ACRP 02-22 – Case Study Interview Form

Airport/Facility Name: Stockholm Arlanda Airport (ARN)

Date: April 13, 2011

Contact Phone and web address: +46 733 526 083; http://www.arlanda.se/en/

Discussion Topics:

- **1.** Airport Sustainability Program
- **2.** Biogas Production
- **3.** Underground Energy Storage

Detailed Notes about Discussion Topic:

Discussion Topic 1: Airport Sustainability

Alternative Strategies and/or Best Practices:

ARN has now incorporated sustainability into its business model; into every day work and every day activities to include economic, ecological, and social.

The driving force for the airport to adopt an aggressive sustainability posture was stringent environmental requirements in the early 1990s. In the 2000s, the regulatory pressure picked up speed on both sustainability and climate. Environment is a big concern in Sweden and climate had become a big issue.

At the same time, aviation growth was becoming a concern in Sweden. There was a need to expand Arlanda Airport to meet future growth requirements and in particular a new runway was needed. To be able to get authorization to build the runway, the airport had to meet very strict limits on emissions and storm water runoff and agree to a CO₂ cap. The cap set limits on allowable emissions including emissions from vehicles, the LTO cycle, and passengers. Federal legislation set the cap at 1990 emissions levels.

The airport did not initially realize how stringent that limit would be. They found it very difficult to turn back emissions. As their efforts, analysis, and thinking progressed they realized they would even save money if the required emissions reductions were achieved with sustainability in mind. The first projects to consider sustainability addressed the low-hanging fruit, which helped them demonstrate how these projects could achieve cost savings. For example, renewable fuels are profitable at the airport. They also realized they needed a long-term evaluation process. It is not adequate to just look at the next quarter or even next year but a multi-year planning and evaluation period was needed.

Initially, the Environment Department was responsible for reducing emissions and implementing sustainability initiatives. That responsibility has now moved into the broader organization, which brings a greater focus and wider involvement into the process. This has led to a different culture throughout the organization, giving additional force for doing good.

At Arlanda they now have environmental experts installed in other departments so there is no longer a feeling that environmental commitments are being imposed from a different department. This has worked well as the departments come up with their own ideas and ways of doing things. The airport is incorporating environmental and sustainability goals in each department that build up into airport-wide goals. Accountability is now more evident. The individual departments bore the costs of adding the environmental experts but realized they paid for themselves quickly.

The departmental experts are coordinated in a forum through the Environmental Department. This helps give everyone a holistic view of what is going on. Also, the airport has learned that the earlier in the planning process you can get ideas, the better the results will be.

Regulated limits on water, CO₂, and other emissions were very limiting during the construction of the new third runway. An important factor for meeting the limits is that the airport is coordinated with the railway that comes from downtown Stockholm. This was a public-private financed project, which has become a successful model for infrastructure development. The rail does not have CO₂ limits since they are electric and most electric power in Sweden is renewable. The airport is able to get emission reduction credit due to rail use, which avoids vehicular emissions from passenger and employee transport to the airport. The rail operation is incentivized to maximize ridership so they maintain competitive pricing. However, this rail is still more expensive than typical Swedish public rail operations, which are subsidized. There is still room to increase ridership and create additional emission reductions. Currently 25% of passengers arrive via rail and 22% arrive via buses using biodiesel. Together 47% of passengers come using renewable resources.

So far they have lowered emissions from 1990 by 70%. Most of the remaining emissions come from GSE and other airside vehicles (e.g., deicing trucks and emergency response vehicles). They are having trouble finding equipment that works using renewable fuels in this application.

ARN is legally required to achieve the 1990 CO_2 emission levels by June 2011. However they are already at about 90% of the 1990 emissions even though the number of passengers has grown by about 2 million since then. The energy and electricity the airport is using is all non-fossil except in rare temperature extremes. When they purchase electricity they only purchase renewable power. Stockholm Arlanda was the first airport to meet the requirements for the highest level of ACI Europe's Airport Carbon Accreditation program that assesses the climate work of airports.

Even with these accomplishments the airport has been able to maintain its landing fees (and in fact reduced them somewhat) so they have continued to have the airlines' support for their sustainability program. The airlines are okay with the programmatic costs of renewable fuel use.

Green approaches and other air traffic management techniques are now being looked at to minimize airlines fuels. (See also <u>8 out of 10 approaches to be given the option of a</u>

<u>green approach by 2010</u> at<http://www.arlanda.se/en/Informationabout/Environmental/Reducing-carbon-dioxide-emissions/Air-traffic/Greenapproaches/>. The airport Sustainability Manager believes this will become a big part of the success story. Also, the airport recently did a study of producing biojet fuel from forest waste using a Fisher-Tropsch process and they see this as being competitive with an oil price of \$60/bbl.

Discussion Topic 2: Biogas

Alternative Strategies and/or Best Practices:

The airport is currently testing biogas in large diesel vehicles to ensure its low temperature performance. Biogas is produced from municipal solid waste and forest wastes via gasification. It is essentially like CNG with zero fossil carbon. When using biogas, they need to modify the vehicle engines and replace fuel tanks and fuel lines. They can use CNG as a back-up fuel. Most users blend biogas and CNG to meet the fuel volumes needed.

Eventually the airport will probably have its own biogas production facilities. They are considering producing biogas from forest waste. The have a significant resource nearby in their forests. [As an aside, Sweden imports waste from Europe to gasify or burn in furnaces for renewable energy production.]

Discussion Topic 3: Underground Energy Storage

Alternative Strategies and/or Best Practices:

The airport is looking to maximize energy conservation and they have already saved \$1,000,000 in annual operating costs. One energy conservation technology the airport has recently been using is an underground energy storage system. The airport stores summer heat in a natural aquifer at a nearby boulder ridge, which they can then reclaim during colder times. In another part of the system, they can use the colder water for summer cooling. They are actually increasing the ground water temperature in one area and decreasing it in another. Initially it was difficult to maintain the water levels across the aquifer but they now are able to control this. It is a closed loop system with no water treatment or conditioning. They have found this type of system only works in an area like Sweden with a large annual temperature difference. The airport is achieving a 20:1 boost in energy with the system. It provides 100% of the summer cooling load and 30% of winter heating.

More information about this system can be found on the airport's website. <u>The aquifer – the world's largest energy storage unit</u> http://www.arlanda.se/en/Information-about/Environmental/Reducing-carbon-dioxide-emissions/Energy/The-aquifer/

Benefit Summary:

Through their sustainability efforts Stockholm Arlanda Airport has achieved significant cost savings, has reduced emissions of CO_2 and other pollutants substantially, have easily complied with stringent environmental regulations, and have been recognized locally and internationally for their achievements. In 2009 the airport was awarded the

Swedish Energy Prize for its business model, which adopts a comprehensive approach to energy matters at the airport and has reduced energy consumption by 25 per cent in four years. In 2010 ARN was the first airport to win ACI Europe's Eco-Innovation Award "for outstanding achievement in environmental performance and an innovative approach to environmental management."

Management Assessment:

The airport's new CEO believes big visions drive big ideas for innovation. His philosophy is "stealing with pride," in that they are looking for the best ideas, technologies, and approaches wherever they are found. They now view economic and environmental concerns as equivalent when looked at over a multi-year time frame.

Describe any quantitative goals or metrics used to evaluate the success of this project or program:

The airport's climate goals include Total CO_2 , Airport CO_2 , and Ground Transport CO_2 . They are striving for "zero net emissions" of fossil carbon. So far they have lowered emissions from 1990 by 70%. They have found, however, that some people are confused between "Vision Zero" and a zero fossil carbon goal. Zero total emissions (as opposed to fossil carbon emissions) cannot be achieved.

ACRP 02-22 – Case Study Interview Form

Airport/Facility Name: Aspen/Pitkin County Airport (ASE), Owned and Operated by the County of Pitkin, Colorado

Date: March 15, 2011

Contact Phone and web address: (970) 920-5384, http://aspenairportplanning.com

Discussion Topics:

- 1. Integration of Sustainability into the Master Plan Updates
- 2. Developing a Sustainability Program
 - a. Background
 - b. Methodology
 - c. Defining the Sustainability Approach for Aspen
 - d. Next Steps
- 3. City of Aspen Canary Initiative: Climate Action Plan 2007 2009
- 4. Fly Quiet Program/ Fly Green, Fly Green Program
- 5. Runway Extension
 - a. FAA approved Runway Environmental Assessment
 - b. Sustainable initiatives incorporated into the design and construction of the runway extension
- 6. Energy Smart Resource Center
- 7. Green Energy Initiatives

Synopsis of Sustainability Programs, Policies, Processes, Technologies, and/or Equipment:

The Aspen/Pitkin County Airport's Master Plan is currently being updated from its 2004 version. The goal of the master planning process is to provide general facility improvement guidelines that satisfy aviation demand while remaining compatible with the environment, other modes of transportation, community development and other established community goals, such as affordable housing.

Aspen/Pitkin County Airport is voluntarily undertaking the creation of a full-scale *Evolving Sustainability Program* for the Airport. This program is focused on the primary goals of economic viability, operational efficiency, natural resource conservation and social responsibility. The program will evolve over time in response to local needs and available resources. It will include long- and short-term goals and metrics to measure the success of the goals as they are implemented. The County's goal is to have a fully-functioning sustainability plan in place by 2012.

Facility's definition of sustainability:

Sustainability is not just about dealing with global warming or environmental factors. It is about planning in a way that helps further economic prosperity, social responsibility and environmental stewardship. These three "legs of the stool" are all important and contribute to the overall health of an airport and its surrounding communities. The Sustainable Aviation Guidance Alliance (SAGA) definition of sustainability was chosen to be the best definition for the Aspen/Pitkin County Airport.

SAGA identified sustainability as, "A holistic approach to managing an airport so as to ensure the integrity of the Economic Viability, Operational Efficiency, Natural Resources Conservation and Social Responsibility (EONS) of the Airport." The Airport is focusing on these four categories for the sustainability program.

Airport management also recognizes that sustainability is a journey that is to be approached program by program.

How do initiatives achieve or meet that definition?

As a socially responsible member of the community, the airport is partnering with Pitkin County to address energy savings and green initiatives at the airport that directly affect the surrounding community. For example, in partnership with Pitkin County, the Community Office for Resource Efficiency (CORE) has located their Energy Smart Resources Center in the Aspen Airport Business Center. The Energy Advisors meet with property owners to consult and provide step by step guidance on implementing energy saving plans in their own homes.

Additionally, the Aspen/Pitkin Airport is part of the Voluntary Fly Quiet Program that appreciates and recognizes the commitment of so many pilots to reducing the noise impacts on the Aspen community. The airport also holds open Green Community Meetings, where interested individual can take part in open-forum discussions concerning the noise levels in and around their community.

Thirdly, the airport is exploring new green energy initiatives throughout the airport:

- Build green partnerships to develop renewable energy
 - Initiatives under consideration include:
 - Solar, with potential high school partnership projects
 - Geothermal
- Use significant airport-owned water rights in partnership with the Aspen Skiing Company to develop hydroelectric power opportunities
- Explore options to develop solar power facilities, potentially with off-airport net metering
- Encourage airport tenants to participate in alternative energy programs
- Funding options have not yet been determined

Detailed Notes about each Discussion Topic:

1) Integration of Sustainability into the Master Plan Updates

Current or conventional practice for this application:

The Aspen/Pitkin County Airport's Master Plan is a guide that will present a comprehensive overview of the airport's needs, including the timing and cost for proposed improvements, an analysis of financing options and a clear implementation plan. The Master Plan is currently being updated from its 2004 version. The goal of the master planning process is to provide general facility improvement guidelines that satisfy aviation demand while remaining compatible with the environment, other modes of transportation, community development and other established community goals, such as affordable housing.

Recommended practice for this application:

Aspen/Pitkin Airport is involving the community in a number of community planning efforts, such as:

- The Aspen Area Comm unity Plan Update,
- The West of Maroon Creek Sub Area Plan,
- RFTA Bus Rapid Transit Station Upgrades
- Highway 82 Access Plan

The Airport Master Plan Update team will be closely coordinating with the entities producing these other studies to provide input. They will also solicit their feedback on the Master Plan Update and incorporate their recommendations as appropriate.

Best practice for this application:

The following items are under development. Documents summarizing the findings of these items will be available on-line when finalized:

- Inventory of existing facilities and data collection
- Aviation Activity Forecasts
- Demand/capacity analysis of airport facilities
- Determination of facility and operational improvement demands

2) Developing a Sustainability Program

Current or conventional practice for this application:

<u>Background</u>

Aspen/Pitkin County Airport is voluntarily undertaking the creation of a full-scale *Evolving Sustainability Program* for the Airport. This program is focused on the primary goals of economic viability, operational efficiency, natural resource conservation and social responsibility. The program will evolve over time in response to local needs and available resources. It will include long- and short-term goals and metrics to measure the success of the goals as they are implemented. The County's goal is to have a fully-functioning sustainability plan in place by 2012.

<u>Methodology</u>

The first step to creating the sustainability program was collecting background information, including completing an airport-wide greenhouse gas emissions inventory. In response to a greenhouse gas inventory prepared by the City of Aspen, the first element of the sustainability plan was the preparation an airport-wide greenhouse gas inventory. In 2005, the City of Aspen conducted an inventory of its GHG emissions as part of its Canary Initiative, a program designed to identify and reduce carbon dioxide emissions. In that inventory, Aspen/Pitkin County Airport was identified as contributing 41%, or 344,487 tons, of all area GHG emissions. The County believed that because an industry standard methodology did not exist for airport-related greenhouse gases, that the City's Canary Initiative did not accurately portray airport-related emissions.

Pitkin County prepared its greenhouse gas inventory for the airport using the same methodology adopted by the Transportation Research Board in 2009. This inventory evaluated the emissions of all GHG sources at the airport – the terminal, ground support equipment, ground access vehicles, aircraft, runway lighting and more. The inventory concluded that activity at the airport produced 57,570 tons of CO2 in 2006 versus the 344,487 tons identified in 2005 in the City's report.

Subsequent to the greenhouse gas emissions inventory, the County has conducted a series of workshops with various parties to discuss the implementation of various sustainability practices. Meetings have been held with airport tenants and stakeholders, surveys of aircraft parking, utilities, facilities, recycling procedures and APU/GPU use have also been completed. All of this information helps staff to understand the unique issues and opportunities at the Airport that could be included in the sustainability program.

Stakeholders include the general public and committees, such as:

- Citizen Input Committee
 - Provide input for each planning project at the Airport, most recently the Master Plan and the Environmental Assessment
 - Members include:
 - Citizens (general public)
 - General Aviation pilots
 - Airline representatives

- Ground access operators
- Aspen Ski Company representatives
- Hotel representatives
- Limo company representatives
- Rental car company representatives
- Snow mass representatives
- Focused workshops were held with different interest groups
- Fly Quiet Committee
 - Fly Clean, Fly Green Community Meetings (see summary on following page)

Defining the Sustainability Approach for Aspen

The next step in creating the sustainability program was to agree on how the County would embrace sustainability at the airport. For Pitkin County, sustainability is not just about dealing with global warming or environmental factors. It is about planning in a way that helps further economic prosperity, social responsibility and environmental stewardship. These three "legs of the stool" are all important and contribute to the overall health of an airport and its surrounding communities. The Sustainable Aviation Guidance Alliance (SAGA) definition of sustainability was chosen to be the best definition for the Aspen/Pitkin County Airport. SAGA identified sustainability as, "A holistic approach to managing an airport so as to ensure the integrity of the Economic Viability, Operational Efficiency, Natural Resources Conservation and Social Responsibility (EONS) of the Airport." The Airport is focusing on these four categories for the sustainability program. Airport management also recognizes that sustainability is a journey that is to be approached program by program.

<u>Next Steps</u>

- Development of the Sustainability Program
 - Implement short-term goals and metrics for measurement
 - Develop long-term goals
- Development of Energy Action Plan
 - Determine potential upgrades based on energy audit
- Development of a construction management plan
 - The construction sustainability measures are forthcoming in document form. Airport management will share that document when it's finished.

3) City of Aspen Canary Initiative: Climate Action Plan 2007-2009

Current or conventional practice for this application:

In March of 2005, the City of Aspen adopted a plan to aggressively address global warming by reducing greenhouse gas emissions, called the Canary Initiative: Climate Action Plan 2007-2009. The Plan outlines the City of Aspen's goals for addressing global warming and how they can be achieved; and is also meant to act as a mechanism to monitor progress and as a guiding document for all policies developed within the City of Aspen.

Section C of the Plan focuses on pursuing energy efficient forms of transportation. Objective #5 seeks to reduce emissions from air travel through the following actions:

- Conduct a new comprehensive GHG Emissions Inventory
- Work with the Board of County Commissioners, the Aspen Pitkin Airport, and the Aspen Community Office for Resource Efficiency (CORE) to create, manage and promote a voluntary carbon offset program funds from which will be invested in local, verifiable GHG emissions offset projects and efficiency programs in order to mitigate GHG emissions from air travel.
- Encourage the use of more fuel efficient jets. (In 2006, United Airlines, with support of Aspen Pitkin Airport purchased a new fleet of CRJ700's thereby increasing their fuel efficiency by approximately 30%).
- Encourage visitors and residents to use fuel efficient methods of transportation and promote alternative transportation and fuel efficient rental cars
- Explore new technologies for auxiliary power units (APUs), runway taxi energy use, etc.

4) Fly Quiet Program/ Fly Green, Fly Clean Community Meetings

Current or conventional practice for this application:

Aspen/Pitkin Airport is part of the Voluntary Fly Quiet Program that appreciates and recognizes the commitment of so many pilots to reducing the noise impacts on the Aspen community. Fly Clean, Fly Green Community Meetings are held periodically for interested individuals regarding the Airport's Fly Quiet Report. A Fly Clean, Fly Green briefing is then presented to the Board of County Commissioners regarding the Airport's Fly Quiet Report.

The Aspen/Pitkin Fly Quiet program, created in the early 90's, is a voluntary noise abatement measure. The Fly Quiet Program has evolved into the Fly Green, Fly Clean Program, which focuses not only on noise abatement, but also greenhouse gas emissions. The following efforts are being considered:

- Working with rental car companies to get more efficient vehicles in their fleets
- Working with the airlines and FAA to determine the most efficient flight paths
- Employing continues descent approaches

Fly Clean, Fly Green Community Meetings are held periodically for interested individuals regarding the Airport's Fly Quiet Report. A Fly Clean, Fly Green briefing is then presented to the Board of County Commissioners regarding the Airport's Fly Quiet Report.

5) Runway Extension

Current or conventional practice for this application:

Several airport improvements are planned or underway at the Aspen/Pitkin County Airport. An environmental assessment for a proposed extension of 1,000 ft (300 m) to the airport's existing runway was approved by the FAA in June 2010. That same month the Pitkin County Board of County Commissioners approved the land use application for the runway extension project, giving the green light for construction.

6) Energy Smart Resource Center

Current or conventional practice for this application:

In partnership with Pitkin County, the Aspen Community Office for Resource Efficiency (CORE) has opened a new Energy Smart Resources Center at the Aspen Airport Business Center, where property owners can meet with Energy Advisors to receive step by step guidance on implementing an energy saving plan in their home.

7) Green Energy Initiatives

- Build green partnerships to develop renewable energy
 - Initiatives under consideration include:
 - Solar, with potential high school partnership projects
 - Geothermal
- Use significant airport-owned water rights in partnership with the Aspen Skiing Company to develop hydroelectric power opportunities
- Explore options to develop solar power facilities, potentially with off-airport net metering
- Encourage airport tenants to participate in alternative energy programs
- Funding options have not yet been determined

Additional Sources:

Aspen/Pitkin County Airport Fly Quiet Program, On-Line at: <u>http://www.aspenairportplanning.com/attachments/150_aspen%20flyquiet%20feb%202010%20</u> <u>mtg%20presentation.pdf</u>

Aspen/Pitkin County Airport 2009 Fly Green/Fly Clean Annual Report, On-Line at: <u>http://www.aspenairportplanning.com/attachments/149_Aspen%20Fly%20Quiet%202009%20Annual%20Report%20(Final).pdf</u>

Aspen Pitkin County Airport Planning Initiatives, On-Line at: <u>http://www.aspenairportplanning.com/</u>

Aspen Greenhouse Gas Emissions Inventory 2006, On-Line at: <u>http://www.aspenairportplanning.com/attachments/130_Greenhouse%20Gas%20Inventory%20A</u><u>mend%202009.pdf</u>

City of Aspen Canary Initiative: Climate Action Plan 2007-2009, On-Line at: <u>http://www.aspenpitkin.com/Portals/0/docs/City/GreenInitiatives/Canary/CAP-final%202009.pdf</u>

Good Vibrations: Going Green- Airport Challenges, by Jim Elwood, Aspen/Pitkin County Airport, March 2009, On-Line at: <u>http://airquality.ucdavis.edu/pages/events/2009/revolution/Elwood4.pdf</u>

ACRP 02-22 – Case Study Interview Form

Airport/Facility Name: Austin-Bergstrom International Airport (AUS), City of Austin Department of Aviation, Austin, TX

Date: March 8, 2011

Contact Phone and web address: 512-974-2000; <u>http://www.ci.austin.tx.us/austinairport/</u>

Discussion Topics:

- 1. Airport Planning and Construction
 - a. AFB closure and facility/infrastructure reuse
 - b. City of Austin sustainability requirements for new airport construction
- 2. Central Plant/Chilled Water
- 3. Alternative Fuels for Fleet Vehicles
- 4. Photovoltaic Power
- 5. Solid Waste Management
 - a. Terminal areas
 - b. Department of Aviation Buildings
- 6. Joint Projects with South Austin Regional Wastewater Treatment Plant
- 7. Energy Efficiency Upgrades
- 8. Social/Cultural Sustainability

Synopsis of Sustainability Programs, Policies, Processes, Technologies, and/or Equipment:

From its inception, Austin-Bergstrom International Airport (ABIA) was planned and designed with sustainability in mind. The closing of the Bergstrom Air Force Base (AFB) in the early 1990s gave the City of Austin the opportunity to relocate their existing airport operations from Mueller Municipal Airport, which had already reached its capacity, to the former AFB site. By doing so, the new airport development was able to redevelop a brownfield site and reuse much of the existing military infrastructure. The FAA Southwest Region recognized these sustainable initiatives, among others, and presented the City of Austin with an Environmental Achievement Award in 1997 (see Appendix B). The airport officially opened in 1999.

The driving force behind many of the current environmental and sustainability initiatives at the airport are the result of initiatives by the City of Austin and the electric utility, Austin Energy (which is also a department of the City of Austin). Many of the initiatives through the Austin Department of Aviation are typically advanced at a "grassroots" level.

The City of Austin is proactive on many sustainable initiative fronts particularly through its Office of Sustainability. Recently they have passed an ordinance that all new City-

owned buildings be constructed to LEED Silver level which will impact the future terminal expansion currently in the planning phase. This culture of sustainability promotes partnerships, even within the City departments, such as energy efficient upgrades through Austin Energy or composting and reclaimed water use with the Austin Water Utility.

Some projects, such as photovoltaic arrays at the airport are in the planning phase, but because there is currently little incentive in Texas, the airport has had difficulty finding a partnership to move forward. In addition, the airport in not in a non-attainment area and therefore air quality initiatives do not receive as much attention, however, through partnerships with third parties, fleet vehicles are using alternative fuels.

The Austin Department of Aviation (DOA) sustainability programs focus on results based on their "Strategic Sustainable Outcomes" which is a modification of the commonly referred triple bottom line of sustainability. The Austin DOA goals are delighted customers, financial success, operational effectiveness, environmental stewardship, and social responsibility. The programs initiated by the DOA are required to have goals that attain one or more aspects of these outcomes.

Facility's definition of sustainability:

The Austin Department of Aviation (DOA) sustainability programs focus on results based on their "Strategic Sustainable Outcomes" which is a modification of the commonly referred triple bottom line of sustainability. The Austin DOA goals are delighted customers, financial success, operational effectiveness, environmental stewardship, and social responsibility.

The DOA defines a Sustainable Future as "[developing the] airport in a matter that meets the needs of the present without compromising the ability of future generations to meet their own needs". [Source: City of Austin Aviation Department, Focus and Execution Plan for a Sustainable Future, 2011 – See Appendix C]

How do initiatives achieve or meet that definition?

As outlined in the 2011 "Focus and Execution Plan for a Sustainable Future", the "Five Year Priorities and 2011 Initiatives" include the following main priorities or goals:

- Continue to develop a differentiated business strategy focused on quality service at a moderate cost.
- Improve ABIA credit rating from A- to AA by October 2015.
- Reduce the percentage of operating revenue paid by the airlines to less than 40% by October 2015.
- Secure non-stop transatlantic service by October 2015.
- Secure ISO 14000 certification for the Environmental Management System (EMS) by October 2015.

With the exception of the last goal, the remaining priorities seem to focus on financial sustainability and customer satisfaction. Environmental sustainability will be a key priority with regard to the development of the EMS, however, there are certain other programs that are also a part of the DOA's sustainable initiatives that were not addressed in the 2011 Plan above, at least not directly.

Although financial sustainability and customer satisfaction were the focus of the 2011 Plan, the DOA does have several ongoing environmental and operational sustainability initiatives. A report on the Department of Aviation Conservation Programs by the AUS DOA dated March 2, 2011 (see Appendix C), shows that AUS has been reporting and documenting certain sustainability metrics at least as far back as 2008 for some of the programs it has initiated. These include electrical usage, terminal and DOA office waste disposal and recycling, landscape waste composting, light bulb and battery recycling, reclaimed water, and the Ameresco energy upgrades.

Examples of the success of these programs include the landscape waste composting program which has diverted over 700 tons of brush from landfills over the last three years for use at the nearby wastewater treatment plant where it is composted and added as an amendment to their digested biosolids. What makes this program exceptional is that landfill costs are relatively cheap in Texas, yet the AUS recognizes that, although there is a small financial incentive, the environmental cost savings is great. Another program at AUS that is being pursued is the conversion of fleet vehicles to alternative fuels. Because AUS in in an attainment area, there is little regulatory pressure for improving air quality, however, through partnerships with the City (through the Car2Go car sharing program and hybrid car replacement) or with private entities such as the CNG fueling station for shuttle bus operations, AUS still strives for sustainability when feasible through partnerships or grants, even if the regulatory or financial incentive is weak.

Social sustainability was also evident at ABIA. The terminal boasts that all its concessionaires are locally-derived vendors. It also promotes local artists, musical or otherwise, through performances, displays, and exhibits throughout the terminal and with daily local musical acts playing live or over the sound system at the terminal. Through this, the DOA promotes the local culture and economy. Management has stated that "the terminal is a reflection of Austin culture".

Appendix A – ACI Environmental Achievement Application, March 1998 **Appendix B** - City of Austin Aviation Department, Focus and Execution Plan for a Sustainable Future, 2011

Appendix C – Department of Aviation Conservation Programs dated March 2, 2011 **Appendix D** – Photographs representative of the Discussion Topics below taken during site visit on March 8, 2011

Detailed Notes about each Actual Discussion Topic:

(Complete the following for each actual topic/initiative/major area discussed during the case study interview. Attach additional sheets as necessary)

Discussion Topic 1: Airport Planning and Construction

Alternative Strategies and/or Best Practices:

Current or conventional practice for this application:

Planning strategies for the airport since its inception in the 1990s have attempted to reuse the existing AFB infrastructure wherever feasible. This is especially true of existing pavements such as former taxiways and runways. Although some pavement was not suitable for aviation, these pavements were converted to other uses rather than demolishing them, as in the new east employee parking lot. Some former AFB buildings were also reused and converted into new airport facilities including the 290-room Hilton Hotel, the City of Austin Education Center and many of the current Austin Department of Aviation's offices. Former military housing was relocated and made available for low-income housing. Fuel tanks were relocated and refurbished.

Recommended practice for this application:

Maintain current practice. Planning has indicated that it intends to reuse existing AFB infrastructure wherever it can. Although there are few remaining unused resources in the northern airfield, there are still some vacant or unused AFB facilities that are being maintained for future use.

Describe benefits:

Through reuse of existing infrastructure, the City of Austin has realized a cost savings by not requiring complete demolition and hauling of some former AFB facilities. This also reduces fuel usage and air emissions due to demolition equipment and keeps material from area landfills.

Describe whether the anticipated benefits were achieved and explain why/why not:

The City has realized cost savings through the reuse of the former AFB facilities. For example, relocation of the military housing saved the City approximately \$1 million; the relocation of the fuel tanks saved \$200,000.

Describe costs and financial impacts (order of magnitude if detailed cost information unavailable):

The City has realized cost savings through the reuse of the former AFB facilities. For example, relocation of the military housing saved the City approximately \$1 million; the relocation of the fuel tanks saved \$200,000. The cost savings from the reuse of former AFB pavement, which includes several taxiways, a runway, and the north cargo apron area (former B-52 staging area), are probably in the tens of millions of dollars.

Does this initiative meet the facility's definition of sustainability? Why or why not?

Initiative established prior to facility but is carried through their current capital improvement projects whenever feasible.

Describe the driving force(s) (e.g., manager, champion, or external advocate) behind this initiative. Describe how the decision was made to pursue this initiative. Identify any tools or models used. Draw a flow chart or schematic of the process, as appropriate.

Initiative established by the City of Austin in cooperation with the US Air Force but the spirit and intent are currently applied through their capital improvement projects whenever feasible.

Discussion Topic 2: Central Plant/Chilled Water/Thermal Storage

Alternative Strategies and/or Best Practices:

Current or conventional practice for this application:

The central plant for the airport utilizes a 1.5 million gallon water tank to provide thermal storage to reduce peak electrical demand. Operation of the thermal storage system allows the facility to send chilled water to the terminal during the peak hours of 4:00 to 8:00 pm from May to October instead of operating the air conditioning systems. The chilled water absorbs the heat in the terminal and returns it to the storage tank where it is rechilled overnight and recirculated the next day.

