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Executive Summary: The Green Airport Initiative at Fort Lauderdale-Hollywood International Airport

The Green Airport Initiative (GAI) is a comprehensive program developed by the Clean Airport Partnership (CAP) to assist airports in establishing programs for guiding sustainable development. In November 2005, CAP was retained by the Broward County Board of Commissioners to assist the Broward County Aviation Department in implementing the GAI at FLL.

As a product of this work, CAP established an "environmental footprint" (Task 1), representing the impacts of current operations at FLL. It also conducted extensive research documenting FLL's current achievements and those opportunities that remain for further improving environmental quality and efficiency (Tasks 4, 6, 7 and 9).

In this Executive Summary, "priority" recommendations are noted with an asterisk (*) and represent strategies that provide significant environmental benefits and potential return on investment. Cost-benefit analyses were conducted for the top three quantifiable air quality strategies, with two analyses each conducted for energy conservation, renewables, water quality, and solid waste. Strategies are presented in the order of task numbers (Task 4, Water; Task 6, Energy; Task 7, Waste, and Task 9, Air).

Tracking Environmental Progress

The Task 1 baseline report developed an environmental footprint as a quick and easy way for BCAD management, the Board of County Commissioners (BOCC), and the public to gauge FLL's environmental performance. The value of using an environmental footprint is the ability to track performance over time to see how the footprint changes – seeing where environmental initiatives are successful and where more effort may be required. The footprint can also be used to evaluate new operating procedures or new equipment prior to implementation.

Recommendation #1: BCAD should begin with the baseline footprint developed in the Task 1 report and publish it along with annual updates and a table representing the latest computation of the Impact Metrics provided in the *BCAD Annual Statistical Report.*

Recommendations for Maximizing Environmental Performance

I. Water

Opportunities for improving water quality and the efficiency of water use are categorized into four areas: Groundwater, storm-water, potable water, and non-potable water. The analysis found that FLL aggressively monitors tenant use, storage, and handling of hazardous and petroleum products to insure compliance with applicable laws and avoid contamination.

A. Potable Water

*Recommendation #1: Install lower-flow toilets, urinals, and sinks to conserve water and save money.

FLL was billed for over 65 million gallons of water from October 2005 through September 2006. Significant opportunities exist for further reducing the consumption of potable water and the burden imposed on sewer infrastructure and treatment. FLL currently uses low-flow toilets, sinks, and faucets in its restrooms. New technology, however, now exists that would enable FLL to further improve efficiency. According to the analysis conducted, the installation of lower-flow toilets, sinks, and urinals would cost about $234,000 and further reduce potable water consumption by 43 million gallons annually. This reduced water use would save the airport $281,000 annually and provide a payback of investment in ten months.

Recommendation #2: Work cooperatively with tenants to reduce consumption by applying best management practices to sub-metered tenants and assessing the viability of overseeing water use through a centralized control monitoring system.

An additional 142 million gallons of water was billed to 141 sub-metered airport related users during that same period of time. It appears that the sub-metered users are a combination of food service establishments (there are 27 such tenants in the airport as of October 2006), rental car companies, airlines, BCAD, Federal Aviation Administration, Broward County Animal Control, Fort Lauderdale Small Boat Club and others.

B. Non-Potable Water

*Recommendation #3: Conduct a detailed system audit to determine current levels of efficiency, best management practices, and priorities for improving irrigation efficiency for BCAD and sub-metered users.

Landscape irrigation is the dominant consumer of non-potable water. The role of irrigation is to provide water when needed and in the amount needed to keep a plant healthy and thriving. Any water applied past this required amount is considered waste; any less causes stress to the landscape. Excess watering not only wastes water but can also cause other problems such as: nutrient leaching (resulting in groundwater contamination), erosion, extra costs in the form of unwarranted energy consumption and premature failure of system-- plant disease and its associated need for additional chemicals to combat the disease; and excess consumption of water resources.

