



FlightTurf®

Turfgrass Technology Developed to Increase Safety and Efficiency on Airfields



FlightTurf® at Northeast Philadelphia Airport (PNE)

Prepared by FlightTurf®, LLC

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I. The Many Problems of Current Turf Management

A. *General Problem: Standard Turfgrass Management is Energy Intensive and Not Optimized for Safety*

Current airfield turf management is fraught with inefficiency and expenditure. Marked by safety hazards, maintenance inefficiencies, and environmental degradation, the same mowing practices have been employed since the introduction of the airfield in the 1920s. While airplanes have evolved technologically, growing larger, faster, safer, and using less fuel to carry more weight, turf management practices remain mostly unchanged. Instead of supporting technological evolution and advancement, traditional mowing practices devour resources and have handicapped the aviation industry.

Wildlife is naturally drawn to the open spaces of airfields. Commonly used turfgrasses, as well as the weeds and insects that live within the turf, are sought-after food sources. Aircraft collisions with birds and other wildlife are a known serious safety issue in the aviation industry. The United States Department of Transportation Inspector General's office issued an alarming report in August, 2012 entitled, "*FAA (Federal Aviation Administration) Has Not Effectively Implemented Its Wildlife Hazard Mitigation Program*", highlighting the gravity of the problem. Various elementary methods for deterring wildlife have been employed – sharp shooters, images of foxes, pyrotechnics, etc. – but not effectively

In summary, customary turf mowing protocols consume dwindling resources and cause runway incursion. New safety measures have not surfaced that significantly discourage wildlife from airfields. A safer, cost-saving solution that also deters wildlife is needed; aviation industry leaders must employ efficient and progressive techniques that solve safety and maintenance issues on airfields.

B. *Change in Turfgrass Management is Imminent*

It is important to understand that whether or not an airport chooses to update its turfgrass management practices, change is imminent and will occur regardless. Frequent mowing consumes too many resources to continue as the standard practice. In addition to being time, energy and capital intensive, high frequency mowing has serious environmental consequences. The aviation industry simply can no longer afford to maintain these archaic management practices.

While more specific environmental issues such as storm water runoff and emissions are outlined in this paper, the dependence on fossil fuels required to maintain airfields is becoming increasingly unsustainable. As fuel costs escalate due to limited supply, those who mow frequently will be forced to update their practices.

Effective wildlife control is essential for maintaining airport safety. As the human population grows, land will become increasingly scarce. Over time, wildlife will flock to these dwindling open areas in increasingly large numbers. Facilities taking a proactive approach to this growing problem would gain the most value.

C. *Problems with Traditional Turf Management.* Specific turf management practices that inhibit industry growth have been identified. Following is a list of issues relating to typical turf management:

1. Mowing:

Constant mowing, marked by the incessant groan of oversized, fuel-guzzling mowers, is a process that consumes an airport's maintenance budget. According to an independent study dated February, 2012 by Urban Engineers, Philadelphia International Airport (PHL) mows its airfields 22 times a year. Factoring-in equipment costs, labor, and fuel (using 2010 gas prices), at \$38 per acre each mow, PHL spent over \$725,000 in 2010 on mowing and maintenance services alone. Many airports mow even more frequently than PHL. With inflation and fuel prices on the rise, expect to see even higher expenditures if mowing is not reduced.

2. Wildlife Strikes:



Atlanta Southeast (Delta) bird strike, April 1, 2011

According to the Inspector General's report to the FAA, "In the past 2 decades, wildlife strikes have steadily and dramatically increased, from 1,770 reported in 1990 to 9,840 reported in 2011, a five-fold increase. Wildlife strikes have resulted in at least 24 deaths and 235 injuries in the United States, and since 1988, 229 deaths worldwide. They also have caused nearly 600,000 hours of aircraft downtime and \$625 million in damages annually." While the FAA has quoted similar statistics¹, the bottom line is the same – human lives are being risked unnecessarily while millions of dollars are being squandered. Taxpayers should not be burdened with this cost.

An underlying cause of wildlife strikes is the standard turfgrass employed by most airports. Wildlife are attracted to the grass as well as other food sources on airfields. Animals flock and gather on and around airfields, impeding the flights of airplanes, endangering lives, and damaging aircraft.



US Airways Flight 1549, bird strike crash into Hudson River, Jan. 15, 2009

¹ See http://www.birdstrikecanada.com/documents/DeFuscoRussell_NorthAmericanBirdStrikeAdvisorySystem.pdf



Bird strike on commercial aircraft, March 9, 2002



Fatal crash, Addison, TX, July 8, 2003

3. Runway Incursion:

The use of heavy equipment in runway safety areas presents a significant safety risk. Airports experience difficulties maintaining operational capacity when shutting down runways to mow airfields. Both airport profitability and safety are significantly impaired.