If the airport exceeds their electrical demand level for this time period, they are penalized heavily by the electrical utility (Austin Energy), which is also a City of Austin department.

Describe benefits:

Although personnel could not quantify the amount of energy required to run the chilled water system, they indicated that the system does require more energy to run than a conventional cooling system for the terminal. The benefit is that Austin Energy (electric utility) does not need to build additional capacity (through a power plant expansion or new power plant altogether).

Describe whether the anticipated benefits were achieved and explain why/why not:

It is estimated that there is a 48% reduction in peak demand. Because of this Austin Energy (electric utility) does not need to build additional capacity for the City to meet the peak demand.

Describe costs and financial impacts (order of magnitude if detailed cost information unavailable):

It seems that the cost savings in this case is toward the City, although the finances are confusing since the electric utility and the airport are both departments in the City of Austin, and it would appear that the one department (airport) pays the other (utility) for the service of providing electricity.

Describe life-cycle, return-on-investment, or payback cost analysis (if any prepared):

In this case, the life-cycle analysis would include the impact to Austin Energy. If peak demand was not reduced by this system, additional capacity would have to be added by the utility. No actual life-cycle costs or benefit analysis were available.

Describe how the facility tracks the financial impacts of this initiative. Are projected goals being met? Why or why not?

DOA tracks overall electrical usage by month since January 2008 in order to monitor progress. See "DOA Electrical Usage" Department of Aviation Conservation Programs, March 2, 2011. Data through November 2010 is attached in Appendix C.

Note that data is from October 2008 to November 2010. Energy efficiency upgrades (see Discussion Topic 7) started 2009 and were substantially complete in December of 2010. The impact of these upgrades is not apparent at this early stage in the data collection. Current data (through March 2011) is pending.

Does this initiative meet the facility's definition of sustainability? Why or why not?

It appears to meet the City's sustainability needs (by not building additional power capacity to meet peak needs) but the airport requires more electricity to run this system than it would with a conventional system. The benefit (to the City) being the nearly 50% decrease in peak demand.

Describe the driving force(s) (e.g., manager, champion, or external advocate) behind this initiative. Describe how the decision was made to pursue this initiative. Identify any tools or models used. Draw a flow chart or schematic of the process, as appropriate.

Austin Energy and the City of Austin were the main driving force behind this initiative.

Discussion Topic 3: Alternative Fuels for Fleet Vehicles

Current or conventional practice for this application:

The facility has an existing propane fueling station and a CNG station currently under construction. Propane is used for fueling shuttle buses, some support equipment (non-GSE related), and lawn mowers. The future CNG fueling station will also be used for buses and fleet vehicles. The DOA also has several hybrid vehicles (Ford Escape) and has a city-wide car sharing program (Car2Go) site located at the DOA office building.

Describe benefits:

Propane and CNG are cleaner burning fuels compared to diesel or gasoline. Propanefueled vehicles reduce NO_x by 30% to 60% and particulate matter by 100%. http://www.afdc.energy.gov/afdc/vehicles/emissions_propane.html

CNG-fueled vehicles emit 80% less particulates but methane emissions increase five-fold compared to gasoline.

http://www.afdc.energy.gov/afdc/vehicles/emissions_natural_gas.html

Describe costs and financial impacts (order of magnitude if detailed cost information unavailable):

The financial impacts were minimal to the airport. The project was funded through a third-party grant from Propane Research Education Council and CNG is being built by a third-party, Clean Energy.

Identify the source(s) of funds used to support this initiative (e.g., AIP, PFC, other airport revenue, bonds, grants):

The project was funded through a third-party grant from Propane Research Education Council and CNG is being built by a third-party, Clean Energy.

Describe how the facility tracks the financial impacts of this initiative. Are projected goals being met? Why or why not?

The DOA buys the propane that it uses for its shuttle bus fleet. The buses are owned by DOA but operated by a third party. DOA tracks propane use by its shuttle bus fleet sporadically but cost benefit comparison to conventional fuel buses is not currently being evaluated or tracked.

Does this initiative meet the facility's definition of sustainability? Why or why not?

Yes. The use of alternative fuels aids in the reduction of carbon emissions and other pollutants.

Describe the driving force(s) (e.g., manager, champion, or external advocate) behind this initiative. Describe how the decision was made to pursue this initiative. Identify any tools or models used. Draw a flow chart or schematic of the process, as appropriate.

Although not in a non-attainment area, the DOA took the initiative to install propane for its fleet vehicles though the opportunity that presented itself via the third-party grant. The CNG fueling station is also being constructed through third party funding sources. The DOA typically looks for strategic partnerships to initiate these types of programs, especially since the regulatory environment does not create a large enough incentive for clean air projects.

Describe any quantitative goals or metrics used to evaluate the success of this project or program:

Usage is tracked sporadically.

Discussion Topic 4: Photovoltaic Power Projects

Alternative Strategies and/or Best Practices:

Current or conventional practice for this application:

The airport has evaluated options for photovoltaic arrays at the airport and has identified up to 200 acres of land at several locations, including former AFB landfill sites for ground-mounted solar arrays. There is a ten-year old photovoltaic pilot project through Austin Energy that is located next to the DOA Office building (ground-mounted).

Describe benefits:

Photovoltaics can reduce electrical demand by producing off-grid electricity on-site.

Describe whether the anticipated benefits were achieved and explain why/why not:

According to DOA staff, the incentives for building solar at the airport have declined and they are currently looking for a strategic partnership to advance those plans to develop the underutilized parts of the airport with ground-mounted solar arrays. A plan is in place but the financial opportunity has not presented itself. The Austin Energy pilot project does not directly benefit the airport. Austin Energy collects solar electric power and sends it to their grid from the airport site.

Describe costs and financial impacts (order of magnitude if detailed cost information unavailable):

Costs have not been determined at this point.

Identify the source(s) of funds used to support this initiative (e.g., AIP, PFC, other airport revenue, bonds, grants):

DOA is currently looking for third-party partnerships to advance their solar power generation plan.

Does this initiative meet the facility's definition of sustainability? Why or why not?

This initiative meets the facility's definition of sustainability with regards to environmental stewardship. Depending on the partnership arrangement, it may also meet their economic sustainability definition.

Describe the driving force(s) (e.g., manager, champion, or external advocate) behind this initiative. Describe how the decision was made to pursue this initiative. Identify any tools or models used. Draw a flow chart or schematic of the process, as appropriate.

Currently, the driving force for this program is dependent on finding a strategic partner to develop solar power at AUS. DOA and Austin Energy have been instrumental in initiating and maintaining this program but it appears another partner or a government grant or incentive will help get this project off the ground and past the planning stages.

Discussion Topic 5: Solid Waste Management

Alternative Strategies and/or Best Practices:

Current or conventional practice for this application:

The DOA and its tenants recycle the waste collected in designated trash cans at the terminal using segregated chutes for trash and recycling at the concourse level and at the baggage claim level. The segregated waste is then carted to a centralized waste disposal area. The centralized waste disposal area has segregated compactors for recyclable and non-recyclable waste. There are also areas for mercury lamp disposal and battery recycling maintained by the Electricians and Field Maintenance, respectively. The DOA also recycles at their offices by providing segregated containers for single-stream recycling. Landscape waste is composted at the nearby wastewater treatment plant (discussed in Discussion Topic 6).

Recommended practice for this application:

Possibly recommend waste minimization program for DOA and tenants.

Best practice for this application:

Possibly recommend source reduction program for DOA and tenants.

Describe benefits:

Reduce landfill waste and minimize environmental and economic impacts of using virgin raw materials.

Describe whether the anticipated benefits were achieved and explain why/why not:

Based on the Department of Aviation Conservation Programs, March 2, 2011, presentation, there appears to be "lots of room for improvement". Much of the improvement will be in waste diversion from the terminal and aircraft. Programs to facilitate this are underway or currently under development.

Getting the tenants into a unified program has been difficult but is proceeding incrementally. Currently, the airline ticket offices and TSA offices are being initiated into the recycling program. Future plans involve conversion to single stream recycling versus segregating recyclables at the source. Further improvement includes the addition of glass recycling and working with airlines on recycling deplaned waste.

Describe costs and financial impacts (order of magnitude if detailed cost information unavailable):

Landfill disposal costs are relatively inexpensive in Texas (about \$15 per ton), however, the City of Austin recognizes the environmental benefit of recycling even though it may be more costly.

Identify the source(s) of funds used to support this initiative (e.g., AIP, PFC, other airport revenue, bonds, grants):

Funding is primarily from airport operating funds.

Describe how the facility tracks the financial impacts of this initiative. Are projected goals being met? Why or why not?

AUS tracks their terminal waste and recycling totals on a monthly basis. Data going back to 2009, indicates that they are recycling approximately 11% of the terminal waste (about 17 tons out of 150 tons on an average monthly basis since January 2009). See "ABIA Terminal Waste & Recycling Totals" Department of Aviation Conservation Programs, March 2, 2011.

Does this initiative meet the facility's definition of sustainability? Why or why not?

Solid waste management programs help reduce the facility's environmental impacts.

Describe the driving force(s) (e.g., manager, champion, or external advocate) behind this initiative. Describe how the decision was made to pursue this initiative. Identify any tools or models used. Draw a flow chart or schematic of the process, as appropriate.

Terminal recycling initiatives were mainly driven by City of Austin directives. DOA office recycling was employee-driven through the formation of a "Green Team" which consisted of a member from building/division.

Describe any quantitative goals or metrics used to evaluate the success of this project or program:

AUS tracks their terminal waste and recycling totals on a monthly basis. Data going back to 2009, indicates that they are recycling approximately 11% of the terminal waste (about 17 tons out of 150 tons on an average monthly basis since January 2009). See "ABIA Terminal Waste & Recycling Totals" Department of Aviation Conservation Programs, March 2, 2011.

The lamp recycling has data going back to 2003. The department tracks the number of whole lamps and pounds of crushed lamps on an annual basis. These totals have been

increasing since 2008. In 2010, more than 4,000 lamps and nearly 1,500 lbs of crushed lamps have been collected.

See "Light Bulb Recycling Totals" Department of Aviation Conservation Programs, March 2, 2011.

Battery recycling is tracked on an annual basis going back to 2006. Battery recycling totals have been increasing every year, especially for alkaline batteries. Over 800 pounds of batteries (alkaline, rechargeable, cell phone, lead acid) were recycled in 2010. See "Battery Recycling Totals" Department of Aviation Conservation Programs, March 2, 2011.

The employee-driven office recycling program by the DOA has been tracking their recycling totals since the 1st quarter of 2008. DOA office recycling has increased from less than 2 tons in the 1st quarter of 2008 to over 12 tons in the 1st quarter of 2010.

Discussion Topic 6: Joint Projects with South Austin Regional Wastewater Treatment Plant (WWTP)

Alternative Strategies and/or Best Practices:

Current or conventional practice for this application:

- 1. Reclaimed water reuse from wastewater treatment plant (WWTP) will be used for irrigation of landside areas. Irrigation infrastructure was installed when terminal was constructed in 90s.
- 2. Brush/landscape waste composted at WWTP with biosolids.

Recommended practice for this application:

- 1. Reclaimed water may be suitable for other uses at airport, e.g. process water, toilet flushing, etc.
- 2. Include food waste for composting.

Best practice for this application:

- 1. Collect graywater or rainwater for above uses.
- 2. Compost and reuse landscape waste and food waste on-site where possible.

Describe benefits:

- 1. Reclaimed water use reduces potable water demand.
- 2. Composting landscape waste reduces pressure on landfills.

Describe whether the anticipated benefits were achieved and explain why/why not:

- 1. Reclaimed water irrigation is currently under development and will be completed in 2011. Reclaimed water could save 35 million gallons of potable water use at AUS.
- Since 2008 over 700 tons of landscape waste has been composted at the WWTP's biosolids drying fields. Composted landscape waste and biosolids are sold by the WWTP as a soil amendment.

Describe costs and financial impacts (order of magnitude if detailed cost information unavailable):

- 1. Reclaimed water total cost \$1.5 million but DOA's portion was about \$175,000. Water savings estimated at 35 million gallons.
- 2. Landscape waste disposal at the WWTP was initially free but, due to a change in the composting process at the plant, the water authority now charges for disposal. In addition to this financial cost, AUS spends resources on staff and transportation to dispose the waste at the facility (6 mile round trip distance plus employee time).

Does this initiative meet the facility's definition of sustainability? Why or why not?

Initiatives meet the airport's definition of sustainability and were both accomplished through a strategic partnership with the nearby WWTP.

Describe the driving force(s) (e.g., manager, champion, or external advocate) behind this initiative. Describe how the decision was made to pursue this initiative. Identify any tools or models used. Draw a flow chart or schematic of the process, as appropriate.

- 1. Reclaimed water use was planned when the terminal was being designed. The driving force was the City of Austin.
- 2. Landscape waste recycling was an effort driven by AUS personnel. There is no financial incentive for this initiative.

Describe any quantitative goals or metrics used to evaluate the success of this project or program:

- 1. No metrics; project currently under development.
- 2. The DOA tracks annual weight of landscape waste sent to the WWTP. They have been tracking this since 2008. Over 700 tons of landscape waste has been composted in this manner.

Discussion Topic 7: Energy Efficiency Upgrades

Current or conventional practice for this application:

DOA is spending nearly \$1.5 million to upgrade lighting, HVAC systems, water fixtures and to commission terminal systems. This project is being done by Ameresco. A total of 8 energy conservation measures (ECM) were proposed: lighting upgrades, lighting controls, P&E Building chiller replacement, Central Plant boiler upgrade, EMS upgrades, water conservation, P&E Building infiltration.

Describe benefits:

By upgrading the energy consuming systems and improving energy efficiency, the DOA will realize not only financial saving but also environmental benefits resulting from decreased fossil fuel demand.

Describe whether the anticipated benefits were achieved and explain why/why not:

The project was substantially complete in December 2010. Continuous commissioning is currently ongoing. Data showing the impact of these improvements is not available at this early stage.

Describe costs and financial impacts (order of magnitude if detailed cost information unavailable):

The 8 ECMs proposed by Ameresco are anticipated to cost \$1,453,170 will reduce electric consumption by 2,169,970 kWh and gas consumption by 46,165 Therms.

Describe life-cycle, return-on-investment, or payback cost analysis (if any prepared):

The annual savings to AUS is anticipated to be \$258,724 which gives a simple payback period of 5.62 years.

Identify the source(s) of funds used to support this initiative (e.g., AIP, PFC, other airport revenue, bonds, grants):

Funding was through a State energy conservation grant involving performance contracting where funding would be made available if it can be shown that the payback period was less than 7 years.

Describe how the facility tracks the financial impacts of this initiative. Are projected goals being met? Why or why not?

Financial impacts are tracked by measuring overall facility electrical usage. Data is not available to show impact at this early stage.

Does this initiative meet the facility's definition of sustainability? Why or why not?

This initiative meets the facility's definition of sustainability meeting its financial and environmental requirements.

Describe the driving force(s) (e.g., manager, champion, or external advocate) behind this initiative. Describe how the decision was made to pursue this initiative. Identify any tools or models used. Draw a flow chart or schematic of the process, as appropriate.

The project was done through a partnership with Ameresco and Austin Electric.

Describe any quantitative goals or metrics used to evaluate the success of this project or program:

Too early to evaluate; the projects were substantially complete in December 2010.

Discussion Topic 8: Social/Cultural Sustainability

Current or conventional practice for this application:

AUS believes in local branding throughout its terminal. Only local vendors and concessionaires are found in the terminal. Local musicians perform live frequently within the terminal. Local art and sculptures are displayed throughout. The culture of the City of Austin is fully on display at the airport.

Best practice for this application:

Current practice to promote local culture and businesses is best practice.

Describe benefits:

Promoting local vendors and artists helps support the local economy, not only through direct sales but also as a form of advertising. In addition to economic sustainability, because the vendors are locally derived, transportation costs and environmental impacts due to transport are presumably minimized.

Does this initiative meet the facility's definition of sustainability? Why or why not?

This initiative meets two of the five goals of the airport's definition of sustainability: delighted customers and social responsibility. By promoting the local culture, customers at the airport get a sense of place and a feel for the culture when arriving, departing, or laying over at the airport. This improves the traveller's experience by giving the facility a unique character rather than a generic terminal that gives no indication where the traveller is. The airports social responsibility is evidenced by the use of local vendors and artisans that benefit financially and from the exposure to a highly visited, heavy trafficked venue to display and, in some cases, sell their wares.

Describe the driving force(s) (e.g., manager, champion, or external advocate) behind this initiative. Describe how the decision was made to pursue this initiative. Identify any tools or models used. Draw a flow chart or schematic of the process, as appropriate.

This initiative was driven by the AUS DOA from a City of Austin directive.

Wrap-up Questions:

What programs or initiatives are next on the horizon? What are your shortterm and long-term goals (including Net Zero goals)? How will benefits or results be measured and verified?

- 1. Photovoltaic power currently in the planning phase with several on-airport locations identified but waiting for opportunity to present itself, either outside funding or partnership. Electricity will be produced but it is unclear at this time whether this will be used for powering the airport directly or fed to the grid.
- 2. Electrification of GSE vehicles ABIA is evaluating installation of gate charging stations for aircraft GSE, the project is funded for 2012. Projected funds should provide 20 charging points for GSE. Currently discussing implementation with airlines. ABIA is also participating in an EPRI study to evaluate implementation.
- 3. Reclaimed water discussed in Topic 6. This initiative is currently underway and due to be completed this year. Results will be measured by amount of water saved through the use of reclaimed water from the nearby WWTP.
- Sustainability documentation and tracking DOA is currently compiling and tracking various sustainability metrics in order to track progress and form future goals.

Describe challenges, difficulties, or uncertainties facility had to overcome:

In the case of photovoltaic power, solid waste management, and air quality issues there is a weak financial and/or regulatory incentive to promote these sustainability initiatives. In some cases, AUS has carried on with initiatives in these areas (e.g. landscape waste recycling, alternative fuel station) but financial obstacles also exist (e.g. photovoltaics) without subsidies.

What advice would management offer another facility?

AUS is currently defining its metrics and has been actively collecting data in some areas for a few years. The purpose, as stated by the facility director and other interviewees, is to document what is currently being done so that you can attach goals moving forward. Without defining where you are, you can't determine how to move forward. [paraphrased quote from Jim Smith]

ACRP 02-22 – Case Study Interview Form

Airport/Facility Name: Chicago Department of Aviation (CDA) O'Hare and Midway International Airports

Date: April 12, 2011

Contact Phone and web address: 773-686-6726, http://www.cityofchicago.org/city/en/depts/doa/provdrs/sai.html

Discussion Topics:

- 1. Sustainable Airport Manual
- 2. Vegetated Green Roofs
- 3. LEED Certification
- 4. Recycling
- 5. Vehicles and Equipment
- 6. Noise Management
- 7. Energy and Water Use Reduction
- 8. Balanced Earthwork Management Plan
- 9. Sustainable Evaluation and Recommendation Team (SERT)
- 10. Construction Recycling

Synopsis of Sustainability Programs, Policies, Processes, Technologies, and/or Equipment:

The CDA continues to serve as a benchmark for environmental stewardship by embracing the best environmentally, socially, and economically responsible practices at their airports.

The CDA has accomplished cutting edge sustainability measures, including the development of the Sustainable Airport Manual to guide the implementation of sustainability initiatives at O'Hare and Midway International Airports. They have installed green roofs, saved energy, reduced air emissions, conserved water and other natural resources. They have salvaged and recycled materials and kept construction waste and water bottles out of landfills.

Facility's definition of sustainability:

CDA's goal is to complement and promote the City of Chicago's commitment to green initiatives and to enhance the quality of life for their citizens.

How do initiatives achieve or meet that definition?

Sustainability initiatives accomplish the balanced environmentally, economically, and socially responsible directives of the CDA.

Detailed Notes about each Discussion Topic:

Discussion Topic 1: Sustainable Airport Manual

Alternative Strategies and/or Best Practices:

Provide airport-specific sustainable planning and practical application throughout the construction, operations, maintenance and all airport functions with minimal impact to project schedules or budgets.

Current or conventional practice for this application:

Under the leadership of Mayor Richard M. Daley, the O'Hare Modernization Program (OMP) introduced the Sustainable Design Manual (SDM) in 2003 to ensure that sustainable initiatives and measurements were implemented during the build-out and modernization of O'Hare International Airport. The SDM positioned Chicago as the first in the nation to develop sustainable guidelines for design and construction at airports. It established the model for green airport development and has since received national and international recognition. The SDM was just the beginning. The CDA continues to expand its focus to incorporate sustainability initiatives for airport planning, operations and maintenance, and concessions and tenants. To encompass all of these areas into one comprehensive document, they created the Sustainable Airport Manual (SAM). The SAM is an integral part of Chicago's ongoing efforts toward implementing more environmentally sustainable buildings and civil infrastructure, incorporating best practice guidance for planning, operations and maintenance of all City airport facilities and functions, and those of its tenants.

There are currently more than 200 contributors to the SAM including Airports, Environmental Experts, Regulators and Industry Leaders.

Broken down into 5 different chapters:

- Administrative Procedures Guides the integration of sustainability into administrative activities associated with airport planning, design, construction, maintenance, and daily operations.
- Planning Sets-the framework-for-incorporation of sustainability into all airport functions, from initial plans through commissioning and operation, by providing policy guidance, measurable checklists, and case study examples.
- Design & Construction Guides the incorporation of sustainability into design and construction of civil-airside, civil-landside, occupied buildings and unoccupied buildings/structures in an airport environment.
- Operations & Maintenance Guides the incorporation of sustainability into an airport's everyday activities, with a focus on training, monitoring, reporting, and the refinement of Best Management Practices.
- Concessions & Tenants Guides the incorporation of sustainability into the planning, design, construction, and operation of all terminal concessionaire, landside, and airside tenant facilities.

Describe benefits:

Recognizes the designers and contractors for sustainable achievements

Describe whether the anticipated benefits were achieved and explain why/why not:

Along with the guidelines a project rating system is in place that awards certification on various levels with Green Airplanes.

Does this initiative meet the facility's definition of sustainability? Why or why not?

Yes - SAM is intended to be a living document that will continuously evolve, improve and grow as future technologies emerge. It is only by working collaboratively, with participation from all the key industry stakeholders - from airport and airline professionals to contractors and environmentalists – so that they can advance their efforts to implement progressive sustainable measures at airports. SAM is envisioned to become the global industry standard for sustainability planning, development, and everyday functions at airports around the world.

Describe the driving force(s) (e.g., manager, champion, or external advocate) behind this initiative. Describe how the decision was made to pursue this initiative. Identify any tools or models used. Draw a flow chart or schematic of the process, as appropriate.

Commissioner Andolino was a driving force in the creation of the original SDM and the revamped SAM.

Describe any quantitative goals or metrics used to evaluate the success of this project or program:

The SAM Rating System of Green Airplanes

Discussion Topic 2: Vegetated Green Roofs

Alternative Strategies and/or Best Practices:

Current or conventional practice for this application:

Through the SAM the CDA encourages the installation of vegetated roods on airport facilities wherever possible to reduce the urban heat island effect, conserve energy, and reduce storm water runoff. The CDA has installed 232,534 square feet of vegetated roof spaces at ORD and MDW with an additional 126,456 square feet currently proposed or under construction.

Vegetative sedum species were selected by the CDA for their tolerance to drought, low maintenance requirements, lack of food production, and deficiency of habitat, thereby reducing their attractiveness to wildlife. Vegetated roof designs also take into account wind speed requirements reducing the potential of foreign object debris (FOD).

Location of Existing Green Roofs

- ORD Aircraft Rescue a Fire Fighting Facility #3
- ORD Guard Post #1 Canopy
- ORD South Airfield Lighting Control Vault
- ORD North Airport Traffic Control Tower Base Building
- ORD North Airport Traffic Control Tower Electrical Building
- ORD FedEx Vehicle Maintenance Building
- ORD FedEx World Services Center
- ORD FedEx Main Sort Building
- ORD Enterprise Rental Car Maintenance Building

- ORD Enterprise Rental Car Customer Service Center
- ORD Booster Pump Station (Building 815)
- MDW Economy Elevated Parking Structure and Electrical Vault

Vegetated Roofs under Construction/Proposed

- ORD United Airlines Cargo Building
- MDW Consolidated Rental Car Facility

Describe benefits:

Reduction of Heat Island Effect, Lower operating costs, life cycle, stormwater retention, reduce air emission impacts, noise reduction, aesthetics and visibility

Describe costs and financial impacts (order of magnitude if detailed cost information unavailable):

Vegetated roofs improve insulation, reducing heating and cooling costs. Cost savings are expected from reduced energy consumption and improved stormwater quantity/quality management.

Does this initiative meet the facility's definition of sustainability? Why or why not?

Yes – the benefits of vegetated roofs are in line with the hopes of the City to improve the quality of life for its citizens. All new civic buildings are required to meet the Silver standard set by LEED.

Describe the driving force(s) (e.g., manager, champion, or external advocate) behind this initiative. Describe how the decision was made to pursue this initiative. Identify any tools or models used. Draw a flow chart or schematic of the process, as appropriate.

The City of Chicago is leading the way in the US with aggressive sustainable design measures which demonstrate their commitment to sustainability. In general, Chicago promotes green buildings through awards, grants, design competitions and fairs. For example, they expedite the building-permit process for approved builders of green buildings and waiving a service fee for developers installing green roofs. In addition, any public or publicly funded building has to meet the LEED silver certification standard, set by the U.S. Green Building Council.

Discussion Topic 3: LEED Certification

Alternative Strategies and/or Best Practices:

Current or conventional practice for this application:

As mentioned in Discussion Topic 2: Vegetated Green Roofs, the City of Chicago is leading the way in the US with aggressive sustainable design measures which demonstrate their commitment to sustainability. In general, Chicago promotes green buildings through awards, grants, design competitions and fairs. For example, they expedite the building-permit process for approved builders of green buildings and waiving a service fee for developers installing green roofs. In addition, any public or publicly funded building has to meet the LEED silver certification standard, set by the U.S. Green Building Council.

Currently CDA has four facilities that have received or are pursing LEED Certification:

- ORD North Air Traffic Control Tower
- ORD FedEx Cargo Facility
- ORD Enterprise Rental Car Facility
- Midway Consolidated Rental Car Facility

Describe benefits:

Third party verification that a building was designed and build using strategies aimed at improving performance. Areas of focus include: energy savings, water efficiency, CO2 emissions reduction, improved indoor environmental quality, and stewardship of resources and sensitivity to their impacts.

Does this initiative meet the facility's definition of sustainability? Why or why not?

Yes – it aims are the construction of green buildings at the CDA Airports

Discussion Topic 4: Solid Waste

Alternative Strategies and/or Best Practices:

Current or conventional practice for this application:

The CDA is committed to reducing its environmental footprint in an efficient, costconscious manner. Recycling (reprocessing of waste material into marketable commodities), reuse (employing discarded items in new roles) and cost-effective management of non-hazardous and hazardous waste each play a role in managing their fiscal costs.

In June of 2010, the City of Chicago awarded a new competitive bid contract for waste hauling, recycling, and disposal at both MDW and ORD. Under this contract, they clarified and expanded the materials to be recycled off-airport, and made provisions for simplified, cost-effective handling of materials to be recycled as a single stream. Materials routinely recycled in this stream now include mixed paper (office paper, newspaper, magazines, cardboard, paperboard, telephone directories) and containers (steel cans, aluminum cans, glass bottles, plastic bottles). Compacted recyclables are hauled away (for less than 25% of the cost of regular trash) and processed for recycling.

Household batteries contain toxic chemicals and should be prevented from entering the waste stream. CDA maintains a household battery collection system in multiple building areas. Once household batteries are collected, they are properly disposed.

Does this initiative meet the facility's definition of sustainability? Why or why not?

Yes – it shows CDA's commitment to green initiatives and a social responsibility of minimizing the amount of waste that is sent to landfills.

Discussion Topic 5: Vehicles and Equipment

Alternative Strategies and/or Best Practices:

Current or conventional practice for this application:

The CDA requires contractors to use the newest, most efficient construction equipment available. Older construction equipment must be retrofitted with oxidation catalysts or particulate filters to improve air quality emissions. All construction vehicles on the OMP are required to use ultra-low sulfur diesel (ULSD) fuel. This practice was initiated when OMP construction started in October 2005, 5 years prior to the federal mandate.

The CDA has established specifications to minimize air quality impacts during construction. Each contractor is required to:

- List all vehicles used on the project prior to the start of construction;
- Certify that all vehicles are in compliance with U.S. Environmental Protection Agency (EPA) Tier Standards;
- Track fuel usage for each vehicle in a monthly and annual report; and
- Identify when new equipment is brought on the project site or when old equipment is replaced.

All construction vehicles are labeled to recognize program equipment and fuel compliance

Diesel-powered vehicles and equipment are not allowed to idle for more than 5 consecutive minutes in a 60-minute period when equipment is not in use, occupied by an operator, or otherwise in motion.

During snow events, O'Hare operates up to four diesel-powered spreader vehicles with the latest engine technology to reduce nitrogen oxide (NOx) emissions. In compliance with the U.S. EPA's mandate, these vehicles use diesel particulate filters (DPF) and selective catalytic reduction (SCR) applications to reduce engine emission levels by 98% of what they were in 1999.

The CDA is also testing anti-idling diesel retrofits and auxiliary power units to heat the cab, hydraulic fluid, and engine components in snow removal equipment prior to use; these devices reduce fuel bum and emissions.

In support of the CDA's green vision, T.J. Lambrecht Construction uses the Caterpillar® D7E Bulldozer on OMP construction.

- The D7E consumes 10-30% less fuel per hour than conventional mid-sized bulldozers, resulting in a 10-30% reduction in greenhouse gas emissions.
- The electric drive train configuration has fewer moving parts, requiring less service and replacement than conventional transmissions, extending the drive train component life and reducing lifetime operating costs.
- The cab of the D7E provides improved visibility, increasing safety on the jobsite and improving worker comfort.