The analysis presents eleven separate strategies for improving the efficiency of FLL's non-potable water irrigation system and reducing demand for potable water. It concludes that for an investment of $75,000 to $125,000 dollars, BCAD could improve irrigation efficiency by up to 70%. The precise return on investment would be dependent upon the combination of strategies ultimately implemented.

Recommendation #4: Assess the feasibility of managing consumption of sub-metered tenants through establishment of a centralized control monitoring system.

Sub-metered tenants are major water users but BCAD has little ability to monitor their consumption. A centralized system would enable BCAD to better manage use but the costs may be high relative to the benefits, which have not been determined.

II. Energy Supply, Distribution, and Conservation

BCAD's facilities consume only electricity. Many restaurants and tenant spaces, however, are provided with separate electric and natural gas services and the tenants are billed directly by the utility companies. From July through June 2005, FLL consumed 83,000,000 KWH of electricity at a cost of over $6.3 million. Because improvements in building efficiency can be directly influenced by BCAD, this area represents the most compelling opportunity for FLL to both improve environmental quality and save money.

Implementation of a comprehensive energy program for the existing facilities at FLL could generate electric savings of 15,000,000 KWH, reduce consumption by 18%, and save about $1,100,000 per year in electricity costs. Implementing the total array of recommended projects would cost about $7,000,000 with a simple payback in about 6 to 7 years. However, select projects could also be combined and yield significant environmental benefits, having a total cost of approximately $2,000,000 and a simple payback of 3 to 4 years. These projects are primarily composed of lighting and HVAC system improvements.

A. Conservation

*Recommendation #1: Adopt a policy that new construction and renovations be designed to achieve Leadership in Energy and Environmental Design (LEED) standards.

LEED is a framework that has recently been developed for New Construction and Existing Buildings by the U.S. Green Building Council. "LEED promotes a whole-building approach to sustainability by recognizing performance in five key areas of human and environmental health: sustainable site development, water savings, energy efficiency, materials selection, and indoor environmental quality." LEED includes recommendations for a Commissioning Agent that could be used on all future new and renovation construction projects. The same Commissioning Agent should be a part of the design team from the inception of a project to help ensure standardization and consistent goals even when the architect and engineer for specific projects are different.

FLL should also implement a comprehensive series of conservation measures to improve the efficiency of FLL's existing buildings. These measures include:

*Recommendation #2: Implement a comprehensive program comprised of improved lighting efficiency and demand reduction strategies.

There are currently over 35,000 lighting fixtures at FLL. The lighting audit provides a series of detailed recommendations for improving lighting efficiency. Lighting modifications are the most rewarding strategies and can reduce electricity use by 7.5 million KWH annually. Consumption and demand reduction can decrease electricity use by an additional 2.5 million KWH annually. Examples of lighting improvements examined and found to be cost-effective include: reducing the number of lights and the installation of room occupancy sensors and lighting controls. The report found that installing more efficient lighting in FLL's terminals, maintenance facilities, offices, and parking garages would cost approximately $3 million and save $600,000 in annual electricity charges, resulting in payback on investment of 5 years.

*Recommendation #3: Renovate chillers based upon life cycle costs.

BCAD should move forward with its planned renovations to chillers in terminals 3 and 4. However, the final chiller and system selection for the renovation project should be based upon a life cycle cost analysis that includes: (1) first cost, (2) operating (energy) cost and (3) maintenance cost.

Experience has shown that when life cycle cost analysis is used to evaluate firm and competitive proposals from chiller manufacturers, much more efficient chillers, such as modern high efficiency variable speed centrifugal chillers, are economically justified as compared to less efficient "low bid" equipment. Additional options noted in the report should also be considered for further maximizing the efficiency of the renovated chillers. Chiller improvements for terminals 3 and 4 can reduce electricity use by over 2 million KWH per year (from 18.5 to 16.5 KWH per year). This would achieve savings of over $135,000 per year, with payback on the $660,000 investment achieved within 5 years.

