Introduction

A Master Plan provides an evaluation of an airport's aviation demand and an overview of the systematic development that will best meet those demands. The Master Plan establishes development objectives and provides for a 20-year planning period that details the rationale for various study elements, including airfield configuration, facility development, on-airport land use recommendations, and support facilities. It also serves as a strategic tool for establishing airport improvement priorities and justifying the need for federal and state funding assistance.

The Federal Aviation Administration (FAA) recommends that airports update their Master Plan every seven to 10 years, or as necessary, to address local changes at the airport. The last Master Plan for McKinney National Airport (TKI or Airport) was completed in 2006. More recently, an Airport Layout Plan (ALP) Update/Narrative Report was completed in 2012. The preparation of this Airport Master Plan is necessary as a timely reassessment of the development direction of TKI to meet the needs of the local economy and an ever-changing air transportation industry.

The Airport Master Plan has been undertaken to evaluate the Airport's capabilities and role, to forecast future aviation demand, and to plan for the development of new or expanded facilities that may be required to meet that demand. The ultimate goal of the Master Plan is to provide guidelines for the Airport's overall maintenance, development, and operation in an environmentally and fiscally responsible manner while adhering to appropriate FAA and Texas Department of Transportation – Aviation Division (TxDOT) standards.

An important outcome of the Airport Master Plan process is a recommended development plan that reserves sufficient areas for future facility needs. Such planning will protect development areas and ensure they will be readily available when required to meet future needs. The intended outcome of this study is a detailed on-airport land use concept which outlines specific uses for all areas of airport property, including strategies for revenue enhancement.

The City of McKinney (City) recognizes the importance of air transportation to the surrounding region. In doing so, the City Council of the City of McKinney has established a series of goals for the City to achieve, and one of which is to, "Maximize the Development Potential of the McKinney National Airport." A series of strategies have been identified to help meet this goal and includes the following:

- Implement initiatives and strategies to attract and expand corporate and commercial aviation.
- Identify and implement land use regulations and policies which preserve and expand long-term operational success.
- Improve communication and marketing of the value of the McKinney National Airport to the City and region.
- Continually maintain national recognition for excellence in fixed base operations.

With a sound and realistic Master Plan in place, TKI can take steps to achieve these goals and strategies that have been set forth. Furthermore, the Airport will continue to remain an important link to the regional and national air transportation systems, as well as maintain the public and private investments in its facilities.

STUDY OVERVIEW

The City of McKinney is responsible for funding capital improvements at the Airport, as well as obtaining FAA and TxDOT development grants. In addition, the City oversees facility enhancements and infrastructure development conducted by private entities at the Airport. The Master Plan is intended to provide guidance for future development and justification for projects which the Airport may receive funding through an updated capital improvement program (CIP) to demonstrate the future investment required by the City of McKinney, as well as the FAA and TxDOT.

The Airport Master Plan will follow a systematic approach outlined by the FAA to identify existing and future airport needs in advance of the actual need for improvements. This is done to ensure that the City of McKinney and Airport administration can coordinate environmental reviews, project approvals, design, financing, and construction to minimize the negative effects of maintaining and operating inadequate or insufficient facilities. The intended result is a recommended development concept which outlines the proposed uses for all areas of the Airport.

The City of McKinney has contracted with the airport planning firm of Coffman Associates, Inc. to undertake the Airport Master Plan. The study is prepared in accordance with FAA requirements, including Advisory Circular (AC) 150/5070-6B, *Airport Master Plans*, and AC 150/5300-13A, *Airport Design*.

MASTER PLAN GOALS AND OBJECTIVES

The primary objective of the Airport Master Plan is to develop and maintain a financially feasible, long term development program, which will satisfy aviation demand of the region, while also being compatible with area development, other transportation modes, and the environment. Accomplishing this objective requires an evaluation of the existing airport to decide what actions should be taken to maintain a safe, adequate, and reliable airport facility.

This Airport Master Plan is intended to provide guidance through an updated capital improvement and financial program to demonstrate the future investments required by the City of McKinney. The new planning study also provides justification for new priorities. The plan will be closely coordinated with other planning studies in the area and with aviation plans developed by the FAA and TxDOT. This study will also utilize historical planning efforts (2006 Master Plan and 2012 ALP Update/Narrative Report) that have been undertaken by TKI.

While the Master Plan must be developed per FAA and TxDOT requirements, it can also be prepared in a manner which makes it useful in strategic planning for the Airport. The FAA requires specific elements within a Master Plan. The elements, to be detailed in the following section, are guidelines which allow for a systematic and technical approach to reach the final recommended plan.

Specific goals and objectives to be considered in the Airport Master Plan include, but are not limited to, the following:

- Research factors likely to affect all air transportation demand segments in the City of McKinney, Collin County, and the Northeastern Dallas-Fort Worth Metroplex Region over the next 20 years. The analysis will include the development of forecasts of potential commercial airline passengers, air cargo shipments, general aviation activity, and military demand elements;

- Determine projected needs of TKI users for the next 20 years factoring in recent revisions to FAA airfield geometry design standards, global positioning system (GPS) and Next Generation (NexGen) approaches or other new technology, the impact of commercial and general aviation fleet transitions on design standards, and re-evaluate historic efforts to offer commercial service to the community. This analysis will also include considerations of military needs and usage;

- Determine the Airport's current and future critical design aircraft;

- Recommend improvements which will satisfy the potential for future commercial airline and air cargo activity as well as increased general aviation needs, understanding the Airport is space constrained. Commercial airline passenger opportunities will consider recommendations to provide terminal building spaces, auto parking, and rental car facility developments;

- Analyze the existing airfield system to determine the existing and ultimate runway length required to satisfy the Airport's critical aircraft both now and into the future;

- Demand capacity analysis to re-evaluate current plans for development of a future parallel runway;
- Analyze all opportunities and develop strategies for acquiring adjacent properties to serve long term aviation needs and to offer incompatible land use encroachments;
- Outline strategies to develop west-side Airport facilities to include redevelopment options as well as property acquisition opportunities;
- Consider opportunities for east-side development to include aviation, non-aviation, roadway, and utility infrastructure development options;
- Evaluate the highest and best uses of Airport property to include the potential to relocate hangar facilities as needed to present redevelopment opportunities;
- Produce accurate base maps of existing and proposed facilities and updated ALP drawings consistent with FAA and TxDOT standards;
- Review future use and zoning of Airport property, instrument approach areas, and nearby developments to ensure flight safety and land use compatibility. This will involve the development of new noise exposure contours, application of current land use compatibility guidelines, review of local land use controls and plans, and analysis of land use management techniques;
- Establish a schedule of development priorities and a program for improvements proposed in the Master Plan, consistent with TxDOT and FAA CIP planning; and
- Consider sustainability efforts, specifically waste and recycling improvements, as part of FAA's updated standards.

MASTER PLAN TASKS

The Master Plan for TKI specifically addresses the following tasks:

- Assist the City of McKinney, through a Planning Advisory Committee (PAC), a Technical Advisory Committee (TAC), and a series of Public Information Workshops, in determining a vision for the Airport;
- Conduct a Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis, identifying strengths, weaknesses, realistic markets, goals, resources, and strategies to move forward. This analysis will factor the strengths and weaknesses of TKI to include physical and operational features. The analysis will also present the same for competing airports in the region;

- Based on the realistic evaluation of the facility in terms of configuration, condition, amenities, location, competition, and forecasted aviation demand, establish goals and priorities for the Airport to meet that vision;

- Identify airfield alternatives based on goals and opportunities, as well as FAA and TxDOT applicable design standards. The analysis will include an evaluation of the airfield geometry to address potential runway incursion hot spots and non-standard conditions;

- Provide a landside development plan that identifies areas for accommodating the forecasted growth of aviation and aviation-related businesses and, if appropriate, areas for non-aviation revenue-producing opportunities. Consideration will be given to the potential for new or expanded aviation facilities, including, but not limited to, terminal facilities, aircraft storage hangar capacity and apron capacity, and airport support facilities;

- Assess compatible land uses near the Airport; and

- Prioritize preservation and rehabilitation recommendations in order of greatest overall positive impact.

BASELINE ASSUMPTIONS

A study such as this typically requires some baseline assumptions that will be used throughout the analysis. The baseline assumptions for this study include:

- The Airport will continue to operate as a publicly-owned, general aviation reliever airport through the 20-year planning period;

- TKI will continue to serve general aviation tenants, and itinerant and/or local aircraft operations by commercial, air taxi, general aviation, and military operators;

- The commercial airline passenger and general aviation industries will grow through the planning period as projected by the FAA. Specifics of projected growth in the national commercial airline and general aviation industries are contained in Chapter Two of the Master Plan; and

- A federal and state airport improvement program will be in place through the planning period to assist in funding capital development needs.

MASTER PLAN ELEMENTS AND PROCESS

The Airport Master Plan is being prepared in a fashion pursuant to the scope of services that has been coordinated with the City of McKinney and TxDOT. The study has 10 specific elements that are intended

to assist in the identification of future facility needs and which provide the supporting rationale for their implementation. **Exhibit A** provides a graphical depiction of the elements and process involved with the study.

Element 1 – Initiation includes the development of the scope of services, schedule, and study website. A PAC and TAC are also formed and study material will be assembled in a workbook format. General background information will be established that includes outlining the goals and objectives to be accomplished during the Master Plan.

Element 2 – Inventory is focused on collecting and assembling relevant data pertaining to the Airport and the area it serves. Information is collected on existing Airport facilities and operations. Local economic and demographic data is collected to define the local growth trends, and environmental information is gathered to identify potential environmental sensitivities that might affect future improvements. Planning studies which may have relevance to the Master Plan are also collected.

Element 3 – Forecasts examines the potential aviation demand at the Airport. The analysis utilizes local socioeconomic information, as well as national air transportation trends to quantify the levels of aviation activity which can reasonably be expected to occur at TKI over a 20-year period. The results of this effort are used to determine the types and sizes of facilities which will be required to meet the projected aviation demand at the Airport through the planning period.

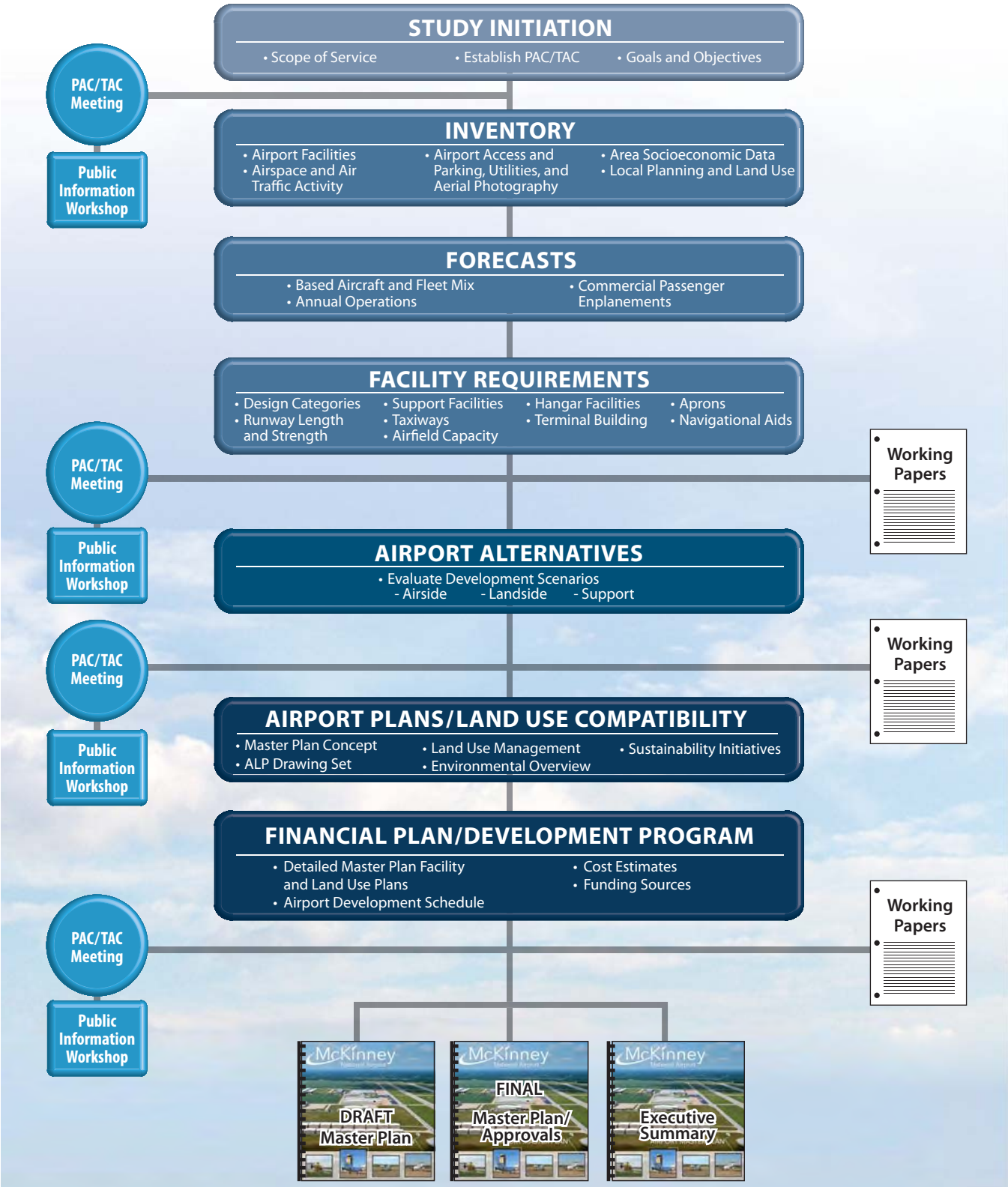
Element 4 – Facility Requirements converts aviation demand needs into types and volumes of actual physical facilities required to meet existing and forecast demands in aviation activity. The critical design aircraft and physical planning criteria based upon AC 150/5300-13A, *Airport Design*, is also established in preparation of a needs assessment for airside and landside facilities.

Element 5 – Airport Alternatives considers a variety of solutions to accommodate projected airside and landside facility needs through the long-term planning period. An analysis is completed to identify the strengths and weaknesses of each proposed development alternative, with the intention of determining a single direction for development.

Element 6 – Airport Plans/Land Use Compatibility provides both a graphic and narrative description of the recommended plan for the use, development, and operation of the Airport. An environmental overview is provided to analyze potential environmental impacts of proposed Airport development projects and a waste audit and recycling plan is also conducted to identify opportunities for the Airport to be more sustainable in its approach to waste management. The official ALP drawings that are produced based on the recommended development concept and used by the FAA and TxDOT in determining grant eligibility will also be included.

Element 7 – Financial Plan/Development Program provides a proposed capital needs program which defines the schedules, costs, and funding sources for the recommended development projects.

MASTER PLAN WORK FLOW



Element 8 – Final Reports and Approvals provide documents which depict the findings of the study effort and present the study and its recommendations to appropriate local organizations. The final document incorporates the revisions to previous working papers prepared under earlier elements into a usable Master Plan document.

STUDY PARTICIPATION

The Airport Master Plan is of interest to many within the local community and region. This includes local citizens, local businesses, community organizations, City officials, Airport users, Airport tenants, and aviation organizations. As a component of the regional, state, and national aviation systems, the Master Plan is of importance to both state and federal agencies responsible for overseeing the air transportation system.

To assist in the development of the Airport Master Plan, the City of McKinney has identified two different groups to act in an advisory role in the development of the Master Plan. The PAC is comprised primarily of Airport users and Airport stakeholders with a vested interest in the future development of TKI. The TAC is made up of local governmental agencies and representatives of adjacent communities. Members of the PAC and TAC will meet four (4) times at designated points during the planning process to review study materials and provide comments to help ensure that a realistic and viable plan is developed.

Draft working paper materials will be prepared at various milestones in the planning process. The working paper process allows for timely input and review during each step within the Master Plan to ensure that all issues are fully addressed as the recommended program develops.

A series of open house Public Information Workshops are also conducted as part of the study coordination effort. These workshops are designed to allow any and all interested persons to become informed and provide input concerning the Master Plan process. Notices of meeting times and locations are advertised through local media outlets. Draft working papers and other information related to the Master Plan are available to the public via a website dedicated to the study at: **http://mckinney.airportstudy.com**.

SWOT ANALYSIS

A SWOT analysis is a strategic business planning technique used to identify **S**trengths, **W**eaknesses, **O**pportunities, and **T**hreats associated with an action or plan. The SWOT analysis involves identifying an action, objective, or element, and then identifying the internal and external forces that are positively and negatively impacting that action, objective, or element in a given environment. For this study, the SWOT analysis factors are being applied to TKI within the confines of the Master Plan. As a result, it provides a continuous vision and direction for the development of the Master Plan.

SWOT DEFINITIONS

As previously discussed, this particular SWOT analysis groups information into two categories:

- **Internal –** attributes of the Airport and market area that may be considered strengths or weaknesses to the action, objective, or element.
- **External –** attributes of the aviation industry that may pose as opportunities or threats to the action, objective, or element.

The SWOT further categorizes information into one of the following:

- **Strengths –** internal attributes of the Airport that are helpful to achieving the action, objective, or element.
- **Weaknesses –** internal attributes of the Airport that are harmful to achieving the action, objective, or element.
- **Opportunities –** external attributes of the industry that are helpful to achieving the action, objective, or element.
- **Threats –** external attributes of the industry that are harmful to achieving the action, objective, or element.

SWOT ANALYSIS EXERCISE

The SWOT analysis for TKI is based upon information gathered, including kick-off PAC and TAC meetings that were conducted in November 2016. As previously discussed, the PAC and TAC are diversified groups of stakeholders, community leaders, and governmental agencies that represent several interests in the Airport. A SWOT analysis was conducted with these groups to identify key factors that might be addressed in the Master Plan. A summary of the results from the SWOT analysis exercise is shown in **Table A**. These results were used to frame the subjective or judgmental processing of the data presented in the Master Plan.

TABLE A
SWOT Analysis Results
McKinney National Airport

	STRENGTHS	WEAKNESSES
INTERNAL (attributes of the Airport market area)	• Runway length • Availability of developable land on and adjacent to the Airport with ability to expand • Proximity to corporate markets that rely on business aviation • Proximity to highway infrastructure • Ease of airspace (edge of Class B airspace) • Airport traffic control tower • Available precision instrument approach procedures to the runway • Professional Airport staff – administration and FBO • Aviation services offered – customs, FBO, air medical, air charter, corporate, flight training, maintenance, aircraft sales and management • Support from the City and TxDOT • Great working relationships with the FAA and TxDOT • Educational activities offered (flight training) • Economic impact to the City and surrounding region ($44 million impact on local economy) • Ability to incorporate a regional economic draw • Airport maintenance personnel (cleanliness/ upkeep of Airport property)	• Communicating the value and role of the Airport • Limited hours of operation for the Airport Traffic Control Tower • Single runway operations • Runway length • Lack of de-icing capabilities • Hangar availability (based and transient aircraft) • Fire station – not directly associated with Airport operations • Lack of extensive aircraft maintenance facilities • Road structure to/from the Airport • Age/condition of Airport infrastructure (hangars) • High fuel prices associated with the FBO • Lack of affordable housing in the City • Lack of control associated with adjacent land uses • Proper location of landside infrastructure (high-activity services vs. low-activity services)
	OPPORTUNITIES	**THREATS**
EXTERNAL (attributes of the industry)	• Education potential (flight training) • Scheduled charter/commercial service • Location of Airport in relationship to City (no direct overflights) • Ability to increase tenant base • Ability to boost local tax base • Diversified economy that serves the local area • Land acquisition potential • Multitude of aviation services that can be offered at the Airport • Roadway access improvements • Better communication of the value of the Airport • Capture aviation demand in the Dallas-Fort Worth Metroplex • UAS/drone market • Connection to mass transit system • Continue to maintain positive communication with adjacent cities/towns • Growth associated with the City and north Dallas area • Hangar waiting list (demand for more based aircraft) • Texas Air Shuttle	• Adjacent residential land uses (noise) • Competition at other airports in the Dallas-Fort Worth Metroplex (hangar development) • Impacts of worldwide events (oil industry) • Loss of farming income to support Airport revenues • Encroachment around the Airport and compatibility with aviation activities • Future funding availability (competitive nature of federal/state funds; contract tower program)

Chapter One

Inventory

The inventory chapter of existing conditions is the initial step in the preparation of the McKinney National Airport (TKI or Airport) Master Plan. The inventory will serve as an overview of the Airport's physical and operational features, including facilities, users, and activity levels, as well as specific information related to the airspace, air traffic activity, and role of the Airport. Finally, a summary of socioeconomic characteristics and review of existing environmental conditions on and adjacent to the Airport are detailed, which will provide further input into the study process.