Heavy mowing equipment causes runway incursion



Runway closed for mowing

4. Compliance with FAA Regulations:

Although not a “problem” per se, the FAA and the Air Force require that grass be maintained at specific heights in order to reduce wildlife strikes. The FAA specifies that grass be kept 6-12 inches in height. The Air Force mandates that grass be kept 7-14 inches in height. Compliance requires constant monitoring, maintenance scheduling, and upkeep.

5. Storm water Runoff:

Traditional airfield turfgrass does not effectively infiltrate storm water. Insignificant 2-3 inch root systems fail to absorb water as heavy rains pound on airfields. Storm water runoff and flooding often become serious issues on airfields, leading to costly remedies.

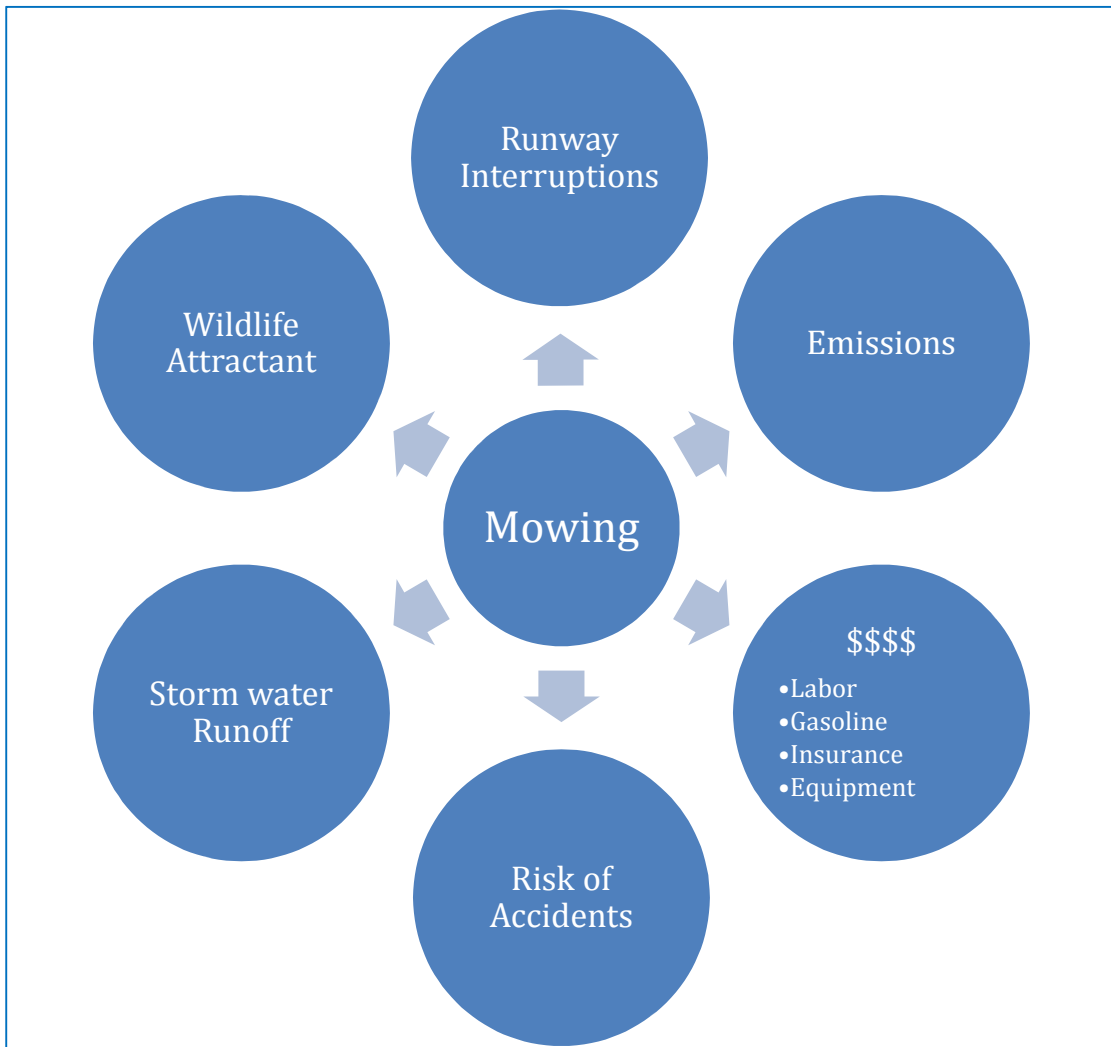
When storm water runoff carrying airfield contaminants pours into local lakes and rivers, it poisons drinking water sources for local communities. This harms both people and the environment. If contaminants are traced to an airport source, it can cost the airport its reputation.

