

Chapter Seven: Aviation Trends and New Technologies

The aviation industry plays an important role in the state of Iowa and the nation. In recent years, the aviation industry has experienced some volatility related to the cost of aircraft operation as well as changes in aircraft types and navigational options. The trends and technologies associated with the aviation industry are summarized in this chapter to provide some insight into topics that may affect aviation in Iowa. These topics are organized in the following order:



- Aircraft Trends
- NextGen and FAA Database Changes
- Aviation System Users
- Sustainability and Technologies
- Biofuels

7.1 Aircraft Trends

The following highlights specific aircraft trends and technologies that are expected to impact the Iowa aviation system over the next twenty years. These include the use of light sport aircraft (LSA), very light jets (VLJs), and unmanned aerial vehicles (UAVs).

7.1.a Light Sport Aircraft and Sport Pilot Certificates

Light sport aircraft (LSA) is a recently created classification targeted towards recreational flyers. These aircraft are designed to reduce the costs associated with maintaining and operating a traditional recreational airplane, which in turn has the potential to benefit recreational aviation in Iowa. In July 2004, the Federal Aviation Administration (FAA) issued the light sport aircraft/sport pilot (LSA/SP) rule that opened the door for growth in the general aviation market. The FAA defines light sport aircraft as having a maximum gross takeoff weight of not more than 1,320 pounds, a maximum airspeed of 120 knots in level flight at maximum continuous power, a maximum stall speed of 45 knots, no more than two seats, and a single reciprocating engine. Simply stated, LSA are small, easy to operate, low performance aircraft.

The FAA recognized the design potential of these smaller aircraft, which lead to the issuance of the LSA/SP rule. The rule eliminated gaps in previous regulation, increased

the safety level of these aircraft, and initiated new and innovative aircraft designs. Complex FAA testing has been replaced by streamlined industry standards, which has encouraged design innovation and cost competition among manufacturers and has lowered aircraft costs and pilot certification expenses. The cost of light sport aircraft range from \$40,000 up to \$140,000, whereas the cost of a fixed-wing aircraft typically starts around \$170,000.

Numerous aircraft can be certified as light sport aircraft as long as they fall within the weight specifications and other guidelines defined by the FAA. Such aircraft include powered and glider airplanes, gyroplanes, powered parachutes, weight-shift control trikes, free balloons, and airships. **Figure 7-1** illustrates two examples of light sport aircraft models. In addition, a number of designers and manufacturers of experimental aircraft kits are developing models that will be compliant with light sport aircraft rules, creating an even larger pool for sport pilots.