Information provided in Chapter One serves as the baseline for the remainder of the Master Plan, which is compiled using a wide variety of resources, including: applicable planning documents; on-site visits; interviews with Airport staff, tenants, and users; aerial and ground photography; federal, state and local publications; and project record drawings. Specific sources include those listed below. Note that environmental resources are detailed at the end of this chapter.

- 2015 Annual Development Report (City of McKinney Planning Department, 2016)
- Master Plan Update for Collin County Regional Airport (February 2006)
- Collin County Mobility Plan (2014 update)
- City of McKinney: Comprehensive Plan (as amended June 2015)
- Texas Airport System Plan (2010 update)
- Federal Aviation Administration (FAA)
- Collin County, Texas, Website
- City of McKinney, Texas, Website
- Economic Impacts Report for Collin County Regional Airport at McKinney (2011)
- Airport Layout Plan Update/Narrative Report (March 2012)

AIRPORT SETTING

LOCALE

The Airport is located within the jurisdictional boundaries of the City of McKinney, which has a land area of almost 63 square miles. With a population of 168,358 people, McKinney holds the Collin County seat.[1] McKinney is in the northeastern quadrant of the Dallas-Fort Worth Metroplex, approximately 30 miles north of downtown Dallas on U.S. Highway 75 (also known as Central Expressway or Sam Johnson Highway) and 35 miles northeast of Dallas/Fort Worth International Airport via the Sam Rayburn Tollway. McKinney falls within the broader Dallas-Fort Worth-Arlington (DFW Metroplex) Metropolitan Statistical Area (MSA), which was home to over seven million people in 2016. In addition to Collin County, the DFW Metroplex encompasses Dallas, Denton, Ellis, Hood, Hunt, Johnson, Kaufman, Parker, Rockwall, Somervell, Tarrant, and Wise Counties.[2] **Exhibit 1A** depicts the regional setting.

LAND USE

TKI is situated on 745 acres at an elevation of 588.9 feet above mean sea level (MSL). The Airport is in the rapidly growing North Texas Region. The City of McKinney categorizes Airport property as an airport land use, surrounded primarily by open land, much of which is for agricultural purposes. Several industrial land uses are found west of the Airport, with single- and multi-family residential developments scattered around the Airport, with the heaviest concentrations to the northwest. The existing land uses surrounding an airport can have a significant impact on operations and growth, thus an understanding of the current land uses around TKI is pertinent to ensuring future Airport development is compatible to the bustling growth McKinney is experiencing. **Exhibit 1B** depicts existing land uses for the City of McKinney.

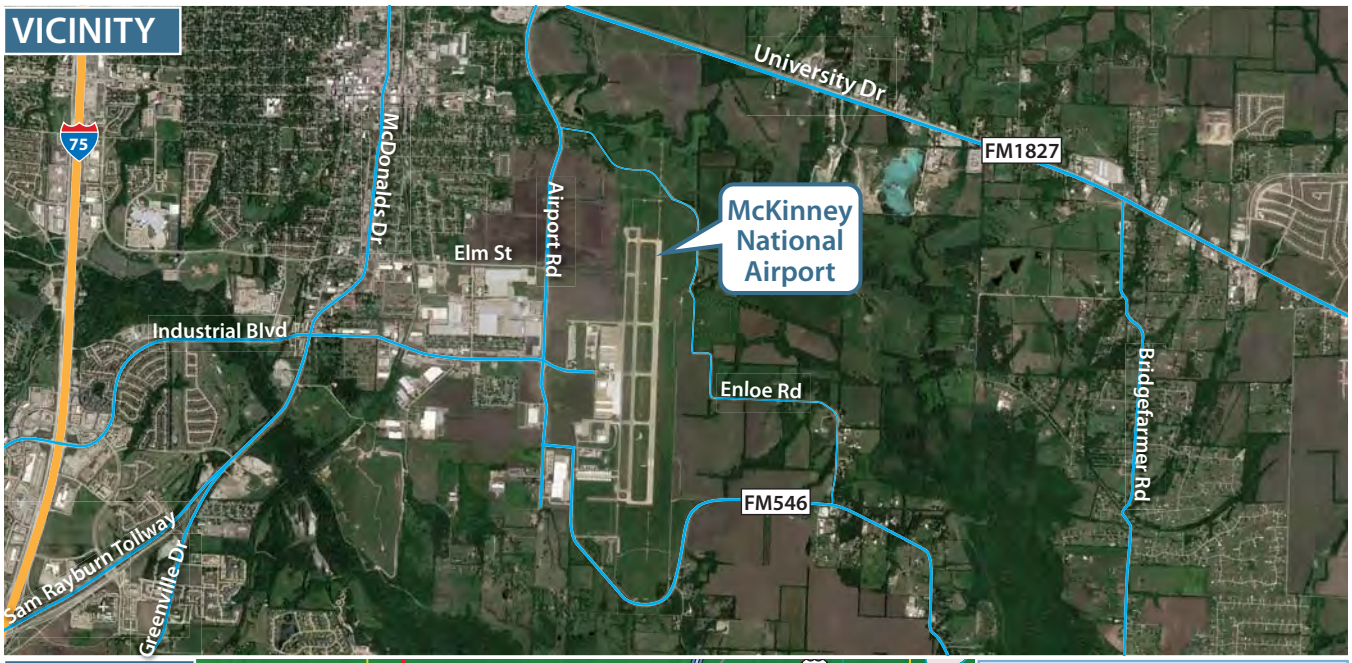
CLIMATE

Local weather conditions can significantly impact an airport's operations. Knowledge of the local climate allows an airport to be better prepared for regional conditions and greatly enhances a pilot's flying capabilities. For example, the Airport's runway should be oriented to match predominant wind patterns for the area.

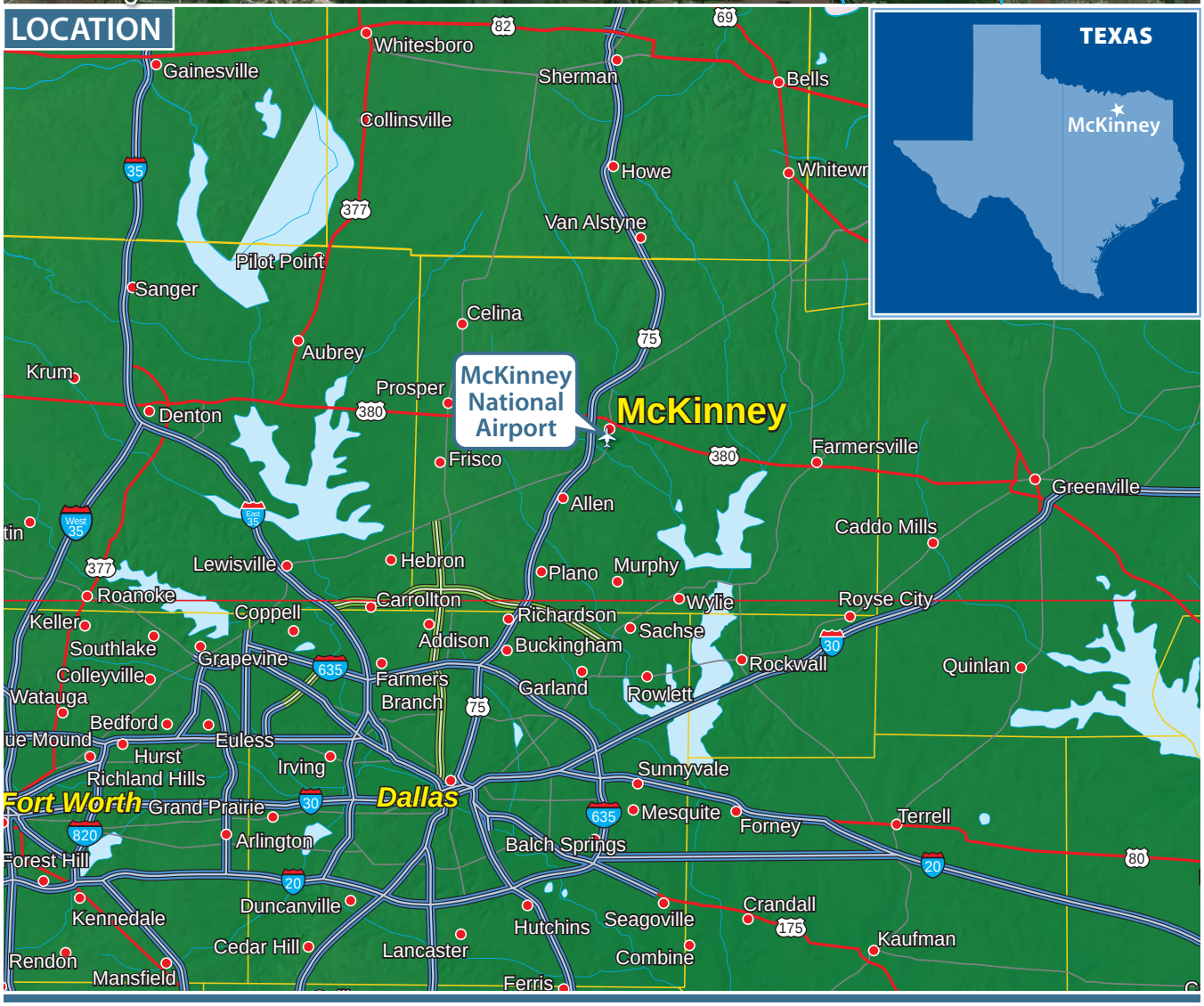
Weather data in **Exhibit 1C** is provided by the National Oceanic and Atmospheric Administration (NOAA) via the automated surface observation system (ASOS) located at the Airport. The ASOS constantly monitors surface weather conditions at the Airport and broadcasts the data on frequency 119.925 MHz.

[1] City of McKinney (population as of January 1, 2017)
[2] Source: July 2015 OMB Bulletin No. 15-01 (2015). Accessed here: https://www.whitehouse.gov/sites/default/files/omb/bulletins/2015/15-01.pdf

VICINITY



LOCATION



The overall climate in McKinney is described as humid subtropical with hot summers and a wide annual temperature range from the low 30s (degrees Fahrenheit) to highs in the mid 90s. The hottest days typically have fair skies, westerly winds, and low humidity. Precipitation varies from 1.95 inches to 5.34 inches, with the highest amount occurring in May. Most of this annual precipitation results from thunderstorms that bring brief periods of intense rainfall. Regardless of the season, McKinney is frequently subjected to severe weather events, which can have varying implications for Airport operations. The most common weather hazards include extreme heat, flooding, hail, thunderstorms and lightning, tornadoes, and winter weather.[3]

Exhibit 1C also displays wind patterns at the Airport. Wind patterns at TKI are typically out of the south (160 to 180 degrees) with wind speeds reaching their peak in the springtime. April averages the fastest wind speeds at 8.8 knots.

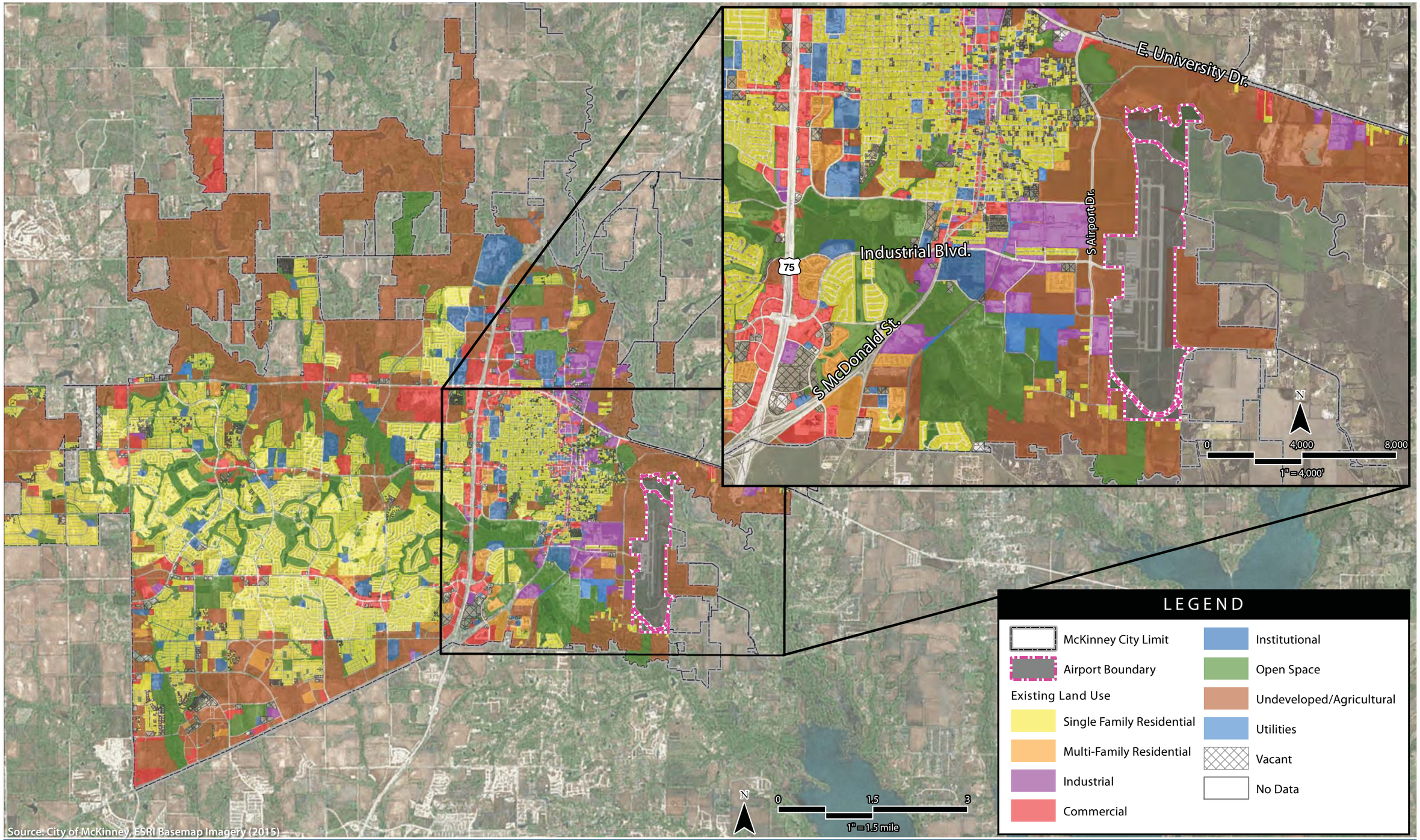
Table 1A indicates that visual meteorological conditions (VMC) occur 88.31 percent of the time. When under VMC conditions, pilots can operate using visual flight rules (VFR) and are responsible for maintaining proper separation from objects and other aircraft. Instrument meteorological conditions (IMC) account for all weather conditions less than VMC conditions that still allow for aircraft to safely operate under instrument flight rules (IFR). Under IFR, pilots rely on instruments in the aircraft to accomplish navigation. IMC conditions occur approximately 7.47 percent of the time. Less than IMC, or poor visibility conditions (PVC), are present approximately 4.21 percent of the time. These weather conditions are lower than instrument approach minimums, making the Airport inaccessible to most air traffic.

TABLE 1A
Weather Conditions
McKinney National Airport

Condition	Cloud Ceiling	Visibility	Percent of Total
VMC	≥ 1,000’ AGL	≥ 3 statute miles	93.68%
IMC	≥ 500’ AGL and < 1,000’ AGL	≥ 1 to < 3 statute miles	4.28%
PVC	< 500’ AGL	< 1 statute mile	2.04%

VMC: Visual Meteorological Conditions
IMC: Instrument Meteorological Conditions
PVC: Poor Visibility Conditions
AGL: Above Ground Level
Source: NOAA Station ID: 772541 – 53914 McKinney Municipal Airport. 104,928 all-weather observations from 1/1/2007 thru 12/31/2016.

[3] https://www.mckinneytexas.org/411/Severe-Weather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Industrial Blvd.
S Airport Dr.
S McDonald St.
75
N
0
4,000
8,000
1" = 4,000'
LEGEND
McKinney City Limit
Airport Boundary
Existing Land Use
Single Family Residential
Multi-Family Residential
Industrial
Commercial
Institutional
Open Space
Undeveloped/Agricultural
Utilities
Vacant
No Data
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0
1.5
3
1" = 1.5 mile
Source: City of McKinney, ESRI Basemap Imagery (2015)

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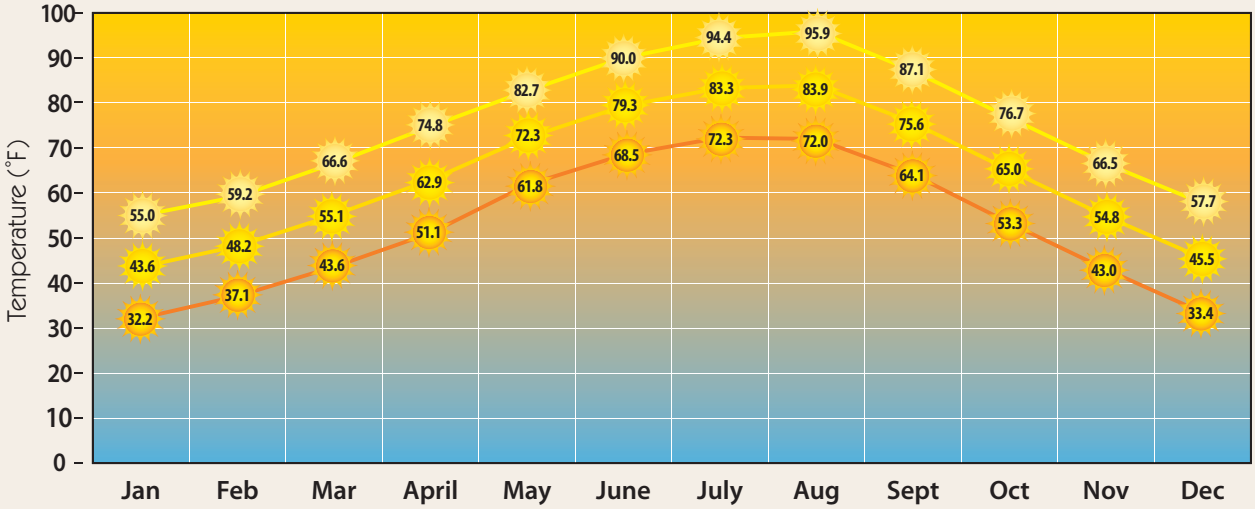
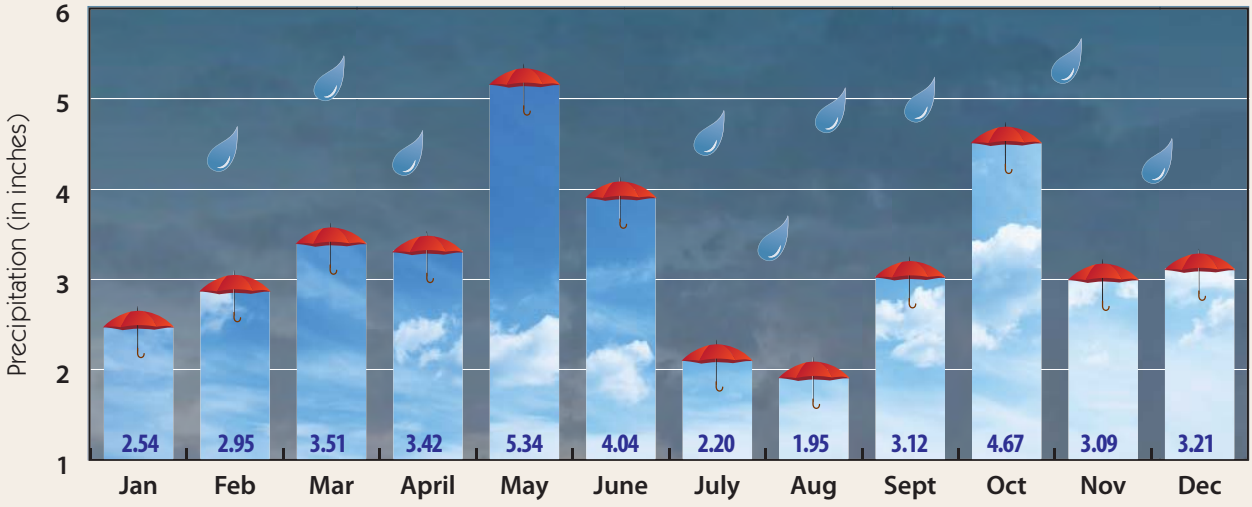
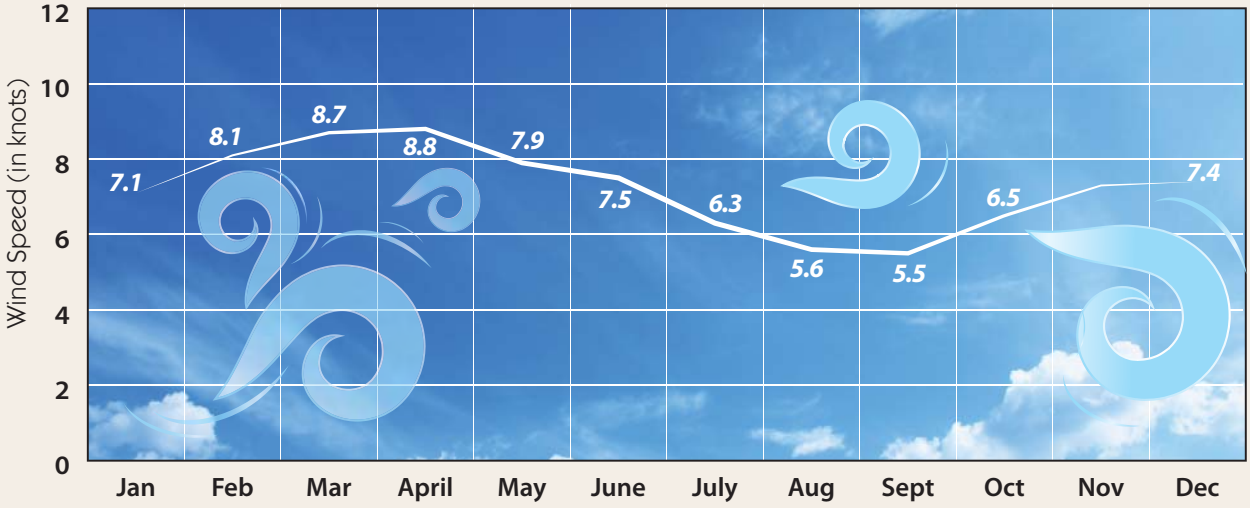
MONTHLY TEMPERATURES