6. Additional Environmental and Safety Issues:

The mowing process itself degrades the environment. Constant mowing releases toxic emissions, thereby impairing air quality. In fact, mowing machinery is known to emit especially high levels of hydrocarbons compared to other vehicles. Because emissions counts are quantifiable, numbers released to the public damage the reputations of cities where airports are located. Mandatory emissions controls for mowers are on the horizon, and implementation will be costly for the aviation industry.

The flushing of insects that result from mowing is a major wildlife attractant.² This increases the risk of wildlife strikes even more. The straw produced from mowing clippings is also a wildlife attractant. To remove this straw from runways, airports employ even more heavy equipment. Thus, not only are they attracting wildlife, but they cause more runway incursion.

² See FAA Advisory Circular 150/5200-33B: Hazardous Wildlife Attractants On Or Near Airports, p. 7



The Problems Related to Mowing

II. Solution to the Problem of Current Turfgrass Management

A. *General Solution: Be an Industry Innovator*

As resources become more scarce and new environmental restrictions are invoked, it is very likely that current turf management practices will become obsolete. The only question that remains is whether an airport should wait to upgrade its turf management practices until mandated, or whether they should take a pro-active role. If the airport chooses to remain stagnant as long as possible, nobody wins – the airport will continue to waste money on old-fashioned turf management and drain resources at the same time. The latter option allows the airport to emerge as an industry innovator, gaining valuable recognition in the process.

It is important to note that while a call for change is in order, all changes must comply with stringent FAA regulations. The challenge therefore becomes to establish a turf management practice that is a safer, economically effective, and more sustainable alternative to traditional airfield management. Any solution must address all of these factors while also meeting FAA specifications.

B. *More Specific Solution: Plant a Vegetative Cover that is cost efficient while minimizing any attraction by wildlife*

“Proper airfield turf management, including choice of vegetative cover, is the single most important thing you can do for wildlife deterrence and the single most commonly violated principle,” according to military and FAA advisor Dr. Russell P. DeFusco, Ph.D., USAF (ret), VP of BASH, Inc. (from the military acronym Bird/Wildlife Aircraft Strike Hazard). Dr. DeFusco clearly advocates the planting of safer and smarter vegetative covers.

Yet, as previously explained, in light of depleting natural resources and the attraction of wildlife to the food source within open airfields, standard turfgrass practices *must* progress. The best solution is often the most logical. In this case, in line with Dr. DeFusco’s thinking, it is clear that standard turfgrass and its maintenance is the source of the problem. Therefore, the most logical solution is to plant an alternative vegetative cover. The optimal vegetative cover would achieve two goals: one, it would offer cost savings, and two, it would deter wildlife.



Flocking geese are common on airfields in the USA

C. Most Logical Solution: FlightTurf®

FlightTurf® is a sustainable live turfgrass alternative that is cost-effective, low maintenance, and helps to deter wildlife. It achieves the two part goal of low-maintenance input and wildlife deterrence *simultaneously*. FlightTurf® requires only 20% of the typical turf grass mowing to maintain a 7-inch height, which falls directly in the FAA’s grass height requirement of 6-12 inches for airports. FlightTurf® is the only product of its kind that has demonstrated these qualities through airfield research.

FlightTurf® is a patented proprietary mix and method of maintaining airfields. It meets the Federal Aviation Administration (FAA) seeding specification, Part 139 requirements, FAA Advisory Circulars, USDA recommended wildlife control, and industry standard best practices.



FlightTurf® at Erie International Airport (ERI)

1. FlightTurf® Research

FlightTurf®, LLC has been studying the safety, economic, and environmental benefits of replacing traditional turfgrass with low-maintenance, wildlife-detering turfgrass installations within airport operations areas. FlightTurf® discovered that by using select grasses less attractive to wildlife, installing the seeds using variable processes, and maintaining the field as a monoculture through novel weed control methods, the turf stand could fulfill a two-fold goal of (1) low-maintenance input, requiring minimal mowing to maintain a 7-inch height and (2) wildlife deterrence.

