareness of environmental impacts. According to the Gallup Organization, the environment is consistently more important than economics in the public's mind. (Carlson, 2005) It is important for airport personnel to consider their social responsibility how the public is going to feel about the project that is being implemented. If the project does not support sustainability there is a possibility there may be negative reactions towards the airport from the public. In states such as Oregon sustainability already plays a large role in society. People in Portland, Oregon generally already have a "greener ethic." (Hewitt, 2007) Another area where there is a strong environmental culture is San Francisco, California. (Hewitt, 2007) Going green is nearly becoming mandatory due to the strong environmental culture that exists in San Francisco. (Hewitt, 2007) Conversely, environmental cultures are just starting to take hold in some areas.

Airports have the potential to become leaders in changing an area's environmental ethics. For example, the O'Hare Modernization Program has become one of the biggest green projects the city has committed to. (Hewitt, 2007) Boston's Logan International Airport (BOS) has been a major contributor to the creation of sustainable airports. (Logan Airport: Airport Programs, 2009) BOS has become a leader in reducing its environmental impact, which has been dramatically reduced in the past decade. (Logan Airport: Airport Programs, 2009) The airport has been tremendously proactive in developing its own initiatives and goals to maintain a sustainable environment. Logan's Delta terminal is expected to be a "national model for environmentally-friendly airport facilities." (Logan Airport: Airport Programs, 2009) The facility maximizes the use of

green technology by implementing the use of reused materials, natural lighting, energy conservation plans, and the use of alternative fuels. (Logan Airport: Airport Programs, 2009) The Delta terminal at Boston's Logan is the first to earn LEED certification in the United States. (Airport Terminal First To Earn LEED Certification, 2006) This is done by using the principles of environmentally friendly design to different facets of the construction. BOS's terminal includes the installation of a particular glass that is designed to reflect heat from the windows. This minimizes heat loss in the winter and heat gain in the summer. Also included is the participation in recycling programs and the use of storm-water filtration devices which lower levels of solids and phosphorus in runoff. (Airport Terminal First To Earn LEED Certification, 2006)

Another example of Boston's Logan International is the use of warm-mix asphalt on the runways. BOS is the first to use warm-mix asphalt for repaving. FAA specifications do not address warm-mix currently. Crews can place warm-mix asphalt at cooler temperatures, which cools off quickly. (Cho, 2009) This is important because the cooler temperatures of warm-mix asphalt will reduce emissions and lower fuel usage. (Evaluating Warm-Mix Asphalt Field Performance, 2010) Wind turbines have also been placed at BOS. There are twenty, six foot tall wind turbines placed on top of the airport's headquarters. They are placed at a certain angle to capture the winds. (Yu, 2008)

Large and medium hubs across the nation have provided excellent examples of sustainable facilities and grounds. Airports have developed a variety of ways to contribute to sustainable environments. Everything from advanced recycling programs, the use of wind turbines, green roofs, alternative fuels, to the use of warm-mix asphalt has been developed. (Hewitt, 2007)

Another important step in the race for sustainability is the development of City of Chicago's Sustainable Airport Manual (SAM), which is a comprehensive guide for environmentally friendly design and construction, designed in conjunction with O'Hare's Modernization Program. (Cho, Global Input Grows O'Hare 'Green Bible', 2009) Included is a specific scoring system for design, construction, operations and maintenance, and tenants. The manual also includes forms to fill out that record compliance of contractors. LEED certified professional are required to participate on each design team. (Cho, Global Input Grows O'Hare 'Green Bible', 2009)

### **Current Trends at Chicago O'Hare International Airport**

Chicago O'Hare continues to focus on airport sustainability through the O'Hare Modernization Program and the Sustainable Airport Manual. The focus of O'Hare's projects is to bring sustainable practices into every part of the design and construction processes. The current trends in sustainable airport planning at ORD are creating a better use of assets at the airport while reducing the environmental footprint. The use of more advanced and sustainable technology will continue to help ORD reduce costs. O'Hare intends to reduce impact on the environment through the best use of environmental, social, and fiscally responsible practices as outlined in the Sustainable Airport Manual. This includes communicating with tenants to ensure better infrastructure in the future, which can be done through practices as simple as recycling.

Many awards have been given to O'Hare due to their excellence in sustainability, including the 2008 Governor's Pollution Prevention Award. This award is designed to recognize efforts in pollution prevention in the state of Illinois. The OMP reduces delays

and increases capacity at O'Hare. (O'Hare Modernization Program, 2009) It has also created a vast number of jobs in the Chicago region.