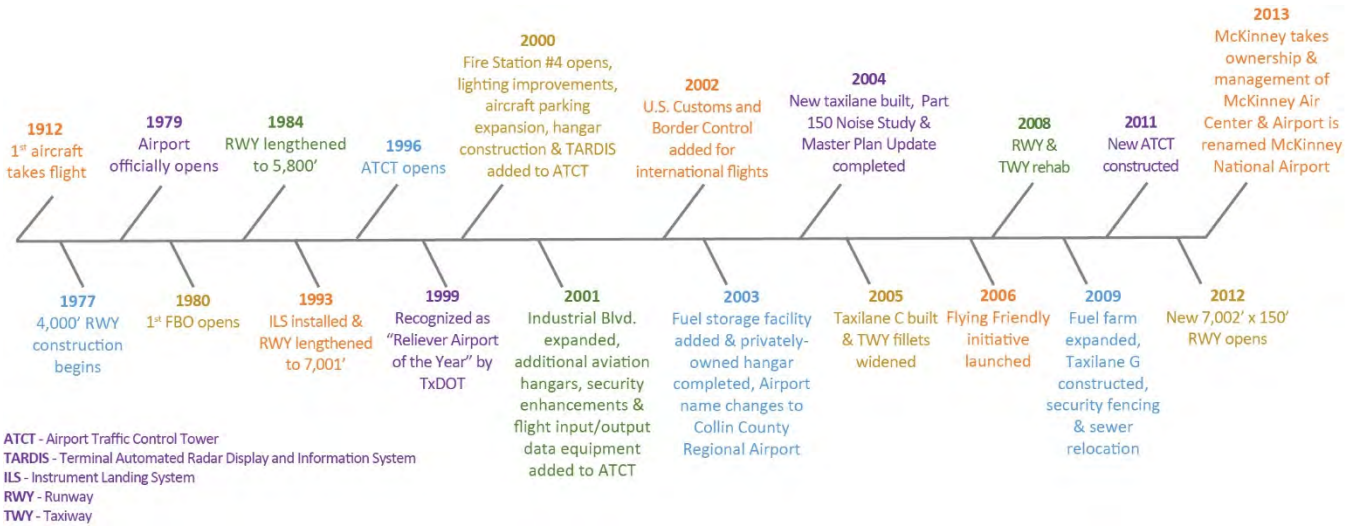
MONTHLY PRECIPITATION



MONTHLY WIND DATA



Source: NOAA temperature and precipitation climate normal, Station ID: GHCND: USW00053914 (1981-2010).



AIRPORT HISTORY

The City of McKinney first opened the Airport as McKinney Municipal Airport, but renamed it Collin County Regional Airport in 2003. Ten years later, the name changed again to McKinney National Airport to reflect its updated designation as a national facility in the *General Aviation Airports: A National Asset* (2012) study done by the Federal Aviation Administration (FAA). The City purchased the Fixed Base Operations (FBO) and its facilities – McKinney Air Center – in November 2013 from a private owner/developer. Prior to the acquisition of McKinney Air Center, the City owned 745 acres of dedicated Airport land and received revenue primarily from land leases, hangar rental, and fuel flowage fees, in addition to generating ad velorem taxes.

Construction of the Airport initiated in 1977 when an FAA grant allowed for the acquisition of the property necessary to develop TKI, construct a runway, taxiways, and general aviation apron area. The construction of these facilities led to the opening of the Airport in 1979, when the runway was only 4,000 feet long and 75 feet wide. Over the years, significant improvements have been made to the Airport to continue its rich history of supporting businesses and personal aviation in the North Texas region, as detailed in the Airport's timeline above.

The AIP is funded through the Aviation Trust Fund, which was established in 1970 to provide funding for aviation capital investments, such as facilities and equipment, and research and development.

CAPITAL IMPROVEMENT HISTORY

To assist in ongoing capital improvements, the FAA and the Texas Department of Transportation – Aviation Division (TxDOT) provide funding to TKI through the Airport Improvement Program (AIP). Texas is a member of the FAA's Block Grant Program, giving TxDOT the responsibility, among other things, for administering AIP Grants to reliever and general aviation airports, which includes TKI. [4] The State of Texas also offers funding opportunities that TKI is eligible for, which are listed below.[5]

[4] https://www.faa.gov/airports/aip/state_block/
[5] http://txdot.gov/inside-txdot/division/aviation.html

- Routine Airport Maintenance Program – TxDOT matches local government grants up to $50,000 for basic improvements, such as parking lots, fencing, and other airside and landside needs.
- Federal/State Aviation Grants – provides federal and state grant funding for airport maintenance and improvement projects to airports included in the *Texas Airport System Plan* (TASP).

Table 1B summarizes Airport capital development projects and maintenance undertaken since 2006 that received funding from federal, state, and local sources. Over this time, the Airport has received nearly $50 million in federal and state grant funding. An additional $37.5 million was contributed by local funding entities.

TABLE 1B
Airport Development Project History
McKinney National Airport

Fiscal Year	Local Funding	State Funding	Federal Funding	Project Description
2006	$572,126		$5,215,465	• Reconstruct/strengthen RWY 17-35 • Reconstruct TWY "A" section • Construct north ramp connector TWY • Overlay TWY A • Overlay Cross Taxiways B, C, D, E & F • Construct north ramp tie-down modifications • Construct TWY C drainage improvements • Mark & stripe RWY 17-35
2007	$50,000[1]	$50,000[1]		• Drainage channel maintenance & improvements • Design & construction of public-use aircraft wash rack • Turf improvements to reduce wildlife hazard • Purchase water filled barricades for use on upcoming CIPs
2008	$26,557		$293,013	• Design of air traffic control tower
	$305,512		$2,160,879	• Engineering & design services for new RWY & FM Road 546 alignment
	$72,546		$652,914	• Engineering, design & construction TWY G • Construct concrete riprap in existing drainage channel
	$50,000[1]	$50,000[1]		• Pavement management plan • Airfield drainage maintenance • Aircraft parking apron lighting improvements • Airport entrance road lighting maintenance
2009	$53,051[1]	$50,000[1]		• Airport automated gates improvements • Complete turf and drainage maintenance • Replace signs & purchase airfield markers • Install perimeter fence gates • Apron lighting maintenance • Security improvements
	$350,960		$3,158,641	• Realign FM Road 546
	$642,918		$5,786,258	• RWY grading/clearing & grubbing • RWY subgrade & HMAC base

TABLE 1B (Continued)

2010	$50,569[1]	$50,000[1]		• Construct maintenance building • Pavement markings & sidewalk construction for terminal/tower access • Airport entrance sign • Security camera improvements
	$879,418		$1,260,987	• Construct new ATCT
2011	$47,766[1]	$47,766[1]		• General airport maintenance
	$13,832		$124,493	• ALP update/East Side Development Plan & obstruction survey
	$2,893,655		$7,036,251	• Construct TWYs B2, B3 & B4 • Repair drainage at existing TWY A & E • Construct replacement RWY 18-36 • Construct airport perimeter road with 3 gates
	$1,730,402		$8,329,582	• Construct replacement RWY 18-36 • Construct TWY B1-Segment 1 • Convert existing RWY 17-35 to TWY B • Electrical & electronics replacement RWY • Install MALS RWY 36 • Construct TWYs B2, B3 & B4 • Construct TWY B5-Segment 1
2012	$48,679[1]	$48,679[1]		• AWOS maintenance & general airport maintenance
2013	$49,781[1]	$49,781[1]		• General airport maintenance
	$25,000,000			• Purchase of airport facilities and assets
	$458,145		$4,123,308	• Reimbursement for replacement RWY Environmental Assessment • Reimbursement for Tracts 25, 19 & 20 for RPZ & relocation of FM Road 546
	$9,646		$86,818	• FAA required Wildlife Hazard Assessment & Management Plan
2014	$43,422[1]	$43,422[1]		• General airport maintenance
	$195,133		$1,756,202	• Reimbursement for land tract 27
	$20,575		$185,149	• Engineering/design for apron reconstruction
	$178,606	$1,607,450		• Reimbursement for land tract 24, 26A, 26B & various right-of-way
2015	$50,000[1]	$50,000[1]		• General airport maintenance
	$565,736		$5,039,524	• Reconstruct/expand terminal apron • Relocate automobile parking lot
2016	$50,367	$50,000		• General airport maintenance

[1] Projects funded entirely by the Routine Airport Maintenance Program (RAMP)
AWOS: Automated Weather Observing System
CIPs: Capital Improvement Project
HMAC: Hot Mix Asphalt Concrete
FM: Farm to Market
MALS: Medium Intensity Approach Light System
NAVAIDS: Navigational Aids
RPZ: Runway Protection Zone
RWY: Runway
TWY: Taxiway
Source: *Texas Airport System Plan* (TASP)

ECONOMIC IMPACT

In 2011, the University of North Texas Department of Economics conducted a study, *The Economic Impact of General Aviation in Texas*, which found that the airports included in the TASP generate thousands of jobs and provide billions of dollars in economic activity to Texas. TKI contributes to the State's general aviation impacts by boosting the region and State's economic activity, providing thousands in salary; wages and benefits; and employment opportunities. Capital expenditures for infrastructure and other Airport improvements over a five-year period (2006 to 2010) generated $44.2 million in economic activity that created 378 job-years[6] of employment. **Table 1C** illustrates the economic impact that TKI has had in the region, as well as the impact of general aviation in the State of Texas.

TABLE 1C
Aviation Economic Impact

	TKI	Texas General Aviation
Economic Activity	$44,248,730	$14,582,332,000
Salary, Wages & Benefits	$17,709,560	$3,127,309,000
Employment	378	56,635

Source: Economic Impacts, Collin County Regional Airport at McKinney (2011); Economic Impact, General Aviation in Texas (2011)

The McKinney City Council also approved a Tax Incentive Reinvestment Zone (TIRZ) in 2010 for the area around the Airport (**Exhibit 1D**). The City established a base year for tax generation in this area, and then the taxes collected in subsequent years within the TIRZ are dedicated to a capital project in that zone that is determined by the TIRZ Board of Directors.

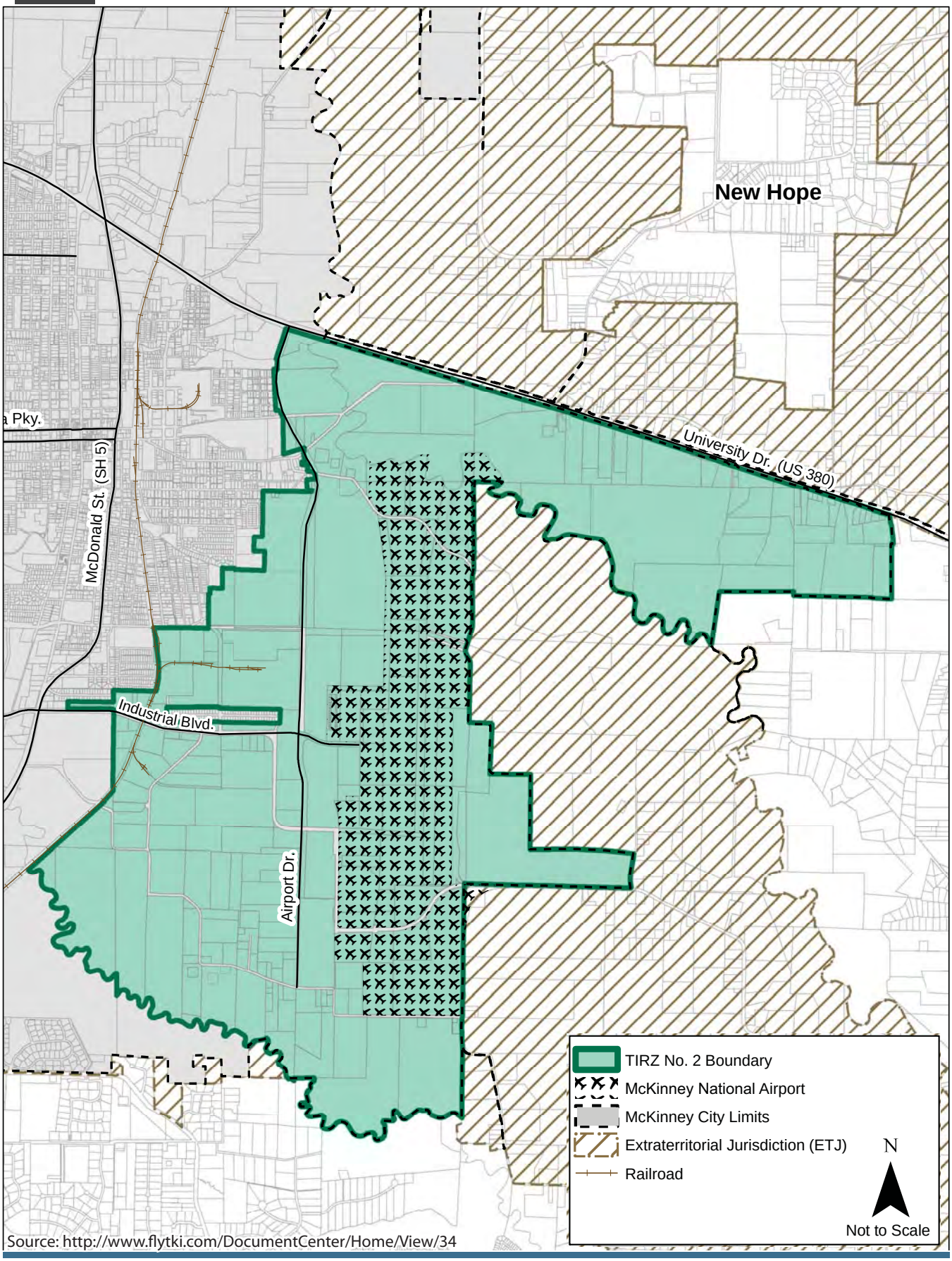
AIRPORT ADMINISTRATION

The City of McKinney has owned the Airport since it opened in 1979; however, the Executive Director, Operations Manager, and FBO General Manager handle daily Airport functions. In addition to these roles, the Airport employs an Administrative Assistant, Line Manager, Customer Service Supervisor, Airport Maintenance Specialists, Flight Line Technicians, and Customer Service Representatives.

THE AIRPORT'S SYSTEM ROLE

Airport planning takes place at the local, state, and national levels, each of which has a different emphasis and purpose.

[6] One job year is equivalent to one job that lasts one year.



Source: http://www.flytki.com/DocumentCenter/Home/View/34

- **Local**: The Airport has an Airport Master Plan, which was last updated in 2006. The Airport also has an Airport Layout Plan, last updated in 2012.
- **State**: TxDOT created the *Texas Airport System Plan* (TASP) based on input from local planning documents (i.e., master plans and airport layout plans).
- **National**: The Airport is included in the *National Plan of Integrated Airport Systems* (NPIAS), which categorizes overall airport roles and responsibilities based on input from local and state planning efforts (i.e., master plans and state system plans).

LOCAL AIRPORT PLANNING

14 CFR Part 150 Study – Noise Exposure Maps and Noise Compatibility Program (2005) - This noise study addresses noise and land use compatibility issues related to the Airport. The primary objectives of the study are to identify TKI's existing operational procedures and evaluate future operational noise mitigation measures, and to evaluate the existing and future land use compatibilities near the Airport.

Airport Master Plan (2006) – The Airport Master Plan is the primary local planning document that provides a 20-year airport development vision based on aviation demand forecasts. The 2006 *Master Plan Update for Collin County Regional Airport* used 2003-2004 empirical data. Given the inevitable uncertainties as the master plan ages, the FAA recommends airports update their master plans every five to ten years, or as necessary to address any significant changes.

Collin County Regional Airport Land Use Plan (2009) – This Plan provided a detailed future land use plan for the Airport and its environs, which included an alternative roadway access layout for a proposed thoroughfare.

Airport Layout Plan Update/Narrative Report (2012) – Federal Grant Assurances require the Airport to maintain a current airport layout plan (ALP) on file with TxDOT as Texas is a block grant state representing the FAA in most issues and actions that affect general aviation airports. ALPs are drawings that graphically depict current and future airport facilities, which are regulated by Advisory Circular (AC) 150/5070-6B. TKI's ALP Update provides guidance for the Airport on forward growth strategies based on existing facilities and future needs.

Collin County Mobility Plan (2014) – This plan covers all forms of transportation in Collin County, including TKI. The document discusses the role of the aviation system within the broader mobility of the County and beyond.

McKinney National Airport Strategic Plan (2015) – The City Council created this strategic plan to establish the direction and implementation plan for TKI in the future. The established direction focused on maximizing the Airport's development potential via a land acquisition plan, a marketing program, analysis of the regional aviation system, and establishing an Airport access control and management plan.