As an initiative of the City of Philadelphia Division of Aviation's (DOA) toward Environmental Stewardship and Sustainability, the DOA has evaluated FlightTurf® at Northeast Philadelphia Airport (PNE) since 2009.

Wildlife monitoring and data collection began with one PNE FlightTurf® test plot seeded in August 2009. Due to favorable results, the study was expanded to include two airfield experimental FlightTurf® plots, each 1.25 acres in size, and two equal sized control plots of existing grass. Seeded in October 2010, the plots test FlightTurf® in the harsh conditions found alongside active runways. The test plots are thriving.

Deborah Cahill, ASLA, a Landscape Architect with the Philadelphia Department of Public Property, offered her positive thoughts on FlightTurf®:

“Christina and I visited PNE in the summer of 2012, with record temperatures and drought conditions. The FlightTurf® I viewed on the airside and landside of PNE was green, healthy and free of invasives. Turf normally becomes dormant when these environmental conditions persist for a long period of time. Dormancy includes browning of the blades and an increase of invasive species. FlightTurf® did not exhibit any of those negative attributes.”

Dusk and dawn biweekly wildlife monitoring and data collection continued on the airfield plots from October 2010 through September 2012. The research results were submitted to the FAA for review. In an email dated June 18, 2012 Mr. Brian Rushforth, Manager of the Airport Safety and Operations Division of the FAA, indicated that the FAA had not found any evidence that FlightTurf® causes any increase in attracting wildlife. Although the FAA does not endorse any products as an agency, Mr. Rushforth also stated that since wildlife attraction is not increased [by the use of the product], the FAA will not prohibit any airport from using the product.

Significantly, as the FlightTurf® plots matured, the bird counts dropped over time. By 2012, no birds were observed on the airside experimental plots, while birds continued to visit the airside control plots. The landside FlightTurf® plot, though smaller in size, showed a marked reduction in birds compared to the larger landside control plot, consisting of existing mowed turfgrass.

This favorable result was obtained even though the experimental plots were mowed as little as once a year while the control plots required weekly or biweekly mowing throughout the March to November growing season.

It should also be noted that all FlightTurf® plots were mostly grasshopper-free, whereas the control plots all supported large populations of grasshoppers, which are known to be wildlife attractants.

2. Properties of FlightTurf® Validated by Airfield Research:

a. Reduced Mowing

FlightTurf® maintains an average 7-inch height with reduced mowing. FlightTurf® can be mowed more often if a more manicured appearance is preferred. This substantially reduces the time and energy input necessary for maintenance. FlightTurf maintenance is explained in point 3 in more detail.



Runway safety areas are weedy and difficult to mow



**FlightTurf®, by contrast, is weed-free and requires little mowing.
Plot pictured above is 20 months old**

b. Economic Savings

The economic savings from reduced mowing can be dramatic. Urban Engineers, Inc., has demonstrated that Philadelphia International Airport would save nearly \$800 per acre each year (2010 dollars) after converting airfields to FlightTurf®. This calculation factors in equipment costs, labor and fuel associated with mowing 22 times per year (conservative, 2010 gas prices were used in this analysis). Factoring in reduced wildlife management and runway closure expenses increase savings well beyond \$800 per acre each year.

c. Decreased Runway Incursion

Also worthy of note are the significant improvements in both safety and airport profitability related to the reduced need for mowing equipment in sensitive areas, such as runway safety areas. Reductions in runway closures and the hazards involved with mowing these areas are in some cases the greatest benefit of converting conventionally mowed turf to FlightTurf®.

d. Attractive Appearance

FlightTurf® has an attractive appearance with minimal upkeep.

e. Storm water Infiltration and Erosion Control

Roots of plants dry the soil thereby increasing the capability of a soil to infiltrate water. FlightTurf® has deep root systems that extend approximately 14 inches into the ground, as opposed to the insignificant 2-3 inch root systems of regular turfgrass. The deep roots improve the ability of the soil to infiltrate water, resulting in better storm water management.

The more biomass, the greater the plant's ability to remove storm water through evapotranspiration. Unmowed FlightTurf® has considerably more biomass than mowed turf, therefore its ability to remove water through evapotranspiration is greater.

The taller and thicker the grass is, the slower the movement of water through it therefore the more time there is for infiltration. FlightTurf® forms a taller, dense monostand which slows the movement of storm water.