Figure 7-1: Examples of Light Sport Aircraft Models

Aeronca L-3



Source: Office of Aviation

Cessna Skycatcher

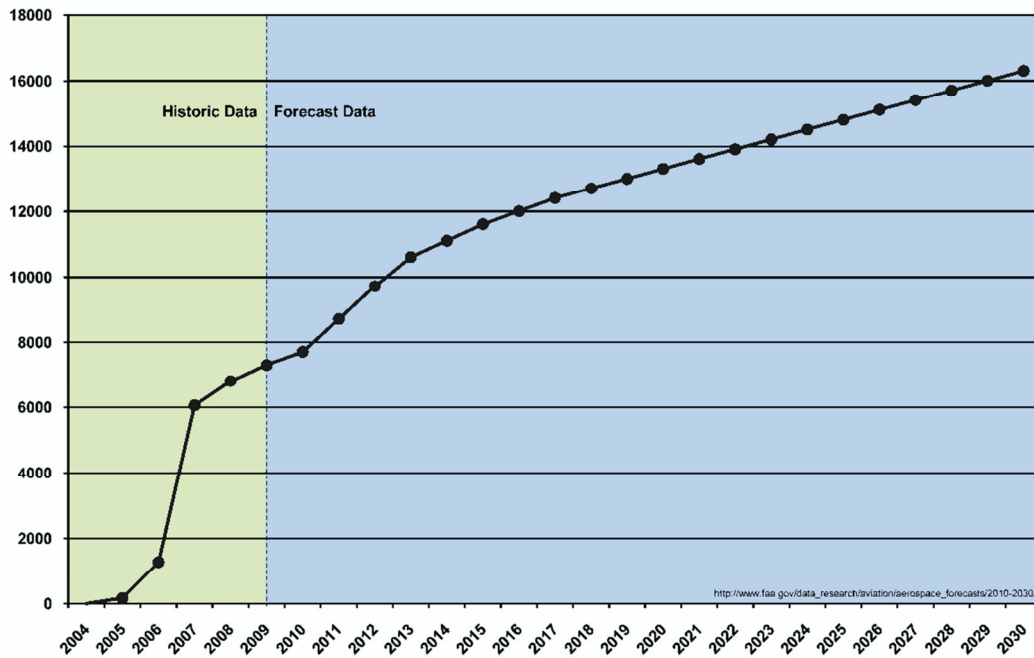


Source: Cessna Aircraft Company

Coupled with the development of these aircraft types is a new license class with less stringent requirements that allows for more recreational pilots to obtain training to operate these aircraft. A sport pilot certificate is required in order to operate any certified light sport aircraft and can be obtained with 20 hours of successful training. An FAA medical certificate is not required for a sport pilot applicant, as compared to a traditional pilot's license, which lessens the certification costs significantly. A sport pilot certification permits day time operation and one passenger, which makes general aviation accessible to the personal flyer and fulfills the needs of a large segment of recreational flyers.

Since the inception of the FAA LSA/SP rule in July 2004, the demand for light sport aircraft has experienced steady growth, as shown in **Figure 7-2**. The FAA projected a total of 7,711 active sport aircraft in 2010 and an annual average growth rate of approximately 5.6 percent (5.6%) nationally until 2020, or an additional 5,600 active sport aircraft for a total of 13,311 by 2020. The FAA forecasts suggest the average annual growth rate will decrease to approximately 2.1 percent (2.1%) from 2020 until 2030, resulting in a total of 16,311 active sport aircraft in 2030.

Figure 7-2: FAA Forecast for Active Sport Aircraft from 2010 to 2030



Source: http://www.faa.gov/data_research/aviation/aerospace_forecasts/2010-2030/

Growth forecasted in this segment of general aviation has the potential to increase aviation activity levels throughout the state. This more affordable option to earn a pilot's license is expected to increase the number of registered pilots both across the U.S. and in Iowa. As forecasted by the FAA as part of the 2010-2030 aerospace forecasts, the number of active sport pilots is projected to grow at an annual average rate of 7.2 percent (7.2%) from 4,060 pilots in 2010 to 14,100 pilots in 2030. This projected increase is a reversal of the growth rate experienced between 2007 and 2010 when the number of pilots nationally decreased by more than 2,000. Accommodating the needs of this segment of the aviation market will be crucial for the future success of the state's aviation system. New development by airports may be necessary to successfully meet increased demand such as runway/taxiway improvements and new hangar construction. Opportunities also exist for airports to increase revenue through additional flight instruction programs, aircraft fueling options, and repair/maintenance services. Additional investments made by airports into facilities and services as a result of increased LSA activity will contribute to an Iowa aviation system that is more capable of meeting the demands of its users.

7.1.b Very Light Jets

Very light jets (VLJs) are light weight, jet aircraft with a maximum certified takeoff weight of less than 10,000 pounds. VLJs are operated by a single pilot in a glass cockpit using advanced flight management systems that allow the pilot to operate safely in all weather conditions. VLJs typically carry four to eight passengers and travel a relatively short distance at speeds between 250 and 350 knots. In 2006, the FAA certified the first VLJ to fly in the National Airspace System (NAS).



Prior to 2008, forecasting for VLJs indicated exponential growth with several thousand aircraft anticipated to enter the NAS in the next two decades, according to the Aircraft Owners and Pilots Association (AOPA). Unfortunately, with the recent economic downturn, two major manufacturers of VLJs entered bankruptcy proceedings in 2008 due to lack of funding, which consequently dampened projection expectations. In 2009, the FAA revised the VLJs forecast to reflect an increase of 200 per year until 2012 and a rate of 300 per subsequent year over the planning period.

VLJs are designed to have lower operating costs and shorter runway requirements than larger business jets, allowing them to operate at an increased number of airports across the country while avoiding larger, more congested airports that offer commercial service. VLJs can provide business users with on-demand service and the opportunity to visit a number of destinations and various clients in a short amount of time.

Forecasted growth in the number of active VLJs has the potential to increase the type and level of operations found at airports throughout Iowa. Iowa's central geographic location in the continental United States positions it favorably to support the operations of VLJs that may traverse the country. Aircraft traveling from coast to coast may require a stop at an Iowa airport for refueling, repair/maintenance, or if they are unable to reach their intended destination as a result of weather or air traffic control delay. A network of airports with adequate infrastructure and services to accommodate the demands of this rising segment of aviation will be important in order for Iowa to accommodate this segment of aviation throughout the planning period.