STATE AIRPORT PLANNING

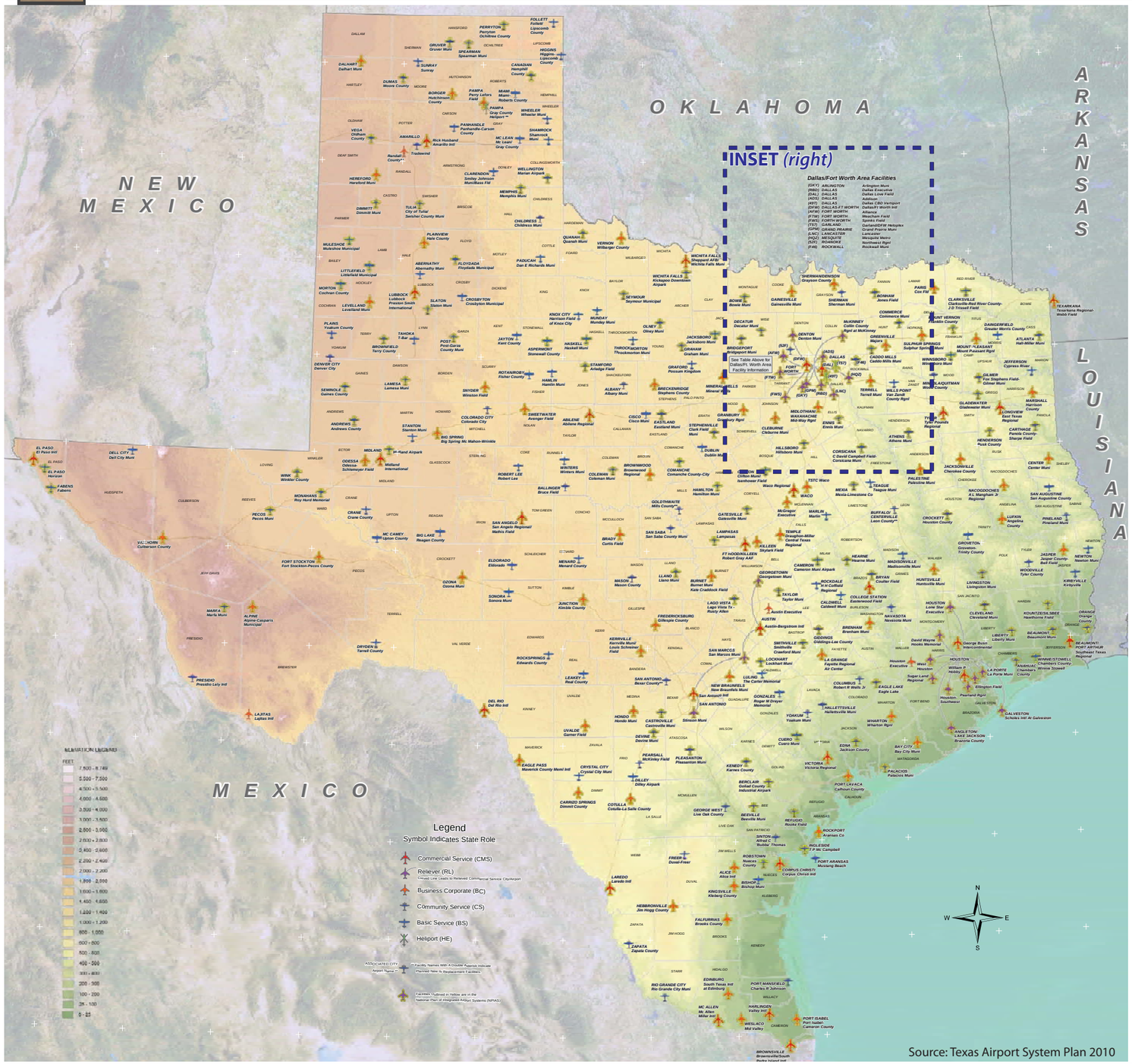
The primary planning document for the State of Texas is the TASP, which was last updated in 2010. This document identifies the public use aviation facilities in the State that perform a critical role in the economic and social development of Texas by providing adequate air access. At the time of publication, the TASP included 292 airports and two heliports classified by the role provided. TKI is classified as a reliever airport in the TASP. **Exhibit 1E** shows all TASP facilities, which are broken down by service levels, as follows:

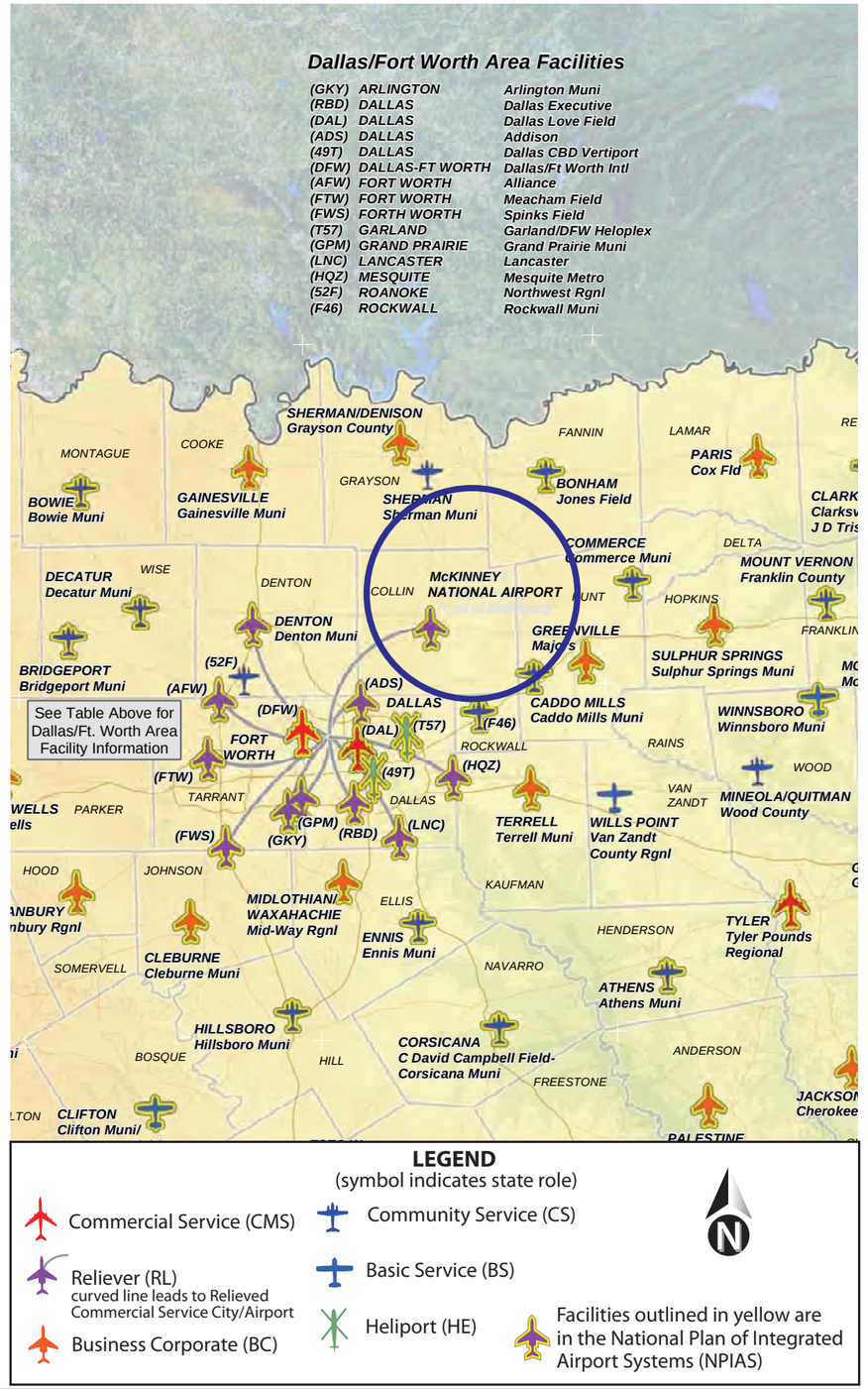
- **Primary Commercial Service:** These airports support scheduled passenger service by large and medium transport aircraft and enplane at least 10,000 passengers on an annual basis.
- **Non-Primary Commercial Service:** Airports capable of accommodating scheduled passenger service by smaller transport aircraft and enplane fewer than 10,000, but more than 2,500 passengers annually.
- **Reliever:** Airports designed primarily to relieve congestion at Commercial Service airports by providing alternative general aviation facilities.
- **General Aviation (Business/Corporate):** These airports provide community access as they are capable of accommodating business jets.
- **General Aviation (Community Service):** Airports that provide community access by single and light twin-engine aircraft and a limited number of business jets.
- **General Aviation (Basic Service):** Airports capable of providing air access for communities less than 30 minutes (drive time) from Commercial Service, Reliever, Business/Corporate, and Community Service airports, and supports essential but low activity levels.
- **General Aviation (Heliport):** A facility capable of accommodating helicopters used by individuals, corporations, and helicopter air taxi services. These facilities may support scheduled passenger service if demand exists.

Current breakdown of airports in the TASP:

- Commercial Service: 27
- Reliever: 24
- Business/Corporate: 67
- Community Service: 106
- Basic Service: 68
- Heliports: 2

The primary goals of the TASP are to develop a statewide airport system that provides adequate access via air to the population and economic activity centers in Texas, as well as provide timely development and maintenance of the aviation system. The TASP also seeks to maximize the economic benefit and return on investment to the State, local communities, counties, and cities from development of the airport system, as well as integrating the airport system with other transportation modes. **Table 1D** lists the minimum facility and service requirements for airports classified as relievers in the TASP. The current airport layout and available services at TKI exceed these minimum standards.


NEW MEXICO
OKLAHOMA
ARKANSAS
LOUISIANA
MEXICO
INSET (right)
Dallas/Fort Worth Area Facilities
(GKY) ARLINGTON Arlington Muni
(RBD) DALLAS Dallas Executive
(DAL) DALLAS Dallas Love Field
(ADS) DALLAS Addison
(49T) DALLAS Dallas CBD Vertiport
(DFW) DALLAS-FT WORTH Dallas/Ft Worth Intl
(AFW) FORT WORTH Alliance
(FTW) FORT WORTH Meacham Field
(FWS) FORTH WORTH Spinks Field
(T57) GARLAND Garland/DFW Heloplex
(GPM) GRAND PRAIRIE Grand Prairie Muni
(LNC) LANCASTER Lancaster
(HQZ) MESQUITE Mesquite Metro
(52F) ROANOKE Northwest Rgnl
(F46) ROCKWALL Rockwall Muni
See Table Above for Dallas/Ft. Worth Area Facility Information
ELEVATION LEGEND
FEET
7,500 - 8,749
7,000 - 7,500
6,500 - 7,000
6,000 - 6,500
5,500 - 6,000
5,000 - 5,500
4,500 - 5,000
4,000 - 4,500
3,500 - 4,000
3,000 - 3,500
2,500 - 3,000
2,000 - 2,500
1,500 - 2,000
1,000 - 1,500
500 - 1,000
0 - 500
Legend
Symbol Indicates State Role
Commercial Service (CMS)
Reliever (RL)
Curved Line Leads to Relieved Commercial Service City/Airport
Business Corporate (BC)
Community Service (CS)
Basic Service (BS)
Heliport (HE)
Facilities Outlined in Yellow are in the National Plan of Integrated Airport Systems (NPIAS)
N
W
E
S
Source: Texas Airport System Plan 2010


Dallas/Fort Worth Area Facilities
(GKY) ARLINGTON Arlington Muni
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(HQZ) MESQUITE Mesquite Metro
(52F) ROANOKE Northwest Rgnl
(F46) ROCKWALL Rockwall Muni
See Table Above for Dallas/Ft. Worth Area Facility Information
SHERMAN/DENISON Grayson County
BOWIE Bowie Muni
GAINESVILLE Gainesville Muni
SHERMAN Sherman Muni
BONHAM Jones Field
PARIS Cox Fld
COMMERCE Commerce Muni
MOUNT VERNON Franklin County
DECATUR Decatur Muni
DENTON Denton Muni
McKINNEY NATIONAL AIRPORT
GREENVILLE Majors
SULPHUR SPRINGS Sulphur Springs Muni
BRIDGEPORT Bridgeport Muni
CADDO MILLS Caddo Mills Muni
WINNSBORO Winnsboro Muni
DALLAS
FORT WORTH
MINEOLA/QUITMAN Wood County
TERRELL Terrell Muni
WILLS POINT Van Zandt County Rgnl
MIDLOTHIAN/WAXAHACHIE Mid-Way Rgnl
ENNIS Ennis Muni
TYLER Tyler Pounds Regional
CLEBURNE Cleburne Muni
ATHENS Athens Muni
HILLSBORO Hillsboro Muni
CORSICANA C David Campbell Field-Corsicana Muni
CLIFTON Clifton Muni
JACKSON Cherokee
MONTAGUE
COOKE
FANNIN
LAMAR
GRAYSON
COLLIN
DENTON
WISE
HUNT
RAINS
WOOD
VAN ZANDT
ROCKWALL
TARRANT
DALLAS
PARKER
HOOD
JOHNSON
KAUFMAN
ELLIS
HENDERSON
SOMERVELL
NAVARRO
HOPKINS
DELTA
FRANKLIN
BOSQUE
HILL
ANDERSON
FREESTONE
LEGEND
(symbol indicates state role)
Commercial Service (CMS)
Reliever (RL)
curved line leads to Relieved Commercial Service City/Airport
Business Corporate (BC)
Community Service (CS)
Basic Service (BS)
Heliport (HE)
Facilities outlined in yellow are in the National Plan of Integrated Airport Systems (NPIAS)
N

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TABLE 1D
Facility and Service Criteria for TASP Reliever Airports

Airport Criteria	Minimum Objective
Airport Reference Code	C-II thru D-II
Design Aircraft	Business Jet
Runways	
Length	To handle 100% of small aircraft fleet
Width	75 feet
Strength	30,000 lb.
Lighting	Medium Intensity Runway Lighting
Approach	Precision
Visibility Minimums	¾-mile
Taxiways	
Type	Full Parallel
Services	
Services Available	Terminal, automated weather observation system, fuel

Source: Texas Airport Systems Plan (2010)

FEDERAL AIRPORT PLANNING

The FAA maintains a database of airports that are eligible for AIP funding that are for public use called the *National Plan of Integrated Airport Systems* (NPIAS). The NPIAS categorizes these facilities by the type of activities that take place, including commercial service, cargo service, reliever operations, and general aviation (as seen in **Table 1E**). Furthermore, the FAA provides definitions for the various roles that general aviation facilities provide for their service areas, which **Table 1F** describes. TKI is currently classified as a National Reliever Airport in the FAA's NPIAS. Reliever airports are considered high capacity general aviation facilities in major metropolitan areas that provide pilots with alternatives to congested hub airports, while simultaneously providing access to the surrounding area. The following represent reliever airport eligibility requirements:

- The airport must be open to the public;
- The airport must maintain 100 or more based aircraft; or,
- The airport must have at least 25,000 annual itinerant operations.

TABLE 1E
Airport Classifications

Airport Classifications		Hub Type: Percentage of Annual Passenger Boardings (enplanement)	Common Name
Commercial Service: Publicly owned airports that have at least 2,500 passenger boardings each calendar year and receive scheduled passenger service	**Primary:** Have more than 10,000 passenger boardings each year	**Large:** 1% or more	**Large Hub**
		Medium: At least 0.25%, but less than 1%	**Medium Hub**
		Small: At least 0.05%, but less than 0.25%	**Small Hub**
		Nonhub: More than 10,000, but less than 0.05%	**Nonhub Primary**
	Nonprimary	**Nonhub:** At least 2,500 and no more than 10,000	**Nonprimary Commercial Service**
Nonprimary (Except Commercial Service)		Not Applicable	**Reliever General Aviation**

Source: https://www.faa.gov/airports/planning_capacity/passenger_allcargo_stats/categories/

TABLE 1F
General Aviation Airport Descriptions

Role	Description
National	Supports the national and state system by providing communities with access to national and international markets in multiple states and throughout the United States.
Regional	Supports regional economies by connecting communities to statewide and interstate markets.
Local	Supplements communities by providing access to primarily intrastate and some interstate markets.
Basic	Links the community with the national airport system and supports general aviation activities (e.g., emergency services, charter or critical passenger service, cargo operations, flight training and personal flying).
Unclassified	Provides access to the aviation system.

Source: https://www.faa.gov/airports/planning_capacity/passenger_allcargo_stats/categories/

General aviation airports are public-use airports that do not have scheduled service or have less than 2,500 annual passenger boardings (49 USC 47102[8]). Approximately 88% of airports included in the National Plan of Integrated Airports System (NPIAS) are general aviation.

While TKI is classified in the NPIAS as a Reliever Airport, it has also been identified in the *General Aviation Airports: A National Asset* (2012) study as a "national" Airport. This study identified 84 airports within the national grouping. The FAA describes the national group as airports that support the national and state system by providing communities with access to national and international markets in multiple states throughout the U.S. These airports have high levels of activity, including jet and multi-engine aircraft operations, as well as single engine aircraft, and average 200 based aircraft, including 30 jets.

The most current plan is the NPIAS 2017-2021, which identified 3,340 public-use airports (3,332 existing and 8 proposed) that are important to national air transportation. The plan estimates that approximately $32.5 billion in AIP-eligible airport projects will require financial assistance between 2017 and 2021. **Table 1G** identifies the type of airports included in the NPIAS.

TABLE 1G
Activity and Development at NPIAS Airports

Number of Airports	Airport Category	Percentage of NPIAS Airports	Percentage of 2014 Total Enplanements[1]	Percentage of All Based Aircraft[2]	Percentage of NPIAS Cost[3]
30	Large Hub	1%	72	0.7%	20.9%
31	Medium Hub	1%	15	1.7%	9.6%
72	Small Hub	2%	8	4.7%	12.8%
249	Nonhub	7%	4	11.6%	16.2%
382	**Primary Subtotal**	**11%**	**99%**	**18.6%**	**59.4%**
89	National	3%	n/a	11.5%	5.4%
531	Regional	16%	n/a	25.6%	12.2%
1,261	Local	38%	n/a	21.2%	15.3%
813	Basic	24%	n/a	3.2%	6.6%
256	Unclassified	8%	n/a	1.0%	0.03%
2,950	**Nonprimary Subtotal**	**89%**	**n/a**	**62.6%**	**39.5%**
3,332	**Total NPIAS Airports**	**100%**	**99%**	**81.2%**	**99.0%**

[1] The remaining one percent of enplanements occurred at non-NPIAS airports
[2] Based on an active general aviation fleet of 203,880 aircraft in 2015
[3] These costs are rounded and do not include the cost for new airports (one percent)
Source: 2017 – 2021 *National Plan of Integrated Airport Systems* (NPIAS)

AVIATION ACTIVITY

Records of the Airport's operational activity are the basis for determining the types and sizes of facilities and eligibility for federal funding. Airport staff and the FAA maintain statistics on aircraft operations, enplaned passengers, and based aircraft which are analyzed to aid in projecting future trends.

OPERATIONS

Aircraft operational statistics at the Airport are recorded by the ATCT, which classifies operations as either a takeoff or a landing. The ATCT is open from 6:00 a.m. to 10:00 p.m. daily. Aircraft operations are segregated into four general categories: air carrier, air taxi, military, and general aviation.

- **Air Carrier** – operations performed by commercial airline aircraft with greater than 60 seats.
- **Air Taxi** – operations associated with commuter aircraft, but also include for-hire general aviation aircraft.
- **Military Operations** – operations conducted by airplanes and helicopters with a military identification.
- **General Aviation** – includes all other aviation activity from small ultralights to large business jets.

Exhibit 1F shows aircraft operations activity at TKI by year and month, as well as broken out into itinerant and local operations. Operations declined from the early 2000s through 2007 before spiking in 2008. Since 2011, operations at TKI have been on the rise. General aviation movements comprise the bulk of operations.

Monthly operational trends also illustrate that overall operations are on the rise at the Airport, as indicated by the increasing trendline. With some inevitable variation, June to October capture the highest number of operations annually, which becomes especially apparent in more recent years. From 2013 to 2016, these months (June – October) capture just shy of 50 percent of operations for the entire year. Based on the entire timeframe (2010 – 2016), the Airport averages 7,945 operations per month; however, in 2016, the Airport exceeded this average every month except for December, as well as for eight months in 2015.