To reduce vehicle emissions, the CDA operates alternatively fueled and hybrid vehicles in its vehicle services fleet.

• Over 25 Ford Escape hybrid vehicles are used by the CDA Facilities, Operations, and Safety and Security divisions.

- The CDA owns a step van, generator, scrubber and steam cleaner using propane as the primary fuel source.
- The CDA operates electric powered Segway personal transport vehicles, forklifts, and steam cleaners/ pressure washers.
- 15 solar powered message board trailers.
- 28 vehicles in the CDA's fleet are capable of running on E85 (a blend of 85% ethanol and 15% gasoline).
- Every Chicago Police Department squad car purchased by the CDA is also E85 capable.

The CDA is working with the Chicago Department of Environment at 350 Green to provide electric vehicle charging stations for public use in customer parking lots and garages at ORD and MDW. In January 2011 the first electric charging station was installed at ORD in the main parking garage.

Recommended practice for this application:

In the next 3 years the CDA is considering up to 60 hybrid vehicles for potential purchase to replace aging less efficient vehicles.

Discussion Topic 6: Noise Management

Alternative Strategies and/or Best Practices:

Current or conventional practice for this application:

The CDA's noise management program is an integral part of the overall sustainability program of their airports. Not only does the noise management program offer significant environmental benefits in terms of reduction of noise impacts, it also serves social aspects of education and community outreach. Their approach to noise management begins with measurement and trending of noise levels within the surrounding communities, and tracking the type, frequency and position information of all aircraft arriving and departing our airports. CDA implements a robust noise abatement program to affect operational changes in aircraft activity to reduce noise impacts to their neighbors. The sound insulation programs for homes and schools significantly reduce interior noise levels while providing building envelope improvements that also benefit energy efficiency.

Installed in 1996, the Airport Noise Management System (ANMS) enables the CDA to monitor the amount of noise being generated over the communities surrounding O'Hare and Midway by the aircraft operating at the airports. The ANMS collects, analyzes and processes data from a number of sources of information including a network of 45 noise monitors around O'Hare and Midway, FAA radar data, weather data and noise complaints. Over 120,000 flights and 400,000 noise events are recorded by the ANMS each month for the CDA. The City of Chicago and the O'Hare and Midway Noise Compatibility Commissions utilize data from the ANMS to facilitate the development and management of noise abatement programs at the Airports.

In 1997, Mayor Richard M. Daley announced that airlines operating at O'Hare and Midway International Airports had agreed to use designated noise abatement flight procedures in accordance with the Fly Quiet Program. The Fly Quiet Program was implemented in an effort to further reduce the impacts of aircraft noise on the surrounding neighborhoods. The Fly Quiet Program is a voluntary program that encourages pilots and air traffic controllers to use designated nighttime preferential runways and flight tracks developed by the CDA in cooperation with the O'Hare and Midway Noise Compatibility Commissions, the airlines, and the air traffic controllers. These preferred routes direct aircraft over less-populated areas, such as forest preserves, highways, as well as commercial and industrial areas. As part of the Fly Quiet Program, the CDA prepares a Quarterly O'Hare Fly Quiet Report. This report is shared with CDA officials, the O'Hare Noise Compatibility Commission, the airlines, and the general public. The Fly Quiet Report contains detailed information regarding nighttime runway use, flight operations, flight tracks, and noise complaints and 24-hour tracking of aircraft engine ground run-ups. The data presented in this report is compiled from the ANMS and airport operation logs

The CDA is strongly committed to the Residential Sound Insulation Program (RSIP), which aims to reduce the impact of aircraft noise in homes surrounding O'Hare and Midway. The goal of the program is to make it easier for the highest impacted homeowners surrounding the airports to talk on the phone, watch TV, listen to music, take a nap, or have a conversation in their own homes. By properly sound insulating these homes, homeowners not only gain a guieter interior, but may also benefit from long-lasting improvements and increased efficiency in their heating and cooling utilities. Since 1982, the CDA has administered the School Sound Insulation Program (SSIP) in communities surrounding O'Hare and Midway. The program is the largest and among the most established in the world and has provided approximately \$280 million in federal and airport funds to sound insulate 116 schools with an additional .4 schools in process around O'Hare and approximately \$103 million in federal and airport funds to sound insulate 39 schools with an additional 2 schools in process around Midway. The SSIP is designed to reduce aircraft sound levels in schools and create a guieter learning environment for students surrounding the airports. School sound insulation may include noise attenuating windows, additional roofing and ceiling insulation, improved doors, and related measures intended to reduce the transmission of aircraft noise into schools.

Discussion Topic 7: Energy and Water Use Reduction

Alternative Strategies and/or Best Practices:

Current or conventional practice for this application:

In 2010 the CDA began a program to replace incandescent light fixtures in the Terminal Pedestrian Corridors with more efficient fluorescent light fixtures; reducing the number of overall fixtures by 20% and energy consumption by nearly 80%, while still increasing ambient light levels throughout the corridors. The CDA continues to replace incandescent airfield lighting with energy efficient light emitting diode (LED) lights, including taxiway edge, centerline, and Elevated Guard Lights. The CDA is also testing energy efficient options for roadway and bridge lighting, including LED and induction lights.

The CDA requires all project to maximize water efficiency within building to reduce the burden on municipal water supply and wastewater systems; and to limit of eliminate the use of potable water for landscape irrigation. The CDA only plants drought tolerant, low maintenance plant species and fescue turf to reduce the need for irrigation.

The CDA is modernizing airport restroom facilities by installing high efficiency faucets, toilets, and urinals to conserve water and energy.

The CDA installed liquid disposal stations at select high-volume security checkpoints at both airports. The stations provide a method to dispose of liquids prior to entering the security lines, which has provided a dramatic reduction in the weight of liquids to the waste stream, thereby reducing disposal costs.

In 2010, the CDA began testing a filter water bottle refill station for passenger who previous emptied their water containers before entering security. This allow passengers to refill the same bottle at the filtered water refill station after clearing security and will provide passengers a convenient way to stay hydrated and reduce the number of plastic bottles sent to the landfills.

In 2010, twenty-four AeraVironment AVX1000 wind turbines were installed atop the Elevated Parking Structure at Midway. Each turbine has a height of approximately 8 feet and is capable of producing 1 kilowatt of power. Annual savings for the turbines are estimated at greater than \$9,000 from using wind instead of conventional power.

Describe costs and financial impacts (order of magnitude if detailed cost information unavailable):

Annual savings for from the wind turbines at MDW are estimated at greater than \$9,000 from using wind instead of conventional power.

Discussion Topic 8: Balanced Earthwork Management Plan

Alternative Strategies and/or Best Practices:

Current or conventional practice for this application:

The OMP is a multi-phased program that includes the construction and commissioning of four new runways and the extension of two others. These runway improvements will require the relocation of existing soil and pavement materials. Some of this soil had been stockpiled in berms by previous airport projects including projects that pre-date the start of the OMP. The remaining soil quantities and pavement demolition materials will be generated by design cuts and fills. The FAAs Environmental Impact Statement noted that the OMP will manage its earthwork movements within the boundaries of O'Hare International Airport property as defined on the Future Airport Layout Plan.

Discussion Topic 9: Sustainability Evaluation and Recommendation Team (SERT)

Alternative Strategies and/or Best Practices:

Current or conventional practice for this application:

SERT was created to assist in continuing the sustainable efforts of the Airport and to evaluate and recommend new sustainability initiatives and ideas for potential applicability and implementation at ORD and MDW. SERT is comprised of representatives from numerous division of the CDA.

The purpose of SERT is to:

- Enhance the airport environment through incorporation of sustainability initiatives
- Seek grant incentive and rebate opportunities for projects
- Review green products and services for applicability and benefits to ORD and MDW
- Collaborate on sustainability initiatives with other City Departments

Does this initiative meet the facility's definition of sustainability? Why or why not?

Yes – it demonstrates CDA's commitment to sustainability and the involvement of various stakeholders to implement cutting edge sustainability measures.

Discussion Topic 10: Construction Recycling

Alternative Strategies and/or Best Practices:

Current or conventional practice for this application:

Construction waste generated as part of the OMP is used on other non-OMP related projects or hauled away to nearby debris sorting facilities to maximize the recovery of materials. As of December 2010 over 500,000 tons of materials have been recycled.

Concrete: crushed aggregate is sorted for reuse, steer rebar is extracted and recycled Other recycled construction items include: bricks, scrap metal, light bulbs and landscaping
ACRP 02-22 – Case Study Interview Form

Airport/Facility Name: Sustainable Material Usage on Chicago Department of Transportation (CDOT) Projects

Date: March 30, 2011

Contact Phone and web address: (312) 744-3600; http://www.cityofchicago.org/city/en/depts/cdot.html

Discussion Topic:

1. Sustainable Materials on CDOT Projects

Synopsis of Sustainability Programs, Policies, Processes, Technologies, and/or Equipment:

The Chicago Department of Transportation is responsible for planning, design, construction, maintenance and management of public-way infrastructure projects. CDOT projects include some of the most heavily trafficked public spaces in Chicago, where usage takes an incredible toll on architectural materials. Subways, train stations, plazas, bridges, and underpasses name of few of CDOT's projects that are regularly exposed to harsh weather conditions, heavy pedestrian and vehicular traffic, and the potential for vandalism. Many consider sustainable materials to be ones that are made from recycled materials or ones that can be reused at the end of their useful life. There's no doubt that these materials are sustainable, but building owners often underestimate the benefits of low-maintenance, long-lasting materials that can add life to a building and greatly reduce operating costs for maintenance or replacement.

Over its existence, CDOT has tested the integrity of materials in its harsh public environments and generated a collection of architectural materials robust enough to pass the test of time. Years of evaluation and lessons learned regarding the performance of materials in public environments can provide much advice to airports considering the use of long-lasting materials in public spaces at airports.

CDOT's preferred list of materials includes:

- Granite diamond 10 finish instead of velvet; exterior flamed, 1 ¼" thick, up to 2" for custom areas
- Concrete treated with sealers and/or cleaners
- Structural Glazed Faced Tile Block (SGFT) 4" wythe SGFT with mortar joints raked back ³/₄" and replaced with epoxy grout
- Precast Concrete treated with sealers and/or cleaners
- Stainless Steel type 304 interior, type 316 exterior
- Glass Bullet-proof and/or vandal-resistant glass with 3m film

Facility's definition of sustainability:

One of CDOT's main goals is to build projects that will last, and projects that do not require major maintenance or repair for 50-100 years are inherently sustainable. In regards to material sustainability, CDOT is concerned with selecting high quality materials to ensure the longevity of a project's life. CDOT understands the importance of building spaces and structures made of materials that last. They are willing to install the appropriate materials to ensure a project will require minimal maintenance and last 50-100 years. The result is potentially millions of tax dollars saved in maintenance and replacement costs.

How do initiatives achieve or meet that definition?

CDOT has tested architectural materials over decades to generate a set of standard materials that can withstand the demands of their public environments. Years of successful CDOT projects have helped give Chicago the reputation as the metropolitan mecca for architecture and engineering that we're familiar with today.

Detailed Notes about Discussion Topic:

Discussion Topic 1: Sustainable Materials on CDOT Projects

Alternative Strategies and/or Best Practices:

Current or conventional practice for this application:

Conventional building owners do not necessarily generate a set of standardized materials. This may result in a lack of continuity among projects that can generate maintenance and operations issues for building owners. Maintenance staff struggle to maintain dozens of unique maintenance situations and building owners pay the price. Conventional building owners also may not consider that the benefits of using robust materials will outweigh having to conduct major maintenance on inadequate materials within 10 years of a project's completion.

Recommended practice for this application:

CDOT has generated a collection of versatile and beautiful materials that maintain the robust characteristics required of their applications to public spaces. Years of study, experimentation, and testing have allowed CDOT to determine which materials have performed for their desired applications. A dedication to appropriate material selection can greatly benefit a building owner who is interested in long-lasting buildings. For building owners like an airport or CDOT that manage numerous buildings, a standardized set of proven materials can streamline maintenance over the life of those buildings. Ordering replacement components and repairs is efficient when the maintenance staff is familiar with the standardized materials and construction techniques.

Describe benefits:

The benefits of using sustainable robust materials are two-fold: reduced maintenance and a long life of beauty. CDOT understands the importance of preserving the integrity of their projects through the use of robust materials. The resulting projects last longer without needing major maintenance than comparable projects that did not use the highest quality materials. Reduced maintenance translates to tax dollar savings for Chicago to spend elsewhere on public good. These materials also preserve the beauty of the project so that 50 years after completion, they still look like new.

Describe whether the anticipated benefits were achieved and explain why/why not:

CDOT has abundant successful infrastructure projects in Chicago that serve millions of occupants every year. Projects that require less maintenance give the opportunity to put the extra tax dollars to good use. The standard materials used by CDOT like glazed tile and stainless steel create the opportunity for the beauty and creativity that can be seen in recent CDOT projects such as the South Loop Transfer Tunnel at the Roosevelt Red Line CTA Station and renovated CTA Brown Line Elevated Stations. CDOT has armed designers with years of experience and a wealth of knowledge to guide their creative designs to create beautiful public spaces. Anyone who visits Chicago can

understand that the benefits of careful material selection pay off by creating a beautiful city.

Describe costs and financial impacts (order of magnitude if detailed cost information unavailable):

The up-front cost of a typical CDOT project is generally higher due to the use of robust, attractive materials like granite, SGFT, and stainless steel. CDOT understands the importance of preserving the integrity of their projects through the use of these materials and is not likely value engineer materials to save on up-front cost.

Describe life-cycle, return-on-investment, or payback cost analysis (if any prepared):

The financial impact of using long-lasting materials is not specifically being tracked by CDOT. The return-on-investment is in the form of decreased maintenance and a reduced potential for replacement over the life of a project. For example, a conventional hollow metal door and frame costs \$950, but needs to be re-painted roughly every 5 years and completely replaced after 20-30 years. A stainless steel door costs \$2,750, but can last with minimal maintenance for 50+ years.

Identify the source(s) of funds used to support this initiative (e.g., AIP, PFC, other airport revenue, bonds, grants):

CDOT projects use Federal, State, and City of Chicago tax dollars to fund projects. While there are not specific grants dedicated to the use of sustainable materials, the associated tax dollar savings are a responsible use of public funds that allow that money to be utilized elsewhere for public good.

Describe how the facility tracks the financial impacts of this initiative. Are projected goals being met? Why or why not?

CDOT does not track the financial impacts of material selection. It is simply a standard practice that was adopted decades ago.

ACRP 02-22 – Case Study Interview

Airport/Facility Name: Denver International Airport (DEN)

Date: 3/15/11

Contact Phone and web address: 303-342-2000, http://business.flydenver.com/community/enviro/index.asp

Discussion Topics:

- 1. Aircraft Deicing
- 2. Waste Management
- 3. Recycling
- 4. Grease Recycling
- 5. Composting
- 6. DEN Social Programs
- 7. Solar Power
- 8. Operations
- 9. Construction Measures
- 10. Sustainability Management Plan
- 11. Energy and Emissions Reduction
- 12 Environmental Management System

Synopsis of Sustainability Programs, Policies, Processes, Technologies, and/or Equipment:

Systematically manage environmental aspects to identify opportunities for continual improvement.

Maintain systematic programs to support continued compliance with all applicable regulations.

Enhance material and energy efficiency and pursue pollution-prevention opportunities.

Foster environmental stewardship at all levels within the organization.

Grow their business and their facility in an environmentally and economically sustainable manner.

Engage their business partners to support DEN's environmental commitment.

Recognize and take advantage of opportunities to derive business value from improved environmental performance.

Facility's definition of sustainability:

Meeting the needs of the present without compromising needs of the future.

How do initiatives achieve or meet that definition?

Detailed Notes about each Discussion Topic:

Discussion Topic 1: Aircraft Deicing

Current or conventional practice for this application:

There are dedicated deicing pads and a deicing fluid collection, conveyance and storage site, and glycol recycling facility. DEN captures about 70 percent of the aircraft deicing fluid (ADF) that is applied to aircraft. This is the best ADF capture rate in the United States. In 2009-2010 deicing season 1,376,267 of glycol was collected, 50 million gallons of stormwater contaminated glycol was sent to Metro.

Of the aircraft deicing fluid applied, we collect 70%; of that 70% collected, 72% is recycled, 28% sent to Metro, and less than 1% in landfill (these are 2009-2010 numbers). Generally inland takes everything above 1%, typically deice pads piped to Inland, ADF at gates and Cargo go to ponds that then goes to Metro.

Discussion Topic 2: Waste Management

Current or conventional practice for this application:

In 2010, 11,000 tons were diverted from landfill, which accounts for 14% of the total waste at the Airport. The Airport currently uses a single waste stream, but separates cardboard products.

Describe any quantitative goals or metrics used to evaluate the success of this project or program:

The goal of DEN is to be Zero Waste by 2020.

Discussion Topic 3: Recycling

Current or conventional practice for this application:

DEN recycled more than 1,400 tons of municipal solid waste in 2009 that otherwise would end up in the landfills. Cardboard alone accounted for 663 tons of recycled material in 2009. Twenty-three different types of waste are recycled at DEN.

The current price of recycling goods is \$60 per ton. There are 15-17 large green recycling bins located throughout the Airport. DEN provides cardboard compactors for tenants. DEN gets \$70-80 per ton of cardboard.

300 tons per year of recycled scrap material is being diverted from the landfills.

Discussion Topic 4: Grease Recycling

Current or conventional practice for this application:

At DEN, grease is collected and recycled by a contractor (Darling) and sold to third parties. The sold grease is used for biofuels, dog food, and makeup.

Discussion Topic 5: Composting

Current or conventional practice for this application:

There are composting containers in 11 employee lunchrooms and compost is collected from more than 15 food vendors. A1 Organics collects the composting piles three times a month and it averages 10 tons per month that are recovered.

Discussion Topic 6: DEN Social Programs

Current or conventional practice for this application:

Denver maintains many social programs including: DEN Art Program Blood Drives Children's Christmas Holiday Party Cancer Buddies Paint-A-Thon DEN Wellness Program Blood Drives Carpool and Value Pass Program Employee Gym

Discussion Topic 7: Solar Power

Current or conventional practice for this application:

DEN has three solar arrays at the Airport. All solar projects were developed through a public-private partnership and are part of Xcel Energy's Solar Rewards Program.

Pena Boulevard Array (Solar I)

- 2 Megawatt facility (DC)
- 7.5 acres
- 9,254 solar panels at 216 watts/panel
- Generated 3.3 million kWH year 1

Fuel Farm Array (Solar II)

- 1.6 Megawatt facility (DC)
- 9 acres
- 7,392 panels at 216 watts/panel
- DEN fuel farm and distribution
- Expected to generate 2.4M kWh year 1

2010 Project (Solar III)

- 4.3 MW facility
- 30 acres

Solar I DEN then buys the energy and sells it to the Utility companies (Xcel). Solar II – DEN buys from owner and feeds the fuel farm...fuel farm pays utility bill which is typically 0 kWH, but there are still some other charges. Solar III DEN buys from owner and feeds Lift Station I... utility bill which is typically 0 kWH, but there are still some other charges. The draw at Lift Station 1 is so low that most gets plugged back into the grid.

Discussion Topic 8: Operations

Current or conventional practice for this application:

In terms of field maintenance, there are updated airfield sensors (sensors are used to measure temp and precip, and are useful for pavement deicing not aircraft deicing) and the extensive glycol recovery system. The deicing system was something DEN had planned from the very beginning.

Discussion Topic 9: Construction Measures

Current or conventional practice for this application:

In terms of field maintenance, there are updated airfield sensors (sensors are used to measure temp and precip, and are useful for pavement deicing not aircraft deicing) and the extensive glycol recovery system. The deicing system was something DEN had planned from the very beginning.

Construction Activity is expected to have Dust Control Measures in place and a composting pilot program is complete.

Discussion Topic 10: Sustainability Management Plan (SMP)

Current or conventional practice for this application:

There is a SMP currently underway.

Discussion Topic 11: Energy and Emissions Reduction

Current or conventional practice for this application:

- Anti-idling campaigns
 - No idling message on fuel pump system
 - "Engines OFF!" air fresheners
 - No Idle Zone signage
- Replacement of gasoline vehicles in favor of CBNG, electric and hybrid vehicles
- Engine retrofits
- Carpool and public transportation incentives
- Lighting retrofits
- Hybrid taxi fee reduction program
- Vehicle re-programming to auto shut-off within 5-10 minutes

Discussion Topic 12: Environmental Management System

Current or conventional practice for this application:

DEN was the first international airport in the United States to design and implement an ISO 14001-certified environmental management system for an entire airport.

Wrap-up Questions:

What programs or initiatives are next on the horizon? What are your shortterm and long-term goals (including Net Zero goals)? How will benefits or results be measured and verified?

DEN has goals to:

- Expand the composting program
- Encourage concourse recycling
- Modify the parking garage lighting
- Take further measures for energy reduction
- Implement a formal Sustainability Policy
- Develop a Sustainability Checklist that is more user friendly
- Create a Sustainability Report Card

General Notes

Many of the initiatives taken at DEN are policy driven and directed from the City/Mayor/County.

ACRP 02-22 – Case Study Interview

Airport/Facility Name: Dallas Fort Worth International Airport (DFW)

Date: 3/7/11

Contact Phone and web address: 972-973-5560; <u>http://www.dfwairport.com/sustainability/index.php</u>

Discussion Topics:

- 1. Sustainability Manager Position
- 2. Success Stories
- 3. Sustainability Message
- 4. Employee Education
- 5. Green ITS Initiative
- 6. Solar Panels
- 7. Integration into the Organization
- 8. Operations & Maintenance
- 9. Resources outside of aviation community
- 10. Continuous Commissioning
- 11. Contractors
- 12. Executive Responsibility
- 13. ACRP Guidebook
- 14. Identifying Solutions
- 15. Live Well Program
- 16. Operations
- 17. Water Sense
- 18. Recycling

Synopsis of Sustainability Programs, Policies, Processes, Technologies, and/or Equipment:

Vision Statement: DFW International Airport – Connecting the World

Mission Statement: DFW International Airport will provide their Customers outstanding facilities and services, expanding global access and economic benefits to those they serve.

Primary Business Goal: Grow the core business of domestic and international passenger and cargo airline service.

Key Results:

- Cost Competitive
- Customer Satisfaction
- Operational Excellence
- Employee Engagement

Beliefs:

- You're Important!
- Own It!
- Step Up!
- Reach Out!
- Innovation Wins!

Facility's definition of sustainability:

Sustainability is a journey.

Sustainability is not a thing that they do, but a way that they do.

Sustainability is more than just LEED.

Sustainability is a mindset, not a thing.

Sustainability is not the end, it was a means to the end.

Sustainability = Business Model

Sustainability is the norm.

How do initiatives achieve or meet that definition?

Sustainability is embedded into the fabric of the mission statement, business goals, key results and beliefs.

Detailed Notes about each Discussion Topic:

Discussion Topic 1: Sustainability Management Position

Current or conventional practice for this application:

DFW is currently in the process of recruiting a Sustainability Programs Manager. It is a full time position where they are looking for an employee who can devote their efforts to making sustainability a key priority in their organization and increasing the amount of community outreach and communication with the employees to make sustainability personal to them.

A Sustainability Manager does not have to be a sustainability guru but they should be someone that is able to influence others and solicit buy in from employees.

Discussion Topic 2: Success Stories

Current or conventional practice for this application:

There are many success stories within the organization and people to a large extent are naturally grasping the policies. DFW recognizes that this is due in part to sustainability is more prevalent in the employees everyday life outside out of work.

Due to the message being so prevalent at the Airport and the consistent messaging, the Communications Department has started adding sustainability information to their content without being prompted.

Through the lessons they have learned they are able to continue to move along through the Sustainability Schematic.

Discussion Topic 3: Sustainability Message

Current or conventional practice for this application:

DFW makes sure that employees receive consistent messaging in terms of sustainability by following the 4 Key Results and 5 Core Beliefs. It is an overall unifying theme that fits together.

The implementers have faced small hurdles in other staff members organization wide not being as receptive to the message if they feel they are being told what to do. A positive has been that no one thinks that sustainability is a bad thing so it is harder for them to say 'no' and obstruct progress as it would put them in a position of risk. Who is against the environment?

The Sustainability Schematic is still in place but it is an ongoing challenge to keep up without maintenance and new players need to be educated. DFW is considering the development of recommended base readings for construction program managers so they are up to speed.

It is important that the intent of the message is being received properly by the intended audience.

Describe the driving force(s) (e.g., manager, champion, or external advocate) behind this initiative. Describe how the decision was made to pursue this initiative. Identify any tools or models used. Draw a flow chart or schematic of the process, as appropriate.

Jim and Rusty have been the long-term driving factors in the sustainability movement at DFW.

Jim has been an Executive Vice President since 1998 and is the executive champion while Rusty has been the implementation champion.

Discussion Topic 4: Employee Education

Current or conventional practice for this application:

DFW posted sustainability information on their intranet site so it is available to all employees.

When people change out jobs or take on new responsibility they need to be educated. The example was given that the organization and the goal of sustainability is like a forest and the individual employees need to be shown where they fit in that forest (i.e seeing the forest rather than the individual trees).

Environmental Stewardship Training is currently a part of new employee training. In 2011 DFW will be working towards Sustainability Education that will also be given to new employees.

Discussion Topic 5: Green ITS Initiative

Current or conventional practice for this application:

As other departments look to incorporate sustainability the IT department at DFW has invested in ipads for senior staff members as part of a larger paperless initiative.

Discussion Topic 6: Solar Arrays

Current or conventional practice for this application:

DFW tries to be committed to the triple bottom line so they previously have not had any solar photovoltaics because it is not very cost effective. Currently, with the aid of an ARRA grant, DFW is embarking on their first solar array.

Describe life-cycle, return-on-investment, or payback cost analysis (if any prepared):

There is no standard procedure for cost/benefit analysis but DFW is moving more towards life cycle analysis (stated in DFW's Sustainability policy). They have come a long way from the days of just a first look analysis.

Discussion Topic 7: Integration to the Organization

Current or conventional practice for this application:

By sustainability being accepted as the way business is done they are able to follow the triple bottom line in their everyday doings. An example was given of a conference room that was designed in a particular manner and cost around \$15,000. When it came time to build out the conference room the contractor did not follow the plans at all, so the product they ended up with was not what that had designed for. They should ask themselves why they are spending so much money when it is a waste to not see the project through as intended.

Discussion Topic 8: Operations & Maintenance

Current or conventional practice for this application:

For any projects outside of terminal development LCA and maintenance assessments are performed.

Discussion Topic 9: Resources outside of aviation community

Current or conventional practice for this application:

Rusty is a member of various organizations outside of the aviation community and is an active participant so DFW can learn through cross-pollination from planning/architecture activities to the sustainability as it applies to the Airport.

Most DFW employees are members of non-airport organizations because that is where the knowledge is. By imparting what they've learned to their peers that aren't as empowered they are teaching as well. The bottom line is they look for ideas that have mutual value and question if it supports DFW's missions and goals.

The Airport went external to seek out examples from other industries and decided how it translates to DFW, they calculated the cost benefit, and held an objective review. All of this led to creative solutions.

Describe benefits:

Working relationships formed can provide an avenue for awards that DFW is eligible for or may be nominated for. At DFW awards that have been won are often showcased in the various office buildings rather than the main executive administration building.

Awards are just confirmation of their efforts and motivate people to want to do more.

Identify the source(s) of funds used to support this initiative (e.g., AIP, PFC, other airport revenue, bonds, grants):

There are grants available all over the place outside of the just the FAA. There are DoE, ARRA, etc. grants.

Does this initiative meet the facility's definition of sustainability? Why or why not? Yes because it is a way of doing business not an additional measure that has to be taken.

Discussion Topic 10: Continuous Conditioning

Current or conventional practice for this application:

Through the use of Continuous Commissioning DFW is able to actively track big rock items and focus on energy oriented savings. The process that they use was developed at Texas A&M by faculty and licensed professionals. It is now being applied to the Terminal Renewal Program and gives hard data and real savings to show the initiatives delivered as they were intended to.

Previous Continuous Commissioning has shown that the Rental Car Facility is achieving 20% energy savings over a baseline condition with a 50% ROI and the Administrative Building is showing 38% energy savings with a 100% ROI.

Describe benefits:

An additional benefit is through Continuous Commissioning they are able to address daily comfort of employees and adjust accordingly for a more comfortable indoor environment.

Describe whether the anticipated benefits were achieved and explain why/why not:

Yes they were achieved because they take into consideration the comfort level of employees while that are at work.

Describe costs and financial impacts (order of magnitude if detailed cost information unavailable):

On average, Continuous Commissioning has saved DFW \$1/sq. foot with a total program ROI in excess of 50%.

Identify the source(s) of funds used to support this initiative (e.g., AIP, PFC, other airport revenue, bonds, grants):

Funding for the Continuous Commissioning is pulled from the O&M budget based on the ROIs and in the case of temperature adjustments to staff buildings has resulted in immediate savings.

Discussion Topic 11: Contractors

Current or conventional practice for this application:

Contractors have their own staging sites for waste and are responsible for the separation of contaminated items, recyclable or reclaimable items.

DFW's philosophy is that they can start with the big items with contractors and teach them the smaller items along the way. It is an overall cultural change and is a continuous learning environment. What they have found is that there is some difficulty in taking interpretative line drawings and having the fieldworkers comprehend them, there is too high of a precision for a layperson. DFW needs to act as an interpreter and translate so it is easier for them to understand.

Describe benefits:

When everyone is on the same page there is less confusion as to the common goal they are working towards and less time and money will be wasted in the process.

Describe costs and financial impacts (order of magnitude if detailed cost information unavailable):

There will most likely be a reduction in cost because less time and money will be wasted.

Discussion Topic 12: Executive Responsibility

Current or conventional practice for this application:

DFW understands that there is a responsibility on the part of the top executives to support, champion and interact as an active member of the process. This can include things such as an upper level review of fixtures with the asset management team.