7.1.c Unmanned Aerial Vehicles

Unmanned Aerial Vehicles (UAVs) are becoming a larger player in the aviation industry with civilian uses increasing. UAVs, as the name implies, are aircraft that are operated remotely. UAV technology has been significantly researched and advanced by the

military since the early 1960s. Initial UAVs were generally used by the military for surveillance purposes with combat value realized in the 1970s during the Vietnam War.

In addition to military applications, UAVs can perform a wide variety of tasks in civilian environments including remote sensing, transport, scientific research, and search and rescue operations. UAVs can be fitted with various sensors, cameras, and instruments to capture scientific or research data. The aircraft can also be used to transport cargo, such as medicine



or food, to locations that cannot be reached by land after a catastrophic event. Local and state agencies can use UAVs to monitor engineering sites, waterways, pipelines, high crime areas, crowded settings, traffic and security situations, pollution levels, forest fire movement and crop surveillance, among many other applications.

Future applications of UAVs are limitless; however, the FAA must address how such vehicles fit into the national airspace. The FAA developed the Unmanned Aircraft Systems (UAS) Office to “review proposed applications and ensure that approvals to fly unmanned aircraft, regardless of size, do not compromise the high level of safety for other aviation, the public, and property on the ground.” The ability of an UAV to identify and avoid manned aircraft is critical to their successful deployment in national airspace. Current FAA policies prevent a number of UAVs from flying in national airspace because regulations have yet to be written for such aircraft.

Until more defined policies, procedures, uses, and federal regulations are established, the impact UAVs will have on aviation in Iowa is unknown. Given the increased interest in utilizing these aircraft for civilian purposes, it is anticipated that UAV use may become more prevalent. The ability of these aircraft to stay aloft for several hours at a time has practicality for surveillance uses such as law enforcement and monitoring the progress of crop growth or in evaluating areas affected by natural disasters, decreasing the response times of emergency crews. Surveillance and cargo delivery capabilities of these aircraft could provide a more cost-effective aerial assistance option for agencies responding to these types of events as well. Agricultural spraying could also benefit as a result of lower operational costs and elimination of the human element, which in turn will increase safety, efficiency, and the effectiveness of the product application. Monitoring advances in UAV technology and accommodating their use accordingly will permit the system to integrate this segment of aviation.

7.2 NextGen and FAA Database Changes

NextGen is the transformation of the NAS from a ground based system of air traffic control to a satellite based system of traffic management. The evolution of the system is important to meet future user demand and to avoid gridlock both in the air and on the ground at airports. NextGen will support continued growth and increased safety of aircraft operations while reducing the environmental impact of aviation operations.

Several technologies will support the NextGen system including the Global Positioning System (GPS) and advances in weather forecasting, data networking, and digital communications. New procedures will take effect with the implementation of NextGen, including the shift of some decision making responsibility from the ground to the cockpit.

When NextGen becomes fully developed, the system will allow a larger number of aircraft to safely fly closer together on more direct routes, resulting in reduced delays and unprecedented benefits for both the economy and the environment through reduced carbon emissions and fuel consumption.

7.2.a Automatic Dependent Surveillance – Broadcast (ADS-B)

Route frequency has increased in the U.S. in recent years, which leads to more congested airports. The increase in flights has corresponded with an increase in aircraft accidents and “close calls.” New technology in the aviation industry as part of NextGen, including Automatic Dependent Surveillance – Broadcast (ADS-B), may play a critical role in both the national navigation system and the navigation system within Iowa.

ADS-B is a technology that allows pilots in the cockpit and air traffic controllers on the ground to track aircraft traffic with more accuracy than other systems, specifically radar. ADS-B relies on the Global Navigation Satellite System to determine an aircraft's precise location. The position data is combined with other information such as aircraft type, speed, altitude, and flight number. The information is converted into a digital message and broadcasted via a radio transmitter.

There are two components to the system. The first is a transponder located on an aircraft that emits a continuous signal. The second is a ground based transceiver that gathers location information and projects it onto a vehicle tracking/surface moving map used by pilots and air traffic controllers.

There are several advantages to using the ADS-B technology:

- ADS-B improves safety by giving pilots and controllers reliable, accurate, real-time information about aviation traffic. ADS-B can report aircraft positions to an accuracy of 25 feet, compared to a range of a quarter to a half mile for radar.

- Because the system has an effective range of 100-200 miles, ADS-B provides a greater margin to implement conflict detection and resolution.
- ADS-B can signal while an aircraft is grounded. This provides safer, more efficient taxi operations and results in greater airport capacity.
- The system has proven to be successful with regards to safety and was first used in Alaska where accidents declined after implementation.
- As part of its NextGen system, the FAA has requested \$564 million each year through 2013 for ADS-B infrastructure development, demonstration, and implementation.