Additionally, the deep roots of FlightTurf® prevent erosion by stabilizing the soil more effectively.

f. Persistence and Durability

FlightTurf® is persistent and durable. It remains a consistent, thick stand even with moderate vehicle traffic. The grass naturally fills in bare areas over time, tolerates salt, and typical contaminants present on airfields very well.

g. Drought Tolerance

FlightTurf® performs well year around with no supplemental irrigation, only showing signs of dormancy briefly during the hottest driest months. The dormant grass greens up fully when cooler temperatures return, or when there is adequate moisture. As discussed, FlightTurf® has a much more extensive root system than regularly mowed turfgrass, which allows it to thrive in dry conditions where other turfgrasses cannot. FlightTurf® performs well in full sun conditions.

h. Minimal Chemical and Fertilizer Use

Although sometimes beneficial to apply chemical weed treatment in the establishment phase, FlightTurf® naturally tends to form a mono-stand, free from other plant species. The low nutrient requirements of FlightTurf® help to ensure the longevity of the installation with minimal fertilization. Depending on the soil analysis, FlightTurf® requires either no fertilizer, or very little, at the time of installation. Extensive roots pull nutrients from deep within the soil.

i. Disease, Weed, and Insect Resistance

FlightTurf® is very weed resistant due to its thick growth characteristics and allelopathic properties. These act as a natural herbicide to control competing weeds and disease. There were no signs of turf disease in any of the plots and insect activity was reduced. The presence of endophytic activity is likely a major contributor to these qualities.

j. Other Environmental Benefits

Emissions and noise pollution are eliminated in direct proportion to reductions in mowing, a major environmental benefit, as well as a benefit to nearby communities. According to the study by Urban Engineers, reducing mowing at Philadelphia International Airport (PHL) to one annual mow will reduce emissions output by 95%.

While the reduction in mowing is tremendously beneficial to the environment, it will also vastly improve the image of an airport. The trend in the aviation industry today is not only to cut costs, but to save money while increasing efficiency and becoming more 'green'. With the environmental benefits realized through the elimination of mowing, an airport can use its sustainable improvements to improve its public perception.

l. FAA allowance of FlightTurf® use

FlightTurf® meets the FAA seeding specification, Part 139 requirements, FAA Advisory Circulars, USDA recommended wildlife control, and industry standard best practices.

3. FlightTurf® Maintenance

Once established, FlightTurf® is easy to maintain. FlightTurf® grass blades maintain an average 8-inch height with minimal mowing (additional mowing may be needed depending upon the site climatology). Taller, wispy seed stalks develop depending upon stresses on the grasses and/or maturity. Typical height will be 10"-14". Best to allow the seed heads to mature then time mowing accordingly. Minimum mow cut to a height as low as 6 inches.

More frequent mowing of immature stands during the first few growing seasons promotes tillering, which can help fill-in bare spots as well as control weeds.

If left uncut, the FlightTurf® re-seeds itself naturally. This is advantageous in hard to access areas such as drainage ditches. Fewer mowing events encourage deeper roots.

It is important to follow the recommendations of FlightTurf® or a FlightTurf® Certified Installer during the first few seasons of establishment to ensure a successful stand.

Thereafter, a yearly inspection by FlightTurf® or a FlightTurf® Certified Installer is recommended to assess the health of the stand. Every installation has unique soil and climate conditions, and any special needs should be addressed on a case-by-case basis.

4. FlightTurf® Installation Projects (State)

a. Airports:

San Francisco International Airport (CA), Northeast Philadelphia Airport (PA), Erie International Airport (PA), Rochester International Airport (NY), Elmira Corning Regional Airport (NY), Baltimore Washington International Airport (MD), Portland International Airport (OR), Greater Rockford Chicago International Airport (IL)

b. Utilities and Departments of Transportations:

PSEG Transmission Corridor (NJ), PECO/Exelon Burholme Substation (PA), PECO/Exelon Center Point Substation (PA), Delaware Department of Transportation (DE), Pennsylvania Department of Transportation (PA), Pennsylvania Turnpike Commission (PA), Harris County Public Works - Texas

c. Solar:

Ameresco/Fort Detrick (MD)

d. Educational Institutions:

Rochester Institute of Technology (NY), West Chester School District (PA)

III. Conclusion

Current airfield turfgrass and mowing protocols attract wildlife and increase the risk of bird and wildlife collisions with aircraft. They increase runway incursion and interrupt operations. These antiquated practices are unnecessary, costly, deplete natural resources, and pollute our environment. There is no reason to continue with current methods when there is a safer, cost-slashing, and environmentally-beneficial alternative.

The FlightTurf® method of managing airfields is the best alternative. Ultimately, FlightTurf® can increase airport safety and cut hundreds of thousands of dollars in mowing costs annually, all while transforming an airport into a more sustainable and efficient enterprise.