It is the executive component to understand where the junctions are and where decisions need to be made. The example of the while ceiling tiles in the terminal was given where it was up to Upper Management to step in and challenge the designer when they produced a design that fit the designer's needs but was not conducive to the operation and maintenance of the terminal. In this instance it was the executives' responsibility to make the architects think of the long term implication of their design on the maintenance. They had the architects walk the terminal with maintenance personnel to have a first hand look at what they would be dealing with. The goal is to produce a design that is aesthetically pleasing but also cost effective in order to lower maintenance costs.



Designers need to learn to appreciate the input given by operations and maintenance because they will assist in telling you how create better more functional designs.

Recommended practice for this application:

It is prudent to look at what you have in problems before you even enter the design stage.

Best practice for this application:

Include any stakeholders needed in projects and decisions. This can include designers, architects, construction managers, admin, IT, concessions, operators, maintenance, engineers, airlines, tenants, regulators etc.

Sustainability involves continuous learning and there needs to be a top down approach.

Do what you can and do better tomorrow.

The CEO needs to creatively and systematically reach out to all stakeholders, understand value streams, look beyond traditional avenues for grants, and conduct analyses (NPV, economic impacts).

Describe benefits:

This walk through practice has produced designs that are pleasing to the architect but also remain cost effective and lead to lower maintenance costs.

Describe whether the anticipated benefits were achieved and explain why/why not:

Yes, there is a lower maintenance for the final design rather than for the initial one produced by the architect.

Describe how the facility tracks the financial impacts of this initiative. Are projected goals being met? Why or why not?

Designers and Architects are not aware of the operations and maintenance costs that their drawings will create. This drives Continuous Commissioning and the need to have operators and maintainers provide input from the beginning of a project



Describe the driving force(s) (e.g., manager, champion, or external advocate) behind this initiative. Describe how the decision was made to pursue this initiative. Identify any tools or models used. Draw a flow chart or schematic of the process, as appropriate.

Jim Crites is a big advocate of the collaboration of maintenance personnel and architects to create a design that is both pleasing to all parties and cost effective.

Discussion Topic 13: ACRP Guidebook

Current or conventional practice for this application:

DFW would like to see this guidebook develop into mandatory reading for Airport Management and include a test that can verify people were educated.

Discussion Topic 14: Identifying Solutions

Current or conventional practice for this application:

Many energy inefficiencies are driven by the peak demand. DFW looks for clever things that can creatively address the part load efficiencies such as building to base loads and accommodating the peak rather than building to peak levels. Although unconventional, it is more energy efficient.

Treat projects as a continuous learning loop. Previously architects didn't know what they were doing wrong because they never receive feedback. In normal situations they complete the design work and move on to the next project. By providing them feedback on what did or did not work they were able to not only apply these lessons learned to future DFW projects, but to their other projects.

Discussion Topic 15: Live Well Program & Wellness Center

Current or conventional practice for this application:

The goal is to strengthen the link between personal and organizational health. The program keeps the well being of the employees in mind but also helps to lower the health care costs that DFW would incur if employees are not in their optimal shape. It also fosters employee engagement.

Describe benefits:

Employees are in better physical condition and feel better about themselves.

Describe whether the anticipated benefits were achieved and explain why/why not:

Yes, employees are actively participating in the program and taking advantage of what it offers to better their health.

Describe costs and financial impacts (order of magnitude if detailed cost information unavailable):

A healthier employee leads to less medical costs that DFW would have to pay.

Does this initiative meet the facility's definition of sustainability? Why or why not?

Yes it highlights the social aspect of the triple bottom line.

Discussion Topic 16: Operations

Current or conventional practice for this application:

DFW has redone their custodial specifications and it has produced a 50% savings while resulting in a much cleaner building for half of the cost and with a smaller carbon footprint to complete.

Discussion Topic 17: Water Sense

Current or conventional practice for this application:

DFW's participation in the EAP Water Sense program came about when Region 6 EPA contacted DFW based on what they hard heard about the publicized terminal redevelopment program (restroom renovation with water efficient fixtures). This was a success for DFW in that they now have others approaching them on projects and initiatives.

Discussion Topic 18: Recycling

Alternative Strategies and/or Best Practices:

Current or conventional practice for this application:

The air cargo carriers have been incorporated into the recycling program. Airlines such as American are also looking to be included as well.

For different aspects of the program there are different stakeholders that are accountable for the costs.

Wrap-up Questions:

What programs or initiatives are next on the horizon? What are your shortterm and long-term goals (including Net Zero goals)? How will benefits or results be measured and verified?

Future projects include:

- Renovations to the Environmental Affairs Building
- Ground source energy/geothermal
- Rampmaster modular fueling equipment
- Identify heating/cooling energy to do work that they are doing otherwise
- Identify what the cost of the peak energy demand is and offset them with combinations of other initiatives
- Solar power

DFW is working on additional community outreach.

Describe challenges, difficulties, or uncertainties facility had to overcome:

In order to solicit participation from employees it has been stressed that everyone can contribute. The tool of empowerment lets everyone feel as if they have a voice and a vested interest in the success.

Sustainability needs someone with disciple that is willing to say no and send people back to the drawing board.

What advice would management offer another facility?

Extrapolate benefits realized from previous projects and use that knowledge on projects moving forward.

Determine if marginal benefits can be achieved in the short term and look for partial solutions.

Airports need to question themselves as to where there is knowledge and challenge themselves to advance the bar.

Airports should track their record of success (especially on stewardship) and create and informal, off the record on how it could be more implementable and have a real world value to it. This will ultimately lead to less pushback and faster implementation.

Normalize what you are doing so that it becomes the nature of your business.

Airports are a great demonstration platform for their communities. There is a large amount of passengers that pass through the Airport everyday and it is the perfect audience for pilot projects.

General Notes

DFW is doing something right if they have the lowest costs and highest customer service rating.

ACRP 02-22 – Case Study Interview

Airport/Facility Name: Fort Lauderdale – Hollywood International Airport (FLL)

Date: 3/8/11

Contact Phone and web address: 866-435-9355; <u>http://www.broward.org/AIRPORT/COMMUNITY/Pages/Environment.aspx</u>

Discussion Topics:

- 1. Green Airport Initiative
- 2. Operations
- 3. Sustainability Program
- 4. Staff Training
- 5. General Funding
- 6. ACRP Sustainability Guidebook
- 7. Coordination with Broward County
- 8. Initiatives that Preceded GAI

Synopsis of Sustainability Programs, Policies, Processes, Technologies, and/or Equipment:

FLL has previously completed a Green Airport Initiative but it now is taking a prudent look at their Airport operations while trying to take into consideration community concerns.

Sustainability items that FLL would like to look into include; air, water, waste, recycling, noise, energy reductions, and emission reductions.

Facility's definition of sustainability:

FLL is just getting in to developing a mission statement.

Detailed Notes about each Actual Discussion Topic:

Discussion Topic 1: Green Airport Initiative (GAI)

Current or conventional practice for this application:

The Green Airport Initiative Study began in 2005 and was completed in 2007. The purpose of the study was "to create a collaborative program that identifies innovative approaches to protecting the natural environment above and beyond Federal, state, and local regulatory requirements." The goal was to "identify priority research and an overall environmental strategy that can yield benefits during a period that spans the next several years to several decades."

Over the course of the program an environmental footprint for FLL operations was established by evaluating; water quality, solid waste, air quality, energy consumption and noise.

The study included an investigation of air emission impacts on the community; the feasibility of utilizing recycled vegetable oil as vehicle fuel; identification of water reduction opportunities and recommendations; an evaluation of FLL's energy supply, distribution and conservation opportunities; solid and hazardous waste reduction opportunities and recommendations; and investigations related to reductions in harmful air emissions.

Describe benefits:

As part of the GAI, the Airport was able to put in place a comprehensive listing of environmental reports. Moving forward Broward County now incorporates LEED initiatives in to every new construction or renovation project at the Airport. As a result of the program it has also added recycling bins throughout the airport's common areas that aid in source separation and increase public awareness of on-site recycling; motivated the Airport to move forward with BMPs and Sustainability Guidelines, retrofitted its irrigation system to reduce water use, revamped the parking garages with energy efficient lighting; incorporated preconditioned air conditioning and 400 htz electrical supplies into its passenger loading bridges to reduce overall emissions; installed energy efficient chillers; and incorporated high albedo value roofing materials into its terminal reroofing projects to increase reflectivity and decrease energy use and air conditioning costs. Additionally at a Master Plan level; some examples include: looking at airfield configurations and design that sought to minimizing runway occupancy time and terminal construction alternatives identified layouts that would efficiently utilize space to help reduce future Operation and Maintenance costs.

Describe whether the anticipated benefits were achieved and explain why/why not:

One of the challenges that FLL had with the GAI is that the program was domiciled within the Environmental Section which was a subcomponent of Planning and Development Division. As such in this administration the Environmental Section had little influence on implementation of capital projects (i.e. a parking garage renovation). The Environmental Section normally has a compliance review of a project at conception but they had no direct influence through the design or construction process. With a reorganization, the Environmental Section became part of a larger division of Planning & Environmental. In this organization environmental initiatives have become part of the Planning and Programming elements of development process and are better integrated into the design and construction where appropriate. Management is currently working

through the project process to further integrate the sustainability practices at earlier stages of the development process, and throughtout the life of capital projects. The sustainability initiative also seeks to expand environmental initiatives beyond the airport development process and engage the entire Aviation Department's organization on multiple goals objectives and tasks.

Does this initiative meet the facility's definition of sustainability? Why or why not?

In the eyes of FLL, the GAI has created a fundamental framework moving forward in their sustainable efforts. It was an important step forward to build a foundation of sustainability plan.

Discussion Topic 2: Operations

Current or conventional practice for this application:

FLL underwent an Airfield Refinement Plan that developed an airfield layout of the Airport to reduce the amount of time planes spend taxiing. Hi Speed exits and airfield taxiway circulation was developed to minimize runway occupancy and taxiing time.

Discussion Topic 3: Sustainability Program

Current or conventional practice for this application:

The GAI laid the framework for FLL's developing Sustainability Program. FLL is working not just to focus on environmental compliance, but to maintain a balance between the environmental, social and economic aspects of their operations. The new approach of this initiative is to have sustainability initiative transmitted through the organization from the Executive branch to all levels of the Divisions.

FLL hopes that this top down approach will incorporate sustainability into the organization as a whole and not just the Environmental Section, It is hoped that this will achieve buy in and direction from the top administrative levels down to other groups within the Airport. Each employee would be able to see what part they play in the overall program and see the importance of their role and daily tasks.

The program will be something that is organization wide and filtered down to the different divisions through vaguely touching on past work but also determining where they want to be in the future. A Sustainability Program provides a platform for FLL to pursue other green opportunities which may include:

- Sustainability Initiatives in Administration
- Sustainability Design Guidelines
- Sustainability Construction Guidelines
- Sustainable Operation and Maintenance Procedures
- Sustainability Initiatives with Tenants and Leases
- Intermodal Connectivity at the Airport
- Additional green areas on the Airport
- Renewable Energy

A structured program would include a Sustainability Management System that can aide FLL in distributing the ownership amongst the various divisions so everyone is empowered and accountable for the success of the program. As sustainability is

disseminated across the organization everyone is part of the process. In addition, with all information in a common location accessible to everyone reporting efforts can be simplified and it will be easier to spot where adjustments are needed.

FLL is looking to rollout the SMS in around a year after which they will identify individual goals and objectives for each division that will be linked to the Broward County objectives.

Describe life-cycle, return-on-investment, or payback cost analysis (if any prepared):

Currently there are no metrics in place to measure this, but FLL would like to explore determining the lifecycle costs of their building maintenance.

Describe the driving force(s) (e.g., manager, champion, or external advocate) behind this initiative. Describe how the decision was made to pursue this initiative. Identify any tools or models used. Draw a flow chart or schematic of the process, as appropriate.

With the close coordination to other offices within Broward County, FLL hopes that the rollout of the SMS will have a point person within each division that will be able to champion the projects.

Discussion Topic 4: Staff Training

Current or conventional practice for this application:

FLL recognizes that an important part in achieving success in their Sustainability Program involves internal education. There is a recognition with a new initiative there may be some staff members who are hesitant to fully embrace the sustainably efforts at the Airport because their current workload. The goal is however to incorporate sustainability into existing core tasks of employees as a philosophy. Executive management feels the path towards sustainability needs to be embraced organization wide. Additionally the Executive Management is trying to convey the message that they are not re-inventing the wheel, and that many best management practices are currently in place, some may need futher refinement and other standards and metrics need to be set for further improvement. An additional component is that many practices are not always broadcast as part of a comprehensive Outreach program. As such the organization as whole may lack an understanding of what has been achieved and what vision there is for future sustainable initiatives..

Recommended practice for this application:

The next step for FLL in their Sustainability Management is employee training on their overall education; on their own habits and how they affect the organization. Outreach is both good public relations and makes employees feel good about where they work and that their employer cares about them as a person.

In new hires they are looking for people that can handle the coordination of sustainability into the different aspect of the organization as an expected part of their daily duties.

Discussion Topic 5: General Funding

Current or conventional practice for this application:

FLL is currently pursuing grants but most initiatives that are currently in place or that have been enacted are out of FLL's operating and capital budget.

Discussion Topic 6: ACRP Sustainability Guidebook

Recommended practice for this application:

FLL would like to see some sort of how-to manual produced for airports particularly in the areas of how to fund sustainability projects/initiatives. Also, they feel it would be helpful to have a laundry list of items that would assist in assessing a project that is sustainable. It would also be important to see how to gauge and convey a cost/benefits analysis that was perhaps non-traditional beyond finance terms and captured an understanding of the balance between economic, environmental and social initiatives. The external help of the guidebook would help their organization even though the ultimate accountability would fall to the internal staff members.

The industry is in need of a guidebook because the information that is currently is not comprehensive and consistent.

Discussion Topic 8: Initiatives that Preceded GAI

Current or conventional practice for this application:

Various practices were already in place prior to the GAI including:

- Development of Regional Impact document
- Use of a Cell phone lot
- Consolidated Rental Car Facility
- Fuel services all under one roof
 - Professionally managed
- Vegetated noise berm
 - Provides noise buffer and green area to neighboring communities
 - Material Recovery Facility
 - Handles waste and sorts on-site

Discussion Topic 7: Coordination with Broward County

Current or conventional practice for this application:

FLL is operated by Broward County, and is therefore tightly tied to the various offices and directives of Broward County as a whole.. Broward County does have a Sustainability Office which may serve as a resource in developing a sustainability program at FLL..

All new developments at the Airport must meet the County LEED requirements.

The Airport is tied to both the County and Florida growth management plans. The close connection and seeing FLL as part of the County allow for more fluid interactions.

Wrap-up Questions:

Describe any in-house training or coordination that supports this facility's sustainability program (including, but not limited to team building, staff education, employee training programs):

See Discussion Topic 4: Staff Training

What programs or initiatives are next on the horizon? What are your shortterm and long-term goals (including Net Zero goals)? How will benefits or results be measured and verified?

In addition to the Sustainability Program that FLL is looking to enact, they are also looking towards publicizing information on their website to advertise what the County and the Airport are doing. Some items to begin with may be; a link to the FLL Best Management Practices (BMPs) on a runway project, stronger community outreach regarding the developments at FLL, and outreach internally for the FLL employees.

As a whole, FLL wants to put something in place that will actually make a difference in daily habits and operations of the Airport.

Describe challenges, difficulties, or uncertainties facility had to overcome:

There has been push back from staff members because they feel the sustainability component is an added task to their daily duties but FLL is determined to build on existing success and demonstrate how many of the items they do today would qualify as sustainable and show that future initiatives can be incorporated within their daily efforts.

While some concessions and tenants already incorporate sustainability into their organization, FLL would like to be a leader and guide all of the other tenants as well. Over time some items may evolve in to language that is included in lease agreements.

What advice would management offer another facility?

For Airports that are not independently owned, by viewing the Airport as part of the Region (County/City/etc). rather than as a separate entity., In this approach you open the door for more interaction by other interested stakeholders that may lead to a better solutions and success rate in seeing sustainability initiatives/programs and efforts through implementation.

ACRP 02-22 – Case Study Interview Form

Airport/Facility Name: Ithaca Tompkins Regional Airport (ITH)

Date: March 17, 2011

Contact Phone and web address: 607-257-0456; <u>http://flyithaca.com/content/view/sustainable-airport-master-plan.html</u>

Discussion Topic:

1. Sustainable Master Plan

Facility's definition of sustainability:

A holistic approach to managing an airport that ensures economic viability, operational efficiency, natural resource conservation, and social responsibility of the airport.

Detailed Notes about Discussion Topic:

Discussion Topic 1:

Alternative Strategies and/or Best Practices:

Sustainability Master Plan

Current or conventional practice for this application:

In 1996, the airport's Master Plan was basically complete and a new plan was needed. The Airport Director suggested to their long time consultants (C&S Engineers) that the new plan should incorporate a number of environmental considerations. Ithaca is highly environmentally sensitive and broader political interests were already setting goals for greenhouse gas (GHG) reduction – a county plan [Tomkins County Comprehensive Plan] was being used as guidance for an airport plan. The consultants suggested producing a "Green" Master Plan.

An early step in the process was a meeting that was set up with FAA's Division of Environmental and Community Needs in the Airports Office (Ralph Thompson is the office director they met with). The Airport Director and the President of the engineering firm were among those who attended the meeting to convey the significance of their suggested approach to the new master plan. FAA supported the approach and suggested using the term "Sustainable" Master Plan. ITH thus was the first airport to develop such a plan. Having a sustainable master plan allows the airport to systematically incorporate sustainability into their actions, decisions, and investments and according to prioritized needs.

FAA subsequently initiated a 10-airport pilot program for developing sustainable master plans. A key decision in this process was to allow for Airport Improvement Program (AIP) funding to be used for developing Sustainable Master Plans. The engineering consultants also approached two local schools – Cornell University and Ithaca College – to support the plan development. Having student involvement gained widespread community and FAA support. The students undertook several stand-alone projects to support the plan development, including developing and implementing passenger surveys. The student involvement is presently at the "draft final" stage for a long menu of sustainability initiatives. Some initiatives are more theoretical than practical at this point, for example, adopting large, high performance diesel engines for fire trucks and snow removal equipment that exceed current best capabilities. However, their involvement has been quite positive.

The airport is prioritizing its efforts from a baseline emissions inventory. Ground support equipment (GSE) is one of the first targets. Airlines often deploy their oldest GSE at small airports and ITH would like to have a plan to accelerate GSE turnover and engine replacement for larger equipment to reduce emissions. They are presently looking to NY State Energy Research and Development Authority (NYSERDA) and FAA for grant funding for these actions.

One related activity is a move to go paperless with all key documents (e.g., reports, asbuilt drawings). The county has been putting their documents onto disk drives and offered to do the same for the airport. ITH is working with the FAA Regional Office (NY ADO) to confirm this work.

Sustainable Master Plan Implementation – ITH has a Stakeholder Committee that works in an advisory capacity. It includes airlines, tenants, and frequent flyers among others. They have also hired a part-time person to develop an implementation plan that summarizes the many discrete activities that are needed. To this point, the dates attached to the plan's targets (e.g., when things might be needed) are somewhat arbitrary.

The county's sustainability initiative is overarching the airports plan. The airport will prepare annual reports to the county on benefits achieved, which will initially be measured by fuel use. The benefits achieved are not yet tracked or quantified very carefully.

Does this initiative meet the facility's definition of sustainability? Why or why not?

Yes, it represents a holistic plan that touches on all stakeholders and meets the airport's environmental needs consistent with the community's environmental and social sensibilities.

Describe any quantitative goals or metrics used to evaluate the success of this project or program:

The Airport Manager believes ITH's sustainability master plan has already served as a positive example for other airports and the benefits will accrue widely. At the airport, the plan has stimulated a lot of people to look for and think about sustainability opportunities. Together these many small accomplishments will represent an overall significant benefit.

Example initiatives

• ITH is replacing their grass with a type of vegetation that requires less mowing, which will reduce the use of mowers that use diesel engines.

- The terrazzo flooring in the terminal has historically been covered with a coating that required regular polishing. They have now ground down the surface to expose the terrazzo, which is highly durable. This change will show a 2-year payback, significantly reduce the use of the coating material, eliminate the use of chemicals for stripping the floor, and eliminate regular polishing.
- The airport explored using a permeable pavement for a new parking area but found it was relatively costly. Since storm water runoff is not a problem in the Ithaca area, there was insufficient impetus to pay the differential cost.

Describe challenges, difficulties, or uncertainties facility had to overcome:

The most difficult component of the sustainable master plan was working thought the Stakeholder Committee. Many of the meetings were very intense. Many of the participants, particularly the professors, were experts and would challenge goals and objectives. This required the airport to develop very specific justification, which ultimately was a benefit. The Airport Direct or does not have any regrets over the process and would not organize or schedule the process differently if he were to do it over again.

The meetings were held irregularly and some who were invited did not attend regularly; for example rental car agency representatives and the FAA ADO. The following were topics of the meetings:

- Meeting 1 Kickoff and description of the process and goal of developing a sustainable master plan
- Meeting 2 Break-out sessions on various topics
- Meeting 3 Presentation of baseline and initial findings with discussion of the preferred alternative.
- Future Presentation of findings to the County Board, information displays in the terminal describing the process and outcome, and press releases.

What advice would management offer another facility?

Gaining community support at other locations might be much more difficult than it was in Ithaca.

Getting students and as many other outsiders as possible involved in the process was a great benefit.

General Notes

ITH Airport Director would like to see the ACRP 02-22 guidebook be a <u>simple</u> reference rather than a big, thick tome that requires an expert to review in detail.

He would like to see <u>practical</u> recommendations. For example, do not recommend solar panels without qualifying where they are economically feasible.

He would welcome examples of alternatives for reducing emissions from the large diesel engines that ITH uses in its fire and emergency response vehicles, snow removal equipment, and mowers.

See also: <u>http://www.sustainableITH.com</u>

ACRP 02-22 – Case Study Interview

Airport/Facility Name: Los Angeles International Airport (LAX)

Date: 3/1/11

Contact Phone and web address: 310-577-3400, http://www.lawa.org/welcome_LAWA.aspx?id=1036

Actual Discussion Topics:

- 1. Construction Mitigation
- 2. Air Quality
- 3. Recycling
- 4. Vehicles
- 5. Construction Activity
- 6. Noise Abatement & Mitigation
- 7. Community Benefit Agreement
- 8. Sustainable Guidelines
- 9. Operations
- 10. Water Conservation
- 11. Energy Conservation
- 12. Overall Funding
- 13. Sustainability Performance Improvement Management System
- 14. Environmentally Friendly & Socially Responsible Products
- 15. Promote Sustainability Awareness

Synopsis of Sustainability Programs, Policies, Processes, Technologies, and/or Equipment:

Los Angeles World Airports (LAWA) is a self-supporting department of the City of Angeles that operates and maintains three airports in the system: Los Angeles International (LAX), LA/Ontario International, and Van Nuys Airports. The sevenmember Board of Airport Commissioners that governs LAWA, appointed by the Mayor of Los Angeles, and approved by City Council, demonstrated top-down leadership when it adopted LAWA's Sustainability Vision and Principles. The Sustainability Vision and Principles form the foundation upon which LAWA's sustainability program is built. The Sustainability Vision and Principles also address communicating LAWA's outlook to its employees, tenants, suppliers, passengers, peers, and neighboring communities.

Building upon the Sustainability Vision and Principles, LAWA adopted the Sustainability Performance Improvement Management System (SPIMS) as its tool for setting sustainability objectives, implementing initiatives focused on those objectives, and providing continuous improvement in its sustainability activities. SPIMS provides a management system framework that facilitates LAWA's ability to enrich its sustainability performance through a process of continuous improvement.

The SPIMS process has six specific activities for integrating sustainability into LAWA's on-going operations. Each the following steps are continuously re-evaluated to ensure that LAWA stays on the leading edge of sustainability. SPIMS fosters awareness and encourages all LAWA employees to become actively involved in continual performance improvement in its day-to-day responsibilities. SPIMS builds upon existing processes and procedures to facilitate and coordinate continual sustainability improvements.

- 1 **Conduct Sustainability Assessment** LAWA formed Implementation Teams that assessed the status of LAWA's policies, procedures, programs, and initiatives and identified those areas that could be made more sustainable and encourage more sustainable behavior and practices.
- 2 Identify Opportunities From the Sustainability Assessment, LAWA's Implementation Teams identified those opportunities that could be more sustainable and encourage more environmentally-friendly behavior and practices
- 3 **Establish Objectives and Targets** From a review of the first two steps, LAWA established the fundamental objectives for achieving the principles outlined in the Sustainability Vision Statement and Principles, Green LA, Greening LAX Motion, and the Mayor's Directive. From these objectives, LAWA set targets that will lead LAWA into becoming the Global Leader in Airport Sustainability.
- 4 **Implement Initiatives** After establishing objectives and setting targets, LAWA's Coordinating Committee reviewed the initiatives identified by the Implementation Teams and chose initiatives that achieve LAWA's and these objectives. The Coordination Committee also outlined implementation plans

for the chosen initiatives that focused on interdivisional collaboration and the streamlining of time and cost efficiency.

- 5 **Monitor Progress** In addition to the new initiatives identified, LAWA, during the assessment phase, identified existing programs, initiatives, and projects that will help to achieve continuous improvement in sustainability performance and meet LAWA's objectives. These programs, initiatives and projects are monitored on a regular basis to track progress.
- 6 **Communicate Progress** As part of addressing the Social Responsibility aspect of sustainability, LAWA takes serious the need to keep everyone aware of the activities performed at LAWA. In addition to the mandate for annual update to the City Council on "Greening LAX" and the Mayor's annual Sustainability Report, uses its website, internal and external publications (LAXpectations, Aerogramme, etc.) to communicate progress.



It is planned that the SPIMS process outlined in the discussion and figure above will be integrated into every facet of LAWA's operations.

LAWA staff at all levels supports the champions in capturing the diverse skills and knowledge of LAWA's employees. The SPIMS organization is made up of the Champions, the Advisory Council, the Coordinating Committee, and six Implementation Teams. The Champions, Advisory Council and Coordinating Committee are permanent. The structure of Implementation Teams is not permanent. The Implementation Teams will meet for specific activities as directed by the Champions and/or Coordinating Committee. Each of these levels of organization has specific tasks to meet LAWA's sustainability vision.

- **Champion**: Provides vision and leadership.
- Advisory Council: Monitors the implementation SPIMS and sets direction of future activities.
- Coordinating Committee: Develops objectives, sets targets, prioritizes and coordinates initiatives, and monitors and reports progress,
- Implementation Teams: Form the heart of LAWA's Sustainability program. As previously stated, implementation Of SPIMS initiatives requires the engagement of staff throughout LOAWA. SPIMS fosters coordination of these efforts and provide added recognition of LAWA staff who work to achieve LAWA's sustainability

objectives. The Implementation Teams are comprised of LAWA staff who want to work on a specific improvement initiative. The Coordinating Committee and/or Advisory Committee provide direction and guidance, as necessary. The Implementation Teams assemble for a specific duration to achieve the sustainability objectives and implement initiatives. The Coordinating Committee summarizes and communicates the results of the Implementation Team's activities. Initial Implementation Teams chartered are:

- Water Efficiency: Addresses issues of potable water conversation, water efficient landscaping, and water re-use.
- Materials & Resources: Addresses issues of materials procurement and waste minimization and recycling.
- Energy & Atmosphere: Addresses issues of energy use, energy efficiency, and air quality.
- Transportation: Addresses issues of traffic congestion and non-single occupancy vehicle alternatives.
- Administrative Processes: Addresses issues relating to sustainable policies, guidelines, and plans.
- Sustainable Design: Addresses issues of sustainable planning, design, and construction guidelines and green specifications.

Facility's definition of sustainability:

Defining what sustainability means to LAWA was a critical first step toward further implementing sustainability as a key measure in the overall success of LAWA projects. LAWA recognizes the difference between the concepts of green and sustainability. Green practices focus solely on environmental stewardship, such as reducing waste or conserving energy. Sustainability moves beyond environmental stewardship and integrate economic growth (e.g. use of local contractors and suppliers) and social responsibility (e.g. implementing fair labor practices) in LAWA's operations.

The Sustainable Airport Planning, Design and Construction Guidelines (LSAG) is included in all LAWA's bib documents, design specification and construction contracts.

LSAG goes beyond LEED® and is a compilation of sustainable planning, design and construction practices that meet the unique circumstances and needs of an airport. Because of the overlap between LSAG and the USGBC's LEED® rating systems for buildings, building projects are recommended to achieve LEED® certification. All building projects on LAWA property are encouraged to achieve LEED® Silver certification. Some building projects may be required to achieve LEED or other green certifications based on existing building codes. Although projects that achieve LEED® certification do not need to adhere to the Sustainable Planning/Design (PD) performance standards, these projects are recommended to adhere to Sustainable Construction (CN) performance standards and achieve a LAWA Sustainable Construction Level. Separate LAWA Sustainable Levels for PD and CN will be awarded upon completion of the project. Application of the Rating System, and the number of points required for each level of

certification, is based on the size and type (category) of the project and whether it includes the construction of a new building or the reconstruction or interior renovation of an existing building.

How do initiatives achieve or meet that definition?

LAWA employs the Triple Bottom Line approach to find integrated solutions and improve sustainability performance.



The Triple Bottom Line philosophy recognizes that in order to be sustainable, LAWA success should not only be measured by traditional bottom line of financial performance but also by its impact on the local, regional and global economy, environment, and society.

LAWA's sustainability commitment not only shapes its internal business practices, but also its external relationships with its tenants, contractors, passengers, suppliers, peers and the neighboring communities.

Detailed Notes about each Actual Discussion Topic:

(Complete the following for each actual topic/initiative/major area discussed during the case study interview. Attach additional sheets as necessary)

Discussion Topic 1: Construction Mitigation

Current or conventional practice for this application:

All construction contractors at LAWA are required to comply with construction related mitigation requirements that include, but is not limited to, traffic mitigation and haul route control measures, air quality construction related measures, restrictions on construction material stockpiles, dust control, construction noise and other miscellaneous items that could vary depending on the project site and its specific project level requirements.