Some disadvantages to using ADS-B technology include the following:

- General aviation (GA) operations will be linked to the Universal Access Transceiver while commercial operations will link with the 1090 MHz squitter. These frequencies are incompatible, which means, to date, the vehicle tracking/surface moving map may not depict aircraft at both frequencies.
- The targeted implementation date for onboard avionic transponders equipage is 2014 for commercial aircraft and 2020 for all aircraft. Aircraft owners would be expected to install the required equipment to comply with these dates. Funding sources to help pay for the additional required equipment has not been identified. The 1090 MHz frequency for commercial operations has been used in Europe. Based on experience with the same frequency, some officials in Europe predict system overload in the early 2010s. Despite greater space across the U.S., some officials remain skeptical.

7.2.b Airports Geographic Information System (Airports GIS) Program and Electronic Airport Layout Plans (eALPs)

In response to Executive Order 12906, the FAA implemented the Airports Geographic Information System (Airports GIS) Program in 2010 which is aimed at creating standard formats for the collection and input of aviation data. The standardization and centralization of data into a shared electronic environment is expected to improve the FAA's overall operational efficiency and provide enhanced access to data for analysis and decision making. Furthermore, it is expected to enhance communication and collaboration between the FAA and airport sponsors on airport planning and development projects, support NextGen initiatives, and streamline data sharing among agencies within the industry.

The FAA is working with the Air Traffic Organization (ATO), Office of Aviation Safety (AVS), and the Airport Obstructions Standards Committee (AOSC) to refine Aeronautical Survey standards and the Airports GIS requirements. The Airports GIS is a single, web-based information repository for survey data, which is managed jointly by the FAA and the airport sponsor.

There is an immediate need for enhanced aviation data collection, quality assurance, and information sharing practices. Through the establishment of a standardized methodology to capture survey data for submission into Airports GIS and to validate the information for use on multiple projects, the system introduces a centralized, web-based data source meeting standards capable of supporting the needs of both the FAA and airport sponsors. This system will be used for the development of electronic Airport Layout Plans (eALPs) and will serve as a platform to enable data sharing for both the planning and engineering required by NextGen.

Airport Layout Plans (ALPs) serve as planning documents that typically identify existing infrastructure and also show future development planned for an airport facility. ALPs are mandatory for every public use airport within the NPIAS and it is recommended that they be kept current to facilitate their use as a guideline document for development. Traditionally, ALPs have been created using electronic drafting programs such as AutoCAD and have been stored in hard copy formats. With the implementation of the Airports GIS system, the FAA is in the process of integrating the ALP process into the GIS system so that users will be able to view, evaluate, format, print, and grant access to airport data located within the GIS database, as well as import and export data from external resources.

The FAA initiated a pilot program to test the AGIS/eALP process and its integration into the Airports GIS system in FY 2009. The end result will be a standardized GIS presentation of the ALP drawing set, a query driven airport database, and an active archiving of previous ALP data sets. Ultimately, this program will set a new national standard for the development, review, and approval coordination of official ALPs.

7.3 Aviation System Users

Understanding trends associated with users of the Iowa aviation system helps airports better understand, prepare, and accommodate future demands. Utilizing forecasts, existing trends, and advances in technology, the following sections present the influence these user groups are anticipated to have on aviation in the state throughout the planning period.

7.3.a General Aviation

The general aviation sector has taken a significant hit during recent years as a result of economic uncertainty. According to the General Aviation Manufacturers Association (GAMA), U.S. manufacturers of GA aircraft delivered 1,587 aircraft in 2009, which was 48.5 percent (48.5%) less than in 2008. This translates into a second consecutive year of decline in shipments that was preceded by four years of sustained growth. In 2009, turbine aircraft, including turbojets and turboprops, were down 46.2 percent (46.2%) and

19.2 percent (19.2%), respectively; piston deliveries declined 55.1 percent (55.1%); single-engine deliveries were down 54.6 percent (54.6%); and the multi-engine category was down by 64.8 percent (64.8%). Billings in 2009 totaled \$9.1 billion, down 32.1 percent (32.1%) compared with 2008 and represented the first reported decline since 2003.

Between 2000 and 2009, the number of local and itinerant GA operations at airports nationally measured by the FAA Terminal Area Forecast (TAF) declined at a Compound Annual Growth Rate (CAGR) of 1.84 percent (-1.84%) from 87,201,036 to 73,807,196. At the same time, Iowa experienced a CAGR of 1.20 percent (1.20%) from 718,315 to 799,545 annual operations, as shown in **Table 7-1**. The national declining trend is attributed to several factors, primarily the increasing cost of owning and operating an aircraft and the fluctuations in the economy over the decade. Overall, the increase in GA operations in the state can be attributed to increasing agriculture related operations over the same time period. Also, significant changes made in 2008 to the TAF air activity recording procedure account for the increase in operations reported in Iowa that year.