TABLE 1H
Based Aircraft
McKinney National Airport

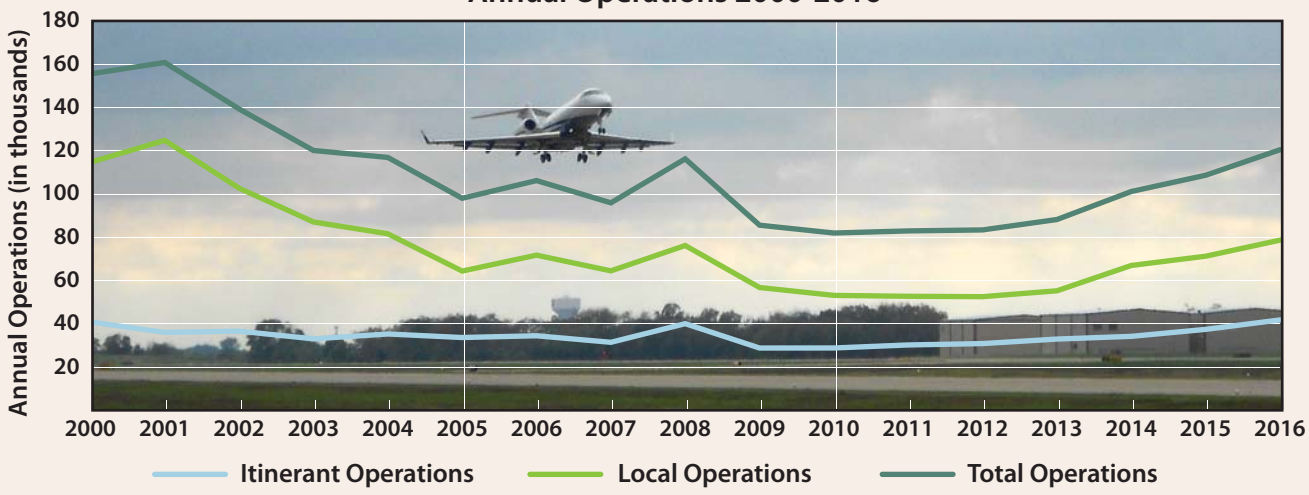
Year	Based Aircraft
1990	135
1991	142
1992	142
1993	142
1994	142
1995	144
1996	144
1997	144
1998	144
1999	144
2000	144
2001	144
2002	162
2003	210
2004	210
2005	210
2006	210
2007	143
2008	177
2009	208
2010	204
2011	210
2012	218
2013	239
2014	265
2015	296
2016	286

Source: FAA TAF, Airport Management

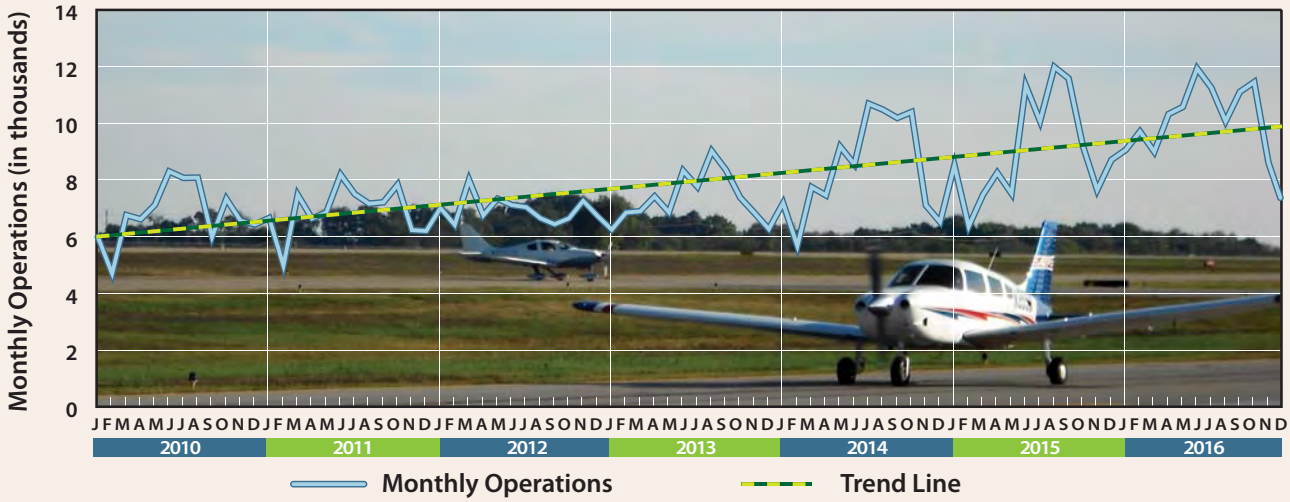
Current and historical numbers of based aircraft help determine the current and future demand for a variety of aircraft support facilities at the Airport, including aircraft storage hangars, parking aprons, and pilot and passenger services. Historical data, as provided in **Table**

	ITINERANT					LOCAL			
Year	Air Carrier	Air Taxi	General Aviation	Military	Total	Civil	Military	Total	Total Operations
2000	0	2	40,628	12	40,642	115,138	0	115,138	155,780
2001	0	141	35,825	49	36,015	124,773	10	124,783	160,798
2002	0	292	36,298	27	36,617	102,704	6	102,710	139,327
2003	0	235	32,783	25	33,043	87,077	4	87,081	120,124
2004	0	637	34,619	37	35,293	81,609	12	81,621	116,914
2005	0	540	33,070	52	33,662	64,332	32	64,364	98,026
2006	0	578	33,837	57	34,472	71,715	24	71,739	106,211
2007	0	906	30,449	94	31,449	64,437	34	64,471	95,920
2008	0	7,143	32,903	20	40,066	76,185	4	76,189	116,255
2009	0	1,132	27,631	41	28,804	56,752	24	56,776	85,580
2010	0	1,249	27,522	54	28,825	52,707	425	53,132	81,957
2011	1	1,328	28,857	36	30,222	52,700	16	52,716	82,938
2012	0	1,405	29,415	36	30,856	52,302	243	52,545	83,401
2013	15	1,464	31,429	42	32,950	55,243	16	55,259	88,209
2014	0	1,560	32,622	21	34,203	66,959	12	66,971	101,174
2015	0	2,042	35,349	35	37,426	71,234	15	71,249	108,675
2016	2	2,503	39,224	62	41,791	78,657	22	78,679	120,470
Total	18	23,157	562,461	700	586,336	1,274,524	899	1,275,423	1,861,759

Annual Operations 2000-2016



Monthly Operations 2010-2016



Source: FAA OPSNET (Accessed January 2017)

1H, show that the number of based aircraft has remained stable, with almost no change from 1990 to 2001 before the Airport increased based aircraft in 2002. The number of based aircraft remained at 2003 levels until dropping back down in 2007. From 2008 to 2016, the Airport has continually increased its number of based aircraft, dropping slightly from 296 in 2015 to 286 in 2016. The current mix of based aircraft includes:

- 221 – Single Engine Piston
- 19 – Multi-Engine Piston
- 12 – Turboprop
- 27 – Jet
- 7 – Helicopter

AIRPORT FACILITIES AND SERVICES

There are four broad categories of facilities and services at the airport: airfield, landside, aviation services, and support.

Airfield facilities – facilities directly associated with aircraft operations, including runways, taxiways, lighting, markings, navigational aids, and weather reporting. **Exhibit 1G** depicts all airfield facilities at TKI.

Landside facilities – facilities necessary to provide a safe transition from surface to air transportation and support aircraft parking, servicing, storage, maintenance, and operational safety, including non-aviation facilities that typically provide a revenue stream to the airport. **Exhibit 1H** depicts all landside facilities at TKI.

Aviation services – organizations or facilities that provide aviation services, including aircraft fueling, aircraft parking, hangar space/leasing, flying clubs, flight instruction, air medical services, and aircraft maintenance.

Support facilities – serve as a critical link to provide the necessary efficiency to aircraft ground operations, such as aircraft rescue, airport maintenance, firefighting (ARFF), and fuel storage.

AIRFIELD FACILITIES

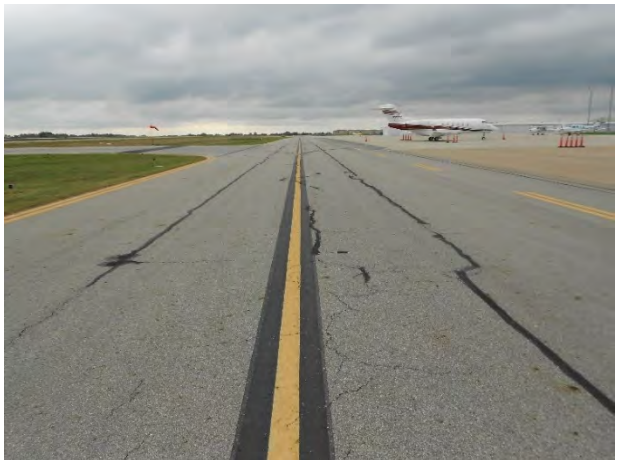
The airfield category includes those facilities directly associated with aircraft operations. This section includes information related to the runway, taxiways, lighting, markings, navigational aids, and weather reporting aids at TKI.

RUNWAY

Runway 18-36 is the only runway at TKI, measuring 7,002 feet long and 150 feet wide. The concrete pavement on Runway 18-36 is in good condition having been constructed within the last ten years. The runway's load bearing strength, along with other features, are included on **Exhibit 1G.** Single wheel loading (SWL) refers to design aircraft landing gear with a single wheel on each main landing gear strut. Dual wheel loading (DWL) refers to design aircraft landing gear with two wheels on each main landing gear strut. Double tandem wheel loading (DTWL) refers to aircraft landing gear with four wheels on each main landing gear strut.

TAXIWAYS

The taxiways vary in width from 40 to 100 feet. Note that taxiway widths shown on **Exhibit 1F** are measured from centerline to centerline. The FAA has designated the north and south portion of Taxiway B as a Hot Spot, which officially defines this area of the Airport as a place with a history of potential risk of collision or runway incursion, and where heightened attention by pilots and drivers is necessary. Pilots may confuse Taxiway B for Runway 18-36 as Taxiway B used to be the runway until the present-day runway was constructed farther east. The Airport widened the taxiway centerline and printed "TAXI" on Taxiway B to reduce confusion and mitigate potential landing errors.

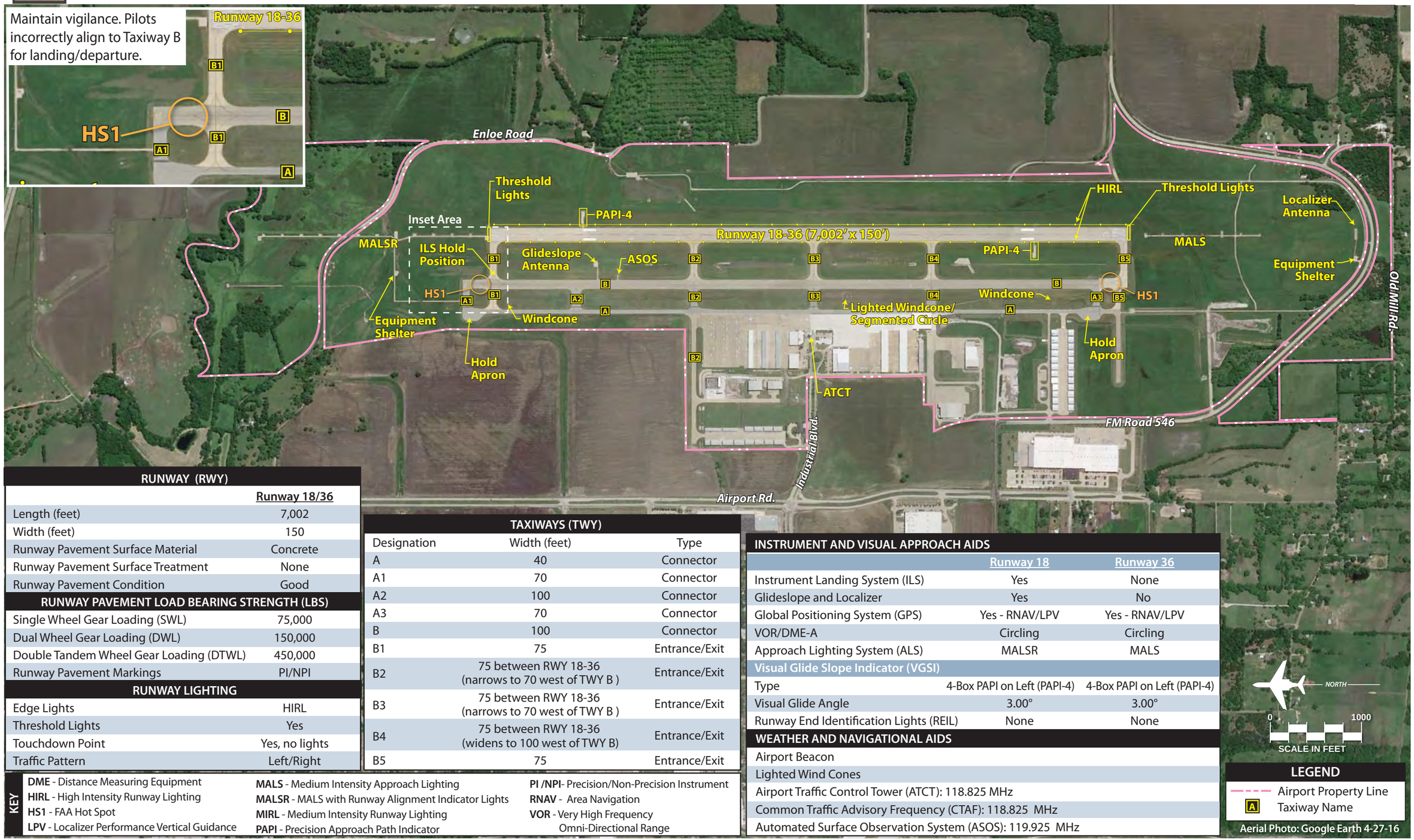


TAXIWAY A FACING SOUTH

TAXIWAY B MARKINGS AT DESIGNATED HOT SPOT

AIRIFIELD LIGHTING

Airfield lighting systems extend an airport's usefulness into periods of darkness and/or poor visibility. The Airport has a variety of lighting systems installed for this purpose. The following list categorizes existing lighting systems by function.



RUNWAY (RWY)	
	Runway 18/36
Length (feet)	7,002
Width (feet)	150
Runway Pavement Surface Material	Concrete
Runway Pavement Surface Treatment	None
Runway Pavement Condition	Good
RUNWAY PAVEMENT LOAD BEARING STRENGTH (LBS)	
Single Wheel Gear Loading (SWL)	75,000
Dual Wheel Gear Loading (DWL)	150,000
Double Tandem Wheel Gear Loading (DTWL)	450,000
Runway Pavement Markings	PI/NPI
RUNWAY LIGHTING	
Edge Lights	HIRL
Threshold Lights	Yes
Touchdown Point	Yes, no lights
Traffic Pattern	Left/Right

TAXIWAYS (TWY)		
Designation	Width (feet)	Type
A	40	Connector
A1	70	Connector
A2	100	Connector
A3	70	Connector
B	100	Connector
B1	75	Entrance/Exit
B2	75 between RWY 18-36 (narrows to 70 west of TWY B)	Entrance/Exit
B3	75 between RWY 18-36 (narrows to 70 west of TWY B)	Entrance/Exit
B4	75 between RWY 18-36 (widens to 100 west of TWY B)	Entrance/Exit
B5	75	Entrance/Exit

INSTRUMENT AND VISUAL APPROACH AIDS		
	Runway 18	Runway 36
Instrument Landing System (ILS)	Yes	None
Glideslope and Localizer	Yes	No
Global Positioning System (GPS)	Yes - RNAV/LPV	Yes - RNAV/LPV
VOR/DME-A	Circling	Circling
Approach Lighting System (ALS)	MALSR	MALS
Visual Glide Slope Indicator (VGSI)		
Type	4-Box PAPI on Left (PAPI-4)	4-Box PAPI on Left (PAPI-4)
Visual Glide Angle	3.00°	3.00°
Runway End Identification Lights (REIL)	None	None
WEATHER AND NAVIGATIONAL AIDS		
Airport Beacon		
Lighted Wind Cones		
Airport Traffic Control Tower (ATCT): 118.825 MHz		
Common Traffic Advisory Frequency (CTAF): 118.825 MHz		
Automated Surface Observation System (ASOS): 119.925 MHz		

KEY

DME - Distance Measuring Equipment
HIRL - High Intensity Runway Lighting
HS1 - FAA Hot Spot
LPV - Localizer Performance Vertical Guidance
MALS - Medium Intensity Approach Lighting
MALSR - MALS with Runway Alignment Indicator Lights
MIRL - Medium Intensity Runway Lighting
PAPI - Precision Approach Path Indicator
PI /NPI- Precision/Non-Precision Instrument
RNAV - Area Navigation
VOR - Very High Frequency Omni-Directional Range

LEGEND

Airport Property Line
A Taxiway Name

Aerial Photo: Google Earth 4-27-16

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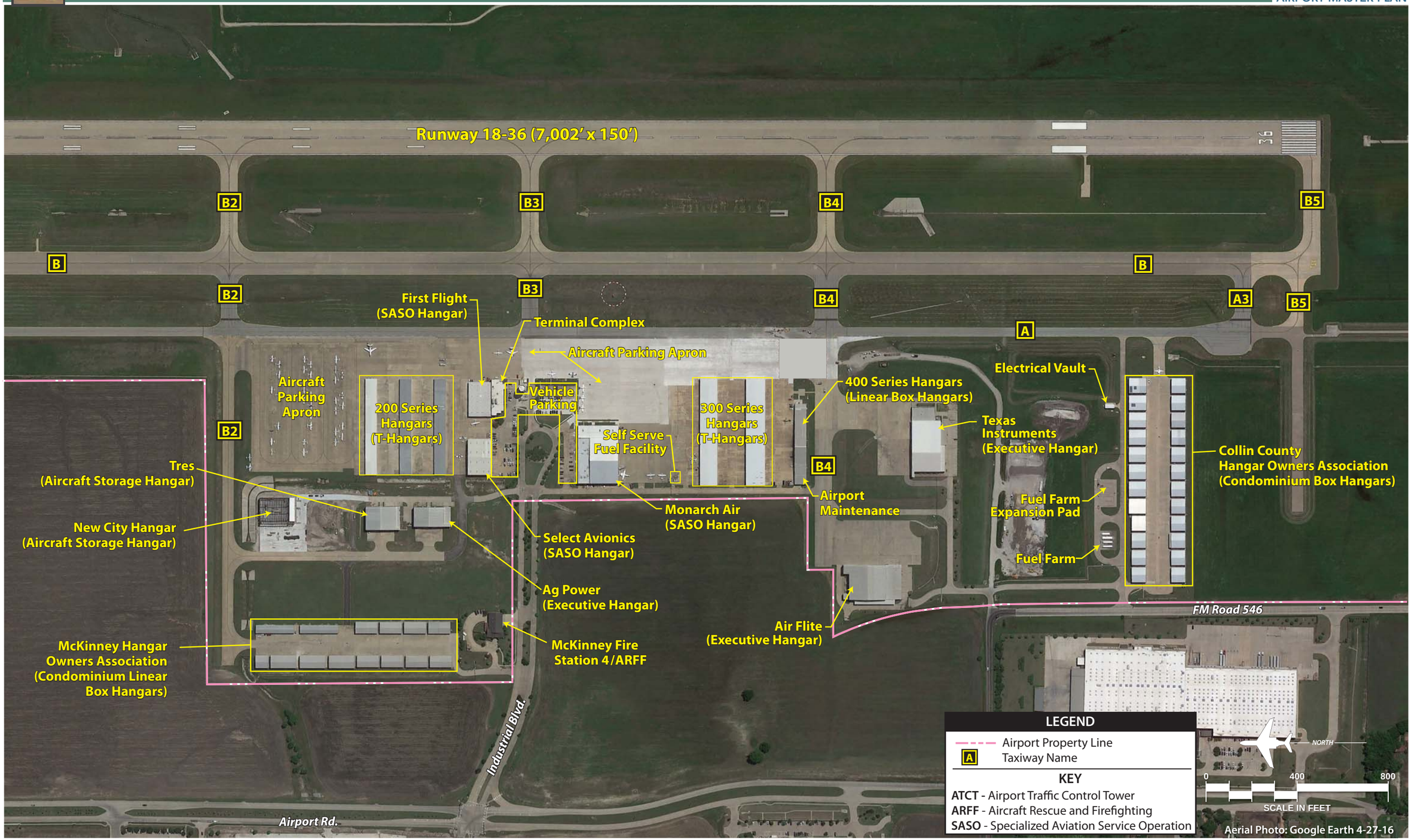
Runway 18-36 (7,002' x 150')
18
36
B2
B3
B4
B5
B
A
A3
First Flight (SASO Hangar)
Terminal Complex
Aircraft Parking Apron
Aircraft Parking Apron
200 Series Hangars (T-Hangars)
Vehicle Parking
Self Serve Fuel Facility
300 Series Hangars (T-Hangars)
400 Series Hangars (Linear Box Hangars)
Electrical Vault
Texas Instruments (Executive Hangar)
Collin County Hangar Owners Association (Condominium Box Hangars)
Tres (Aircraft Storage Hangar)
New City Hangar (Aircraft Storage Hangar)
Monarch Air (SASO Hangar)
Airport Maintenance
Fuel Farm Expansion Pad
Fuel Farm
Select Avionics (SASO Hangar)
Ag Power (Executive Hangar)
Air Flite (Executive Hangar)
McKinney Hangar Owners Association (Condominium Linear Box Hangars)
McKinney Fire Station 4/ARFF
Industrial Blvd.
Airport Rd.
FM Road 546
LEGEND
Airport Property Line
A Taxiway Name
KEY
ATCT - Airport Traffic Control Tower
ARFF - Aircraft Rescue and Firefighting
SASO - Specialized Aviation Service Operation
NORTH
0
400
800
SCALE IN FEET
Aerial Photo: Google Earth 4-27-16

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Airport Identification Lighting: A rotating beacon signals the location of the Airport at night or during low-visibility weather. The rotating beacon does this by projecting two beams of light, one white and one green, 180 degrees apart. TKI's beacon operates from sunset to sunrise and is located atop the ATCT.

Approach Lighting System (ALS): An ALS is a configuration of lights positioned symmetrically along the extended runway centerline to supplement navigational aids, such as an instrument landing system (ILS), to provide lower visibility minimums. TKI has a Medium Intensity ALS with Runway Alignment (MALSR) on Runway 18 and a Medium Intensity ALS (MALS) on Runway 36. The MALSR extends approximately 2,500 feet north from the Runway 18 threshold. The MALS on Runway 36 extends approximately 1,500 feet south from the Runway 36 threshold.

MALSR ON RUNWAY 18

MALS ON RUNWAY 36

Runway Pavement and Edge Lighting: Pavement edge lighting defines the lateral limits of the pavement to ensure safe operations during night and/or times of low visibility, which maintains safe and efficient access to and from the runway and aircraft parking areas. Runway 18-36 is equipped with High Intensity Runway Lighting (HIRL) and threshold lights.