Monitoring and Control:

Contractors are responsible to be in compliance with all specified mitigation requirements and are required to provide the Engineer a monthly summary status report of compliance of these specifications. LAWA randomly monitors the Contractor's

compliance with mitigation requirements throughout the term of the Contract.

LAWA can assess penalties for non-compliance. These penalties could be up to \$1,000 per day and per occurrence for each non-compliance of the specified requirements.

All Contractors' records related to the implementation of these construction related measures are subject to a Third Party Monitor review and LAWA audit at any time, and for the duration of the Contract.

HAUL ROUTES

The Contractors shall comply with specific traffic requirements, specifically Haul Routes.

The Contractors are required to submit haul routes for all construction traffic, deliveries, and employee travel within 30 days from Notice to Proceed. Haul routes shall be located away from residential areas. Construction trucks are not allowed on certain roads as defined by the Airport.

STOCKPILES

The Contractors are required to submit a Contractor Recycling Plan (CRP) within 30 days from Notice to Proceed. The Contractor Recycling Plan shall describe what materials will be recycled and how the recycling will be implemented. The CRP is to be approved by LAWA prior to start of construction or demolition.

Construction Material Stockpiles Locations and Maintenance

- A. Stockpile locations are required to be confined to the laydown areas shown on the plans. Stockpile locations/staging areas are to be accessed by construction vehicles with minimal disruption to adjacent public streets.
- B. The Contractors are required to seal the surface of all stockpiles of rock and earth materials that are not being actively constructed or mined with a dust control product. Treatment may include water spray via irrigation systems, proprietary non-toxic crusting agents, anchored geotextile fabric or tarps, erosion control fabric, seeding, or other methods approved by LAWA. The method employed shall be appropriate for the expected duration of, and the material in, the stockpile. Throughout the duration of the project, the Contractors will be required to maintain the dust control seal to meet the requirements of this section.
- D. Whenever possible, the Contractors will be required to utilize on-site rock crushing facility during construction to reuse rock/concrete and minimize off-site truck haul trips. To reduce impacts from emissions of fugitive dust, rock-crushing operations, if any, are to be located away from airport-adjacent residential areas.
- E. In addition, the Contractors are required to emply whatever operational controls needed to reduce the dust potential of stockpiles. These operational controls may include, but are not limited to:
 - 1. Locating stockpiles behind natural or manufactured windbreaks.
 - 2. Locating the working area on the leeward side of the active piles.
- 3. Use stone ladders, telescopic chutes, stacker conveyors of other mechanical devices to limit the drop of fall and exposure to wind when the stockpile is being constructed.
- 4. Limiting the height of the stockpile.
- 5. Minimize vehicle traffic, and vehicle speeds, in and around stockpiles.
- 6. Add or remove material from the downwind portion of the storage pile.
- 7. Avoid steep sides or faces on stockpiles.

AIR POLLUTION CONTROL

The Contractors are prohibited from discharging smoke, dust equipment exhaust, or any other air contaminants into the atmosphere in such quantity as will violate any Federal, State or local regulations. The Contractor is required to abate dust nuisance by cleaning, sweeping and spraying with water or other means as deemed necessary.

Dust Control

- A. The Contractors are required to remove from the construction site and other public streets, excavated materials and debris resulting from the project. Vehicles exiting the project site shall have all dirt clods and mud removed from their tires.
- B. The Contractors must contain dust and remove it from the Site at intervals sufficient to prevent contamination outside work limits and as directed by the Engineer. The Contractor is required to use adequate watering techniques to alleviate accumulation of construction-generated dust.
 - 1) The Contractors are responsible for containment of dust emission from all construction, transport, storage or handling activities, in accordance with South Coast Air Quality Management District (SCAQMD) Rule 403: Fugitive Dust.
 - 2) The Contractors are responsible for the continuous clean-up of all construction-related dirt on approach routes to the Site.
 - 3) The Contractors must furnish trash bins for all debris resulting from Construction.
- C. If needed, the Contractors are required to furnish and operate a selfloading motor sweeper with spray nozzles at least once each Working Day for the purpose of keeping paved areas acceptably clean wherever construction, including restoration, is incomplete.
- D. The Contractors are required to post a publically visible sign(s) with the telephone number and person to contact regarding dust complaints; this person will respond and take corrective action within 24 hours.

AIR QUALITY

- A. Contractors must make every effort to reduce air pollutant emissions from construction traffic and equipment both on and off the airport. This includes, but is not limited to, use of construction equipment with "cleaner burning diesel" fuel and exhaust emission controls. The Contractors shall use alternative fuel or low emission vehicles to the maximum extent practicable.
- B. The Contractors is required to prepare and submit to LAWA for approval, within

30 days from Notice to Proceed, a list of all equipment to be used, including Sub-Contractors' equipment, necessary to complete the Work. Said list shall include equipment type, model, fuel source and emission characteristics. The equipment list shall be updated monthly and submitted to the Engineer. The Contractors shall ensure that equipment is in proper working order as to minimize harmful emissions.

- C. The Contractors shall submit to LAWA a monthly log showing daily fugitive dust mitigation measures. The log shall specify the subject area, mitigation measures utilized, frequency of control and other relevant information.
- D. All diesel equipment used for construction shall be outfitted with the Best Available Control Technology (BACT) devices certified by the California Air Resources Board (CARB - see <u>www.carb.gov</u>). These devices are primarily to reduce diesel emissions of Particulate Matter (PM), including fine PM, and secondarily, reduce emission of NOx. This requirement shall apply to diesel powered off-road equipment (such as construction machinery), on-road equipment (such as trucks), and stationary diesel engines (such as generators). The BACT device shall be approved by CARB as specified on the website. A copy of each unit's certified BACT documentation, and each unit's CARB or SCAQMD operating permit, shall be provided at the time of mobilization of each applicable unit of equipment. This requirement applies diesel equipment owned and/or operated by the Prime Contractors and Sub-Contractors.
- E. Any emission control devise used by the Contractors shall achieve emission reduction no less than what could be achieved by a Level 3 diesel emission control strategy for a similar-sized engine as defined by CARB regulations.
- F. An exemption to the above may be warranted for a piece of construction-related diesel equipment for which the operator provides a written finding, based upon appropriate market research and approved by LAWA, that the best available emission control device for reducing the emissions of pollutants is unavailable for that equipment. In such case, the Contractors shall use other technology for reducing the emission of pollutants, if any is available and appropriate for that vehicle, and as deemed appropriate by LAWA.
- G. Heavy duty and medium-heavy duty vehicles equipment for the Work that are subject to the CARB Voluntary Software Upgrade Program shall have the low NOx Rebuild Software installed. Subject vehicles are model year 1993-1999 with electronically controlled diesel engines manufactured by Caterpillar, Cummins, Detroit Diesel, International, Mack/Renault and Volvo. Documentation of this software upgrade shall be submitted at time of mobilization or before vehicles are utilized on a LAWA project site.
- H. Under no circumstances shall an emission reduction device or strategy used on the construction site increase the emission of any pollutant above that which is the standard for that engine.

NON-ROAD MOBILE SOURCE CONTROLS

A. The Contractors shall prohibit staging or parking of construction vehicles (including workers' vehicles) on streets adjacent to schools, daycare centers, and hospitals.

B. The Contractors shall prohibit construction diesel vehicles or equipment from idling in excess of the idling restrictions as defined in CARB Vehicle Idling Rule. The Contractor shall advise drivers and operators of these requirements at the pre-construction orientation meeting, remind them on a daily basis, and post signs in appropriate places indicating the CARB Vehicle Idling Rule. Exemptions may be granted for safety-related and operational reasons, as defined in CARB or as approved by LAWA. The Contractors and subcontractors shall have policies and procedures in place for compliance with the Vehicle Idling Rule and a copy of such shall be submitted to LAWA for approval within 30 days of Notice to Proceed.

STATIONARY POINT SOURCE CONTROLS

- A. The Contractors shall specify a combination of electricity from power poles and electricity from portable diesel- or gasoline-fueled generators using "cleaner burning diesel" fuel and exhaust emission controls for his electrical energy requirements.
- B. The Contractors shall obtain prior approval of LAWA for the use of internal combustion engine water pumps, power generators, air compressors and other related construction equipment when an option exists to utilize grid power or electric powered equipment.
- C. In accordance with SCAQMD Rule 431.2, all diesel construction equipment shall use only Ultra Low Sulfur Diesel fuel (15 ppm or lower).
- D. No emission control device shall increase the emission of any pollutant above that which is the standard for that engine.

NOISE CONTROL

- A. Noise generated form the Contractors' operations shall be controlled as specified in contract documents.
- B. The Contractors shall comply with local sound control and noise level rules, regulations and ordinances which apply to Work performed pursuant to the Contract.
- C. Each internal combustion engine, used for any purpose on the job or related to the job, shall be equipped with a muffler of a type recommended by the manufacturer. No internal combustion engine shall be operated on the Project without said muffler.

Beginning in 2007, a 3rd Party Monitor was retained by LAWA to ensure construction contractors' as well as LAWA's compliance with construction mitigations at LAX. The monitor have full access to the construction sites and records (whether LAWA sites or contractor sites) and issue a report bi-annually. Through these audits, LAX is able to ensure compliance with their requirements. Any infractions are then dealt with accordingly.

Describe benefits:

LAX is seeing great benefits from their mitigation program and saving a couple million dollars a day in the field.

Discussion Topic 2: Air Quality

Current or conventional practice for this application:

LAX has a very large Air Quality component in regards to emission control. A majority of LAWA's vehicle fleet is comprised of alternative fuel vehicles and they are the only airport in the world with an on-site hydrogen generation station.

LAX completed the initial phase of an Air Quality Apportionment Study with subsequent phases to follow. This study, once completed, will be the most comprehensive air monitoring, modeling and data analysis program to be undertaken by LAWA for one of its facilities or by any airport authority nationwide. A Technical Working Group (TWG) with representatives of Federal, State and regional air quality control agencies ensured that the study followed reliable methods to produce results.

LAX's Greenhouse Gas emission has goals that are in line with the City of Los Angeles' reduction goals.

Recommended practice for this application:

LAX had stricter restrictions that the California Air Resources Board on idling.

Best practice for this application:

Since 1991, LAWA has been converting its entire fleet to Alternative Feul Vehicles. To date, LAWA fleet is approximately 65% AFV, mainly liquid natural gas, compressed natural gas, gasoline/electric hyprids, etc. Also, a draft policy is under review of Ground Service Equipment Conversion to zero emissions by 2015.

Identify the source(s) of funds used to support this initiative (e.g., AIP, PFC, other airport revenue, bonds, grants):

The CNG buses at LAX were eligible for some State grant money because it involves busing passengers between the remote lots and the terminals. The CNG station was built with a mix of State and Federal money.

The California Air Resources Board has given money for contractors to replace older equipment they have or to retrofit their equipment. It is a demonstration project at no cost to the contractors.

Discussion Topic 3: Recycling

Current or conventional practice for this application:

LAX has in-house collection of recyclable materials generated by LAWA and from common-use recycling containers and bins in airport terminals and airfield areas. Collection of materials from airlines and tenants is done through individual agreements at no cost to participants. Airlines' and tenants' also have their own recycling programs and in turn report on their data to LAWA.

LAX's Recycling Program makes it easy for airport employees and the traveling public to recycle by providing convenient recycling bins in offices, terminals, and on the airfield.

Materials are collected and brought to the transfer facility, sorted, placed in larger containers or bailed, then sent to various vendors for further processing. Recycling units are provided and serviced by LAX staff at no additional cost to the tenants.

Recycling is an important initiative in LAWA's drive to be a sustainability leader. LAWA's recycling efforts have paid off in many ways including maintaining a waste diversion rate of 64% at LAX.

Discussion Topic 6: Noise Monitoring and Abatement

Current or conventional practice for this application:

Prior to the Sustainability Guidelines, there was a Land Use Aviation Program that addressed the surrounding communities.

To date, 7,000 homes in the City of Los Angeles have been insulated and another 12,000 are still in the noise impact areas around LAX and continue to be eligible for sound insulation. LAX has one of the programs with the largest community impacts in the county and they are extremely proud of their noise program.

For Construction Noise Monitoring and Abatement see Discussion Topics 1 & 5: Construction Mitigation and Construction Activity.

Discussion Topic 7: Community Benefit Agreement

Current or conventional practice for this application:

Concurrent with the Master Plan acceptance, a Community Benefit Agreement was put in place. During the course of the MP there LAX discovered a multitude of issues (i.e. AQ and noise factors) that there wanted to approach in a systematic manner. The enactment of the agreement led to LAX and the communities identifying specific activities (ex. AQ Study) that the Airport would pursue.

Discussion Topic 8: Sustainable Guidelines

Current or conventional practice for this application:

Initially the development for the Sustainable Guidelines started in 2007 as part of the LAX Master Plan. As part of the development, LAX wanted to evaluate design and construction activities since there were no benchmarks in place. They also wanted to see how any sustainable efforts would affect construction costs.

Describe how the facility tracks the financial impacts of this initiative. Are projected goals being met? Why or why not?

Initially activities that were undertaken as part of the Sustainable Guidelines were noted as line items on bid sheets for costing. Over time, these costs have been rolled in to the other basic line items of work. Describe the driving force(s) (e.g., manager, champion, or external advocate) behind this initiative. Describe how the decision was made to pursue this initiative. Identify any tools or models used. Draw a flow chart or schematic of the process, as appropriate.

The approval of the Master Plan at the end of 2004 set the framework for LAX to move forward. Also, the development of the airports' sustainable planning, design and construction guidelines provided a focus point for these efforts that were championed by everyone at the Airport from the Board of Airport Commissioners to LAWA executive management, and staff. These guidelines are no longer discretionary but are now mandated.

Discussion Topic 9: Operations

Current or conventional practice for this application:

LAX has in-house collection of recyclable materials generated by LAWA and from common-use recycling containers and bins in airport terminals and airfield areas. Collection of materials from airlines and tenants is done through individual agreements at no cost to participants. Airlines' and tenants' also have their own recycling programs and in turn report on their data to LAWA.

LAX's Recycling Program makes it easy for airport employees and the traveling public to recycle by providing convenient recycling bins in offices, terminals, and on the airfield.

Materials are collected and brought to the transfer facility, sorted, placed in larger containers or bailed, then sent to various vendors for further processing. Recycling units are provided and serviced by LAX staff at no additional cost to the tenants.

LAX previously looked at the possibility of a charging station for the terminals and the tenants' GSE equipment.

Operations also follow the guidelines mentioned in Discussion Topic 8: Sustainable Guidelines. They must be followed both by LAX employees and tenants.

Identify the source(s) of funds used to support this initiative (e.g., AIP, PFC, other airport revenue, bonds, grants):

LAX projects that are mandated as part of an environmental process (ex. EA, EIS) are unable to use State funds; the funds are only available if the project is undertaken on a voluntary basis.

Discussion Topic 10: Water Conservation

Current or conventional practice for this application:

LAX has aggressive goals for recycled water which includes using all recycled water for landscaping at the Airport by 2015. Currently the biggest hurdle is the infrastructure that is in place. Sites on the Airport are ready to use the recycled water but are lacking the network and origin sites. LAX is working with the City's Department of Water & Power to make sure main lines near the Airport are expedited.

LAWA currently uses reclaimed water to irrigate approximately 35% of its landscaped acres. LAWA developed targets to increase the use of reclaimed water at all facilities. These include increasing landscaped acreage that is irrigated by reclaimed water by 50% in 2012 and increasing non-potable/reclaimed water use by 10% by 2010.

In addition to striving to increase the amount of reclaimed water for irrigation, LAWA is also committed to efficiently use reclaimed water. An example of this policy is having the majority of the irrigation systems at LAX computer controlled so that the landscape areas are only irrigated when needed.

In addition to the use of reclaimed water, LAWA recognizes that the need to minimize the amount of potable water used in all facilities is a key factor to sustainable operations. LAWA has taken steps to reduce water usage including the installation of low flow fixtures on all toilets and sinks in all LAX terminals and buildings. In addition, LAX's fleet vehicle car wash recycles water through a treatment system for continuous re-use. Fresh water is added only to make up for losses due to evaporation. To further its water reduction efforts, LAWA will evaluate the feasibility of installing waterless urinals in LAWA buildings. Furthermore, LAWA will install centralized controls to monitor and regulate irrigation, and thereby reduce water usage

Best practice for this application:

In the new Tom Bradley terminal all toilets will use recycled water.

Discussion Topic 11: Energy Conservation

Current or conventional practice for this application:

LAX currently has a goal of acquiring 25% of their energy from green sources and are working with the Department of Water & Power to make sure this is accomplished. The Airport is in the process of rebuilding their Central Utility Plant which will use less energy than their current system.

LAWA has a long history of investing in green power and energy saving programs as demonstrated by its use of cogeneration for steam and electricity at the LAX Central Utilities Plant (CUP) for more than 20 years. The CUP's cogeneration facility **reduces fuel usage** by 10% to 30% compared to separate electricity and heat processes. In addition to providing utilities for LAX facilities, excess electricity is sold at a reduced rate to Los Angeles Department of Water and Power for community use.

These efforts have included:

- Retrofitting 90% of light fixtures at LAX to higher efficiency light fixture including compact fluorescents;
- Upgrading building air-handling units with variable speed drives and soft-start controls;
- Installing light-emitting diode (LED) lights on runways, signs, and other lights; and
- Installing light sensors in LAWA administrative buildings.

In order to meet its targets for reducing energy usage, LAWA will perform these following initiatives:

- Install energy efficient light fixtures when changing burned out bulbs;
- Install new or increase efficiency of existing heating and cooling equipment;
- Purchase more energy efficient computer servers and consolidating servers;
- Install energy efficient variable speed motors during replacement;
- When replacing older building-related process energy systems and equipment, upgrade with energy efficient systems; and
- Install Variable Fan Drives, where needed.

Discussion Topic 12: Overall Funding

Current or conventional practice for this application:

Funding for sustainable initiatives comes from a combination of traditional sources and grants. Mostly from PFCs and very little comes from AIP grants. State grants are also sometimes available.

Discussion Topic 13: Sustainability Performance Improvement Management System

Current or conventional practice for this application:

When looking through the requirements in 2005/6 for LEED Silver/Gold requirements LAX wanted to make sure there was a process in place to integrate various practices and make sure processes were applied across the board. Everyone in the organization has access to the SPIMS and uses it to see why certain initiatives are no being considered and if others already in place are working. If an initiative is not working SPIMS allows it to be a group effort from the bottom up on how to resolve the issue. Everyone within LAWA knows about the system and everyone from plumbers, electricians, sweepers, etc. understand the sustainable efforts undertaken by the Airport and how it relates to their daily jobs, how it improves the way they operate and it provides an avenue for staff to give the Airport feedback on their various initiatives.

Discussion Topic 14: Environmentally Friendly & Socially Responsible Products

Current or conventional practice for this application:

LAWA has a 10+ year history of promoting the use of environmentally and socially responsible products in its operations. In 2006 alone, LAX purchased over 235 tons of recyclable, reusable and recycled-content materials. LAWA is committed to increasing its use of environmentally and socially responsible products. Other examples of LAWA's use of products with high recycle content include:

- One hundred percent (100%) of paper towels used at LAX are made from 40% post consumer recycled paper- saving 438,977 pounds of paper.
- One hundred percent (100%) of paper used in printers and copiers is 30% postconsumer recycled paper.
- Approximately 45% of toilet paper used at LAX are made from 45% post consumer recycled paper.
- Approximately 30% of toilet seat covers at LAX are made from 45% post consumer recycled paper.
- One hundred percent (100%) of trash bags are made from 30% post consumer plastic.

To ensure that recycled-content paper is purchased when economically feasible, LAWA includes green procurement language in custodial chemical and paper product requests for proposals.

To meet its objective of increasing the use of environmentally and socially responsible products, LAWA is committed to revising its procurement system to allow bidders to include environmentally and socially responsible products in all bids. The new procurement program will be in place by January 2009. LAWA's use of environmentally and socially responsible products will be furthered by the following initiatives:

- Specify only purchases of duplex printers, where feasible.
- Convert hand soap used throughout LAWA facilities to an environmentally friendly alternative, where feasible.

In addition to developing a comprehensive system of purchasing sustainable products, LAWA will continue to increase its use of recycled content paper and will purchase more recycled-content products. Moreover, LAWA will continue to expand its monitoring and tracking of environmentally and socially responsible products.

Discussion Topic 15: Promote Sustainability Awareness

Current or conventional practice for this application:

Aligned with the triple bottom line approach to sustainability, LAWA believes that a sustainable organization looks beyond environmental stewardship and addresses economic growth and social responsibility through interaction with the surrounding community.

Throughout its history, LAWA employees have taken steps to foster close relationships with local educational and charitable organizations. These programs include visiting schools and LAWA facilities and donating time and materials to these organizations. Examples of LAWA's outreach to the greater community are listed below.

- Aviation Academy: The Aviation Career Education (ACE) Academy is a free, week-long motivational program to provide students with a basic understanding of career opportunities within the aviation industry, as well as a general knowledge about LAX. This program is open to all Los Angeles area seventh and eight-grade students and high school students in communities surrounding LAX. Annually, 75 local students participate in the program.
- Food Bank Donations: In 2007, LAWA employees donated over 60,000 pounds of packaged and prepared foods to the Los Angeles Regional Food Bank.
- Gateways Internship Program: This program was launched by LAWA as a collaborative initiative of the Inglewood Unified School District, South Bay Private Industry Council and LAWA. This program provides paid internships to local youth currently attending high school or college. The goal of the program is to expose local high school and college students to career opportunities in the aviation industry.
- AIRCademics "Passport to Art Program:" This unique program is comprised of a 30-week curriculum offered at the Westchester YMCA, near LAX. This school-to-career enrichment program focuses on teaching science, math, reasoning, and aviation through the completion of art projects. Participants also learn about the history of flights while attending lectures and field trips.
- Wings to Fly" Mentoring Program: This mentoring program connects LAWA employees with at-risk youth in local high schools. Over a seven-month period, students come to LAX twice a month for professionally facilitated workshops, guest speakers and one-on-one time with their mentors, and learn about airport opportunities and interact with positive adult role models in a fun atmosphere.
- Job Shadow Day: LAX hosts Job Shadow Days where local high school students have the opportunity to "test drive" a career in the airport industry. LAX pairs airport employees with students on a first-come, first-served basis to share technical skills and knowledge. The Job Shadow Days is coordinated by LAWA's Community Relations and the Inglewood/Airport Area Chamber of Commerce.

For the 68 million passengers who travel through LAWA's airports, LAWA will take a two pronged approach to communicating sustainability. First, LAWA will strive to improve the public arts program in its terminals, offices, and buildings. LAX has several public arts exhibition locations in Terminals 1, 2 and 3 and the Tom Bradley International Terminal.

Second, LAWA will communicate to its passengers its sustainability program through public notices in the terminals and its improved terminal recycling program. These notices will allow passengers to see the progress LAWA is making in creating a sustainable community for its community.

Wrap-up Questions:

Describe any in-house training or coordination that supports this facility's sustainability program (including, but not limited to team building, staff education, employee training programs):

SPIMS enables LAWA stakeholders to evaluate and integrate green practices across the organization by continually tracking and improving environmental, social and economic performance. The management system is facilitates by the use of the Global Reporting Initiative Reporting Guidelines and other industry-standard reporting guidelines.

Implementation teams include:

- Sustainable Design
- Energy and Atmosphere
- Materials and Resources
- Water Efficiency
- Transportation Resources
- Administrative Procedures

What programs or initiatives are next on the horizon? What are your shortterm and long-term goals (including Net Zero goals)? How will benefits or results be measured and verified?

Zero Emissions by 2015

What advice would management offer another facility?

- Make sure to find a way to integrate sustainability into the Airport's everyday processes
- One lesson learned is that Management needs to have their support behind the initiatives but buy in is needed on all levels
- Everyone from the bottom up should be aware of the Airport's efforts and how it relates to their specific job and teach the staff rather than just telling them
- Bottom up education ensures participation and the efforts will soon become the norm
- Be consistent on all contracts across the board

ACRP 02-22 – Case Study Interview Form

Airport/Facility Name: Oakland International Airport (OAK)

Date: 3/24/11

Contact Phone and web address: 510-563-3300; http://www.flyoakland.com/noise/environmental.shtml

Discussion Topics:

- **1**. LEED Certified buildings
- 2. General environmental program activities

Detailed Notes about each Discussion Topic:

Discussion Topic 1: LEED Buildings

Alternative Strategies and/or Best Practices:

OAK's Terminal 2 was the first passenger terminal to be certified LEED Silver. Planning for the terminal began more than 10 years ago when Tay Yoshitani, now CEO of Port of Seattle, was CEO of Port of Oakland. Yoshitani was an advocate of advanced environmental strategies. Also, Jerry Brown, current California governor, was Mayor of Oakland and his administration was pushing energy conservation. At the time (2001-2002) the Terminal 2 project was the big upcoming project and the project team determined that they wanted to go for silver certification and subsequently championed getting certified. Airport staff believe that without striving for LEED certification they would have ended up with a marginally energy efficient terminal. A state waste reduction law provided funds for LEED training for the project, effectively serving as "free" consulting on LEED issues.

In Terminal 2 planning OAK got buy-in from Southwest and other tenants in support of LEED certification. HMS Host International was just coming to the airport as a new master concessionaire so OAK put requirements that support LEED into their contract.

The airport is now going for certification on their Terminal 1 renovation although not for the new Central Utility Plant. There will be a full-time commissioning agent involved in the Terminal 1 project. OAK has found that LEED process is easier now since it is in place and online. Separately FAA is consolidating two current towers into a new LEED Gold control tower. Among other features the new control tower will have geothermal energy.

To be successful the staff has learned it is critical to get sustainability requirements for design and construction into contracts early. Rewards for getting certified are many: you begin to look at the design framework differently, you begin to experience real long-term cost savings, and first costs on subsequent projects are lower since the LEED requirements are better understood. OAK has found that LEED definitely provides energy conservation benefits, some benefits in water conservation, and some benefits in maintenance. LEED does not include an obvious social equity component and only indirectly economic benefits. Having a LEED building made it easier to decide to strive for LEED on the Terminal 1 renovation. The more sustainability practices become incorporated in tools and routine plans and become common practices the more acceptable they become.

Discussion Topic 2: General Environmental Practices

Alternative Strategies and/or Best Practices:

Environmental Brochure – A Port of Oakland brochure "Environmental Efforts Take Flight at Oakland International Airport" was prepared as a proactive initiative to inform the community about a range of environmentally beneficial activities at the airport. It was developed in response to concerns in the community about the Port's air emissions. The brochure describes the Port's environmental priorities and commitment. It discusses improvements that reduce air emissions such as electrification of baggage carts, gate power and air use in lieu of aircraft APU operation, and LEED building certification. Use of alternative fuels is summarized including CNG use by airport taxis, parking shuttles, and buses to and from BART. The solar power systems at the airport (756 kW) and on the FedEx package sorting building (904 kW) are described along with energy conservation initiatives to install LED's in the place of incandescent lights and a cool roof on Terminal 2. (FedEx also recently installed a Bloom Box fuel cell as an energy conservation initiative but this does not yet appear in the brochure.) Other initiatives described in the brochure include the airport-wide recycling and waste-reduction program, storm water management and pollution prevention training, and noise mitigation efforts. An update to the brochure is in process.

Electric GSE – The airport has a program to educate and encourage airlines to use electric GSE. Southwest Airlines, the airport's largest tenant, is almost 100% electric. Under the US's Diesel Emission Reduction Act (DERA), EPA has provided vehicle grant funds to repower some GSE. CALSTART has also provided grant funds.

Electric Vehicle Chargers – Eight electric vehicle chargers have been installed in the public passenger parking lots to accommodate Chevrolet Volts and Nissan Leafs. More than one third of the installation cost for the chargers came from a grant from the US DOE.

GHG Inventory – A baseline greenhouse gas inventory has been prepared that allows the airport to identify key sources and prioritize emission reduction efforts.

Recycling Activities – The Port is installing liquid disposal bins adjacent to bottle recycling bins at the head of security lanes. This will simplify bottle recycling and minimize contamination of the recycling process. They also are working to take recyclables from aircraft although the current diversion rate is low. The airport is beginning to compost paper towels from restrooms. They are also installing some solar-powered "Big Belly" trash and recycling compactors.

Stewardship – There are quarterly meetings with the community, airlines, FBOs and others, which grew out of the last Master Plan. The meetings mostly serve as information sharing but the process does help direct mitigation funds to

community priorities. There is also a group that addresses accessibility and Americans with Disabilities Act (ADA).

Electrical Power– The Port set itself up as a utility, which lets them buy power at wholesale rates and resell it to tenants. They do not yet have sub-meters to do an effective assessment of energy performance or to expose tenants directly to energy costs but that is a potential for the future.

Port of Oakland Strategic Plan – Not a sustainability plan per se and not specific to the airport, the Port's strategic plan nonetheless provides a framework for addressing a variety of challenges and opportunities that commonly appear in a sustainability plan. The plan covers fiscal years 2011 through 2015. The plan's four Strategic Priority Areas are: (1) Sustainable Business and Economic Development, (2) Stewardship and Accountability, (3) Port Workforce and Operations, and (4) Communications and Information. For more information see <u>Port of Oakland Strategic Plan Fiscal Years 2011-2015</u> http://www.portofoakland.com/pdf/Strategic Plan FY 2011-2015.pdf.