Table 7-1: Historical General Aviation Operations Based upon FAA TAF Figures

Year	Iowa GA Operations	Total US GA Operations
2000	718,315	87,201,036
2001	687,676	86,017,963
2002	692,991	85,878,003
2003	689,022	83,551,373
2004	685,774	82,791,153
2005	692,186	81,243,153
2006	684,251	80,265,789
2007	670,814	80,437,920
2008	841,765 ¹	77,915,418
2009	799,545	73,807,196
<i>CAGR (2000-2009)</i>	<i>1.20%</i>	<i>-1.84%</i>

Note: CAGR = Compounded Annual Growth Rate

¹ = Increase attributed to changes in TAF air activity recording procedure

Source: FAA Terminal Aerospace Forecasts 2010-2030 (TAF)

The 2010-2030 FAA TAF projects the number of total general aviation operations will increase from 73,807,196 in 2009 to 82,210,123 in 2030, resulting in a CAGR of 0.51 percent (0.51%) as presented in **Table 7-2**. If operations in Iowa experience a similar growth rate, GA operations could increase at airports included in the TAF to 889,687 annually by 2030.

Table 7-2: General Aviation Operations Forecasts Based on TAF Figures

Year	Total US GA Operations	Total Iowa GA Operations
2009	73,807,196	799,545
2015	73,547,397	824,325
2020	76,218,243	845,560
2025	79,090,435	867,343
2030	82,210,123	889,687
<i>Annual Avg. Growth 09-30</i>	<i>0.51%</i>	<i>0.50%</i>

Source: FAA Terminal Aerospace Forecasts 2010-2030

The projected increase in overall GA operations has many benefits for aviation in Iowa. Increased profits for aviation related businesses such as flight schools, fixed base operators (FBOs), and fueling services will result from additional GA activity. As general aviation is found at all airports throughout the state, growth in this segment will benefit the entire aviation system. Airports in Iowa will need to be prepared to support increased activity through infrastructure and service investments.

Business Aviation – An important sector of general aviation is the business aviation market. Despite recent economic instability and a decrease in demand for leisure travel, business aviation is becoming increasingly important. One of the distinct advantages of business aviation is the efficiency and convenience gained from point to point travel. Access gained through this method of aviation opens up nearly 5,300 airports across the U.S. for businesses to transport people, goods, and services as compared to the fewer than 600 airports that provide commercial airline service.



The FAA expects steady growth in the business aviation sector fueled by these and other factors:

- Economic recovery and improvement of corporate profits.
- Reduction in the frequency of commercial flights to increase passenger load levels.
- Greater capability and improved efficiency of newer aircraft models.
- The ability to land business aircraft at airports without commercial airline service.
- Travel without the increasingly rigorous security screening of commercial service.
- Stabilization of fuel prices.

Air taxi operations, also known as air charters, provide on-demand aviation services most often utilized by businesses. The concept of providing a direct flight on a moment's notice to transport people, goods, and services most conveniently suits businesses that

depend on the just-in-time inventory strategy. Information collected by the FAA on air taxi operations enables the level of business aviation activity to be measured. According to the FAA TAF, between 2000 and 2009, the number of recorded itinerant air taxi operations (GA operations not considered local) in Iowa decreased from 124,061 to 95,212.

Although business operations have declined in Iowa, as well as the nation as a whole, demand for corporate aircraft has grown over the past several years. New product offerings, the introduction of VLJs, and increasing foreign demand have helped drive this growth. Despite the hard economic impact felt as a result of the recession that began in 2008, the FAA expects robust business aviation use in the long term and predicts that this segment of the industry will expand at a faster pace than personal or recreational aircraft use. As illustrated in the projections of the general aviation aircraft fleet in **Table 7-3**, jet aircraft are projected to see the most significant growth over the next 30 years. Iowa is expected to experience similar growth.