PRECISION APPROACH PATH INDICATOR

Visual Approach Lighting: Visual approach aids are installed at the Airport to assist pilots in determining the correct descent path to the runway end during landing. A four-box precision approach path indicator (PAPI-4L) is available on the left side of both runway end approaches. The pilot interprets the system of red and white lights, which gives an indication of being above, below, or on the designated descent path to the runway threshold. A PAPI system has a range of five miles during the day and up to 20 miles at night. Each PAPI at TKI provides a standard 3.00-degree glide path.

MEDIUM INTENSITY TAXIWAY LIGHTING

TAXIWAY SIGNAGE

Taxiway Lighting: TKI has medium intensity taxiway lighting (MITL) that is elevated on mounted units to each side of the taxiways.

Pilot-Controlled Lighting: During nighttime hours when the ATCT is closed (10:00 p.m. to 6:00 a.m.), pilots can utilize the pilot-controlled lighting (PCL) system to activate certain airfield lights from their aircraft through a series of clicks of their radio transmitter utilizing the common traffic advisory frequency (CTAF) (118.825 MHz).

Airport Emergency Lighting System: There are two emergency generators at the Airport supporting the ATCT and the airport lighting systems in the event of a power outage. The generator for the ATCT runs on an unlimited supply of natural gas having enough energy to power all essential equipment related to the tower. The generator for the airport lighting systems runs off a 500-gallon propane tank that can operate continuously for one week.

Airfield Signage: Airfield identification signs assist pilots in identifying runways, taxiway routes, holding positions, and critical areas. The airfield at TKI is equipped with lighted signs located at each taxiway intersection.

AIRPORT MARKINGS

Pavement markings aid in the movement of aircraft along surfaces at the Airport and identify closed or hazardous areas. The Airport provides and maintains marking systems in accordance with Part 139.311(a) and Advisory Circular 150/5340-1, *Standards for Airport Marking*.

Runway 18 is equipped with precision runway markings, which identifies the runway number, centerline, threshold marking, aiming points, edge markings, and touchdown zones. Runway 36 is equipped with non-precision markings, which includes the runway number, centerline, threshold markings, edge markings, and aiming points. Runway markings are in good condition.

All taxiways at the Airport are marked with yellow centerline and holding position markings. Centerline markings assist pilots in maintaining proper clearance from pavement edges and objects near the taxiway edges. Enhanced centerline markings are offered for taxiways leading to the Runway 18-36 holding

position markings. Aircraft holding positions are marked at each runway/taxiway intersection 250 feet from the runway centerline.

NAVIGATIONAL AIDS

Navigational aids are electronic devices that transmit radio frequencies that pilots in properly equipped aircraft can translate into point-to-point guidance and position information. TKI has a very high frequency omni-directional range (VOR) and global positioning system (GPS) for Runway 18-36 to aid aircraft flying in and out of the Airport.

The VOR provides azimuth readings to pilots of properly equipped aircraft by transmitting a radio signal at every degree to provide 360 individual navigational courses. Frequently, distance measuring equipment (DME) is combined with a VOR facility to provide distance as well as direction information to the pilot.

The United States Department of Defense initially developed GPS for military navigation around the world. Now, GPS is used extensively for a wide variety of civilian uses, including civil aircraft navigation. GPS uses satellites placed in orbit around the globe to transmit electronic signals, which pilots of properly equipped aircraft use to determine altitude, speed, and navigational information. This provides more freedom in flight planning and allows for more direct routing to the destination. GPS provides for enroute navigation and non-precision instrument approaches to TKI.

INSTRUMENT LANDING SYSTEM (ILS) EQUIPMENT

Airports offering full ILS approaches are equipped with both a glideslope antenna and localizer antenna array. The glideslope antenna provides vertical guidance to landing aircraft and can be located on either side of the runway; however, it is best to locate the glideslope antenna on the side of the runway with the least possibility of signal reflections from buildings, power lines, vehicles, aircraft, etc. At TKI, Runway 18 is equipped with an ILS (note that the ILS is unmonitored when the ATCT is closed). The glideslope antenna is located on the west side of Runway 18-36 approximately 1,200 feet from the Runway 18 threshold.

GLIDESLOPE ANTENNA

The localizer antenna array provides horizontal guidance and is used to establish and maintain an approaching aircraft's position relative to the runway centerline until visual contact confirms the runway alignment and location. Typically, the localizer antenna array is sited on the extended runway centerline between 1,000 feet and 2,000 feet from the end of the runway. At TKI, the localizer antenna array is

LOCALIZER ANTENNA

AUTOMATED SURFACE OBSERVATION SYSTEM

LIGHTED WIND CONE AND SEGMENTED CIRCLE

located approximately 2,500 feet south of the Runway 36 threshold adjacent to the north side of FM Road 546. The localizer antenna was sited to accommodate a potential runway extension of up to 1,500 feet. The equipment shelter, which houses electronic equipment, is located within 250 feet of the localizer antenna, as required by the FAA.

WEATHER AND COMMUNICATION

As mentioned previously, TKI is served by an ASOS. The system updates weather observations every minute, continuously reporting changes on frequency 119.925 MHz or by calling (972) 548-8525. The ASOS reports cloud ceiling, visibility, temperature, dew point, wind direction, wind speed, altimeter setting (barometric pressure), and density altitude (airfield elevation corrected for temperature). The ASOS is located on the west side of Runway 18-36, approximately 1,500 feet from the Runway 18 threshold.

TKI also has a lighted wind cone and segmented circle located between Taxiways A and B approximately 500 feet southeast of the ATCT. The wind cone informs pilots of the wind direction and speed, while the segmented circle indicates aircraft traffic pattern information.

LANDSIDE FACILITIES

All landside facilities are shown on **Exhibit 1H**. These facilities support the aircraft and pilot/passenger handling functions and include the airport terminal complex, aircraft storage hangars, aircraft maintenance hangars, aircraft parking aprons and support facilities such as fuel storage, vehicle parking, maintenance facilities and equipment, utilities, and safety and security components.

TERMINAL COMPLEX

The two-story terminal complex was built in 1982 and provides for approximately 15,800 square feet (sf) of floor space. FBO activities are provided on the first floor of the complex that include a waiting lobby, pilot's lounge, flight planning, and administrative offices. The second floor of the terminal complex is primarily comprised of office space associated with Airport management and operations, as well as various aeronautical activities. Connected to the terminal complex is a hangar facility that encompasses approximately 12,000 sf of aircraft storage space.

TERMINAL COMPLEX

AIRCRAFT HANGAR FACILITIES

Hangar facilities at TKI include aircraft storage hangars, condominium box hangars, condominium linear box hangars, linear box hangars, T-hangars, specialized aviation service operator (SASO) hangars, and executive hangars. Except for the condominium hangars, all hangars are owned and leased by the City and administratively and operationally managed by McKinney Air Center.

MCKINNEY HANGAR OWNERS ASSOCIATION

Aircraft Storage Hangars - Two aircraft storage hangars are owned by the City and managed by McKinney Air Center for storing long-term (based) and short-term (transient) aircraft tenants. The construction of a third hangar is scheduled for mid-2017. CareFlite uses one of the hangars, which is an aeromedical evacuation SASO. They maintain standby quarters in the hangar's office area, which has two restrooms, a lounge, and several offices used for equipment storage, as well as crew sleeping areas.

Condominium Box Hangars - Twenty-four box hangars are managed by the Collin County Hangar Owners Association, a condominium organization that maintains a liaison with the Airport through its organization's president. The Collin County Hangar Owners Association leases land from the City, upon which individual, privately-owned and maintained hangars are sited.

Condominium Linear Box Hangars - Thirty-two linear box hangars are managed by the McKinney Hangar Owners Association, an organization similar to the Collin County Hangar Owners Association. The McKinney Hangar Owners Association leases land from the City, upon which individual, privately-owned, and

maintained hangars are sited. Even though many in the grouping are physically connected (linear), they are each privately-owned and maintained.

Linear Box Hangars - Five linear box hangars are owned by the City and managed by the McKinney Air Center. One of the five hangars and its adjourning end unit was transformed into office and storage space for use by the Airport as an airfield maintenance facility. As the Airport's Operations Division grows, a second hangar unit will be used for storage, equipment repair, and maintenance.

Another hangar is used for helicopter maintenance by PHI SkyMed, an aeromedical evacuation company. An adjoining end unit was transformed into crew stand-by quarters with bathroom facilities, a kitchen, dayroom, and crew sleeping areas. The quarters are not used as a residential facility.

T-hangars - Ninety-three T-Hangars are owned by the City and managed by the McKinney Air Center. The hangars are identified by hangar door width as either 40-feet wide, 50-feet wide, or 60-feet wide. They are leased by individual aircraft owners; however, some are sublet to multiple aircraft owners.

SASO Hangars - Three SASO hangars are owned by the City and managed by the McKinney Air Center. The largest hangar is occupied by Monarch Air, an all-encompassing Aviation Service Company that operates as a multiple commercial aeronautical activities SASO. The second hangar is occupied by Select Avionics, which provides a full range of avionic products, services, and repair. Select Avionics sublets to Air-O Specialists of McKinney which provides small aircraft maintenance and, by agreement, attends to all aircraft incidents on the airfield. The third hangar is occupied by First Flight, a fixed-wing aeromedical evacuation company.

Executive Hangars – The City owns three executive hangars that are administratively managed by the McKinney Air Center. A corporate flight department occupies each hangar. One of the hangars was updated in 2016 for an increased rental payment. The second hangar is in the process of being updated and expanded by the City for increased rental payment. The third hangar is privately owned by Ag-Power, a John Deere sales and service network.

Table 1J lists all hangars at the Airport. Note that all City-owned hangars are occupied at the time of this Master Plan.

TABLE 1J
Hangar Facilities
McKinney National Airport

Owner/Name	Type	Number of Hangar Units	Hangar Size	Lease Site	Date Built	Building Condition
McKinney Hangar Owners Association	Linear Box	32	74,323 sf	167,930 sf	2003	Good
Collin County Hangar Owners Association	Box	24	100,293 sf	236,184 sf	2006	Good
City of McKinney/ MAC1	Aircraft Storage	1	16,994 sf	60,000 sf	2016	Good
City of McKinney/ Tres Hangar	Conven-tional	1	14,478 sf	36,075 sf	2003	Good
City of McKinney/ Ag Power	Executive	1	13,502 sf	35,520 sf	2003	Good
City of McKinney/ 200-series	T-hangars	60	62,248 sf	N/A	1986	Poor
City of McKinney/ Select Avionics	SASO	1	16,539 sf	N/A	1986	Poor
City of McKinney/ Monarch	SASO	1	53,750 sf	135,792	1998	Good
City of McKinney/ 300-series	T-hangars	32	73,570sf	N/A	2000	Fair
City of McKinney/ 400-series	Linear Box	5	18,213sf	N/A	2000	Fair
City of McKinney/ Texas Instruments	Executive	1	42,950 sf	155,209 sf	1999	Good
City of McKinney/ Air Flite	Executive	1	32,745 sf	214,288 sf	2005	Good
City of McKinney/ First Flight	SASO	1	13,000 sf	N/A	1986	Poor

sf – Square feet
SASO: Specialized Aviation Service Operator
N/A: Not applicable
Source: Airport Management

AIRCRAFT PARKING APRONS

There are several designated aircraft parking apron areas at TKI. The apron area adjacent to the terminal complex extends approximately 500 feet along the west side of Taxiway A and provides for parking and circulation of large and small aircraft using FBO services offered by McKinney Air Center. In total, approximately 9,000 square yards of apron space are offered in this area.

NORTH AIRCRAFT PARKING APRON

Farther north, there is a dedicated parking apron that contains 67 marked tiedowns for smaller general aviation aircraft. This apron area is comprised of approximately 26,400 square yards of space and is also located directly adjacent to the west side of Taxiway A and north of the 200-series T-hangar complexes.

To the south of the terminal area, approximately 16,500 square yards of parking apron space is available. Much of this area was recently reconstructed and expanded in 2015, and offers additional aircraft parking and circulation for transient and based aircraft.

There are several other dedicated parking aprons adjacent to specialty aviation operators that conduct aviation activity on the west side of the Airport. There are additional parking apron areas located throughout the Airport near conventional, executive, T-hangars, and linear box hangars.

All totaled, there are approximately 93,700 square yards of aircraft parking apron offered at the Airport. Within these areas, approximately 70 marked tiedown positions are offered for smaller general aviation aircraft. Most of the parking apron areas at the Airport contain unmarked space that can be configured to meet the demands of small general aviation aircraft up to large business jets.

VEHICLE PARKING BY TERMINAL COMPLEX

VEHICLE PARKING

There are 319 marked vehicular parking spaces to support facilities at the Airport, 78 of which are available for public or common use in the area adjacent to the terminal complex and FBO maintenance hangar, and to the west and south of the ATCT. A total of 241 parking spaces are associated with corporate or otherwise-designated facilities across the Airport.

AVIATION SERVICES

Businesses that choose to locate on or near Airport property provide a significant impact not only to the Airport, but the region as well. Businesses will benefit from being near a commerce and transportation hub, and the community will benefit because the Airport will develop a buffer of industry and manufacturing that will restrict incompatible land uses, such as residential housing, from locating too close to the Airport. Business development on and around an airport can also generate a direct revenue stream. At TKI, there are a variety of aviation services, including aircraft fueling, aircraft parking, hangar space/leasing, flying clubs, flight instruction, air medical services, and aircraft maintenance.

FIXED BASE OPERATOR (FBO) – MCKINNEY AIR CENTER

McKinney Air Center is the only FBO at the Airport. The FBO provides a large host of services, listed below. The hours of operations are from 6:00 a.m. to 10:00 p.m. daily with after-hours services available on request.

Aircraft Fueling

- AVNET Premier FBO Dealer
- AvFuel Brand Jet-A and 100LL
- Competitive Contract Fuel Programs
- Volume fuel discounts
- Promotional AVTRIP Program
- All aircraft fueling capabilities

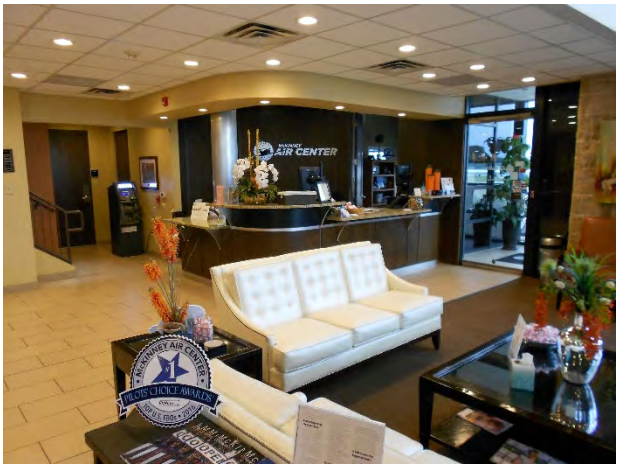
MCKINNEY AIR CENTER

Line Service

- Aircraft storage
- Cleaning and detailing
- Tie-down space
- GPU available
- National Air Transportation Association safety 1st certified line technicians
- Onsite aircraft maintenance and avionics service

Flight Crew Amenities

- Catering
- Complimentary ice, coffee, and newspaper
- Conference room
- Courtesy crew cars
- Flight planning with WSI weather system
- Hotel verification reservation service
- Most major credit cards accepted
- Oxygen and nitrogen service
- Enterprise Rent-a-Car onsite
- Private crew lounge
- Sleep room and showers
- U.S. Customs onsite
- Wi-Fi and internet access



MCKINNEY AIR CENTER

- Lavatory servicing
- Baggage handling
- Secure, climate-controlled hangars
- Standard T-hangars available

In addition to the wealth of services provided by the FBO, McKinney Air Center was voted, for the third year in a row, as one of the top ten FBOs in the U.S. in 2016.

The McKinney Air Center has U.S. Customs and Border Protection (CBP), which is available Monday through Friday from 8:00 a.m. to 5:00 p.m. and is on call after hours. The Airport requires at least a 24-hour notice for all international arrivals. All arriving flights must contact the DFW Landing Rights Office at (972) 456-2333 or (972) 456-2260 for landing rights approval. Weekend arrivals must be scheduled by 4:30 p.m. on the Friday before the weekend. Holiday arrivals must be scheduled by 4:30 p.m. the day before a holiday, and if the holiday falls on a Monday, the arrival must be scheduled before 4:30 p.m. the preceding Friday. All forms and publications related to CBP are available at the Airport's website (flytki.com).

SPECIALIZED AVIATION SERVICE OPERATORS (SASOs)

There are four SASOs at TKI, as detailed below.

AIR-O Specialists of Texas – offers a full line of aviation maintenance. This SASO is available 24-hours per day.

Select Avionics – provides avionics repairs and panel upgrades to a wide variety of aircraft. Select Avionics is an authorized dealer and service center for Garmin, Avidyne, S-Tec, Kin, Aspen, and many other manufacturers.

SELECT AVIONICS

Monarch Air – this SASO provides aircraft maintenance, flight instruction and rental, charter services, and aircraft sales. Monarch Air is an FAA Part 145 repair station, as well as a certified service center for Cessna, Lycoming, and Garmin. Monarch Air also offers on-demand charter services, as well as a jet program for individuals who fly more regularly.

First Flight – offers aeromedical services, as well as turbo aircraft maintenance to the public.

FLIGHT SCHOOLS & FLYING CLUBS

There are three entities at the Airport that operate flight schools: Monarch Air, ATP Flight School, and Le Tourneau University.

Monarch Air is an approved FAA FAR Part 61 and 141 flight training facility, offering discovery flight opportunities, private pilot training, instrument meteorological conditions (IMC) training, commercial pilot, and multi-engine training.

ATP Flight School offers airline transport pilot programs, commercial pilot programs, multi-engine time building programs, type rating programs, and aircraft dispatchers programs.

Le Tourneau University is a college of Aviation and Aeronautical Science that offers programs related to pilot training, aircraft maintenance, air traffic control, and mission aviation training.

The Texins Flying Club is the only local flight club that flies out of TKI. The flying club's purpose is to promote an interest in aviation and cultivate camaraderie among aviators in the area.

LE TOURNEAU UNIVERSITY CO-LOCATED WITH TERMINAL COMPLEX

AIR MEDICAL SERVICES

The Airport has three air medical services on site that provide emergency medical transportation.

PHI SkyMed – provides medical transportation, contracting with hospitals and communities, primarily operating helicopters. PHI has its own helicopter pad located on the east end of the City's 400-series linear box hangars. PHI departures typically involve the utilization of Taxiway B4 to gain access to Taxiway B before lifting off. For arrivals, PHI usually enters straight into their pad from the south, or loop around the ATCT on the west side to approach their pad from the south, as well.

PHI SKYMED HELICOPTER

CareFlite – provides medical transportation primarily via helicopter, responding to requests from hospitals, fire departments, EMS agencies, and law enforcement

within a 150-mile radius in the Dallas-Fort Worth Metroplex. CareFlite recently based a helicopter at the Tres Hangar and began operations in 2016. CareFlite takeoffs and landings occur on the apron attached to the west side of the Tres Hangar, where there currently is sufficient open land for their operations. As the Airport develops, these landing and takeoff procedures may require adjustment.

CAREFLITE HELICOPTER

First Flight – fully-licensed air ambulance company that provides around-the-clock medical air transport for emergency and non-emergency patients. First Flight uses airplanes to provide quieter, faster, and more spacious transport to patients.

FIRST FLIGHT

SUPPORT FACILITIES

Several support facilities serve as critical links in providing the necessary efficiency to aircraft ground operations, such as aircraft rescue and firefighting (ARFF), airfield maintenance, and fuel storage.

FIRE STATION AND ARFF

Part 139 airports are required to provide ARFF services during air carrier operations. Each certificated airport maintains equipment and personnel based on an ARFF index established per the length of aircraft and schedule daily flight frequency. There are five indices, A through E, with A applicable to the smallest aircraft and E the largest (based on aircraft length). Although TKI is not currently certificated under Part 139 and is not required to provide ARFF, the Airport maintains an ARFF facility in addition to the fleet of equipment and trained personnel required.

MCKINNEY FIRE STATION 4

The ARFF building is located at 1401 Industrial Boulevard, adjacent to McKinney Fire Station 4. The station is approximately 10,000 square feet and in good condition. This facility provides fire safety to the Airport and the surrounding community. Firefighters are

assigned to the station 24/7, 365 days per year, with emergency firefighting vehicles and medical attention nearby in the event of an emergency. Firefighters at this location are trained in EMS and are professional, ARFF-trained aircraft rescue firefighters. Other than Fire Station 4 on Airport property, the nearest fire stations are McKinney Fire Stations 1 and 6. There is a Collin County Mutual Aid Agreement with all agencies in Collin County.