ACRP 02-22 – Case Study Interview Form

Airport/Facility Name: Paulding Northwest Airport (PUJ), Dallas, Georgia

Date: March 29, 2011

Contact Phone and web address: (770) 505-7700; <u>http://www.pauldingairport.com/overview.aspx</u>

Discussion Topic:

1. Stormwater Management with Rock Cribs at PUJ

Synopsis of Sustainability Programs, Policies, Processes, Technologies, and/or Equipment:

Paulding Northwest Airport is located in Paulding County, 30 miles northwest of Atlanta, Georgia. The airport completed construction and opened in November of 2008 to provide an alternative to the congestion and high prices of metropolitan Atlanta. The airport was built in a wildlife management area, home of a handful of endangered species. The airport realized the importance of being a good neighbor to the local wildlife and decided to implement sustainable solutions to reduce their impact on the local ecosystem. Because they were building a brand new airport, Paulding was able to create a master plan to address possible impacts on their environment. The design of their fuel farm incorporates multiple environmental safe guards to reduce the possibility of a spill. It is located above ground rather than below ground to reduce the potential for ground and groundwater contamination. The enclosure concrete-encased and double-walled to provide multiple layers of insurance if there is a leak. Paulding has also used LED lighting throughout the airport and even borrowed water from a nearby pond for use in construction rather than consuming potable municipal water. Stormwater is a major issue that requires management on an airport's property. The immense amounts of hard surface do not allow rain to permeate the soils and penetrate the water table. Every airport employs a stormwater management strategy to retain the stormwater and release it slowly into the environment to reduce flooding and demand on city sewers. Paulding Airport is unique in that their stormwater affects the nearby ecosystem.

Stormwater that runs off of the immense area of hard surfaces like runways and tarmacs retains heat from the pavement. The resulting stormwater is 5 to 10 degrees warmer than nearby streams and rivers. This warmer water has the potential affect many fresh water species that are sensitive to water temperature. Paulding installed Rock Cribs to naturally cool the stormwater before returning it to the environment. The rock bed is 30 feet wide and 250 feet long. The 4 foot thick rock assumes the temperature of the ground, which remains relatively constant at 55°F. Rock is a natural thermal mass, which is a material that can retain thermal energy for a long period of time. As the warmed stormwater flows across the rock, it is slowly cooled, then directed to a nearby stream.

Facility's definition of sustainability:

Paulding's sustainable initiatives are driven by stewardship. Paulding strives to be a good neighbor to the surrounding ecosystem as well as those who live near the airport. They're becoming more conscious of their environmental footprint and are working to reduce it. The community in Paulding County shows active concern for their environment and Paulding Airport is dedicated to showing equal concern.

How do initiatives achieve or meet that definition?

As a new facility, Paulding airport is still growing. The airport has not had the chance to establish more than a few sustainable initiatives, but it plans to investigate and actively pursue the potential for future initiatives. Paulding has found their first set of sustainable projects successful, but it looks forward to defining its carbon footprint and working towards reducing it.

Detailed Notes about Discussion Topic:

Discussion Topic 1: Stormwater Management with Rock Cribs at PUJ

Alternative Strategies and/or Best Practices:

Current or conventional practice for this application:

The traditional stormwater method for an airport like Paulding would have utilized a detention pond to hold the volume of stormwater after a rain event. The detention pond would release the water slowly to a nearby stream. However, the water in the detention pond does not have a chance to cool down to match the temperature of the stream before mixing.

Recommended practice for this application:

Rock cribs provide a natural method of appropriately cooling the stormwater before returning it to the ecosystem. This geothermal method uses the relatively constant temperature of the earth to cool rock to transfer heat from the water, cooling it before releasing into a nearby stream.

Describe benefits:

Paulding was motivated to incorporate sustainability to be good stewards of the environment, to be good public citizens, and to be good neighbors in an important ecosystem. The economic benefits of the rock crib stormwater management system are difficult to track, but Paulding is more concerned with the environmental benefits. The airport plans to evaluate population data of key fresh water species over the next 10 years to determine if their stormwater system has had any affects on the ecosystems where stormwater is being introduced into the streams.

Describe whether the anticipated benefits were achieved and explain why/why not:

While Paulding has been unable to track the benefits of their stormwater system, they are proud of the implementation of sustainable strategies that make them good stewards of the environment.

Describe life-cycle, return-on-investment, or payback cost analysis (if any prepared):

This strategy does not have particular financial benefits that would have a return-oninvestment. The return on investment is preserving habitats.

Identify the source(s) of funds used to support this initiative (e.g., AIP, PFC, other airport revenue, bonds, grants):

The entire project was funded by the Federal Aviation Administration. Funding was not specifically given or allocated for sustainable initiatives.

Describe how the facility tracks the financial impacts of this initiative. Are projected goals being met? Why or why not?

Specific financial data was not available. The financial benefits of this type of system are not the motivating factor and would not be able to be tracked.

Describe the driving force(s) (e.g., manager, champion, or external advocate) behind this initiative. Describe how the decision was made to pursue this initiative. Identify any tools or models used. Draw a flow chart or schematic of the process, as appropriate.

The driving factor was the Paulding County community which influenced environmental stewardship. The community lies within a 20,000 acre wildlife management area home of thousands of species of wildlife and a handful of endangered species. A wildlife area of this size only 30 miles from a major metropolitan area makes Paulding County a unique place that the community is very proud of. Enjoying the outdoors is part of the heritage of residents of Paulding County and Paulding Airport strives to preserve the environment for the local community to enjoy.

ACRP 02-22 – Case Study Interview Form

Airport/Facility Name: Portland International Jetport (PWM)

Date: March 18, 2011

Contact Phone and web address: 207-874-7740; http://www.portlandjetport.org/

Discussion Topics:

- **1.** Energy management: LEDs, CFLs, occupancy sensors, white roofs
- 2. Geothermal heating/cooling system for newly constructed Terminal 2
- 3. LEED for buildings: LEED Gold rating for new Terminal 2

Synopsis of Sustainability Programs, Policies, Processes, Technologies, and/or Equipment:

PWM does not have a specific sustainability program per se but they are taking many initiatives to save money and improve operating efficiency.

Facility's definition of sustainability:

Using methods, systems, and materials that relate to the environment and its protection

How do initiatives achieve or meet that definition?

The airport measures energy use reductions as a surrogate for climate emission reductions.

Detailed Notes about each Discussion Topic:

(Complete the following for each actual topic/initiative/major area discussed during the case study interview. Attach additional sheets as necessary)

Discussion Topic 1: Climate Change and Carbon Emissions

The City of Portland has adopted <u>Architecture 2030</u> challenge to go carbon neutral by 2030. Also, in 2010 the PWM has adopted the Maine <u>Governor's Carbon Challenge</u> to reduce greenhouse gas (GHG) emissions to 10% below 1990 levels. PMW created a 1990 GHG emissions baseline.

Current or conventional practice for this application:

Lighting - The airport recently initiated a re-lamping program. There were ~380 metal halide lights in the parking garage. They replaced them with LEDs at a cost of \$180k. Half of the funding for this project came from "Efficiency Maine." They saved \$7k in electricity the first month the LEDs were in place. They have now replaced Exit Signs

with LED versions and are beginning to replace the lighting in the Bag Tug Drive where they expect a 6-month payback.

PWM looked into installing LED streetlights for areas adjacent to the new terminal but learned they are currently too expensive so they are installing metal halide. They expect to go to LED streetlights in the future when the costs have come down. Also, in one relatively new parking area that has T-8 lights, it is not economical to change over to LEDs since the T-8s are already fairly energy efficient.

Changing out lights to LEDs has energized many of the employees, who now look for opportunities to modernize lighting in other areas of the airport.

Occupancy Sensors - The airport has also installed occupancy sensors in many locations throughout offices, bathrooms, and other locations. They also have areas in the terminal where they have multiple rows of lights and they can now switch lights off row by row as needed.

Windows - Solar inflectors (i.e., solar window reflectors or insulators) have been installed in many windows that can be reversed seasonally to either absorb or reflect solar energy.

Roofs – White EPDM (ethylene propylene diene monomer rubber) roofing is being used to cover the entire jetport roof to reflect substantial solar radiation.

Employee involvement: These projects have afforded an opportunity to educate facility maintenance crews in identifying areas where improvements are needed. They also recommend invoving occupants to assist in identifying potential sustainable practices.

Discussion Topic 2: Geothermal HVAC System for New Terminal When PWM was evaluating the heating, cooling, and energy requirements for their new terminal, they evaluated several new "green" technologies including photovoltaics and wind. Geothermal technology appeared best suited for their installation and location.

The project is the largest geothermal installation in the Northeast. It includes 22 miles of piping, 120 wells in a closed loop, at 500 feet deep. This installation will access 49°F water. The project will save 1 ton of NOx per year, equivalent to 100,000 gallons of oil per year.

Initially the project showed a 20-year payback so they signed a \$200,000 contract to conduct an initial study of the project. The project had a \$3 million marginal cost. FAA's VALE program contributed \$2.5 million and they received \$0.5 million in local funding. Construction costs were about \$60k/ton. They are expecting a 40-year project life and anticipate a 2-3 year payback.

PWM expects to start up the geothermal unit in July 2011.

Discussion Topic 3: LEED for Buildings

PWM's new Terminal 2 will be built to LEED Gold standards with primary benefits coming from (1) the building envelope, (2) daylighting, (3) the geothermal HVAC unit, and (4) energy and atmospheric actions. They are adding a recycling center for the jetport as part of the expansion. In their recent RFP for custodial services, they specified LEED acceptable practices and chemicals.

PWM is hiring a commissioning agent for the new terminal.

PWM is also installing smart electrical sub-meters in the terminal to track more carefully where power is being used and who is using it.

Describe benefits:

The airport is primarily motivated by reducing costs and improving efficiency as a philosophy for running the airport as well as a way to meet commitments like those for the Governor's Carbon Challenge.

Describe life-cycle, return-on-investment, or payback cost analysis (if any prepared):

The airport generally looks for a 3-year return-on-investment.

Identify the source(s) of funds used to support this initiative (e.g., AIP, PFC, other airport revenue, bonds, grants):

PWM has received funding from VALE, State of Maine, and local sources for several "green" projects/equipment.

Describe how the facility tracks the financial impacts of this initiative. Are projected goals being met? Why or why not?

For the LED projects, the airport tracks metered costs monthly.

Does this initiative meet the facility's definition of sustainability? Why or why not?

Yes it does since it reduces operating costs while simultaneously reducing emissions.

Describe the driving force(s) (e.g., manager, champion, or external advocate) behind this initiative. Describe how the decision was made to pursue this initiative. Identify any tools or models used. Draw a flow chart or schematic of the process, as appropriate.

The project is the result of several "champions" (e.g., geothermal designer, construction manager, mechanical designer, and owner's agent) who worked together to make the project happen.

PWM initially considered the geothermal project on its own merits but it showed a payback that exceeded what the airport would normally accept. This changed when they got engaged with the VALE program to provide a portion of the funding.

Process Schematic – Portland International Jetport



Wrap-up Questions:

Describe any in-house training or coordination that supports this facility's sustainability program (including, but not limited to team building, staff education, employee training programs):

The airport is looking to build LEED principles into their routine practices. For example, adding the specifications into RFPs for custodial and cleaning services.

What programs or initiatives are next on the horizon? What are your shortterm and long-term goals (including Net Zero goals)? How will benefits or results be measured and verified?

PWM will continue to use their 1990 baseline GHG emissions inventory to guide efforts to reduce energy use to meet the goals of the Governor's Carbon Challenge.

Describe challenges, difficulties, or uncertainties facility had to overcome:

- 1) Educating staff members to identify opportunities (for example, applications for LEDs where other lighting technology is currently used)
- 2) Identifying funding to make the initial cost for "green" technologies comparable to conventional technologies
- 3) Accommodating environmental issues (for example, limitations to the use of windmills due to their visual obstruction.

What advice would management offer another facility?

Designate an individual as a sustainability manager to drive projects, assemble an appropriate team, and identify funding for those projects.

ACRP 02-22 – Case Study Interview Form

Airport/Facility Name: Seattle Tacoma International Airport (SEA)

Date: March 23, 2011

Contact Phone and web address: 206-787-3000; <u>http://www.portseattle.org/Environmental/Pages/default.aspx</u>

Discussion Topics:

- **1**. Sustainability Vision
- **2.** Project Analysis/Asset Management
- **3.** Sustainable Aviation Fuels

Synopsis of Sustainability Programs, Policies, Processes, Technologies, and/or Equipment:

5-Year Sustainability Plan

Facility's definition of sustainability:

The airport does not have a definition of sustainability per se, however, their actions are guided by sustainability philosophies and comprehensive environmental visions. *SeaTac's Commitment to the Environment*: "Our record as an environmental steward will distinguish us from other ports and give us an edge in the very competitive battle for international commerce. The Port of Seattle: Where a Sustainable World is Headed" *Tay Yoshitani, CEO, Port Seattle*

Mission Statement: "Seattle-Tacoma International Airport aims to be the national leader among peer airports in demonstrating environmental stewardship and reducing the environmental impacts of airport operations." Sea-Tac Environmental Leadership Strategy Team

The airport's commitment and mission statement were guided in part by sustainability concepts developed by others including:

Development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs. [UN World Commission on Environment and Development]

The simultaneous pursuit of economic prosperity, environmental quality, and social equity. [*World Business Council on Sustainable Development*]

Detailed Notes about each Discussion Topic:

Discussion Topic 1: Environmental Strategy Plan

Current or conventional practice for this application:

SeaTac's Environmental Strategy Plan was developed through both top down and bottom up effort. The Port of Seattle CEO has set the sustainability policy and the Airport Director has been very supportive of the effort since it began. The airport also hired a full-time manager (i.e., Mike Lufkin) to drive the overall process in concert with many individual initiatives that were developed in the Environmental Department.

When fleshing out their Vision Plan, SeaTac did not want to simply impose it on different departments so they got other stakeholders to participate in setting the agenda and priorities. They formed an Environmental Leadership Strategy Team, all members of which were Port employees. For each impact area, they set goals and then identified appropriate metrics. Their first report, <u>A Vision for 2014 and Beyond, Environmental Strategy Plan 2009</u>, confirmed the baseline and established initial goals. The airport also has bi-monthly meetings with the airlines and some other tenants but they have not engaged the public in the planning process yet.

Since their initial baseline report, the Environmental Leadership Strategy Team has continued to meet to identify annual priority actions. They have subsequently published a first annual Progress Report 2010, which sets priority actions for the coming year and reports progress on impact metrics. It summarizes the airport's execution against the plan and presents lessons learned. The plan includes quantitative and qualitative goals as well as directional goals. Some goals are stretch goals while others are more easily predictable. As they gain experience with the process, goals and metrics have continued to evolve. They have realized some goals have been set wrong, either based on the wrong metric or in conflict with other goals. For example, their baseline for "occupants/vehicle" coming to the airport was 2.6 occupants/vehicle and they originally set a goal of 3.6 occupants/vehicle by 2015. They realized that actions they might take to increase occupancy, such as increasing parking rates, might instead increase the number of vehicle trips to the airport. For instance, someone may ride to the airport with a family member to be dropped off and later picked up after their return rather than driving and parking at the airport. This would increase occupancy but also increase the number of round trips to the airport, defeating the purpose of this emissions initiative. Also, some goals are very generic and more a statement of values, like Goal 19: Integration "SeaTac will integrate environmental and sustainability considerations into core business operations."

Currently the Capital Projects Manager has a requirement to ensure sustainability is considered in all capital projects. The airport is trying to take this further by considering how a Sustainable Master Plan could make the process more strategic rather than tactical. For example, in the planning review, they will identify potential alternatives early in the process rather than simply identifying more sustainable technology or materials as additions to the final project design. The Master Plan process allows for early and more aggressive environmental and sustainability goals. It will also bring energy and environmental goals into long-term plans, not just those associated with passengers or cargo. This will allow the airport to move from a factor-driven approach to a process-driven approach. This approach will illuminate questions such as whether to allocate gates based on a single user versus common use facilities or how to encourage passengers to print out their own boarding passes and tag their own bags. Having a sustainable master plan will allow capital projects to be expanded to upgrade areas that might not be addressed not without a plan. Otherwise, existing activities will persist as they traditionally have. SeaTac's next Master Plan update will be 2-4 years from now and they hope they will be far along enough in their thinking to make it a more sustainable plan.

None of the airport's goals are currently externally imposed as a result of regulation or based on a municipal or state program goal.

As a result of this process, SeaTac has made an effort to expose their tenants to actual operating costs so they can act accordingly. One of the airport's major initiatives was creating a utility (as a legal entity) so they could pass through electricity costs. This allowed the airport to purchase power directly from the generators (e.g., Bonneville Power Administration) at wholesale rates. This gave the airport lower power cost, price stability, and more direct control. Since then they have been installing sufficient submeters to better track and allocate energy usage. Exposing tenants to actual costs gets them motivated to support energy conservation.

The Airport's new rental car facility used LEED guidance although they did not commit to certification. The added costs were not as high as originally anticipated and they have subsequently made the decision to become LEED certified.

Discussion Topic 2: Project Analysis/Asset Management

Alternative Strategies and/or Best Practices:

Current or conventional practice for this application:

SeaTac has an 8-step process for reviewing capital projects going from the initial idea to project completion. They apply hurdle rates and discount rates to economic analyses early in the process as part of the business case. These rates are factors in the project consideration rather than hard limits. They have found that conducting or imposing life cycle analysis can be difficult. Project managers may see this as a barrier to getting the project done if their focus is on first cost rather than operating cost. SeaTac does not have common tools or methodologies to do total cost of ownership analyses but developing such tools is on their list of priorities as is establishing an asset management initiative.

Discussion Topic 3: Sustainable Aviation Fuels

Alternative Strategies and/or Best Practices:

Current or conventional practice for this application:

SeaTac is a member of the Sustainable Aviation Fuels Northwest (SAFN) group, which is working with its various members to evaluate sustainable aviation fuels. They are currently defining opportunities in the region. A report is expected in May. Washington State University, Port of Portland, Alaska Airlines, Boeing, Spokane International Airport, and Port of Seattle are funding the activity. More information can be found on the <u>Climate Solutions</u> website.

Identify the source(s) of funds used to support this initiative (e.g., AIP, PFC, other airport revenue, bonds, grants):

Regarding the Environmental Strategy Plan, some of the projects that fall within its purview have received outside funding. A project to install preconditioned air at all gates to limit APU use received VALE funding. U.S. DOE's Clean Cities program has provided funds to meet the incremental cost of electric GSE.

Describe the driving force(s) (e.g., manager, champion, or external advocate) behind this initiative. Describe how the decision was made to pursue this initiative. Identify any tools or models used. Draw a flow chart or schematic of the process, as appropriate.

Significant cultural change has occurred at the airport in a very positive way. This started when Tay Yoshitani arrived as the CEO of the Port. He said he wanted SeaTac to be the cleanest, greenest airport. Setting the tone allowed others to follow. Mark Reis, Managing Director, Aviation Division, picked up on this concept and has remained very supportive. SeaTac has now arrived at the point where "environmental innovation" is the third priority for the whole airport as established by the airport managers and directors. "Sustainable Asset Management" is another priority that will be the focus of significant thought and development in the coming year.

Describe any quantitative goals or metrics used to evaluate the success of this project or program:

SeaTac feels having and using metrics gains credibility and helps manage the sustainability process. Their baseline and vision are structured on metrics. The following are the high level metrics currently being used to track the success of achieving the goals of their vision.

Air Quality and Climate Change

- Fuel Use by Type (gasoline, diesel, compressed natural gas) gallons
- GHG Emissions (airport emissions, airline/tenant emissions, and public emissions) metric tons/yr
- The airport also computes airport emissions per passenger in pounds
- Transportation (average occupants per vehicle trip) number of occupants

Energy Use and Conservation

- Electricity Use (total kWh of electricity used) kWh
- Electricity use per passenger KWh/person
- Conservation (total electricity saved) kWh/year
- Renewable Energy ("Green Power" purchased) % of total energy used
- Natural Gas Use (total therms used, therms used/passenger, therms/sq. ft.) therms

Buildings and Infrastructure

- Sq. Ft. green buildings or LEED rated buildings million sq ft
- Number of capital, tenant, or concessions projects achieved or proposed for LEED certification
- Facility condition index %

Materials Use and Recycling

- Municipal Solid Waste (generated, landfilled, recycled) tons
 Municipal solid waste recycling rate %
- Hazardous Waste (generated) pounds
- Environmentally Preferable Products (paper, office products) % of total purchased

Water Resources

- Water Consumption (potable water use, potable water use per passenger) gallons, gallons/passenger
- Water Quality (% acreage with water quality BMPs, % acreage with flow control)
 %
 - NPDES permit exceedances

Noise and Education and Integration

• Metrics have not been identified for these indicators

SeaTac is starting primarily with absolute metrics (gallons, kWh, tons) based on the data that is available. They are testing some normalized metrics such as emissions per passenger. The Environmental Department works with facilities to identify what data is needed. For example, they have only begun to install sub-meters for tracking electricity use.

Wrap-up Questions:

Describe any in-house training or coordination that supports this facility's sustainability program (including, but not limited to team building, staff education, employee training programs):

To date, the airport has only done informal training on asset management and sustainability. This type of training is contemplated for the future but for now employees tend to select their own training activities.

SeaTac has realized that training is important for having others embrace the goals. For example, they have begun to educate passengers beginning in the parking area and educating them along the way to the gate so they can actively participate in the recycling program. Passengers need to know it is a goal and how the system works so they are prepared to participate. The airport has also put together a brochure to explain the recycling program to tenants.

What programs or initiatives are next on the horizon? What are your shortterm and long-term goals (including Net Zero goals)? How will benefits or results be measured and verified?

Regional Sustainable Facilities Roundtable is a program where SeaTac shares their best practices with other public and private organizations including Boeing, University of Washington, Puget Sound Utilities, the Port, and many others.

The SAFN program is a high priority for the near future (see discussion of Sustainable Aviation Fuels above).

Figuring out how to implement Sustainable Asset Management policy is also a high priority, as well as developing an approach to sustainability master planning.

Describe challenges, difficulties, or uncertainties facility had to overcome:

SeaTac feels the organization still operates in silos too often and it is hard to arrive at common goals. This is a process of redefining business practices that is hard to accomplish in areas where one is not personally or directly involved. It is also difficult to convince other departments at the airport that they will get full credit for environmental benefits in their projects that were defined by the Environmental Department. The Environmental Department is currently thinking about how to praise or credit this behavior.

The managers noted that it is important to take baby steps (i.e., bottoms up effort). Not everything can be done in a big way (i.e., top down effort).

There is no sustainability "end-game." Sustainability will continue to change continuously into the future. You need to be open to new ways of doing things. Sustainability is not necessarily a project specific activity but more comprehensive in business management practices.

ACRP 02-22 – Case Study Interview

Airport/Facility Name: San Francisco International Airport (SFO) – Overall Airport Discussion

Dates: 3/17/11 and 3/18/11

Contact Phone and web address: (650) 821-5000; http://www.flysfo.com/web/page/about/sustainable_sfo/

Discussion Topics:

- 1. Air Quality
- 2. Water Conservation
- 3. Recycling
- 4. Composting
- 5. Energy Use Reduction
- 6. Solar Array
- 7. Carbon Offset Kiosks
- 8. Concessions Program
- 9. Contractors

Detailed Notes about each Discussion Topic:

Discussion Topic 1: Air Quality

Current or conventional practice for this application:

Over 90% of the gates at SFO provide 400Hz power and pre-conditioned air to aircraft so the aircraft would not have to use the Auxiliary Power Units thereby eliminating the associated global warming gases and air pollutant emissions.

The rental car subsidy program funded by SFO resulted in increased rental of electrical/hybrid/alternate fuel vehicles, and yielded 1,224,000 gallons of gasoline fuel savings in 2010 calendar year.

Describe benefits:

The rental car program expanded their hybrid/alternate fuel vehicles, as it has resulted in ~1,224,000 gallons of gas saved in 2010 calendar year and eliminated the associated emissions from the combustion of this fuel. Similar benefits were derived from the power and conditioned air supply to aircraft parked at the gates.

Describe costs and financial impacts (order of magnitude if detailed cost information unavailable):

Customers who rent hybrid / fuel efficient cars at SFO will receive a \$15 discount at the counter. Likewise, the airport rental car companies, that rent out to customers 15% or more of high-mileage and alternative-fuel vehicles, will qualify for a 20% reduction of their airport rental fee.

About \$2.3 million in subsidies has been given out to date.

Discussion Topic 2: Water Conservation

Current or conventional practice for this application:

SFO uses efficient bathroom fixtures and reuses treated wastewater from landscape irrigation.

SFO built a state-of-the-art wastewater treatment plant and stormwater management facilities to enhance water quality in the San Francisco Bay. The stormwater management system includes over nine million gallons of stormwater detention ponds for collecting and treating the first flush of stormwater runoff during each rainfall event

In terms of drinkable water, SFO realized they have the cleanest water in the country and should not be purchasing bottled water for their offices as they had in the past. They now have water coolers equipped with filters that are set up in each location using the local tap water.

Discussion Topic 3: Recycling

Current or conventional practice for this application:

Over 8,000 tons of solid waste was recycled in 2010 which amounted to about 75% of the waste generated at the Airport.

Multiple solid waste containers are deployed at the terminals for bottles & cans, paper, and trash allowing the passengers to separate their recyclable waste at the source.

Discussion Topic 4: Composting

Current or conventional practice for this application:

Composting is gaining ground at SFO and over 3,000 tons were composted in 2010.

Discussion Topic 5: Energy Use Reduction

Current or conventional practice for this application:

The San Francisco Mayor's Office has embarked upon a program to achieve a 5% reduction in energy consumption in all city departments. SFO's program includes many common sense approaches like turning off lights and other electrical equipment when not in use and turning down the thermostat.

As an energy saving measure, if computers have not been used for over 15 minutes they would be shut off at 7 pm each day.

Discussion Topic 6: Solar Array

Current or conventional practice for this application:

52,000 square feet of solar panels were installed on the roof of domestic Terminal 3 in 2007. The grid-tied system offsets approximately 15 percent of the Terminal's peak daytime power requirements, generating up to 628,000 kW per year. Over its 30-year life, the system is expected to reduce carbon dioxide emissions by 7,200 tons.

Discussion Topic 7: Carbon Offset Kiosks

Current or conventional practice for this application:

Launched in 2009, the kiosks offer travelers a way to calculate the carbon footprint of their air travel and purchase offsets that will support projects based in San Francisco and California. As the first program of its kind in the nation's airports, the three Climate Passport kiosks are available post-security on both sides of the International Terminal and in Terminal 3. Using the kiosks or the website, travelers can easily calculate the carbon footprint of their flights to determine the amount of carbon offsets (aka, Verified Emission Reductions or VERs) needed to address the greenhouse gas impact. When the amount is set, 3Degrees, a local San Francisco carbon and renewable energy marketing firm that manages the Climate Passport kiosks, sources carbon offsets from The Conservation Fund's Garcia River Forest Project and the San Francisco Carbon Fund, to ensure an equivalent amount of greenhouse gases has been reduced. To date the Kiosks have offset about 750 metric tons of carbon emissions associated with passenger flights.

While the level of participation has declined more recently, SFO feels that the current economy is the largest factor in the decline and is continuing with the program.

Discussion Topic 8: Concessions Program

Current or conventional practice for this application:

The airport expects its food and beverage tenants to provide sustainable food to the greatest extent possible. Expectations include using:

- organic, local products
- organic or natural meats
- rBST-free dairy products
- cage-free antibiotic eggs
- sustainable seafood
- fairly traded organic coffee
- non-modified agricultural products
- no artificial color, flavor or additives
- non-hydrogenated oils
- biodegradable to-go containers and utensils
- compostable bio-resin or paper bottles for water
- low- or no-phosphate detergents.

Contractually, concessionaires are not allowed to charge more than 15% more than what they do at their locations in the City of San Francisco. And while some efforts are as a result of signing leases for the new T2, they also appear to be implementing the same initiatives at their other SFO locations without it being mandated.

The Airport does not currently charge the concessionaires for recycling if their solid waste is source separated.

Discussion Topic 9: Contractors

Current or conventional practice for this application:

SFO's solid waste Contractor recycles at least 40% of the mixed waste that is hauled from the airport and SFO has set the goal for the mixed waste recycling level to be increased by 2% each year.

Discussion Topic 10: Community Outreach

Current or conventional practice for this application:

There are posters in the terminal and train stations that encourage passengers to 'travel green'. The renovated Terminal 2 that will be opening on April 14, 2011 will have flags or banners hung to showcase and quantify efforts that were undertaken during construction and the resulting benefits. *A separate interview form was completed just for Terminal 2 (see attached)*.

Wrap-up Questions:

Describe any in-house training or coordination that supports this facility's sustainability program (including, but not limited to team building, staff education, employee training programs):

The overall training program for new employees includes an orientation to sustainability at SFO. This program introduces employees to items such as the commuter benefit program, which is pre-tax, and offers vouchers and direct deposits. There is a fitness program that encourages employees to exercise as part of a healthy lifestyle and offers rewards and recognition.

Commuter Benefit Program

To encourage employees to use public transit or van pools and to take advantage of certain federal tax reduction programs, SFO reduces the cost of public transit by allowing employees to purchase qualifying transit passes or reimbursement for vanpools rides with pre-tax dollars. The Airport's Commuter Benefits Program is based on the City's Commuter Benefits Ordinance 199-08, which was passed by the San Francisco Board of Supervisors in 2008. The Commuter Benefits Ordinance requires all employers in San Francisco that have 20 or more persons performing work for compensation on a full-time, part-time, or temporary basis, and who work an average of at least 10 hours a week while working for the same employer within the previous calendar month, tooffer a commuter benefits program.

What programs or initiatives are next on the horizon? What are your shortterm and long-term goals (including Net Zero goals)? How will benefits or results be measured and verified?

SFO is currently developing a formal Sustainability Plan and an update to their Climate Action Plan.

In addition, the Airport will be updating their 2007 Sustainability Highlights Report.

SFO will be replacing 2 boilers in the Central Plant to increase efficiency. Air conditioning units will also be replaced in various locations.

Describe challenges, difficulties, or uncertainties facility had to overcome:

What advice would management offer another facility?