*Recommendation #4: Initiate retro-commissioning and additional measures to optimize HVAC system efficiency

HVAC system operations often degrade over the life of a building, resulting in system performance well below original design. In addition to the loss of energy efficiency, system performance issues and changes in space use contribute to inadequate comfort control and ventilation. Retro-commissioning building systems based on current building use characteristics is a cost-effective way of identifying specific system problems and addressing the problems. Given the large savings opportunity available through the retro-commissioning of the four (4) terminals it is estimated that HVAC energy use could be reduced by 10% with a savings in total utilities of 4%. This would result in 2-3 year payback on investment. Examples of conservation measures that are commonly part of retro-commissioning include:

- Turning off unneeded HVAC equipment at night so that it is not continuously operating; convert air conditioning systems in the Hibiscus Garage from continuous to variable speed pumping
- Improving the efficiency of electric boilers in Terminal 1
- Installing variable frequency drives and controls on domestic water booster pumps and variable speed fans on air handling units to improve efficiency

- Testing and balancing the chilled and condenser water pumping systems to improve operating efficiency
- Improving the efficiency of demand-based ventilation controls to better adjust outdoor ventilation rates to match building occupancy levels

BCAD should also examine "Ecostart" technology that reduces voltage and current supplied to escalator and elevator motor generators. When demand and loads increase, Ecostart instantly delivers the required power. The soft start feature of Ecostart reduces in-rush current by up to 75%. An adjustable timed ramp circuit gradually increases power until the motor reaches its operating RPM. Kone's (the manufacturer of Ecostart) literature claims that the technology can reduce escalator and elevator energy usage by 40% and have a payback of around 3 years. However, the energy savings claimed in the literature was not well documented and deserves further research.

B. Renewables

*Recommendation #1: Expand day-lighting

Day-light harvesting emphasizes using natural light for indoor and outdoor spaces and installing sensors that turn off or dim lights according to need, avoiding redundancy. The report notes that sensors for outdoor and indoor lighting can have payback on investment of 1-8 years, depending upon the sophistication of the system and whether retrofitted to existing buildings (more expensive) or integrated into new building design.

*Recommendation #2: Examine the feasibility of "thin-film" photovoltaic's

Thin-film photovoltaic's (PV) provides a clean, alternative source of energy that can help reduce demand from coal-fired electric plants. This product has been shown safe and durable in hurricane prone areas. It is integrated with the facility roof and best applied during a re-roofing activity. By combining the two applications it is possible to match the life expectancy of both the roof and the PV, getting at least 20 years of service from each.

This technology can utilize funds from the Florida Renewable Energy Technologies Grants Program combined with federal tax and depreciation incentives utilized by third-party investors. Significant lead-time is required, however, to create these types of public-private partnerships. Attracting this public and private sector support could be facilitated if the County Commission committed to exploring the use of thin-film photo-voltaics on a "pilot project" basis, perhaps designating the airport as a prospective site. By obtaining a commitment of leadership from the County with outside funding and investment support, it may be possible to structure the project with no up-front costs for a site like FLL and annual electricity savings of over $40,000. A similar State and third-party funding approach was recently used to support a $16 million dollar solar project at Fresno Yosemite International Airport. The project is scheduled for completion in 2008 and will generate 2 megawatts of electricity.

III. Solid Waste

Terminal concessionaires, aircraft passengers, and employees generate huge quantities of solid waste that must be collected and disposed through landfills, incineration, or other means. In addition to the pollution and resources associated with collecting and trucking this waste to disposal, landfills represent a finite resource in land-starved Broward County.

A. Non-hazardous Waste

There are four dominant strategies for reducing the generation and disposal of non-hazardous waste: centralizing waste collection; the institution of operational policies that encourage the use of durable versus disposable products and the efficient use of resources; and the recycling of wastes.

Recommendation #1: Establish best management practices for BCAD and guidance for its tenants for minimizing generation of solid wastes.

Internal policies can help to reduce solid waste generated by airport personnel. Examples that FLL may wish to consider, include: The use of electric hand dryers versus paper towers in restrooms; purchasing products in bulk to minimize packaging waste; the use of durable versus disposable cups and utensils; and source separation of recyclables.