The equipment stored at this location includes a crash rescue truck, a fire engine, and a utility light and air truck. The ARFF vehicle includes the following features:

- Dual agent hose reel (dry chemical)
- Forward-looking infra-red ball camera system (FLIR) for enhanced night vision
- 1500-gallon per minute (GPM) pump
- 1500-gallon water tank capacity
- 2007 E-One
- 205-gallon foam tank capacity
- 375/750 GPM bumper turnet 16 PPS (dry chemical)
- 375/705 GPM roof turnet

AIRPORT MAINTENANCE FACILITIES

Equipment, such as vehicles, mowers, and runway sweepers, that the Airport owns is stored in a 400-series linear box hangar bay.

- FODBOSS-8AC Runway Sweeper Mat
- 2007 Ford Explorer
- 2008 John Deere Tractor
- Two 2008 John Deere Rotary Cutters
- 2009 Toro Groundsmaster 4000-D
- 2011 Ford F250 Pick-up
- 2010 John Deere Gator UTV
- 2003 Yale Forklift
- 2012 John Deere Tractor
- 2012 John Deere Rotary Cutter
- 2013 John Deere Zeroturn Mower
- 2014 Ford F250
- 2014 Wylie LCS Trailer Sprayer
- TLD Ground Power Unit
- Hobart Ground Power Unit
- Sun EV Golf Cart S48-8 Shuttle
- 2013 Lektro Tug AP8600A
- 2013 Lektro Tug AP8850SDA
- Two 2014 John Deere 3520 Tractors
- 1986 Ford F600 De-icing Truck

AIRPORT MAINTENANCE FACILITY/EQUIPMENT

AIRPORT MAINTENANCE FACILITY/EQUIPMENT

- Power King Ground Power Unit
- 2016 Fisher Snow Plow Attachment
- 2016 Fisher Hopper Spreader
- 2016 Ford F450 4x4 Regular cab
- 2016 BigTex 12' Utility Dump Trailer

MCKINNEY AIR CENTER FUEL TRUCKS

FUEL STORAGE

Fuel storage facilities at the Airport were upgraded from underground to aboveground fuel tanks in 2002 to promote the safe and environmentally conscious storage of bulk aircraft fuel. McKinney Air Center is the only FBO at TKI offering fuel storage and delivery. McKinney Air Center operates four fuel trucks:

- Two Jet-A – 5,000 gallons and 3,000 gallons
- Two Avgas – 1,200 gallons each truck
- Prist fuel system icing inhibitor available upon request

ABOVE GROUND FUEL STORAGE TANKS

The fuel farm is located directly north of the Collin County Hangar Owners Association hangars. For safety, a six-foot chain-link fence with a one-foot angled barbed-wire top surrounds the farm. The site is also well-lit with two motion-activated CCTV cameras that record all activity.

The farm has 10 tank pads, four of which are currently occupied by above ground storage tanks (AGST). The remaining six pads are currently vacant. The fuel farm consists of the following:

- One 25,000-gallon Jet-A tank (installed 2003)
- One 12,000-gallon Avgas tank (installed 2003)
- Two 15,000-gallon tanks of Jet-A (installed 2005)

SELF-SERVE FUEL FACILITY

All pads have electric conduits running to them from a nearby electric transformer.

The fuel farm is a secondary retention basin with a storm water drain through a sand trap. The drain is kept closed except for drainage and only after a thorough check of the water quality. A self-service fuel island supported by one, 1,000-gallon Avgas and one 1,000-gallon Jet-A tank self-serve units is located farther north in the self-service fuel area. This facility was installed in 2016.

As shown in **Figure 1**, fuel sales have been highest in 2016 for all months except July 2015. The totals shown in this figure represent combined fuel sales for both Jet-A and 100LL fuel. In these last three years (2014 – 2016) the Airport has sold a total of 3.3 million gallons of fuel (Jet-A and 100LL).

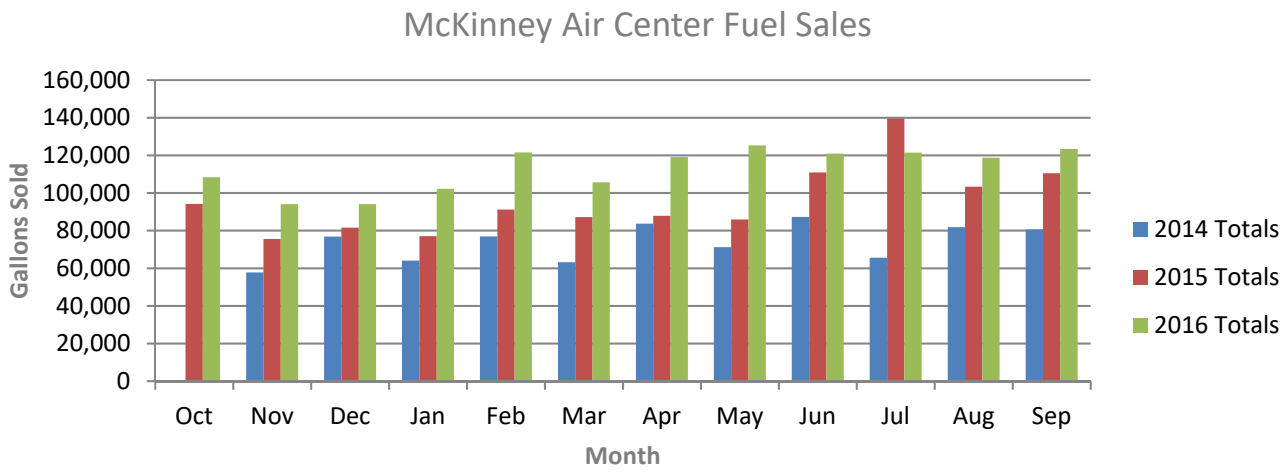


FIGURE 1 MCKINNEY AIR CENTER FUEL SALES (GALLONS)
SOURCE: AIRPORT MANAGEMENT

ACCESS GATE

VEHICLE AIRFIELD ACCESS AND PERIMETER FENCING

The Airport exceeds security guidelines established by the Transportation Security Administration's (TSA) Information Publication A-001 *Security Guidelines for General Aviation Airports* (2004). Airport staff controls perimeter access portals via six automated vehicular access gates, three pedestrian gates, and a ramp access door in the passenger terminal. These portals, as well as much of the runway, taxiway, and ramp areas, are monitored and recorded on video. Airport access cards are only issued to Airport tenants, contractors, and other authorized individuals for a fee.

The Airport has a state-of-the-art and expandable perimeter access control system that allows staff to manage access to the airfield using proximity card readers at each Airport-owned and operated pedestrian and vehicle gate. A camera system is also on-site to monitor and record activity. The combined use of individual access cards and the camera system allows the identification of most personnel who enter the Airport through an Airport-owned gate. Approximately 714 acres of Airport property – the Airport Operations Area – are surrounded by a six-foot chain-linked fence topped with three-strands of barbed-wire, which meets federal security standards.

AIRPORT PERIMETER FENCE

UTILITIES

The availability and capacity of the utilities serving the Airport are factors in determining the development potential of the Airport property, as well as the land immediately adjacent to the facility. Of primary concern in the inventory investigation is the availability of water, gas, sewer, and power sources.

- Water and wastewater – City of McKinney
- Trash and recycling – Progressive Waste
- Natural Gas – Atmos Energy
- Electrical – Powerlines are owned by Oncore Electric, with several different service providers (TXU, Reliant, Oncore Electric, and more)

AREA AIRSPACE AND AIR TRAFFIC CONTROL

The *FAA Act of 1958* established the FAA as the responsible agency for the control and use of navigable airspace within the U.S. The FAA has established the National Airspace System (NAS) to protect persons and property on the ground, in addition to establishing a safe and efficient airspace environment for civil, commercial, and military aviation. The NAS covers the common network of U.S. airspace, including air navigation facilities, airports and landing areas, aeronautical charts, associates rules, regulations, and procedures, technical information, and personnel and material. The system also includes components shared jointly with the military.

AIRSPACE STRUCTURE

Airspace within the U.S. is broadly classified as either “controlled” or “uncontrolled.” The difference between controlled and uncontrolled airspace relates primarily to requirements for pilot qualifications, ground-to-air communications, navigation and air traffic services, and weather conditions. Six classes of

airspace have been designated in the United States, as shown on **Exhibit 1J**. Airspace designated as Class A, B, C, D, or E is considered controlled airspace. Aircraft operating within controlled airspace are subject to varying requirements for positive air traffic control. Airspace near TKI is depicted on **Exhibit 1K**.

Class A Airspace: Class A airspace includes all airspace from 18,000 feet MSL to flight level (FL) 600 (approximately 60,000 feet MSL) over the contiguous 48 states and Alaska. This airspace is designated in Federal Aviation Regulation (F.A.R.) Part 71.33 for positive control of aircraft. All aircraft must be on an instrument flight rules (IFR) clearance to operate within Class A airspace.

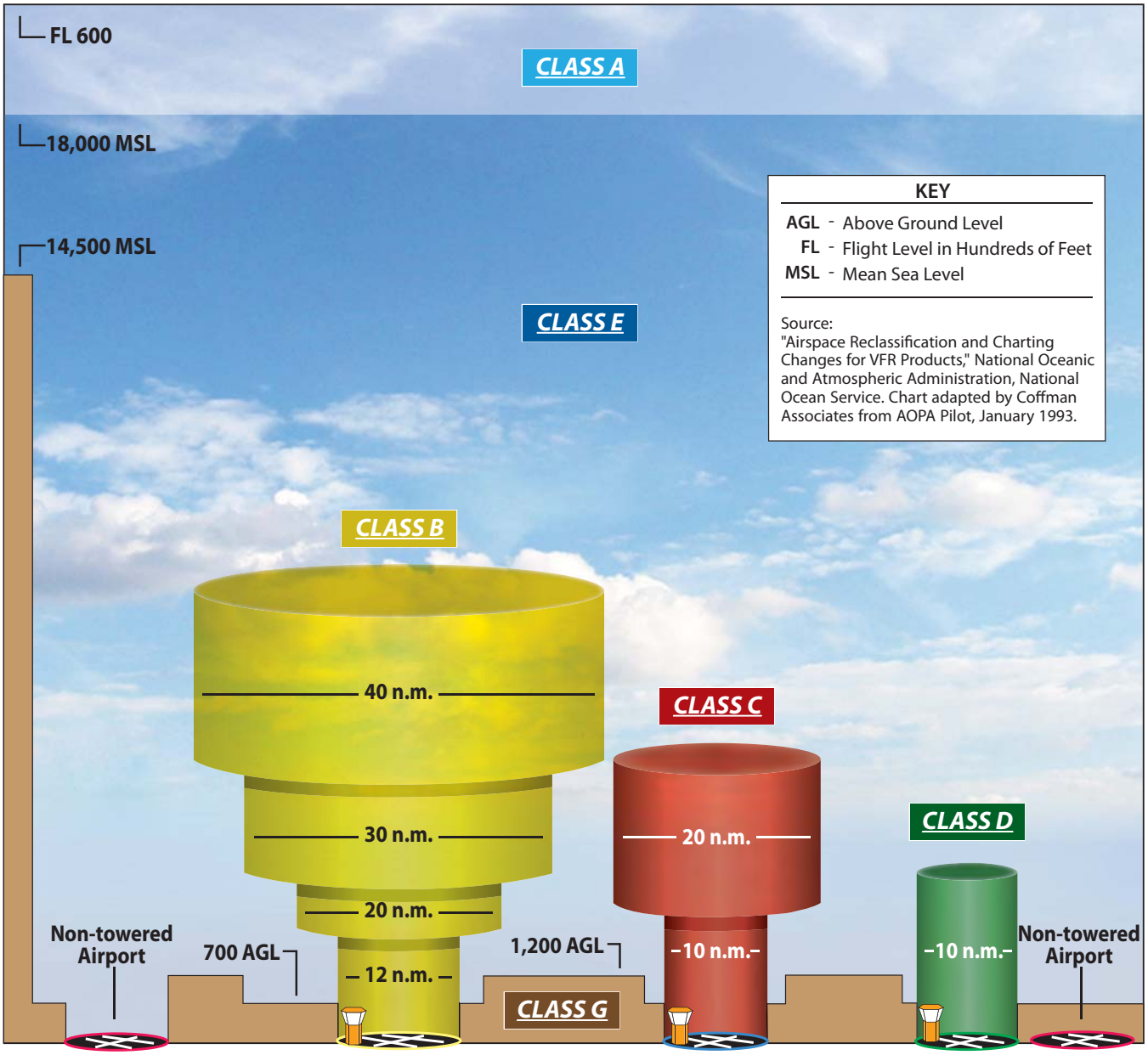
Class B Airspace: Class B airspace has been designated around some of the country's major airports, such as Dallas/Fort Worth International Airport (DFW) or Dallas Love Field (DAL), to separate all aircraft within a specified radius of the primary airport. Each Class B airspace is specifically tailored for its primary airport. All aircraft operating within Class B airspace must have air traffic control clearance. Certain minimum aircraft equipment and pilot certification requirements must also be met. This airspace is the most restrictive controlled airspace routinely encountered by pilots operating under visual flight rules (VFR) in an uncontrolled environment. The nearest Class B airspace supports DFW and DAL, to the southwest.

TKI is located beneath the outer segment of DFW Class B airspace, which begins at 4,000 feet MSL and extends to 11,000 feet MSL. As such, any aircraft operating in the designated Class B airspace around TKI must be equipped with a transponder that has Mode C capabilities and be in contact with ATC.

Class C Airspace: The FAA has established Class C airspace at approximately 120 airports around the country that have significant levels of instrument flight rules (IFR) traffic. Class C airspace is designed to regulate the flow of uncontrolled traffic above, around, and below the arrival and departure airspace required for high-performance, passenger-carrying aircraft at major airports. To fly inside Class C airspace, an aircraft must have a two-way radio, an encoding transponder, and have established communication with the ATC facility. Aircraft may fly below the floor of the Class C airspace or above the Class C airspace ceiling without establishing communication with ATC. The nearest Class C airspace to TKI surrounds Abilene Regional Airport (ABI), approximately 163 nautical miles to the west.

Class D Airspace: Class D airspace is controlled airspace surrounding airports with an ATCT. The Class D airspace typically constitutes a cylinder with a horizontal radius of four or five nautical miles (nm) from the airport, extending from the surface up to a designated vertical limit, typically set at approximately 2,500 feet above the airport elevation. As shown on **Exhibit 1K**, TKI operates within Class D airspace beginning at the surface and extending to 2,900 feet MSL during the operational hours of the ATCT. Aircraft operators planning to operate within Class D airspace are required to contact the TKI air traffic control prior to entering or departing TKI airspace and must maintain in contact while within the controlled airspace to land at TKI or to transverse the area. When the ATCT is inactive, TKI airspace reverts to Class E airspace.

Class E Airspace: Class E airspace consists of controlled airspace designed to contain IFR operations near an airport and while aircraft are transitioning between the airport and enroute environments. Unless



DEFINITION OF AIRSPACE CLASSIFICATIONS

CLASS A Generally airspace above 18,000 feet MSL up to and including FL 600.

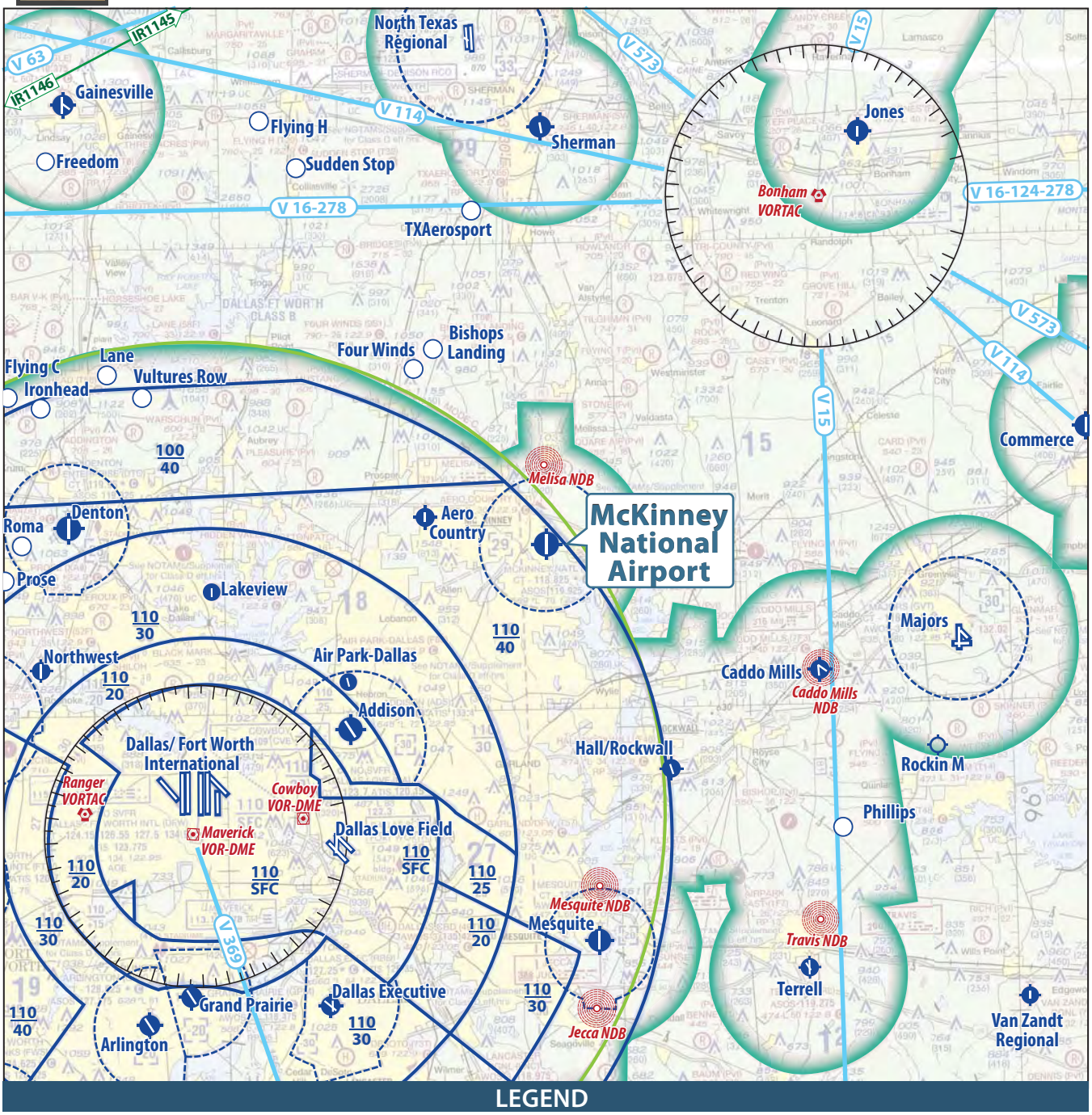
CLASS B Generally multi-layered airspace from the surface up to 10,000 feet MSL surrounding the nation's busiest airports.

CLASS C Generally airspace from the surface to 4,000 feet AGL surrounding towered airports with service by radar approach control.

CLASS D Generally airspace from the surface to 2,500 feet AGL surrounding towered airports.

CLASS E Generally controlled airspace that is not Class A, Class B, Class C, or Class D.

CLASS G Generally uncontrolled airspace that is not Class A, Class B, Class C, Class D, or Class E.



LEGEND

- Airport with other than hard-surfaced runway
- Airport with hard-surfaced runways 1,500' to 8,069' in length
- Airports with hard-surfaced runways greater than 8,069' or some multiple runways less than 8,069'
- VORTAC
- VOR-DME
- Non-directional Radiobeacon (NDB)
- Compass Rose
- Class B Airspace
- Mode C
- Class D Airspace
- Class E Airspace with floor 700 ft. above surface
- Victor Airways
- Military Training Routes

NORTH

NOT TO SCALE

Source: Dallas Sectional Charts, US Department of Commerce, National Oceanic and Atmospheric Administration - 09/15/16

otherwise specified, Class E airspace terminates at the base of the overlying airspace. Only aircraft operating under IFR are required to be in contact with ATC when operating in Class E airspace. While aircraft conducting visual flights in Class E airspace are not required to be in radio communications with ATC facilities, visual flight can only be conducted if minimum visibility and cloud ceilings exist.

As previously discussed, when the ATCT is inactive, TKI operates within Class E airspace. TKI Class E airspace extends from the surface up to 4,000 feet MSL where DFW/DAL Class B airspace begins.

Class G Airspace: Airspace not designated as Class A, B, C, D, or E is considered uncontrolled, or Class G, airspace. Air traffic control does not have the authority or responsibility to exercise control over air traffic within this airspace. Class G airspace lies between the surface and the overlaying Class E airspace (700 to 1,200 feet above ground level).