Investigate and develop a plan to see what areas can be improved upon.

When new purchases must be made (i.e. fleet vehicles) make sure that they are green purchases.

When lighting needs to be replaced, move from traditional bulbs to LED lighting.

SFO had the opportunity to starting early on incorporating sustainability but that does not mean it is not possible for other airports now.

ACRP 02-22 – Case Study Interview Form

Airport/Facility Name: San Francisco International Airport – TERMINAL 2 ONLY

Date: 3/17/11

Contact Phone and web address: (650) 821-5000; <u>http://www.flysfo.com/web/page/about/sustainable_sfo/</u>

Discussion Topics:

- 1. Drivers for a Green T2
- 2. Waste
- 3. Composting
- 4. Concessionaires/Tenants
- 5. Water Efficiency
- 6. Energy Performance
- 7. Displacement Ventilation System
- 8. Sustainable Design
- 9. Community Outreach
- 10. Water Bottles
- 11. **RFP Requirements**
- 12. Stakeholders
- 13. Contractor Education

Synopsis of Sustainability Programs, Policies, Processes, Technologies, and/or Equipment:

The Airport has not developed a sustainability plan but they are implementing sustainable measures around the airport.

Detailed Notes about each Discussion Topic:

Discussion Topic 1: Drivers for a green T2

Current or conventional practice for this application:

The Airport has discussed with designers from the beginning of the project, their goals to achieve LEED certification for T2. They did not start out with their sights set on Gold because they were not sure how the points would add up in the application on a terminal. SFO wanted to align with the City of San Francisco's building construction/renovation goals.

For the Airport it was not just about the accumulation of LEED points, they also wanted to put the joy back into flying and follow their mantra of passenger comfort and energy savings.

Since 2006, the City of San Francisco required by ordinance that any buildings constructed over 5,000 sq. feet, that are paid for with municipal money, need to be at least LEED Silver certifiable.

Describe benefits:

From the beginning of the project, the Airport recognized that they wanted to incorporate sustainable elements to the greatest extent possible and also set the goal of achieving LEED Silver Certification.

Describe whether the anticipated benefits were achieved and explain why/why not:

The benefits were achieved, as the terminal is seeking LEED Gold certification.

Describe the driving force(s) (e.g., manager, champion, or external advocate) behind this initiative. Describe how the decision was made to pursue this initiative. Identify any tools or models used. Draw a flow chart or schematic of the process, as appropriate.

the City of San Francisco required by ordinance that any buildings constructed over 5,000 sq. feet, that are paid for with municipal money, need to be at least LEED Silver certifiable.

Discussion Topic 2: Waste

Current or conventional practice for this application:

In the journey toward Zero Waste the Airport set a goal of recycling 75% of its waste streams from the T2 project. At the time of the interview, 92.8% of the construction demolition waste was being recycled and diverted from the landfills.
There is little reuse of materials on-site, with the exception of concrete fill crushed and reused for aggregate. The majority of waste is recycled off-site by the contractors.

Discussion Topic 3: Composting

Current or conventional practice for this application:

In 2010, 3,200 tons of food waste at SFO was composted Airport-wide. In T2 food court areas separate trash cans will not be deployed as all waste is expected to be compostable, and only receptacles for recycled goods will be needed. There will be 3 different types of receptacles in the common area; bottles/cans, paper, and other.

Currently the waste hauler transports the compostable materials off Airport property to an off-site composting area.

Describe benefits:

At Terminal 2 by not needing to separate their waste, the passengers will be more receptive to participating in the composting operation. It will be much easier for the passengers and they will not even need to think about for separate containers for trash and compostable waste.

Describe costs and financial impacts (order of magnitude if detailed cost information unavailable):

It costs the SFO the same amount of money to compost as it does for traditional hauling. So while it is not necessarily saving them money it is not costing them money either.

Discussion Topic 4: Concessionaires/Tenants

Current or conventional practice for this application:

Concessionaires are accepting of the initiatives because they were a part of the RFP process and there is money to make in the terminal so they will comply.

One requirement imposed on the concessionaires is that they use only compostable containers and serveware.

The Airport encourages companies to acquire a Green Business Certification that is awarded by San Mateo County. If a concessionaire or tenant does become certified they would receive a 50% discount on their monthly garbage bill.

Gensler, the design Architects for Terminal 2, created sustainable guidelines for tenant improvements that concessionaires/tenants will have to follow.

Describe benefits:

Due to the cost of oil, the compostable products are actually cheaper for concessionaires to purchase rather than traditional plastic options.

Initially current tenants gave a little pushback on the requirement of compostable serveware but once they saw that they could actually save money by going that route they accepted it.

Discussion Topic 5: Water Efficiency

Current or conventional practice for this application:

In T2 they have installed dual plumbing to use treated wastewater in the toilets and urinals. This was possible because of the extensive remodeling work being done on the terminal.

For the other terminals, they have gone back to the drawing board to asses how the current supply lines could be reconfigured.

Discussion Topic 6: Energy Performance

Current or conventional practice for this application:

Certain target points were set in the RFP that designers were required to meet. These standards set by the Airport went beyond the City's Building Code for an additional 15% reduction in energy usage over traditional usage.

Discussion Topic 7: Displacement Ventilation System

Current or conventional practice for this application:

With the Displacement Ventilation System, air is delivered at a lower point and therefore doesn't need the same amount of fan power to push the air downward. By not mixing the air with the exhaust system they don't need to chill the air as much. The ventilation system is made up of a small cluster of fans instead of just large fans.

Common practice in European airports, the vents are under the seats in the terminal. The only downside to this is that the ductwork is integrated in to the seating configuration so chairs cannot be moved without adjustments to the ventilation system.

Describe benefits:

There was more than one benefit associated with the Displacement Ventilation System (saves money, higher comfort level for passengers, more quality air circulating).

The mechanical employees are excited about the new system and the benefits of repairing this type of ventilation system versus a traditional system. Repairs can be difficult on one large fan, but since the Displacement Ventilation System has many small fans, the system would be able to operate even when maintenance is needed on some fans.

Describe costs and financial impacts (order of magnitude if detailed cost information unavailable):

Seeing as there are multiple benefits associated with the Displacement Ventilation System SFO feels they received a "bigger bang for their buck."

Describe the driving force(s) (e.g., manager, champion, or external advocate) behind this initiative. Describe how the decision was made to pursue this initiative. Identify any tools or models used. Draw a flow chart or schematic of the process, as appropriate.

The terminal was modeled and these efficiency efforts were drivers to test assumptions and to see how to move forward with the biggest benefits.

Describe any quantitative goals or metrics used to evaluate the success of this project or program:

The staff must maintain the building to the standard to which it was certified. While energy control devices are available to aid, they can be cost prohibitive.

Discussion Topic 8: Sustainable Design

Current or conventional practice for this application:

The terminal went through a 6-month conceptual design process where each department at SFO was approached for input. Although the length of the design was longer than usual, the increase in design time will lead to making future endeavors at the airport easier.

Discussion Topic 9: Community Outreach

Current or conventional practice for this application:

There is an interactive website which is part of a larger initiative by the Airport to showcase their sustainability projects. It is a layperson's explanation of the initiatives undertaken in the terminal and is meant to relay the overall message of sustainability.

SFO also hopes to inspire passengers to make small changes in their own City/office/home through transparent green initiatives.

The installation of hydration stations also encourages passengers to bring their own reusable water bottle as opposed to purchasing bottled water.

Discussion Topic 10: Water Bottles

Current or conventional practice for this application:

SFO installed Hydration Stations at various locations in the terminal to encourage passengers to bring their own reusable bottles rather than purchase bottled water. There is signage that directs passengers to the stations and some vendors may even sell branded San Francisco reusable bottles.

There was a point when SFO thought about banning the sale of bottled water in T2, but there was pushback from vendors on the projected loss of their revenue that would result. Instead they have made it a lease requirement that only water bottled in compostable bottles are allowed to be sold in the terminal.

Describe benefits:

These initiatives divert plastic bottles from the landfill.

Describe whether the anticipated benefits were achieved and explain why/why not:

Yes, benefits were achieved as passengers are allowed to refill their own reusable water containers from home at the airport's Hydration Stations.

Discussion Topic 11: Leased Space

Current or conventional practice for this application:

The lease agreements for T2 concessionaires/vendors require tenants to have a 'Green Story' that goes beyond just recycled content goods and demonstrates how their company would fit into the T2 aesthetic and green policies.

Some of the requirements stipulated were not easy to meet, but it helps to start the dialog that then leads the tenants to deeper thinking.

Discussion Topic 12: Stakeholders

Current or conventional practice for this application:

A lot of parties that attended the design meeting provided input. SFO has been working with various stakeholders throughout the design process, including the airlines.

Virgin America has been very supportive and involved in the project since the beginning. They have made suggestions that were taken into account regarding materials used and are also tailoring their leased space within T2 in hopes of achieving LEED Commercial Interior Platinum. They have requested that the area they will be leasing have lower flow fixtures than originally was planned in the design. SFO has complied and feels this is a great example that Virgin is setting for the rest of the tenants and are grateful that they have pushed the City to do more.

Discussion Topic 13: Contractor Education

Current or conventional practice for this application:

The exposure to LEED has been helpful but it is now becoming more and more of an industry standard. A pre-contract meeting is held with each contractor. They now know this is just par for the course and it is more of a reminder of what they need to follow. Turner (as Construction Manager on this project) is in charge of tracking, as well as any reinforcement.

The tightly controlled specifications hold contractors on what they contractually signed on to. Source control has been something that the superintendents were educated on, products that are not to be used anymore etc. Initially there was pushback the first week but then the contractors adjusted to this as the normal way SFO does business. It is similar to the Title 24 electrical standards in that this is now "just the way things are done." In the future the sustainable efforts undertaken by the contractors voluntarily will become code.

Describe benefits:

By making the efforts personal the contractors are excited to participate and have a personal stake it the project.

Wrap-up Questions:

What advice would management offer another facility?

Intertwine sustainability goals into the design goals that that they can't be engineered out. By their inclusion into the physical design it is no longer just about LEED.

On the airport's side, set the goal high and push your designer to come up with creative solutions. There is often a minimal or no cost increase to make this a requirement of designers.

Provide equipment battery chargers so the electric GSE's can be charged and it will benefit the airport's air quality measures.

Place much consideration in high traffic areas and install low flow plumbing fixtures. It will save energy and water and it is a cheap change to make.

LEED is not always applicable to airports so some tweaking and considerations will be needed.

An airport needs to prioritize what initiatives would give the most benefit to the passengers while providing the biggest value to the project. For example, various other green initiatives were considered for SFO, but after analysis were decided against:

- Solar panels are in installed on the roof of Terminal 3, next to T2, and SFO did not think it was worth duplicating in T2
- After a Photovoltaic Study it was determined that the costs to build and maintain were too large for the amount of power that would be produced
- Green roofs on the Airport were decided against due to wildlife concerns
- White roofs may cause a glare to Air Traffic Controllers and the Airport was concerned that the FAA would not accept this
- SFO does not have as much of a Heat Island effect this resulted in LEED points that were not applicable to them
- Wind turbines are not technologically very efficient in the case that only a few would be installed. One turbine would illuminate only one light bulb.

ACRP 02-22 – Case Study Interview Form

Airport/Facility Name: Harm A. Weber Academic Center at Judson University (WAC)

Date: March 22, 2011

Contact Phone and E-Mail: (847) 628-2500; http://www.judsonu.edu/sustainability/

Discussion Topic:

1. Hybrid Natural Ventilation System

Synopsis of Sustainability Programs, Policies, Processes, Technologies, and/or Equipment:

Judson University is an evangelical Christian university located in Elgin, Illinois, a western suburb of Chicago. Although largely a liberal arts school, Judson's growing population and rising popularity in the study of art, design and architecture generated a need for a new academic building. The Harm A. Weber Academic Center opened in August of 2007 and houses the School of Art, Design and Architecture as well as the Benjamin P. Brown Library. The 88,000 square-foot building features a mixed-mode natural ventilation system for its heating and cooling. The system is particularly unique because it serves the fluctuating climate of the Midwest.

The system is a mixed-mode natural ventilation system because the heating and cooling strategy relies on natural ventilation only when the temperature differential between the desired indoor temperature and measured outdoor temperature is at a minimum during the swing months in spring and fall, while it relies on the use of a mechanical system during summer and winter. The building is designed and programmed to operate fully natural during temperate days and fully mechanical during the harsh winter and hot summer days in the Midwest, but it also assumes a number of modes in between, allowing the building's heating or cooling strategy to be calibrated for ideal efficiency based on the current outdoor conditions. The building uses the natural buoyancy of warm air to move air from the lower level intakes to the upper level exhausts. Using the stack effect, air is pulled and directed through an intricate maze of ducts and plenums to provide fresh air for all spaces.

There are many design components that allow this system to function. The building is primarily constructed with concrete which serves as a thermal mass. Thermal mass is a material that absorbs thermal energy and releases the heat slowly. The Weber Center uses this concept to offset daily temperature fluctuations to save energy and increase thermal comfort. The building also has a central atrium. Natural ventilation is a strategy that is tailored for buildings with a shallow plan. The Weber Center's need for square footage required a deeper plan and the use of its central atrium to serve as a giant air duct to move air from floor to floor as well as a way of bringing daylight to all four levels.

Facility's definition of sustainability:

Stewardship is an important component of the Christian belief structure at Judson University. With this project, that came to include environmental stewardship, and the university embraced the proposed highly sustainable solution for their new academic center. The university strives to make a connection between social justice and environmental justice.

As is with any sustainable design, the owner is also interested in efficiency, energy cost savings, and return on investment.

How do initiatives achieve or meet that definition?

The university's academic and religious community embraced the sustainable initiatives proposed for their new academic center. Even now, environmental stewardship is stressed equally in the university's values and curriculum. The sustainable initiatives at the Weber Center not only achieve the definition, but played a major role in characterizing the definition. Judson's dedication to sustainability has continued post occupancy of the Weber Center. The university has conducted testing to monitor the efficiency of the system and identify how it can be calibrated to become most efficient. The faculty, staff, and students have become invested in their new sustainable building. The addition of this building to the campus has the Judson community thinking regularly about man's relationship to the environment. It has enticed the architecture students to make sustainable design a popular concentration in their studies.

Detailed Notes about each Actual Discussion Topic:

(Complete the following for each actual topic/initiative/major area discussed during the case study interview. Attach additional sheets as necessary)

Discussion Topic 1: Hybrid Natural Ventilation System

Alternative Strategies and/or Best Practices:

Current or conventional practice for this application:

A conventional forced air system uses mechanical heating and cooling equipment to condition air that then gets forced throughout the building by mechanical fans. These systems can be upgraded with high-efficiency equipment to minimize the amount of energy used to condition air and operate fans. However, the fact remains that these systems do not take advantage of the outdoor conditions on temperate days like a natural ventilation system does. A conventional forced air system may not need to dramatically heat or cool air on temperate days, but the fans are constantly being used to move air throughout the building.

Recommended practice for this application:

The natural ventilation system at the Weber Center does not use mechanical fans to move air, but instead the natural buoyancy of warm air to generate air movement. The natural ventilation system, when in fully natural mode, does not use any mechanical heating or cooling to condition the air. The mixed-mode settings allow the system to take advantage of partial natural ventilation to reduce the load on the mechanical system and increase overall efficiency while reducing energy use.

Best practice for this application:

While the hybrid natural ventilation system is quite efficient, it is still under scrutiny as the most sustainable solution in the Midwestern climate. First, the actual efficiency level as recorded by Judson has not met the estimated design efficiency. This could be due to a number of variables including slight discrepancies in the engineering, air leakage in the building, and harsher than anticipated weather conditions during the period that was tested. Additionally, an inherent downside with natural ventilation is a wider allowed temperature threshold for the building's interior climate. Conventional systems allow occupants to keep the temperature threshold within a few degrees of the set-point, but natural ventilation systems lead themselves to requiring a wider temperature threshold that may leave some occupants uncomfortable with the interior climate. This was the case at the Weber Center and the threshold was narrowed slightly, which causes more use of the mechanical system and decreased overall energy efficiency.

Describe benefits:

Environmental and Economic Benefits: The following environmental benefits are summarized in the essay, "Harm A. Weber academic center, post-occupancy building performance and comfort perceptions" written by Keelan P. Kaiser, the Chair of Architecture for Judson. The design proposed a 42-47% energy savings over a conventional academic building of the same size. The design case was modeled against the conventional ASHRAE 90.1 total annual base case energy consumption. The design case anticipated electricity savings of 10.6% and gas savings of 42.6%. The total predicted energy savings was 18.3% over the base code. The Weber Center was tested for a twelve-month period from December 2008 to December 2009 to evaluate its asbuilt performance. The actual electrical consumption was quite low, at 33.9% lower the design estimate. The gas consumption however was higher than anticipated at 278.1% higher than the designers had predicted. This resulted in a 2.3% increase in overall energy use when compared to their target savings, which was 18.3% savings above an academic building of the same size.

Table: Annual Energy Use Comparison: Design Case vs. Actual Energy Use, PercentActual Energy Difference

	Design Case Energy (MMBtu)	Actual Energy Use (MMBtu)	Percent Difference from Design Case
Electricity	5026.4	3324.7	33.9%
Gas	1035.3	2879.1	278.1%
Total	6061.7	6203.7	102.3%

Table from "Harm A. Weber academic center, post-occupancy building performance and comfort perceptions" by Keelan P. Kaiser

Social and Community Benefits: Stewardship is an important component of the Christian belief structure at Judson University. With the Weber Center bringing attention to sustainability, the university now strives to make a connection between social justice and environmental justice within its community. Judson's School of Art, Design and Architecture is proud to consider the life-long impact the building will make on the students and staff who study and work there. Judson University students, faculty and staff use the building on a daily basis, growing their imagination of sustainable lifestyle and sustainable architecture. Judson also hopes that the knowledge is contagious for the greater Elgin area to integrate sustainable design into future neighborhood developments. The Weber Center is already a living case study for sustainable architecture and the mixed-mode natural ventilation system for students and design professionals around the globe.

Describe whether the anticipated benefits were achieved and explain why/why not:

The Weber Center's natural ventilation system was not as efficient for natural gas consumption as anticipated. This has prompted a diagnosis of the problem by mechanical and commissioning engineers. They attribute some of the efficiency loss to possible leaky dampers or building envelope, damper operating errors, boilers not running as efficiently as designed, the system waiting too long to switch from natural to mechanical mode, and the possibility of poor energy modeling due to the unique nature of the building. As a result, Judson continues to test the efficiency of their building and make adjustments where possible.

The Weber Center has contributed in an immeasurably positive manner to its community. The state-of-the-art building is recruiting students from all over the country to Judson University to study art, design and architecture. The university's programs for these majors have grown significantly and much of it is attributed to the building. As a result of the success of the Weber Center, Judson University has declared that all future buildings on campus will be LEED certified.

Describe costs and financial impacts (order of magnitude if detailed cost information unavailable):

The construction cost for the building is roughly \$25M. This type of system is so integrated into the architecture of the building that it is difficult to specifically calculate the system cost. The mixed-mode system is designed to act as a conventional (high-efficiency) forced air system during extreme months when natural ventilation cannot be utilized. Therefore, the system cost is not significantly greater than a conventional forced air system.

Identify the source(s) of funds used to support this initiative (e.g., AIP, PFC, other airport revenue, bonds, grants):

The project was funded primarily by private donors; however it had garnered significant Federal and State of Illinois grants:

2004 Federal Energy and Water Appropriations Bill Illinois Clean Energy Community Foundation Kresge Grant

Describe how the facility tracks the financial impacts of this initiative. Are projected goals being met? Why or why not?

The financial impacts of the mixed-mode natural vent system and the building as a whole is being monitored by Judson's Finance Department. The building's BAS (Building Automation System) tracks all of the efficiency data from the building's mechanical system and the Finance Department compares the actual data to the projected design efficiency as well as current rates for energy. As previously described, due to a number of potential engineering and operations issues, the building does not perform as the design had projected, but the university has taken an active role in continuing to diagnose issues and improve efficiency.

Describe the driving force(s) (e.g., manager, champion, or external advocate) behind this initiative. Describe how the decision was made to pursue this initiative. Identify any tools or models used. Draw a flow chart or schematic of the process, as appropriate.

The project began as design competition amongst hand-picked architecture firms both domestic and international. The design competition generated one scheme that stood out for its sustainable efforts. Submitted by Short and Associates from the United Kingdom, the winning entry was the only one to recommend a LEED certified building that boasted 42-47% energy reduction from a conventional academic building. The university's dedication to stewardship combined with the excitement for a modernized perspective on design and architecture and the promise of grant money, Judson became dedicated to realizing the Short scheme for the Harm A. Weber Academic Center.

Describe any quantitative goals or metrics used to evaluate the success of this project or program:

The university measures the project's success mostly by noticing the amount of growth in the School of Art, Design and Architecture. Enrollment has increased every year since the building opened and design students are increasingly interested in sustainable design curriculum. Judson University also administered testing with the University of Oregon to evaluate the efficiency of the mixed-mode natural ventilation system. Judson plans to continue to test its building to achieve optimum efficiency.

Wrap-up Questions:

Describe any in-house training or coordination that supports this facility's sustainability program (including, but not limited to team building, staff education, employee training programs):

Students and staff needed to be educated on how the building's mechanical system works. There is an element of user control that affects the thermal comfort of interior spaces and overall efficiency of the system. Students and staff soon adjusted to opening windows for fresh air and dressing appropriately to the weather to offset a wider temperature threshold inside the building. The commissioning stage of construction also allowed for maintenance staff training on the highly unique system.

What programs or initiatives are next on the horizon? What are your shortterm and long-term goals (including Net Zero goals)? How will benefits or results be measured and verified?

As a result of the success of the Weber Center, Judson has committed to designing all future buildings at Judson to be LEED certified or better. Judson is more aware of its campus ecological footprint and future projects may aim to reduce Judson's footprint.

Describe challenges, difficulties, or uncertainties facility had to overcome:

The LEED Gold certified building opened in August of 2007 when LEED was not as popular as it is today. The university was challenged with helping its staff, students, and visitors understand some of the sustainable design initiatives that the building featured. The landscape design featured native plantings and a bioswale, and the university has to explain to students and visitors that a seemingly unkempt lawn is in fact prairie grasses that are sustainable and invite native species to return to campus. Before educating students, the bioswale was seen as a mosquito bog rather than a sustainable means of reducing stormwater runoff to the nearby Fox River.

The university was challenged with raising consumption awareness and changing consumption behavior among its staff and students. The natural ventilation system leads itself to a wider allowable temperature threshold for interior climate. Many people are resistant to an interior temperature that may fluctuate more than a few degrees. After becoming acclimated, the students and staff have since become more aware of how their building works and have become accustomed to wearing sweaters on colder days and opening windows on warm days.

ACRP 02-22 – Case Study Interview Form

Airport/Facility Name: Water Harvesting Solutions (Wahaso) – Harold Washington Social Security Building (WHS)

Date: March 9, 2011

Contact Phone and E-Mail: 312-353-8277; http://www.ssa.gov/pgm/greener.htm

Discussion Topics:

- 1. Water Harvesting at Harold Washington Social Security Building
- 2. Water Harvesting's Potential at Airports

Synopsis of Sustainability Programs, Policies, Processes, Technologies, and/or Equipment:

The case study evaluates water harvesting as a sustainable design strategy or technology for airports to consider in both new projects and renovations. Water Harvesting Solutions (Wahaso) is a designer/manufacturer/supplier of water harvesting systems with a collection of projects nationwide. Wahaso was interviewed for their knowledge of systems and strategies for a wide range of project types and sizes. The case study then focuses on their project at the Harold Washington Social Security Building in Chicago, IL.

Wahaso:

Wahaso is a rainwater or greywater system supplier that designs and builds water harvesting systems. Their holistic approach to designing and building water harvesting systems tries to integrate multiple sources of renewable water along both active and passive approaches to capturing and processing water for use in the building. A typical system in its simplest form collects water from a source or multiple sources, filters the water of sediments, sterilizes the water of contaminants, and delivers the water for use.

Sources:

- Rainwater (water from the roof or other above-ground surface)
 - o Roofs
 - o Canopies
- Stormwater (water from outdoor ground-level surfaces)
 - o Parking lots
 - o Roadways
 - o Walkways
 - o Plazas
 - o Runways
 - o Tarmac
- Ground Water (water from below grade)
 - o Sump pump
 - o Underground water table
 - Rainwater that infiltrates soils

- Condensate (water vapor that turns into water when near a cold surface)
 - Cooling towers
- Grey Water (water that has been "gently used" and has not yet been treated)
 - o Sinks
 - o Showers
 - o Baths
 - o Light industrial applications

Uses:

- Toilet and urinal flushing
- Landscape irrigation
- Cooling towers
- Fire suppression systems
- Industrial applications
- Clothes washing

Wahaso's systems integrate as many sources as possible to offset the greatest volume potable water usage possible.

General Services Administration (GSA):

GSA is committed to incorporating principles of sustainable design and energy efficiency into all of its building projects. Specifically at the Harold Washington Social Security Building in Chicago, Illinois, the GSA administered a project for sustainable building upgrades which included water efficiency. GSA initially wanted to capture rainwater from the building's roof for landscape irrigation on-site. GSA consulted Wahaso at the project's conception and Wahaso investigated multiple sources for and uses of recycled water. The finished project (described in detail in later sections) is estimated to save 3,225,000 gallons of potable water annually at the Harold Washington Social Security Building and cut its potable water usage by approximately 80% annually.

Facility's definition of sustainability:

Wahaso's Definition of Water Sustainability:

Fresh, potable water is quickly becoming a threatened resource in the U.S. With high population growth in dry states, dropping aquifer levels, draught conditions and an aging water infrastructure, "water promises to be to the 21st century what oil was to the 20th." We can expect the cost of municipal water to rise dramatically in the next few years.

Despite the early signs of scarcity, commercial buildings continue to use billions of gallons of potable water each day for non-potable uses like flushing toilets, watering landscaping and conditioning the air.

Wahaso's mission is to help municipalities and commercial property owners reduce the impact of their buildings on the environment through innovative sustainable water practices. They believe that some form of water harvesting and reuse can be both economically and environmentally viable for all commercial buildings.

GSA's Definition of Sustainability for Building Projects:

GSA is committed to incorporating principles of sustainable design and energy efficiency into all of its building projects. The result is an optimal balance of cost, environmental, societal and human benefits while meeting the mission and function of the intended facility. It is GSA's intent that sustainable design will be integrated as seamlessly as possible into the existing design and construction process. (www.gsa.gov)

How do initiatives achieve or meet that definition?

Wahaso:

Wahaso provides custom solutions nationwide for harvesting systems that capture, filter, store and apply rainwater, stormwater and greywater in commercial properties. They provide service for Architects. When a building is being designed, they scope the harvesting system by thinking through the best sources and uses for on-site treated water. Wahaso recommends the size and type of system and provides a rough estimate of the project's cost. Water harvesting manufacturers like Wahaso service the project from start to finish. They provide detailed system designs, drawings and specifications with the design team. During construction, they serve as the manufacturer of the specified system. After substantial completion of construction, they provide training and support to the property owner for operating and maintaining the installed system and warrant the entire system. Wahaso has a plethora of successful projects nationwide that help building owners reduce their potable water consumption.

<u>GSA</u>:

GSA uses the Leadership in Energy and Environmental Design (LEED) Green Building Rating System of the U.S. Green Building Council as a tool for evaluating and measuring achievements in sustainable design. The use of LEED® ensures that sustainable strategies are considered in the development of all GSA building projects. GSA has recently increased its minimum requirement for new construction and substantial renovation of Federally-owned facilities to LEED Gold, the next highest level of certification. Until recently, GSA had required LEED Silver. LEED consists of a set of prerequisites and credits with specific requirements for obtaining points in order to become a certified green building. (www.gsa.gov)

Detailed Notes about each Discussion Topic:

Discussion Topic 1: Water Harvesting at Harold Washington Social Security Building

Current or conventional practice for this application:

Prior to the installation of the water harvesting system at Harold Washington Social Security Building, the GSA had installed efficient plumbing fixtures to reduce potable water usage. High-efficiency low-flush toilet fixtures can reduce potable water used for flushing by 20% per flush. Low-flush urinals can use up to 50% less water per flush. Lavatories in bathrooms can be retrofitted with sensors and shut-off timers that reduce potable water. However, these water use reduction strategies are only working to reduce one of the building's many demands on the potable water supply.

Recommended practice for this application:

It is recommended to investigate ways to reduce as many of the building's demands on potable water as possible, and in particular, to reduce those that are most demanding. In most buildings, the largest demand on potable water is not for flushing toilets. The mechanical systems use an obscene amount of potable water every day. Cooling towers and boilers in particular can use tens of thousands of gallons of water per day for an average-sized mid-rise office building. An airport terminal's mechanical systems could demand hundreds of thousands of gallons of potable water in a given day.

Best practice for this application:

The Harold Washington Social Security Building located at 600 W. Madison Street in Chicago, Illinois is owned by the General Services Administration (GSA). The water harvesting system was installed as a retrofit when GSA administered a project for sustainable building upgrades. The GSA already proved to be an advocate for sustainable design and had already done various building upgrades including installing high-efficiency plumbing fixtures. Originally, GSA wanted to capture rainwater from the roof for landscape irrigation on-site, however the landscaped area was rather small, and the volume of water required to irrigate it was minimal (300 gallons/day). Wahaso investigated alternate sources of water as well as uses for recycled water.

Uses	Volume	Unit
Cooling tower	21,000	Gal/day
Boiler make-up water	800	Gal/day
Toilet flushing	350	Gal/day
Landscape irrigation	300	Gal/day

Sources	Volume	Unit
Rooftop rainwater	100,000+	Gal/month
Condensate from cooling system	12	Gal/minute
Groundwater ejector pits	2,000	Gal/day

For this investigation, Wahaso analyzed average rainfall in Chicago and existing building data to calculate the volumes of water available for capture and the volume of water required for use. Wahaso quickly realized that they could design a system that could save upwards of 3,000,000 gallons of water every year.