*Recommendation #2: Work cooperatively with FLL's food vendor to further encourage the contribution of unused, pre-packaged food to the needy; accentuating the cost-savings, public relations, and social benefits.

Tons of unused food are discarded monthly by airport concessionaires. Programs that enable vendors to donate prepackaged and unspoiled food to the needy through food banks and other non-profit organizations enable vendors to obtain tax credits for their donations while reducing disposal. These programs are available in Broward County and should be utilized. Implementation of this program at FLL can reduce food waste disposal by almost 56,000 pounds annually and save vendors about $5,000 per year in disposal costs. More importantly, FLL and its vendors can assume an important community leadership role in providing food to help the needy.

*Recommendation #3: Establish source separation of recyclables throughout FLL.

Recycle bins range from $25 to $500 depending on the type and size of bins. Additionally, different colored bags can be used in recycle bins to demarcate waste type and to facilitate collection by workers. FLL's contractor currently segregates its wastes manually but cost savings may be achievable to FLL and its contractor if disposal is segregated. By segregating wastes, FLL can recycle almost 950,000 pounds of waste annually and save $81,000 each year in disposal costs. Annual costs of the program would be about $60,000 which includes the hiring of a full-time recycling coordinator.

*Recommendation #4: Establish best management practices for BCAD and its tenants and promote consolidation of waste collection services to expand recycling and reduce pollution.

BCAD does an excellent job of waste collection and recycling; however, waste collection for restaurants and fixed based operators at FLL is provided by a variety of vendors. Having one centralized vendor provide these services provides multiple advantages. The first and foremost benefit is that it enables FLL to more directly oversee implementation of best management practices and recycling programs airport-wide. Second, centralized waste collection improves the efficiency of pick-up, reducing the congestion and pollution associated with truck emissions. Third, increasing the volume of waste collected also improves the quantity and cost-effectiveness of recycling efforts.

B. Hazardous Waste

Recommendation #5: Establish best management practices for its own operations and that of tenants, compelling the use of non-toxic products and processes when available.

FLL aggressively monitors tenants to insure compliance with applicable laws. These policies help to insure that good housekeeping practices are utilized to prevent leaks, evaporation, and spills; used solvents and products are recaptured; and the segregation of hazardous and non-hazardous waste to facilitate safe and efficient disposal. Further reduction of hazardous waste is dependent upon working with tenants to continuously seek new ways to minimize waste generation and to apprise them of less toxic processes and products as they become available.

IV. Air Quality

Aircraft operations, landside vehicles, and ground service equipment present significant opportunities for further improving air quality at FLL.

A. Aircraft operations

Aircraft operations are the dominant source of mobile emissions, but they are not under the direct control of BCAD. For that reason, BCAD should work collaboratively with representatives of all tenant airlines to establish best operating practices for reducing emissions and fuel use. Implementing this recommendation would be a multi-step, collaborative process, led by BCAD and including the airlines, FAA, and researchers and academicians who study aviation emissions.

Recommendation #1: Establish an airport-wide policy for all operating entities to identify and follow industry best practices for reducing emissions and fuel use.

Industry practices change with time, with new technologies and operating practices afford new opportunities to improve efficiency and reduce pollution. By encouraging tenants to comply with these practices FLL can help to continuously maximize performance.

Recommendation #2 : Establish a forum for evaluating various aircraft-specific emission reduction opportunities identified through the Green Airport Initiative, which should include both airfield procedures and fuel saving strategies.

This recommendation could be initiated through existing operational initiatives such as the "Fly Quiet" program. This would provide a focal point for educating BCAD staff and airline representatives on the many opportunities to save fuel and reduce emissions. Many airlines already practice fuel saving/emission reducing measures and find that fuel savings more than compensate for pilot training and any other costs associated with their implementation. On that basis, it is likely that all major carriers would similarly be able to implement the best practices at little or no net cost, achieving significant emissions reductions for no net investment.

B. Ground service equipment

Ground service equipment such as baggage tugs, tows, and service equipment, generate emissions disproportionate to their numbers. This is because of their long operating life, their long daily operating schedule, and their inefficient stop/start operating cycle.