Table 7-3: Total U.S. General Aviation Fleet Projections

Year	Single Engine	Multi Engine	Turbo Prop	Jet	Total US GA Fleet
2009	144,745	17,351	9,010	11,418	229,149
2015	141,955	16,520	9,799	14,466	239,522
2020	142,052	15,815	10,516	17,925	249,440
2025	145,323	15,176	11,259	22,069	262,772
2030	150,646	14,176	12,023	27,035	278,723
AAG 09-30	0.2%	-0.8%	1.4%	4.2%	0.9%

Note: AAG = Annual Average Growth

Source: FAA Aerospace Forecast Fiscal Years 2010-2030

Business aviation is an important segment of the industry that serves as a catalyst, helping to drive the state's economy. Accommodating the demands of business aviation users will be necessary to help grow and strengthen Iowa's economy through business retention and recruitment. As the use of jets is projected to increase, some airports may be required to improve infrastructure through investments such as lengthening runways and improving the conditions and sizes of aprons to accommodate these aircraft. Improvements to services such as fueling availability and overnight covered storage options may also be necessary to adequately meet business user demands.

Agricultural Spraying Operations – Crop production is a multi-billion dollar industry within Iowa, which is supported by agricultural spraying operations. It is estimated that 86 percent (86%) of the publicly owned GA airports within the state support agricultural spraying activities. Approximately four million acres of land within Iowa are treated by aerial application each year. The use of airports in Iowa by agricultural sprayers boosts agricultural productivity and is estimated to increase the value of crops grown in the state

by over \$200 million annually. Therefore, it is important that airports across the state continue to serve these types of operations which are forecasted to increase over time.

7.3.b Commercial Aviation

Commercial airlines provide commercial service air transportation for the traveling public on a set schedule. Federal regulations define operating procedures, safety standards, and licensing requirements that must be met by both airlines and airports for this type of operation. In Iowa, commercial airlines are a small but important segment of the overall system, as operations are conducted at only eight airports across the state.

A trend in commercial aviation that impacts aviation in Iowa is the increasing use of regional jet aircraft. As a substitution for mainline narrow-bodied jets, 50-seat regional jets, and 30-50 seat turboprop aircraft, 70 to 90-seat regional jets are anticipated to increasingly serve commercial airports in Iowa. This level of usage may require infrastructure improvements to support these types of aircraft and retain commercial airline operations. Runway length, retention of service funded by the Essential Air Service (EAS) program, and improvements to boarding gates and jet bridges are just a few of the issues commercial airports in Iowa will be faced with throughout the planning period to support these aircraft types.

In addition to changing aircraft types, several other trends in commercial aviation are impacting users and operations. One such trend is the use of web-based applications for booking flights on commercial airlines. Passengers can buy tickets instantly online using a computer or smart phone; there is no longer a need to spend time on the phone with a ticketing agent or travel agent. Travel reservations can be made, changed, or cancelled at the click of a mouse.

The use of kiosks at airports has increased significantly over the past couple of years. Passengers can check in, change seat selections, or choose alternate flights without having to wait in long lines to speak with a gate agent. The kiosks are user friendly and eliminate the need for personnel to be at the desk at all times. While the use of kiosks has been generally successful, there are times where computer malfunction or a lack of technologic savvy results in frustrated passengers.

Security screening processes by the Transportation Security Administration (TSA) have become increasingly stringent since the terrorist attack on September 11, 2001. The development of advanced metal detectors, body scanning devices, and pat down processes has increased the level of safety for passengers, but also frequently increases the wait time for travelers passing through security screening checkpoints. Increased use of technology in screening has also created the need for facility upgrades at the commercial airports.

7.3.c Military Operations

Military units in Iowa are tenants of six airports across the state, which serve Boone, Davenport, Des Moines, Fort Dodge, Sioux City, and Waterloo. Activities at the on-site military units boost both the local and statewide economies. The annual economic activity of these units is estimated at nearly \$300 million annually. Military operations are forecasted to remain constant over the planning period of the IASP, at approximately 24,300 operations. Therefore it is important for the airports who serve as a home to an on-site military unit to continue to support these military operations which benefit the local community and the State of Iowa.

7.4 Sustainability and Technologies

In recent years, the popularity of addressing sustainability has been a focus of many airports in the United States. While there are differing opinions on the definition of sustainability, the FAA's Sustainable Master Plan Pilot Program identifies sustainable actions as those that:

- Reduce environmental impacts.
- Help maintain high and stable levels of economic growth.
- Help achieve social progress through a broad set of actions that ensure organizational goals are achieved in a way that is consistent with the needs and values of the local community.

Sustainability is anticipated to also be an important topic affecting the operation of airports in Iowa throughout the next twenty years. This section identifies some initiatives that airports may implement to increase sustainability.

7.4.a Construction Material Recycling

Airfield construction and improvement projects have the potential to generate a significant stream of solid waste. Recycling airfield construction materials, such as concrete and asphalt, provides a method to reduce the volume of waste deposited by airports into landfills. These materials can be ground up and reused as a base layer prior to the application of new pavement or in the creation of new pavement itself.