A major component that made this retrofit system possible was the fact that the building had 32,000 gallons of storage already installed in the building. There were four 8,000 gallon steel storage tanks in the Mechanical Room that were originally used to hold fluid for some decommissioned mechanical equipment. The building was considering removing the storage tanks until this project enticed them to refurbish and reuse them to store harvested water. The current system harvests approximately 3,487,000 gallons of water annually to offset an annual demand of approximately 4,030,000 gallons. The system saves roughly 3,200,000 gallons of potable water every year and approximately \$9,000 annually (water costs \$0.0028/gallon in Chicago).

Describe benefits:

Environmental Benefit: The current system harvests approximately 3,487,000 gallons of water annually to offset an annual demand of approximately 4,030,000 gallons. The system saves roughly 3,200,000 gallons of potable water every year and approximately \$9,000 annually (water costs \$0.0028/gallon in Chicago).

Economic Benefit: The system saves approximately \$9,000 of potable water cost annually. The cost of potable water in Chicago is relatively inexpensive compared to other parts of the country. As water continues to become scarcer and usage increases, the cost of potable water will only increase thus increasing the economic benefit of the system.

Social Benefit: In an area like Chicago, which gets ample rainfall every year and is located next to one of the largest bodies of fresh water on the planet, the social benefit of harvesting water usually drives the reason for installing a system. While the cost of water in Chicago is relatively inexpensive, Chicagoans are becoming increasingly aware of the finite supply of fresh water in the Great Lakes and the public is generally very interested in and supportive of sustainable design initiatives in public buildings like harvesting rainwater.

Describe whether the anticipated benefits were achieved and explain why/why not:

GSA's initial goal for potable water reduction was greatly exceeded. GSA began the project only aiming to harvest rainwater for irrigation. The final system harvests from multiple sources and offsets multiple uses, reducing their potable water usage by 80%.

The full economic benefit of potable water reduction will be realized in the future. The initial investment has been made and only time will tell just how beneficial it will become. If the price of water increases as projected, the benefit of a water harvesting system of this scale could be huge over the next 50 years.

Describe costs and financial impacts (order of magnitude if detailed cost information unavailable):

The total system construction cost is approximately \$140,000. The system saves approximately \$9,000 in potable water cost annually.

Describe life-cycle, return-on-investment, or payback cost analysis (if any prepared):

The cost of potable water is always increasing which makes the return on investment relative to the region of the country, the projected price of potable water, the lifespan of the building, and lifespan of the system. Without considering the increasing cost of potable water, the system at Harold Washington Social Security Building has a payback period of approximately 16 years. This is due to the relatively inexpensive cost of potable water in Chicago. In regions of the U.S. with a dryer climate, where potable water is scarce and increasingly more expensive, the return on investment is much greater.

Identify the source(s) of funds used to support this initiative (e.g., AIP, PFC, other airport revenue, bonds, grants):

There are not any federal grants that are particularly designed for water harvesting, however several grants given for sustainable building design or upgrades have applied to projects with water harvesting systems as part of a larger sustainable design plan.

Describe how the facility tracks the financial impacts of this initiative. Are projected goals being met? Why or why not?

It is unknown if the Harold Washington Social Security Building tracks the impacts or savings associated with the water harvesting system. However, the system does record the proper data to track its efficiency, and it is wired to integrate into the building's BAS (Building Automation System) which controls and monitors all of the building's mechanical systems.

Any water harvesting system can be equipped with sensors and controllers that record and store data on the efficiency of all sources and uses. Systems can report the data via data tables or graphs for the owner to track efficiency or ROI. If desired, the owner can incorporate web-based displays or public displays to publically exhibit the system's efficiency and/or the owner's dedication to sustainability. Several system owners have realized the marketing benefits of publically exhibiting their system through educational signage or interactive display screens.

Does this initiative meet the facility's definition of sustainability? Why or why not?

Considering the project greatly exceeded the GSA's expectations for the volume of potable water reduction, this project has helped GSA take another step toward their goals of sustainable design in all of their buildings. If this project was submitted for LEED certification, the amount of potable water off-set by the water harvesting system would have helped them achieve multiple points in the Water Efficiency category. Additionally, the innovative design of the system may have qualified the project for bonus LEED points for Innovation in Design. The water harvesting system would have made a legitimate impact on getting LEED certification.

Describe the driving force(s) (e.g., manager, champion, or external advocate) behind this initiative. Describe how the decision was made to pursue this initiative. Identify any tools or models used. Draw a flow chart or schematic of the process, as appropriate.

The GSA's dedication to sustainable design was the driving force for the project. Their efforts for the integration of sustainable design into all of their buildings brought them to investigating water harvesting for this project. Their foresight proved valuable as Wahaso helped GSA realize the benefit of a multi-faceted system.

Discussion Topic 2: Water Harvesting's Potential at Airports

Current or conventional practice for this application:

Potable Water Use:

Mechanical systems use an obscene amount of potable water. Cooling towers use hundreds of thousands of gallons of water to cool the building. Boilers can use thousands of gallons of water to distribute heat throughout the building. Airports are a campus composed of many different building types and sizes that can require heating and cooling. Airport terminals tend to be the largest conditioned structures at the airport, and at larger airports, the mechanical systems could potentially use millions of gallons of water every year. Airports also consume potable water for flushing toilet fixtures, landscape irrigation, washing vehicles, etc. There is ample opportunity to offset this potable water usage, but it is not conventional for airports to employ a water harvesting system.

Stormwater Management:

Airports also have to retain and distribute millions of gallons of stormwater from precipitation that falls on its runways, tarmacs, roads, and parking areas. Conventional practice is to retain stormwater on-site or divert it to the city sewer through any number of varying stormwater strategies. However, it is not conventional practice to retain this water on-site for use elsewhere in the buildings or for landscape irrigation.

Recommended practice for this application:

It is recommended to employ water harvesting strategies where feasible to take advantage of ample water on-site and use it to offset the many consumers of potable water at an airport.

Best practice for this application:

The advantage of airports for employing water harvesting strategies is that they are so large that they have the potential to make an equally large impact on potable water reduction.

Airports can harvest water from a number of possible sources:

- Rainwater from:
 - o Roofs
 - o Canopies
 - o Hangers
 - Stormwater from:
 - Parking lots
 - o Roadways
 - o Walkways
 - o Plazas
 - o Runways
 - o Tarmac
- Condensate from cooling towers

This water can be used to offset the following possible uses:

- Toilet and urinal flushing
- Landscape irrigation
- Cooling towers

- Boiler systems
- Fire suppression systems
- Vehicle washing

Describe benefits:

There is a potential for immense benefits of employing water harvesting at airports. Harvesting water can offset the cost for some of the airport's largest consumers of potable water. As potable water becomes more scarce in our nation, the need for being water conscious will become more and more important. As public buildings where thousands of transients pass through every year, airports create excellent opportunities to reflect the importance of being water conscience to the public. While the components of water harvesting systems often reside behind closed doors, educational signage and interactive public displays provide a means of getting the public excited about sustainability as well as allowing to airport to advertise its sustainable efforts.

ACRP 02-22 – Case Study Interview

Airport/Facility Name: Toronto Pearson International Airport, Toronto, Canada (YYZ), Managed by Greater Toronto Airports Authority (GTAA)

Date: February 17, 2011

Contact Phone and web address: 416-776-3000; <u>http://www.torontopearson.com/en/aboutpearson/environment/#</u>

Discussion Topics:

- 1) Environmental Management System (EMS) and ISO 14001 Certification
- 2) Greenhouse Gas Policy
- 3) Stormwater Management/Central Deicing Facility
- 4) Integration of sustainability into design and construction
 - a. Specifically:
 - i. Fire Emergency Services Training Institute (FESTI) Building
 - ii. Pier G at Terminal 3
 - b. Alternative Energy Analysis led to LEED certification standards, geothermal applications, and solar applications
- 5) Energy Management
 - a. Delamping
 - b. Relamping
 - c. Earth Hour
- 6) Airport Vehicles
 - a. Anti-idling policy
 - b. EVCs for GSE
 - c. Airport fleet vehicles
 - d. LINK train
- 7) Tenant/concessionaire initiatives
- 8) Partners in Project Green

Synopsis of Sustainability Programs, Policies, Processes, Technologies, and/or Equipment:

Today, Toronto Pearson has an Environmental Management System, a LEED silver (certification in-process) building (Fire & Emergency Services Training Institute – FESTI), funding allocation for energy conservation equivalent to the price of annual GHG offsets, centralized deicing facility with glycol recovery and recycling, and actively participates in "Project Green: Eco-Business Zone."

The sustainability programs currently in place at Toronto Pearson International Airport (YYZ) grew out of environmental programs in place since the late 1970s, per the Canadian Federal Government's foresight. YYZ was originally under management by the Canadian Government (Transport Canada). In 1996, Transport Canada leased YYZ to the Greater Toronto Airports Authority (GTAA), a private, not-for-profit enterprise. In so doing, Transport Canada required that GTAA develop an Environmental Management Plan. GTAA went one step further and became the first airport in North America to have their Environmental Management System certified under ISO 14001.

In early 1990, an environmental assessment was completed to assess need to expand YYZ to meet growing aviation demand in the area. The demand was proposed to be met by the addition of three runways and associated infrastructure (terminals and taxiways). The Canadian Environmental Assessment Act requires that environmental assessments evaluate environmental, economic, and social impacts of proposed actions. Water quality and air quality mitigation programs that came out of this environmental assessment (and promises to the local public) led to the development of sustainability initiatives. The Environment Group realized they could improve air and water quality along with airport expansion. Large capital projects offer opportunities for environmental and energy conservation projects to "tag along."

Additional contributors to development of sustainability initiatives came from legal actions. The Canadian DOE sued the DOT (Transport Canada), two Canadian airlines, and five U.S. airlines for criminal negligence under the Federal Fisheries Act when a fuel pipeline broke at YYZ. The DOE won the case. This led to the development of the stormwater management systems at YYZ and the centralized deicing facility.

The initial driving force for considering adopting ISO 14001 is that the airport was out of compliance with Canadian Federal regulations.

Their GHG reduction program evaluates purchased electricity and is an example of their approach for setting long term goals and breaking them down into annual targets (e.g., 2% reduction per year to achieve a 20% reduction by 2020).

Partners in Project Green was begun when a local conservation group came to the airport and asked them to support a broader program. Airport management agreed and supported the program with a \$275,000/year commitment for two years. There are a wide variety of projects that are included in this program but their primary way to measure success is evaluating regional utility savings.

The Environment Group manager has a staff of 9 (including him). An additional, separate, staff of six (6) are responsible for noise abatement and report through their own General Manager (GM). Noise abatement is not part of the Environment Group.

The Utilities Group, with assistance from the Environment Group, conducted a study of alternative energy technologies including solar, wind, low-head hydro in airport creeks, and geothermal. All had marginal cost-benefit results at best. The results were

presented to the CEO, Lloyd McCoomb, to make the final decision for which technology would be tested as retrofit work in the existing North Firehall. Mr. McCoomb was the one to select the geothermal project.

Facility's definition of sustainability:

Sustainability is a journey.

Sustainability = corporate stewardship, not just environmental benefits.

Sustainability stands on three pillars: environmental, economic, and social benefits.

Having active programs encouraging airport growth, reducing environmental impacts, and engaging with the community around the airport on quality of life and business issues. Their current view is that the "air is getting cleaner, the water is cleaner, electrical consumption is going down, they have better community support, they are gaining support from regulators, and they have an overall smaller footprint."

How do initiatives achieve or meet that definition?

Sustainability initiatives get all Departments involved so they all understand and are on board. Sustainability initiatives (balanced on all 3 pillars) give Department leaders permission to do what they've always wanted to do.

Targets are usually based on absolute numbers, not on moveable stats like passenger volume, enplanements, etc.

From the overall airport perspective, they have made some important gains with their approach to sustainability. For projects that are important to their sustainability efforts they initiate them on an informal or trial basis. For example, they built the FESTI building as a green building to test out the costs and benefits of building to the LEED standards. It has since become a model facility that has drawn quite a bit of attention from outside of the airport, which also benefits the commercial goals of their operation (they train firefighting, EMT, and other emergency responders from other airports – several from Europe – as well as local industries). The building has worked as a marketing tool. In addition to the solar wall, it includes passive solar heating/cooling due to structural concrete mass, it has a green roof, and they collect and reuse/recycle the water used onsite for firefighting training. They originally built the building to the LEED silver standard although did not plan to seek LEED certification, however, they recently budgeted funding to go for certification since it has attracted so much attention. Compared to other buildings on the airport, the operating costs are substantially lower although the original capital costs were higher than conventional construction. The airport reports that both the architect and the builder are now using many of the green strategies they employed in the FESTI, which they encountered for the first time, and the airport expects to use many of the same approaches for future buildings at the airport.

As another example, the airport is planning a geothermal heating/cooling installation for a new fire station. They have justified the added first cost of geothermal so they can get experience with the technology and hopefully employ it in a new concourse they are planning to build a few years in the future. The payback for the project might not otherwise be sufficient to justify compared to conventional HVAC technologies. The airport's first experience with ISO 14001 was to implement it in the Environment Group Division. After gaining experience with it there, they gradually rolled out various provisions throughout the rest of the organization. They did not have high-level organizational support for several years. The airport was certified ISO 14001 compliant in 1999.

In July 2009, Toronto Pearson completed their Comprehensive Sustainability Strategy. An important aspect of the strategy was to set a long term goal for reducing their greenhouse gas (GHG) emissions. They set a target of 2% reduction per year over 10 years to achieve an absolute reduction in GHG compared to a 2005 baseline. Each year the airport budgets an amount equal to the cost of purchasing carbon credits, however, rather than purchasing credits, they use the funds for energy conservation projects. The funds may be used to subsidize the initial cost of an energy efficient alternative technology like a solar photovoltaic application or to fund an energy conservation project like the installation of LED lighting.

Detailed Notes about each Discussion Topic:

1) Environmental Management System (EMS) and ISO 14001 Certification

Current or conventional practice for this application:

The EMS gets all GTAA departments involved in sustainable practices so that they are all onboard and working toward the same overall goals. An Environmental Management Plan was required when Transport Canada handed over YYZ to GTAA. GTAA went one step further and decided to become ISO 14001 Compliant; making them the first airport in North America to do so.

Recommended practice for this application:

Under GTAA's EMS, they commit to publishing an annual environmental performance report. For approximately the last six years, GRAA has been following GRI guidelines to track ISO 14001 certification compliance requirements. They are currently developing a sustainability program.

Describe benefits:

ISO sets targets (performance metrics) and allows managers to oversee programs, ensuring they are done and done right. ISO also allows for easier recording, reporting, and auditing of programs. By starting with the EMS and testing it out, GTAA can now go "management-system wide" for all departments.

The local community has taken notice and they are in support of GTAA's efforts. Goodwill from local authorities is there (more so than in past years), but it is conditional on the continuance of good performance.

Describe whether the anticipated benefits were achieved and explain why/why not:

Yes, anticipated benefits have been achieved to date. ISO has been challenging though. There was not a lot of internal backing for it in the beginning. It was all done in house, with no outside or additional staff. Randy's Environmental staff is 9 people (including himself); he also has an additional 6-8 people working on Noise.

Describe costs and financial impacts (order of magnitude if detailed cost information unavailable):

Data/information on CBA used for alternative fuels analysis has been requested.

Describe how the facility tracks the financial impacts of this initiative. Are projected goals being met? Why or why not?

Tracking appears to be quantitative but not rigorous. For example, they track absolute levels of electricity use airport wide and use that as an indicator of success for their energy conservation activities rather than tracking project results independently or specifically.

Does this initiative meet the facility's definition of sustainability? Why or why not?

Yes. EMS establishes yearly targets that GTAA works annually to achieve. This includes long-term targets (10-20 years with the GHG Policy) and short-term targets (1-5 years, or less). This allows GTAA to stay ahead of Cap & Trade and/or a Carbon Tax, for example.

Air is getting cleaner, the water is cleaner, electrical consumption is going down, they have better community support, they are gaining support from regulators, and they have an overall smaller footprint.

Describe the driving force(s) (e.g., manager, champion, or external advocate) behind this initiative. Describe how the decision was made to pursue this initiative. Identify any tools or models used. Draw a flow chart or schematic of the process, as appropriate.

An Environmental Management Plan was required when Transport Canada handed over YYZ to GTAA. GTAA went one step further and decided to become ISO 14001 Compliant; making them the first airport in North America to do so. Randy McGill is the driving force or "Sustainability Champion" at GTAA.

Environment Department manager initiates many actions, programs, and projects under the "sustainability" umbrella, however, the airport management seems open to supporting these efforts and those that arise in other departments

Describe any quantitative goals or metrics used to evaluate the success of this project or program:

GTAA uses GRI guidelines to track ISO 14001 certification compliance requirements. They are drafting the program now. They're doing well, but it's not formalized into a program. It will be when it surfaces in 2012.

2) Greenhouse Gas Policy

Current or conventional practice for this application:

Evaluates purchased electricity.

Under this policy:

- The GTAA commits to a goal of a 20% GHG reduction from 2006 emissions to be achieved by 2020. This can also be expressed as an annual goal of a 2% greenhouse gas reduction, for each year from 2011 to 2020.

- Funds will be made available to the Facilities department on an annual basis, the minimum sum to be equivalent to the cost of the purchase of GHG carbon offsets for the GTAA. These funds will be earmarked for GHG reducing projects, which could include infrastructure, research, testing or other types of projects with an end goal of reducing airport GHG emissions.
- The GTAA will ensure that all future Airport projects take greenhouse gas emissions into account as part of cost estimates and budgeting, such that increased emissions are counted as increased costs, while emissions reductions are counted as savings or cost reductions, as appropriate.
- Annual reporting will be completed describing which projects have been undertaken, the monies spent, and the changes in GHG emissions and/or energy use.

Recommended practice for this application:

Create "accountable executives"

Describe costs and financial impacts (order of magnitude if detailed cost information unavailable):

The GHG Policy is generating approximately \$1.5 - \$3 million per year based on the carbon of GTAA's electricity purchased form the Ontario network.

Describe life-cycle, return-on-investment, or payback cost analysis (if any prepared):

The GHG Policy is generating approximately \$1.5 - \$3 million per year based on the carbon of GTAA's electricity purchased form the Ontario network. Analyses are prepared to determine how best to use the budget to meet the overall goals. They are not just focused on low-hanging fruit – most of those are free. It's good to do them, but GTAA wants to use their whole budget each year. They are looking for several programs/initiatives they can group together to maximize benefits and diversify usage of

the funds; mostly focused on energy reduction. Potential projects only compete against other environmental projects for budget. Greener solutions have funding advantage over traditional projects. There are two ways to utilize funding: differential or identify projects and pay for them.

3) Stormwater Management/Central Deicing Facility

Current or conventional practice for this application:

In early 1990, an environmental assessment was completed for the need to expand YYZ to meet growing aviation demand in the area. The demand was proposed to be met by the addition of three runways and associated infrastructure (terminals and taxiways) at YYZ. The Canadian Environmental Assessment Act requires that environmental assessments evaluate environmental, economic, and social impacts of proposed actions. Water quality and air quality mitigation programs that came out of this environmental assessment (and promises to the local public) led to the development of sustainability initiatives.

Additional contributors to development of sustainability initiatives came from legal actions. The Canadian DOE sued the DOT (Transport Canada), two Canadian airlines, and five U.S. airlines for criminal negligence under the Federal Fisheries Act when a fuel pipeline broke at YYZ. The DOE won the case. This led to the development of the stormwater management systems at YYZ and the centralized deicing facility.

- 4) Integration of sustainability into the planning, design, and construction processes; specifically:
 - Fire Emergency Service Training Institute (FESTI) Building
 - Pier G at Terminal 1

Current or conventional practice for this application:

GTAA requires that new buildings are built to LEED silver-certifiable standard.

The green construction code provides targets to designers for energy reductions over standard construction. Example project: Terminal Face Lift Program

Construction specifications were written with the environment in mind

- GTAA's building code is above and beyond federal and provincial codes
- GTAA has its own building code, building inspectors, safety inspectors, etc.

Conditions Assessments are completed on individual buildings to determine what needs to be improved and how that can be accomplished. If the building is on-site and owned by GTAA, the FOP process (Facilities Operating Permit) allows GTAA to review designs at 30-60-90% (ideally) and provide input. In reality, most plans come to GTAA at nearly 100% complete.

The Environment Group at GTAA assists in the development of the Environment Section of the Master Plan (5-Year Land Planning document).

Pier G is to be added to Terminal 1 based on traffic trigger

- It will be designed to use half the energy of a traditional system, to meet the requirements of the GHG Policy
- FESTI geo-thermal test will benefit application at Pier G

Describe life-cycle, return-on-investment, or payback cost analysis (if any prepared):

Alternative Energy Analyses have been completed to determine the best applications for YYZ, considering the following, using a systems and buildings approach to assess airport-wide opportunities rather than for isolated programs and projects:

- Wind
- Hydro-electric
- Solar
 - Two audits have been completed:
 - FESTI energy audit: showed how the electricity was being used in the building. The biggest use is the compressors for the SCBAs.
 - Equipment audit: since GTAA has decided to stop dry storage of snow equipment and park the vehicles outside for the summer season, it has been determined that equipment is deteriorating from sun/open air exposure. This has led GTAA to develop a concept plan for development of a canopy with solar PV panels atop the structure. GTAA currently has a solar roof installation atop the admin building (that is overlooked by the freeway) and ground-based solar installations on empty, non-zoned property areas

- Geothermal
 - This was the route selected by GTAA (solar was a close second) to be incorporated into FESTI as a test for future Pier G at Terminal 3. Reasoning was that if they were going to go with the Feed-in Tariff (FIT) Program, solar would be the way to go, but since they're not, geothermal was selected.

5) Energy Management

Current or conventional practice for this application:

GTAA pushes energy reduction and management to meet GHG Policy goals, as well as all other goals for sustainability.

GTAA owns all electricity infrastructure (distribution) systems at YYZ; they back-charge the tenants at cost only. Sub-metering is done in some tenant spaces. Because it is a former federal facility and they own their own distribution system, there are not many meters on airport property.

YYZ encompasses 4,400 acres (1,800 hectares) and includes 311 buildings.

Electricity (energy) reduction is achieved by GTAA through:

- Daylighting (sunshine harvesting)
- Delamping
- Relamping

Specifically:

- Airfield lighting/energy reduction is achieved through:
 - ATCT has light level meters to keep controllers aware of energy use as compared to standard (visual readout in tower cab as constant reminder)
 - Removed 432 red obstruction lights that were determined not to be needed (100 w each); remaining were converted to 15 w bulbs
 - Roadway stop signs must flash; GTAA made their own flashlights with fiber optics. GTAA also found out that these lights were tied to the taxiway edge lights; a future program will disconnect them so that they can run independently
- Co-Gen plant (117 megawatt)
 - Operates as a merchant plant, which was determined to be more cost effective than going off-grid. Bids that come in from providers determine how much the plant will run per day – it's typically 4-6 hour blocks.
 - Runs approximately 15% of the time, but it was designed to run 100% at peak (see bullet above...)
- Central Utilities Plant
 - Tied to Co-Gen plant; runs when co-gen doesn't
 - o Natural gas
 - Has 3 turbines, but there's usually only one running at a time; the other 2 sit idle most of the time
- Terminal 3 has its own boiler/chiller plant
 - A plan is currently being assessed to determine if it can be tied into the central plant.

- LED upgrade of 2000 fixtures in the Terminal 3 parking garage
- LINK Train travels among terminals
 - Replaced traditional bussing operations among terminals
 - Re-evaluation of schedules has led to fewer trains running at night and during times of off-peak passenger volumes
- Participation in Earth Hour
 - YYZ was the first North American airport to sign-up as a participant
 - GTAA uses it as a testing ground each year
 - This has led to delamping rather than relamping
- Terminal 1 Extreme Weather Conditions
 - Fresh air intakes are adjusted depending on extremes in outside air temperature year-round
 - Implemented through the building management system
- Heaters and air-handling units are linked so that they now work as a system rather an independent units (all would be on at the same time in an effort to equalize the temperature)

Describe costs and financial impacts (order of magnitude if detailed cost information unavailable):

Electricity costs are anticipated to increase 30% this year.

Describe life-cycle, return-on-investment, or payback cost analysis (if any prepared):

For the LED upgrade of 2000 fixtures in the Terminal 3 parking garage, the CBA (including O/M costs over time/lifecycle costs) anticipates 5-7 year payback

Describe how the facility tracks the financial impacts of this (or any other) sustainability initiative. Were projected goals met? Why or why not?

GTAA has seen \$16 mil in traceable electricity savings since 2004 with the implementation of their energy reduction initiatives.

6) Vehicles

Current or conventional practice for this application:

GTAA provides free electric charging for GSE

- Quick charge
- Electricity is not metered and is "free" to airlines: they are all paying for it in their general fees
- Airport also uses the EVC stations for their airport fleet vehicles

Taxi/Limo initiatives

- The private companies collectively decided to use propane fueled vehicles; there was no such mandate from GTAA
- Some buses to local hotels run on propane

GTAA limits emissions through:

- Anti-Idling Policy at arrival and departure roadways
 - Encourages use of cell-phone lot instead of circling and idling at curbside
 - This is slowly gaining acceptance, but enforcement has been a challenge
- Parking sensors in the Terminal 1 parking structure that notify drivers of open parking spaces to eliminate circling and idling
- Fleet Reservation System: reserve a vehicle on-line when you need one.

- Light vehicle fleet was downsized in numbers, wherever possible, and in types (switched to smaller SUVs) where vehicles are required.
- LINK Train replaced traditional bussing among terminals

7) Tenant/Concessionaire Initiatives and Incentives

Current or conventional practice for this application:

Example: FedEx's building

- GTAA did a walk-through energy audit, at no cost to FedEx, that identified several improvements, which FedEx then implemented at no cost to GTAA
- GTAA would like to take this example and use it to branch-out to a tenant audit program

Green Tenant Policy

- Administered through the leasing department
- Applies to non-terminal tenants
- Encourages environmentally-friendly actions, but is not specific in its guidance

8) Partners in Project Green

Current or conventional practice for this application:

The Pearson Eco-Business Zone, established in 2007, is Canada's largest employment area and provides guidance for members in the areas of flood protection, natural heritage, stormwater, sustainable development, local best practices. GTAA is the driving force behind this initiative and their VP of Corporate Affairs is Chair of the Steering Committee. It is managed daily by Toronto Regional Conservation Authority (TRCA). YYZ's involvement with PPG has been steadily growing over the years, largely in part to the support of Randy McGill, General Manager Environmental Stewardship.

Describe benefits:

Members are provided the following services:

- Eco-efficiency assessments
 - Example: NG provider has developed a new program for warehouses to reduce energy consumption by simply closing doors and using fans at certain times of the day
- Energy planning
 - Provides ability to work with energy providers and take advantage of their incentive programs/rebates for alt energy, renewable energy, and reduced energy consumption overall
- Green purchasing block
 - Group purchasing for green technologies, at 5-45% discounts
 - Applies to GTAA, as well as other large companies (although they were skeptical at first that PPG could get them greater discounts than they were able to negotiate on their own)
 - Also allows for multi-company partnerships on RFPs
 - Example: Rooftop solar is of big interest to partners today
- Green site initiatives

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- Sustainable transportation

- Training and networking
- Sustainability internships
- Online resources
- Sustainability consortiums
 - Sector leadership teams:
 - Hospitality
 - Manufacturing
 - Logistics
 - Offices
 - GTAA staffers sit on all but the manufacturing consortium

Allow members to take advantage of large infrastructure projects such as district energy, biogas, and materials exchange programs (example: solid waste speed dating).

Another example: member roofing companies are creating green jobs and working with Social Services in the local areas to train new, local talent in order to meet their staffing demands and improve economic conditions in low income areas.

Describe whether the anticipated benefits were achieved and explain why/why not:

Anticipated benefits are being achieved.

Identify the source(s) of funds used to support this project/program (e.g., AIP, PFC, other airport revenue, bonds, grants):

\$275,000 annual budget

Does this project meet the facility's definition of sustainability? Why or why not?

Yes!

Describe the driving force(s) (e.g., manager, champion, or external advocate) behind this initiative. Describe how the decision was made to pursue this initiative. Identify any tools or models used. Draw a flow chart or schematic of the process, as appropriate.

TRCA approached GTAA and they became a major investor, supporter, and driving force.

Describe any quantitative goals or metrics used to evaluate the success of this project or program:

PPG tracks success through the following:

- Reductions in energy consumption for members/partners
 - Also requires data from energy providers
- Number of companies joining and the successes they see as a result
- Size of the growing footprint (coverage/member/partner area)
- Self-reporting database for members/partners is in development

Wrap-up Questions:

What programs or initiatives are next on the horizon? What are your shortterm and long-term goals (including Net Zero goals)? How will benefits or results be measured and verified?

Future energy reduction initiatives are anticipated to include:

- Complete roadway lighting audit in 2012
- Intersection lighting LED replacement
- Study of costs/benefits of LED replacement of runway edge lighting
 - This practice has not been seen yet. It could result in increased cost and energy to heat the lamps and replace fixtures, if needed
- Terminal 3 is 20 years old; it will soon need a mid-life cycle upgrade and potential boiler/chiller plant energy upgrade

Passenger EVC stations are planned for the future

General Notes

Based on our interview, we request the following to aid in development of the Guidebook:

- Alternative energy analysis completed by Partners in Project Green (PPG)
- Photos of the deicing facility

Photos

Photo below is the outside of the FESTI building showing the solar wall. The wall collects heat from the sun to heat the air in the interstitial wall space and convey it to the building heating system. When the heat is unneeded, the heated air is exhausted outside via convection. The building is a good example of a "green building" on an airport and additional photos of building features have been requested from Derek Gray.



Terminal Building Photos (Interior):