*Recommendation #3: Work cooperatively with tenants to encourage the use of B20 bio-diesel in ground service equipment, for cost-savings, environmental, and public relations benefits.

Biodiesel is a diesel substitute fuel made from plant or animal fat-based oils. It is a "drop-in" replacement fuel since diesel equipment does not require modification to use biodiesel. It is safe to handle and is compatible with existing pumping, storage, and other airport infrastructure. Its benefits include the fact that its use results in lower emissions and it is renewable since it can be made from agricultural products. The strategy entails minimal disruption in operations and currently yields cost savings of about $.03 cents per gallon.

C. Landside vehicles

Transportation control measures seek to reduce vehicle miles traveled and ease congestion. They achieve the greatest reductions in vehicle emissions because they eliminate vehicle trips. Other landside strategies that focus upon cleaner operating vehicles generally achieve less emissions reduction on a per vehicle basis.

1. Private Passenger Vehicles

Passenger vehicles generate the greatest annual average vehicle miles traveled (VMT), followed by commercial vehicles, employees, and airport fleets. Passenger vehicles generate an average of three times more miles per vehicle trip than employee operated vehicles.[1] They are, however, the most difficult vehicle category to influence.

[1] "Air Pollution Mitigation Measures for Airport Related Activities" (CA Air Resources Board, 2/'05)

*Recommendation #4: Establish pay-on-foot parking (POF) airport-wide.

FLL should proceed with its efforts to establish POF parking throughout its terminal garage facilities. This is a proven program for improving traffic flow, reducing emissions, and reducing the costs associated with increased personnel and roadway infrastructure that would otherwise be required to serve a growing vehicle population.

Recommendation #5: Seek voluntary commitments from rental car companies based at FLL to expand the availability of hybrid-electric vehicles.

Electric-gasoline hybrids vehicles emit significantly less pollution than their gasoline counterparts. Yet, there are no hybrids in any of the rental fleets located on-site. FLL should work cooperatively with these companies to encourage expanded availability of hybrids. This can be accomplished by providing financial incentives or adding these requirements to criteria for those companies providing on-site rental services.

Recommendation #6: Implement strategies to expand employee transit use and ride-sharing

FLL should establish a trip reduction goal for its employees and impose parking fees for single occupant drivers if these goals are not met. Waivers should be available for employees that work off-hours or have unpredictable schedules not conducive to alternative travel modes. The parking fees generated should be utilized to provide employees with convenient transit and ride-share alternatives.

Non-Aviation Department FLL employers that pay parking fees to FLL on behalf of their employees should be encouraged to implement “cash-back” programs that provide employees with the option of receiving the parking fee paid to FLL in exchange for releasing their space. This provides financial motivation for employees to seek ride-sharing alternatives with no cash loss to employers.

To improve the use of these programs, FLL should consider establishing a full-time on-site ride-share coordinator and including materials in salary payment envelopes, provide postings and other updates in communiqués with employees, promoting ride-sharing programs and advising employees of the significant cost savings that can be achieved compared to solo travel. Employee ride-share strategies should also be considered in conjunction with the County’s ongoing analysis of BCAD’s employee parking program.

Recommendation #7: Establish programs to further reduce vehicle travel and idling.

Private motorists and commercial fleets can reduce pollution and health impacts throughout the region and save money by turning off engines when their vehicles are not moving. FLL should further publicize the location and convenience of the cell phone lot within the terminals and concourses to help maximize traffic flow and minimize curbside idling.

As a separate but related issue, FLL should locate signage at curbside areas to educate passengers and motorists about opportunities to reduce vehicle idling and pollution, metro-wide. Due to advances in light duty vehicle technology, pollution and fuel use are reduced if engines are turned off when anticipated idling exceeds thirty seconds.

2. Commercial Passenger Vehicles

*Recommendation #8: Implement an automated vehicle identification (AVI) program.