In addition to recycling airfield construction materials, another common practice is to convert existing runways into taxiways when new runways are constructed. Although pavement still needs to be properly maintained throughout its useful life, reuse reduces the total amount of required material, excavation, and construction vehicles needed for a given project. If airports in Iowa were to consider reuse of pavements as well as ways to recycle construction materials, a considerable amount of money and resources could be

saved and used to develop additional infrastructure or update existing facilities as needed.

7.4.b Airfield Lighting

Airfield lighting is responsible for a significant portion of an airport's energy consumption. In recent years, implementation of Light Emitting Diodes (LEDs) has occurred at a number of airports both in the U.S. and worldwide. According to Hella, a producer of airfield lights, LEDs typically deliver a service life of up to 50,000 hours which is significantly longer than traditional halogen bulbs. This contributes to less energy consumption at airports across the state.



According to a sustainability study conducted by the Hawaii Department of Transportation after the 2007 installation of LED taxiway light fixtures and guidance signs at the Honolulu International Airport, an annual reduction of 600,000 kilowatt-hours (kWh) of electricity was achieved. Although the initial cost of LED lighting is higher than that of traditional lighting types, LED lighting could be cost-effective for several airports in Iowa, particularly those with higher levels of aircraft operations which necessitate longer periods of lighting use.

7.4.c Green Building Construction

An additional component of airport sustainability is construction of 'green' infrastructure. Sustainable design standards, such as those identified by the Leadership in Energy and Environmental Design (LEED) rating system, provide the framework for efficient, more environmentally mindful practices that can be used in building construction techniques.

According to the Environmental Information Administration, buildings account for approximately 40 percent (40%) of the primary energy use in the United States. In an effort to reduce the amount of energy consumed by buildings, some trends in recent years that have garnered interest include:

- Certification and audit of sustainable building design through guidelines established by such programs as LEED, Green Globes, and Energy Star.
- Reduction of waste generated through recycling programs.
- Zero Energy Buildings (ZEB) that are energy self-sufficient and produce no carbon emissions.

Airport improvement projects are increasingly calling for construction that incorporates green building design. Several upgrades that can be made to existing infrastructure include:

- **Automated building controls** – Controls reducing the level of heating, ventilating, and air conditioning (HVAC) during periods when a building is unoccupied can contribute to lower energy consumption.
- **Electric powered ground support equipment** – Ground support equipment powered by electricity instead of gasoline can reduce or eliminate carbon emissions produced from these devices.
- **Energy audit** – Performing an energy audit can help identify areas where energy conservation can be realized through improvements to utilities, building design, and insulation.
- **Geothermal heating and cooling** – Utilization of geothermal processes to heat and cool a building can reduce dependence from outside energy sources.
- **Landfill diversion program** – Recycling programs can reduce or eliminate the solid waste stream generated as a result of day-to-day airport activities.
- **Lighting/lamp replacement** – Use of LED lighting to replace traditional forms of building lighting filaments can reduce energy consumption.
- **Occupancy/daylighting sensors** – Devices such as timers and sensors can reduce or shut off power to areas during periods of inactivity.
- **Photovoltaic solar panels** – Harnessing the sun's renewable energy to power various building utilities can reduce dependence on outside energy sources.
- **Solar thermal** – Energy gained from sunlight can be converted to thermal energy and used to heat water or air for commercial use.
- **Thermal storage** – Storing thermal energy obtained through renewable resources can provide a method to utilize renewable energy at a later time.

Many of these green building design principals can be applied to existing and future airport buildings across the state. Incorporating sustainable building design will allow buildings throughout the aviation system to become more energy efficient, benefiting both airports and the environment.

7.4.d Sources of Alternative Energy

An alternative energy source that has gained some attention from airports of late is wind energy. Some airports have installed small wind turbines to generate power. In 2008, Boston Logan International Airport had 20 small wind turbines installed atop the Logan Center that generate approximately 100,000 kilowatt-hours annually, according to the City of Boston's Department of Environmental and Energy Services. Solar, wind, geothermal, and other sources of alternative energy will likely become increasingly important as utility costs increase and governments push incentives to reduce emissions. Velocities of local winds commonly found in Iowa favor the use of wind turbines to

generate energy. Today, numerous wind turbines are found across the state, generating energy for various entities. This alternate source of energy can be captured at airports; however, the placement of wind turbines and hazard lighting must be compatible with aircraft operations.