O'Hare has completed work on Runway 9L/27R (O'Hare Modernization Program, 2009), which was commissioned on November 20, 2008. It was on schedule and under budget. The North Air Traffic Control Tower was completed on November 20, 2008 as well. The Extension of Runway 10L/28R was completed September 25, 2008, under budget and ahead of schedule.

Passenger enplanements are expected to grow at ORD. Enplanements fell slightly at approximately 22,155, 127 in 2010 from 23,111,802 in 2009. (APO Terminal Area Forecast Detail Report, 2010) However, the FAA Terminal Area Forecast (TAF) at ORD shows a growth in passenger enplanements to 23,786,900 in 2011. (APO Terminal Area Forecast Detail Report, 2010) TAFs are official forecasts of aviation activity at FAA facilities.

### **Future Trends at Chicago O'Hare International Airport**

O'Hare International Airport will continue to focus on sustainable planning practices when dealing with future developments at the airport. Future trends at O'Hare include continuing development of the airport through the use of the O'Hare Modernization Program, as well as continued use of the Sustainable Airport Manual. Officials at ORD hope to complete the runway expansion projects that are outlined in the O'Hare Modernization Program, as well as completing a second air traffic control tower. The City of Chicago officials also hope to continue its work on a new terminal building labeled Terminal 7. This \$15 billion project will be located on the west side and have its

own highway access, as well as possible rail access. (Chicago, 2010) This terminal will incorporate guidelines from the Sustainable Airport Manual.

Despite planning for a new terminal, major concerns about the future of it and runway construction have arisen. Two main airlines, United Airlines and American Airlines, have filed a joint lawsuit in order to prevent the second phase of the expansion plan. (Lazare, 2010) These carriers account for approximately eighty percent of the traffic at ORD, whose biggest concern with the project is the burden of the cost on the airlines and its passengers. (Lazare, 2010) Currently, both the airlines and the City of Chicago are in negotiations after pushing back judicial trial in attempt to mediate a resolution. (Pletz, 2011) In the mean time, ORD will continue to focus on completing the O'Hare Modernization Program, and continue to focus on achieving a sustainable environment through the use of the Sustainable Airport Manual.

## **Conclusion**

The current trends in sustainable airport planning include multiple planning documents, economic, social, and environmental movements. The FAA provides Advisory Circulars that provide guidelines to assist airports in environmental issues, as well as requiring Environmental Assessments and Emergency Management Systems for federally funded projects. However, these documents do not focus on the long term effects of sustainable planning. Therefore, the FAA created the Sustainable Master Plan Pilot Program which focuses on creating long term sustainable planning at airports.

The GAO and ACRP released studies regarding trends in sustainability at airports. These studies identify important aspects of sustainable airport planning. SAGA provides

a database which outlines sustainable planning issues for airport officials. Airports are starting to realize the importance of social concerns in airport planning and focusing on social awareness. The economic impact of sustainable planning can be significant and cost-effective. However, it is difficult for smaller airports to focus on the economic impact because of the initial costs of sustainable airport initiatives. Airports, such as Boston Logan Airport have responded to sustainable airport planning by introducing sustainable initiatives such as wind turbines.

Current trends at Chicago O'Hare International Airport include the O'Hare Modernization Program and the Sustainable Airport Manual. Projects included in the OMP are designed to reflect the SAM. The SAM is a living document that focuses on sustainable airport planning and creates a guideline for airports to follow. Future trends at Chicago O'Hare International Airport include focusing on the completion of the OMP and continuing to build on the SAM. The City of Chicago plans to continue with building the new Terminal 7 to expand on capacity with the growing number of passengers at the airport.

Developing sustainable airports is the future of airport planning. Airports have an impact on the surrounding environments and the people who live in the area. It is important for airports to be socially and environmentally responsible. Many airports have started to develop a sustainable environment. A forerunner in sustainable airport planning is Chicago O'Hare International Airport. The Sustainable Airport Manual has been an essential aspect in the future of sustainable airport planning.

Green Airplanes	Prerequisites	Civil-Airside	Civil-Landside	Occupied Buildings	Unoccupied Buildings	Reference LEED 2009 Rating System:
		8	8	13	12	
		2-19	2-20	2-43	2-34	
		20-24	21-26	44-54	35-44	Certified
		25-30	27-31	55-65	44-52	Silver
		31-40	32-42	66-87	53-70	Gold
		41-56	43-59	88-121	71-97	Platinum
<b>MAXIMUM</b>		<b>56</b>	<b>59</b>	<b>121</b>	<b>97</b>	

Table 1: SAM Green Airplane Rating System

Source: Sustainable Airport Manual, City of Chicago, 2010

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