FLL should assess the feasibility of implementing an AVI system for curb-to-curb airport-based shuttles, hotel shuttles, airport based taxis, Port buses, and other commercial companies licensed to load or discharge passengers at FLL. The system will enable FLL to assess fees based upon the actual number of vehicle trips versus the surrogate deplanement formula currently utilized. It would also allow FLL to monitor the number and types of vehicles loading at the airport, congestion patterns, and to adjust rates to reduce peak congestion and to encourage the use of cleaner operating vehicles. This could provide more direct market incentive for vendors to find ways of improving travel efficiency including the consolidation of services and maximization of vehicle ridership.

Cost-benefit analysis indicates that a system for FLL can be established for about $1 million. Based upon fee systems established at similar airports, an AVI system could generate more than $.05 million dollars in additional annual revenue compared to FLL's current deplanement- based fee system (which generates approximately 1 million dollars in annual revenue). It would also spread these fees across a larger commercial vehicle base. Therefore, the incremental cost of an AVI system could be repaid in 2 years. After this "repayment" period, the system would generate .5 million in additional revenue (beyond the $1 million currently provided annually). As an important additional benefit, FLL would be able to obtain accurate, real-time data on the numbers, types, and dwell times of commercial passenger vehicles serving the airport. This information is essential to more efficiently manage landside operations.

*Recommendation #9: Promote the consolidation of hotel shuttles.

The costs and benefits of implementing a consolidated hotel shuttle program are determined by the number of hotels that currently provide shuttle services, the size of the hotels, and their proximity to one another. The larger the hotels are and the closer their proximity to one another and the airport, the greater the savings that can accrue. Consolidating 2-3 hotels with average of 200 or more rooms each is ideal from an efficiency and passenger convenience standpoint. The last passengers on the route would travel an average of 8-10 minutes more than a single-hotel, dedicated shuttle. More than 3 hotels would result in more than 10 minutes of additional travel time which is generally recognized as unacceptable.

Based upon figures available from the Los Angeles World Airports, a shuttle program can reduce both pollution and operating costs. Capital costs are negligible and primarily associated with administrative and contractual issues associated with conversion to a consolidated system. There are a variety of companies that specialize in working with hotels to establish these consolidated services. Savings accrue from the reduced costs to hotels of administering their programs, paying drivers, and for vehicle maintenance.

FLL could encourage hotels to consolidate shuttle services by helping to organize a meeting to introduce them to experts that can apprise them of potential cost savings; by increasing airport fees on hotel shuttles to motivate consolidation to save money; or by establishing concessionaire agreements for hotel shuttles that compel the use of consolidated services.

Recommendation #10: Promote the use of cleaner operating taxis.

FLL should examine the feasibility of exercising its licensing authority or utilizing an AVI system (discussed earlier); to accelerate the retirement of older, more polluting taxis and to require new taxis and shuttles to meet vehicle standards representing the lowest emissions rate achievable and practicable through the use of conventional fuels.

Regulators have historically preferred establishing emissions-versus technology-based standards to "push" technology and facilitate compliance by innovation. Because taxis and shuttles travel many miles annually, the air quality benefits to FLL and the region would be significant.

3. Heavy-Duty Construction Equipment

*Recommendation #11: Require the use of cleaner operating construction equipment.

Construction of a new runway and new terminal facilities will result in extensive emissions generated by both on-road and off-road construction vehicles. These vehicles have a long operating life that can exceed 30 years. About one-third of diesel powered construction equipment, nationally, was manufactured before the introduction of emissions regulations.[2] According to EPA, in 2007 it will take 60 new model on-road heavy duty diesel trucks to emit the particulate emissions of 1 truck sold in 1988.

FLL should assess the feasibility of establishing standards requiring contractors and sub-agents to utilize newer model on-road vehicles (emissions were tightening significantly in 1998, 2004, and 2007). FLL should also explore the implementation of policies requiring FLL and its contractors to use equipment that meets Tier 1-3 off-road diesel standards.

[2] Mid-Atlantic Diesel Collaborative (PowerPoint presentation, October 2006)