In addition to capturing energy from wind, the capturing of energy from the sun has become a popular topic for use at airports as well. Several airports have installed solar panels on top of terminal buildings, which store energy used to power a variety of elements at an airport. Continual advances in solar technology result in the availability of products at a lower cost. This decrease in initial investment cost allows airports to take advantage of this alternative energy source which once may not have been possible. It is important for airports that utilize solar technology to take into consideration the possible glare that can be emitted from solar panels and place panels at an acceptable angle so that pilots can navigate without being blinded by reflecting light.

Other technologies related to alternative energy include the use of electric and propane powered airport vehicles. Some airports nationally are using geothermal technologies to heat and cool terminal buildings, which is also an alternative for airports within Iowa.

7.5 Biofuels

As the aviation industry continues to grow, so does its need for fuel and the size of its carbon footprint. Aviation greenhouse gas emissions and their impact on climate change are a concern for the industry. Rising crude oil prices and proposals from the Environmental Protection Agency (EPA) to phase out lead from aviation fuels has concentrated efforts towards the use of sustainable means to power aircraft.



Organizations such as the International Air Transport Association (IATA) support the research, development, and use of sustainable fuels. Also known as biofuels, they are derived from renewable biological carbon resources (biomass), such as animal waste, food crops, wood, or plant material. Use of biofuels will help the industry gain energy independence, reduce greenhouse gas emissions, and leverage stability in an unpredictable worldwide fuel market.

First generation biofuels are derived from sugar-rich or starch-rich food crops, but are not suitable for use in the aviation industry because they do not meet the performance or safety standards required for modern jet engine use. Second generation biofuels, or bio-derived oils, can be chemically converted or used directly for jet fuel. Plants such as camelina, which can be grown as a rotational crop with cereal grains, and corn, a crop

significant to the agricultural economy of Iowa, are two such species that can be produced within the state. Third generation biofuels are derived from algae and are currently being researched by the Defense Advanced Research Projects Agency (DARPA) in an effort to develop an affordable and highly efficient alternative process fuel for U.S. military aircraft.

Biofuels are currently being tested in the aviation industry, and a few blends have been used successfully. Industry studies show that biofuel blends meet or exceed all technical parameters for commercial jet fuel and present no adverse effects on engines or their components. Blended fuels have greater energy content by mass than Jet A fuel, which could lower fuel consumption per mile of flight. A variety of fuel blends have successfully been tested, including a fuel derived from jatropha on an Air New Zealand flight; a blend of jatropha- and algae-based fuels on a Continental flight; and a jatropha-, algae-, and camelina-based blend on a Japan Airlines flight.

As flight testing proves to be successful, the American Society for Testing and Materials (ASTM) is preparing for the future introduction of biofuels into the aviation industry. Boeing and other industry players have submitted biofuel research reports to the ASTM for approval, which in turn will prepare for review and endorsement. Once ASTM biofuel standards are specified, Boeing expects biofuels will go into production shortly thereafter.

The aviation industry is motivated to develop fuels that can be mass produced at a low cost and high yield with minimal environmental impact. Second and third generation biofuel sources can be cultivated in a sustainable manner and their use can significantly reduce the aviation industry's environmental footprint. The IATA set a goal for its members to use ten percent (10%) biofuels by 2017, with a 25 percent (25%) emissions reduction per passenger by 2020 and 30 percent (30%) by 2025.

The success of biofuel production and use requires a significant investment of time, cooperation, and funding from both the aviation industry and worldwide governmental bodies. A sound policy framework for sustainable production methods is required with extensive research and monitoring needed on the positive and negative impacts of biofuel production and its use on biodiversity and socioeconomics. As petroleum based fuel prices continue to jeopardize the future of aviation, biofuels represent a critical component for economic survival and sustainability.

Advances in biofuel technology may benefit Iowa in multiple ways. Along with providing an alternative fuel source for aircraft, the state's strong agricultural economy is well suited to supply crops for production of these sustainable fuels. Airports throughout the aviation system have the potential to provide biofuels manufactured in Iowa, benefiting the industry, the environment, and the state's economy.

7.6 Summary

Aviation related activity in Iowa has been affected by the recent economic downturn, but the outlook of the overall system appears to be strong. The Iowa Department of Transportation reported in its 2009 Aviation Economic Impact Report that aviation supports 47,000 jobs across the state and has an economic impact of more than \$18 billion. Projections of aviation demand show steady growth in aircraft operations, passenger enplanements, and the number of based aircraft. In addition, there is a growing demand in the corporate/business aviation sector, as well as in the development and implementation of new technologies such as alternative energy sources and green buildings. All of these elements may impact both the short- and long-term growth of aviation in Iowa; therefore, preparing the aviation system to adapt to these changes is important.