While aircraft may technically operate within this Class G airspace without any contact with ATC, it is unlikely that many aircraft will operate this low to the ground. Furthermore, federal regulations specify minimum altitudes for flight. F.A.R. Part 91.119*, Minimum Safe Altitudes*, generally states that except when necessary for takeoff or landing, pilots must not operate an aircraft over any congested area of a city, town, or settlement, or over any open-air assembly of persons, at an altitude of 1,000 feet above the highest obstacle within a horizontal radius of 2,000 feet of the aircraft.

Over less congested areas, pilots must maintain an altitude of 500 feet above the surface, except over open water or sparsely populated areas. In those cases, the aircraft may not be operated closer than 500 feet to any person, vessel, vehicle, or structure. Helicopters may be operated at less than the minimums prescribed above if the operation is conducted without hazard to persons or property on the surface. In addition, each person operating a helicopter shall comply with any routes or altitudes specifically prescribed for helicopters by the FAA.

Special Use Airspace: Special use airspace is defined as airspace where activities must be confined because of their nature or where limitations are imposed on aircraft not taking part in those activities. The designation of special use airspace identifies for other users the areas where military activity occurs, provides for segregation of that activity from other fliers, and allows charting to keep airspace users informed. These areas are depicted on **Exhibit 1K**.

Victor Airways: For aircraft arriving or departing the regional area using VOR facilities, a system of Federal Airways, referred to as Victor Airways, has been established. Victor Airways are corridors of airspace eight miles wide that extend upward from 1,200 feet above ground level (AGL) to 18,000 feet MSL and extend between VOR navigational facilities. Victor Airways are shown with blue lines on **Exhibit 1K**. For aircraft enroute or departing TKI, there are several Victor Airways available converging at the Bonham VORTAC, which is approximately 36 miles northeast of TKI.

Alert Areas: Alert Areas are depicted on aeronautical charts to inform nonparticipating pilots of areas that may contain a high volume of pilot training or an unusual type of aerial activity. Pilots should exercise caution within these areas. All activity within an alert area should be conducted in accordance with

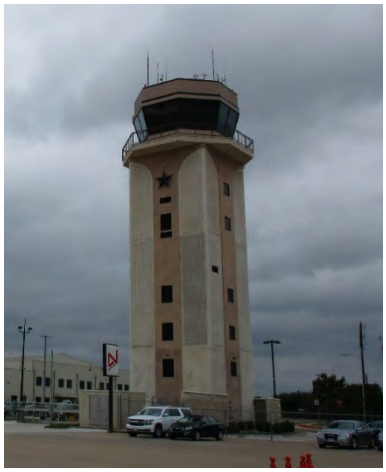
regulations, without waiver, and pilots of participating aircraft, as well as pilots transitioning the area, are equally responsible for collision avoidance. There are no Alert Areas near TKI.

AIRSPACE CONTROL

The FAA has established 21 Air Route Traffic Control Centers (ARTCCs) throughout the continental United States to control aircraft operating under IFR within controlled airspace and while enroute. An ARTCC assigns specific routes and altitudes along Federal Airways to maintain separation and orderly traffic flow. The Fort Worth Center ARTCC controls IFR airspace enroute to and from TKI.

Flight service stations (FSS) are air traffic facilities which provide pilot briefings, flight plan processing, inflight radio communications, search, and rescue (SAR) services, and assistance to lost aircraft and aircraft in emergency situations. FSSs also relay air traffic control clearances, process NOTAMs, broadcast aviation meteorological and aeronautical information, and notify Customs and Border Protection of trans border flights. The Fort Worth FSS is the nearest FSS facility to TKI.

Airport Traffic Control Tower (ATCT): Airport traffic at TKI has been controlled since 1996, when a temporary tower was relocated from Alliance Airport to TKI for use by federal contract controllers. That tower was located approximately 220 feet south of the terminal complex. A replacement ATCT was constructed between 2010 and 2011 that began operating on February 18, 2011, as a federal contract tower, with a controller eye level of 78 feet above ground level. The roof height is approximately 90 feet, with the height to the top of the antennas approximately 110 feet. The ATCT is located approximately 80 feet south of the terminal complex on the west side of the airfield. The tower operates from 6:00 a.m. to 10:00 p.m. local time, seven days a week. The primary responsibilities for tower controllers is to sequence and separate local arriving and departing traffic, as well as provide ground control direction to aircraft taxiing on the ground. Tower radio frequencies are:


MCKINNEY NATIONAL AIRPORT ATCT

- 121.875 for Ground Control
- 118.825 for Tower and CTAF after-hours

FLIGHT PROCEDURES

Flight procedures are a set of predetermined maneuvers established by the FAA, using electronic or visual navigational aids that assist pilots in locating and landing or departing from an airport. For TKI, there are instrument approach procedures and departure procedures as shown on **Exhibit 1L**.

	WEATHER MINIMUMS BY AIRCRAFT TYPE							
	Category A		Category B		Category C		Category D	
	CH	VIS	CH	VIS	CH	VIS	CH	VIS
ILS or LOC Runway 18								
Straight-In ILS	200	½	200	½	200	½	200	½
Straight-In LOC	844	½	844	¾	844	1 ⅞	844	1 ⅞
Circling	831	1 ¼	831	1 ¼	831	2 ½	831	2 ¾
RNAV (GPS) Runway 18								
LPV DA	200	½	200	½	200	½	200	½
LNAV MDA	344	½	344	½	344	⅝	344	⅝
Circling	531	1	531	1	531	1 ½	611	2
RNAV (GPS) Runway 36								
LPV DA	200	¾	200	¾	200	¾	200	¾
LNAV/VNAV DA	261	¾	261	¾	261	¾	261	¾
LNAV MDA	351	¾	351	¾	351	¾	351	¾
Circling	531	1	531	1	611	1 ¾	791	2 ½
VOR/DME-A								
Circling	771	1	771	1 ¼	771	2 ¼	771	2 ½

Aircraft categories are based on the approach speed of aircraft, which is determined as 1.3 times the stall speed in landing configuration. The approach categories are as follows:

Category A: 0-90 knots (e.g., Cessna 172)
Category B: 91-120 knots (e.g., Beechcraft King Air)
Category C: 121-140 knots (e.g., B-737, Regional Jets, Canadair Challenger)
Category D: 141-166 knots (e.g., B-747, Gulfstream IV)
Category E: Greater than 166 knots (e.g., Certain military aircraft)

Abbreviations:

CH - Cloud Height (feet above ground level)
DME - Distance Measuring Equipment
ILS - Instrument Landing System
LOC - Localizer
LP/LPV - Localizer Performance w/Vertical Guidance
GPS - Global Positioning System
LNAV/RNAV/VNAV - A technical variant of GPS (Lateral, Area, Vertical Navigation)
DA - Decision Altitude (Used for vertically guided approaches)
MDA - Minimum Descent Altitude (Used for non-precision approaches)
VIS - Visibility (in miles)
VOR - VHF Omnidirectional Radio

Source: AirNav

Instrument Approach Procedures

Instrument approach procedures are a series of predetermined maneuvers established by the FAA, using electronic navigational aids that assist pilots in locating and landing at an airport, especially during instrument flight conditions. There are currently four published instrument approach procedures, including an ILS approach to Runway 18. Precision instrument approaches provide vertical descent information and course guidance information to the pilot. Non-precision approaches only provide course guidance to the pilot; however, the relatively new GPS localizer performance with vertical guidance (LPV) approaches are currently categorized by the FAA as a non-precision approach even though it provides vertical guidance.

The visibility and cloud ceiling minimums associated with the approach define the capability of an instrument approach procedure. Visibility minimums define the horizontal distance the pilot must be able to see to complete the approach. Cloud ceilings define the lowest level a cloud layer (defined in feet above the ground) can be situated for the pilot to complete the approach. If the observed visibility or cloud ceilings are below the minimums prescribed for the approach, the pilot cannot complete the instrument approach. **Exhibit 1L** summarizes FAA-approved and published instrument approach procedures, including associated weather minimums for TKI.

The most sophisticated instrument approach procedures at TKI are associated with the ILS to Runway 18. The ILS or localizer (LOC) Runway 18 approaches provide visibility minimums as low as ½-mile and cloud ceilings of 200 feet AGL (referred to as a Category I or CAT I approach). Generally, this type of approach is considered the minimum for a commercial service airport; however, this approach is well-suited for a reliever airport such as TKI. Larger hub commercial service airports will typically have even more sophisticated instrument approaches offering lower visibility minimums (Categories II and III).

Instrument approaches based on the GPS have become very common across the country. GPS is inexpensive, as it does not require a significant investment in ground-based systems by an airport or FAA. Both runway ends at TKI are served by GPS approaches with associated minima, as presented on **Exhibit 1L**. GPS LPV approaches provide both horizontal and vertical guidance information to pilots. Advancements in GPS technology have allowed for instrument approach procedures to provide minimums nearly as low as more traditional ILS systems. Currently, the GPS approaches to each runway include an LPV component.

The other published approach utilizes VOR-DME technology and provides for circling minimums, which allow pilots the flexibility to land on the runway most closely aligned with the prevailing wind at that time. This flexibility generally requires circling approaches to have higher visibility minimums than the straight-in approaches. This is done to provide pilots with sufficient visibility and ground clearance to navigate visually from the approach to the desired runway end for landing. This circling instrument approach procedure is non-precision in nature.

Local Operating Procedures

The traffic pattern at the Airport is maintained to provide the safest and most efficient use of the airspace. It is preferred to keep the aircraft traffic pattern on the east side of the Airport; therefore, a standard left-hand traffic pattern is published for Runway 18 and a right-hand traffic pattern for Runway 36. Runway use for aircraft operations typically depends on the direction of the prevailing winds, which roughly equates to Runway 18 being used approximately 65 percent of the time and Runway 36 approximately 35 percent of the time. The typical traffic pattern altitude for rotorcraft is 500 feet AGL, piston aircraft is between 800 and 1,000 feet AGL, and 1,500 feet AGL for turbine aircraft.

Arrival Procedures: The most common arrival procedures for both IFR and VFR are from all corners of the surrounding airspace as they are not funneled through any designated point. Given the amount of training flights from Addison Airport (ADS), there are more VFR flights to and from the southwest compared to any other direction.

Departure Procedures: IFR aircraft departing Runway 18 typically fly a heading of 180 degrees climbing to 2,000 feet for the first several miles. IFR aircraft departing Runway 36 generally fly a heading of 360 degrees climbing to 3,000 feet for the first several miles. VFR aircraft depart in every direction; however, flying east or southeast over the lake is the most common, if the aircraft is not heading to ADS.

TKI does not have aircraft restrictions, curfews, or a mandatory noise abatement program, as these programs would violate the Federal *Airport Noise and Capacity Act* (ANCA) of 1990. Federal law requires the Airport to remain open 24 hours a day, 7 days a week, and to accept all civilian and military aircraft that can be safely accommodated. There are noise abatement signs at both ends of the runway that suggest ways pilots can fly friendly when departing the Airport.

AREA AIRPORTS

A review of other public-use airports with at least one paved runway within a 20-nautical mile radius of TKI was conducted to identify and distinguish the types of air service provided in the region (shown on **Exhibit 1M**). A 20-nautical mile radius was selected because under general FAA planning guidelines, this distance is assumed to approximately represent a 30-minute drive time, which is a common time/distance that a general aviation pilot or user is willing to drive to access a general aviation airport. Many of the nearby airports are privately-owned and are not open to public use. It is also important to consider the capabilities and limitations of these airports when planning for future changes or improvements at TKI. It should be noted that there are other airports in proximity to TKI.

TKI is the only publicly-owned airport in Collin County, and is also the only airport in the County with an ATCT. There are 11 airports in Collin County (including TKI) at the time of this Master Plan.

AERO COUNTRY AIRPORT (T31)

Airport NPIAS Classification ..... **N/A**
FAA Asset Study Classification ..... **N/A**
Location from TKI ..... **8 nm NW**
Elevation ..... **765 ft**
Weather Reporting ..... **None**
ATCT ..... **None**
Annual Operations **9,000**
Based Aircraft **244**
Enplaned Passengers ..... **N/A**

Runways	17-35
Length	4,352′
Width	60′
Pavement Strength	
SWL	6,500 lbs.
DWL	6,500 lbs.
Lighting	MIRL
Marking	Non-precision
Approach Aids	None
Instrument Approach Procedures	None

Services Provided: 100LL fuel, major airframe and power plant service.

AIR PARK-DALLAS AIRPORT (F69)

Airport NPIAS Classification ..... **N/A**
FAA Asset Study Classification ..... **N/A**
Location from TKI ..... **16 nm SW**
Elevation ..... **695 ft**
Weather Reporting ..... **None**
ATCT ..... **None**
Annual Operations **18,000**
Based Aircraft **63**
Enplaned Passengers ..... **N/A**

Runways	16-34
Length	3,080′
Width	30′
Pavement Strength	
SWL	Not Listed
DWL	Not Listed
Lighting	Non-standard LIRL
Marking	Non-standard
Approach Aids	None
Instrument Approach Procedures	None

Services Provided: 100LL fuel, aircraft tiedowns, and major airframe and power plant repairs.

RALPH M HALL/ROCKWALL MUNICIPAL AIRPORT (F46)

Airport NPIAS Classification ..... **GA**
FAA Asset Study Classification ..... **Local**
Location from TKI ..... **17 nm SE**
Elevation ..... **541.1 ft**
Weather Reporting ..... **Yes**
ATCT ..... **None**
Annual Operations **38,020**
Based Aircraft **67**
Enplaned Passengers ..... **N/A**

Runways	17-35
Length	3,373′
Width	45′
Pavement Strength	
SWL	12,000 lbs.
DWL	N/A
Lighting	LIRL
Marking	Non-precision
Approach Aids	None
Instrument Approach Procedures	None

Services Provided: 100LL and Jet-A fuel, aircraft tiedowns and parking, major airframe and power plant service, and high/low bottled oxygen.

ADDISON AIRPORT (ADS)

Airport NPIAS Classification ..... **Reliever**
FAA Asset Study Classification ... **National**
Location from TKI ..... **18 nm SW**
Elevation ..... **644.6 ft**
Weather Reporting ..... **AWOS**
ATCT ..... **Yes**
Annual Operations **96,476**
Based Aircraft **550**
Enplaned Passengers ..... **N/A**

Runways	15-33
Length	7,203′
Width	100′
Pavement Strength	
SWL	60,000 lbs.
DWL	120,000 lbs.
Lighting	HIRL
Marking	Precision
Approach Aids	PAPI-4, REIL (33 only)
Instrument Approach Procedures	ILS/DME

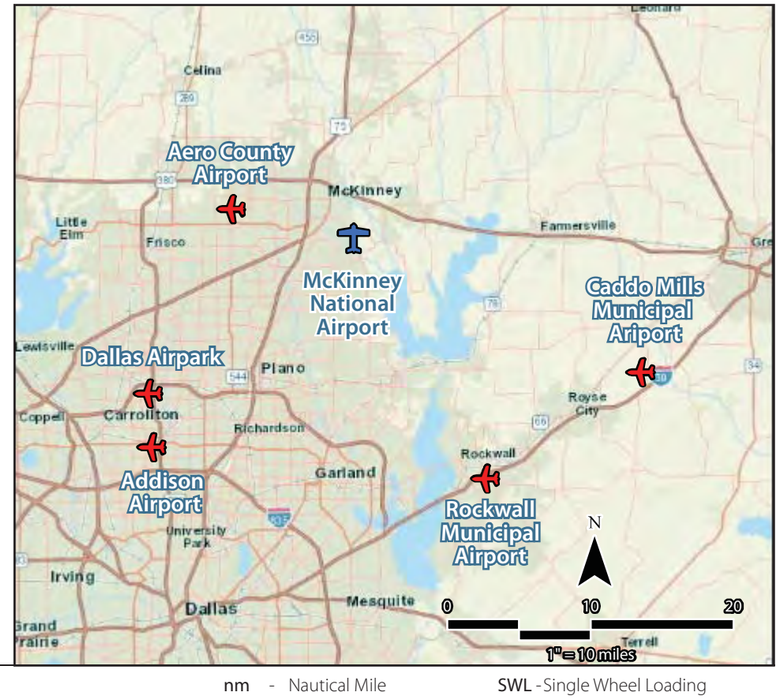
Services Provided: 100LL fuel and Jet A fuel, aircraft tiedowns and parking, major airframe and powerplant service, bottled and bulk oxygen.

CADDO MILLS MUNICIPAL AIRPORT (7F3)

Airport NPIAS Classification ..... **GA**
FAA Asset Study Classification **Unclassified**
Location from TKI ..... **19 nm SE**
Elevation ..... **541.6 ft**
Weather Reporting ..... **None**
ATCT ..... **None**
Annual Operations **14,000**
Based Aircraft **17**
Enplaned Passengers ..... **N/A**

Runways	13-31	18-36
Length	4,000′	4,000′
Width	150′	75′
Pavement Strength		
SWL	26,000 lbs.	26,000 lbs.
DWL	N/A	N/A
Lighting	None	MIRL
Marking	Basic	Non-precision
Approach Aids	None	None
Instrument Approach Procedures	None	None

Services Provided: 100LL fuel and aircraft tiedowns.



KEY

ATCT - Airport Traffic Control Tower
AWOS - Automated Weather Observation System
DME - Distance Measuring Equipment
DWL - Dual Wheel Loading
GA - General Aviation
HIRL - High Intensity Runway Lights
ILS - Instrument Landing System
MIRL - Medium Intensity Runway Lighting
N/A - Not Applicable
NPIAS - National Plan of Integrated Airport Systems
nm - Nautical Mile
REIL - Runway End Identifier Lights
SWL - Single Wheel Loading

Source: AirNav, Airport IQ 5010, FAA

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The following airports are privately-owned, and open to the public:

- Aero Country Airport
- Air Park Dallas

The following airports are privately-owned, and not open to the public (except for emergency use):

- Mullin's Landing
- Short Stop
- JSI
- Lavon North
- Bishop's Landing
- Baylie
- Square Air
- Flying 'T' Ranch

SOCIOECONOMIC CHARACTERISTICS

Socioeconomic characteristics are collected and examined to derive an understanding of the dynamics of growth near an airport. This information is essential in determining aviation demand level requirements as most general aviation demand is directly related to the socioeconomic condition of the surrounding area. Statistical analysis of population, employment, and income trends provide a picture of the economic strength of the region, as well as the ability of the area to sustain a strong economic base into the future. Additional socioeconomic data will be used in the forecast chapter; however, the information provided in this chapter will introduce socioeconomic trends in the study area.

Exhibit 1N shows population, employment, and income trends from 1970 to present day for Collin County, Dallas-Fort Worth-Arlington MSA, and the State of Texas, as well as future projections. **Exhibit 1P** displays information from the City of McKinney's Planning Department that describes historic, current, and future population figures, the top ten major employers in the City, and the top categories of employment in the area.

ENVIRONMENTAL INVENTORY

The Environmental Inventory addresses existing conditions at the Airport and its environs. This inventory is intended to help identify relevant environmental issues that should be considered during preparation of the Airport Master Plan. The inventory is organized using the resource categories contained in Federal Aviation Administration (FAA) Order 1050.1F, *Environmental Impacts: Policies and Procedures* (2015). Available information regarding the environmental conditions at the Airport and within the surrounding area has been derived from internet resources, agency maps, and existing literature. A comprehensive list of resources is included below.

AIR QUALITY

The United States (U.S.) Environmental Protection Agency (EPA) has established National Ambient Air Quality Standards (NAAQS) based on health risks for six pollutants:

- Carbon monoxide (CO)
- Nitrogen dioxide (NO_2)
- Sulfur dioxide (SO_2)
- Lead (Pb)
- Ozone (O_3)
- Two sizes of particulate matter (PM): PM measuring between 10 and 2.5 micrometers in diameter (PM_{10}), and PM measuring 2.5 micrometers or less in diameter ($PM_{2.5}$)

An area with ambient air concentrations exceeding the NAAQS for a criteria pollutant is said to be a nonattainment area for the pollutant's NAAQS, while an area where ambient concentrations are below the NAAQS is considered an attainment area. The U.S. EPA requires that areas designated as nonattainment demonstrate how they will attain the NAAQS by an established deadline. To accomplish this, states are required to prepare State Implementation Plans (SIPs). SIPs are typically a comprehensive set of reduction strategies and emissions budgets designed to bring the area into attainment.

TKI is in Collin County, Texas. According to the U.S. EPA's *Green Book – Texas Nonattainment/Maintenance Status for Each County by Year for All Criteria Pollutants*, Collin County is in nonattainment for 8-hour ozone (2008 standard) and lead (2008 standard). The County has until December 31, 2018, to reach conformity of the federal air quality standards. The 8-hour ozone (2008 standard) nonattainment designation is classified as moderate and as an impact to the entire County. A moderate nonattainment designation for 8-hour ozone (2008 standard) means that the area has a design value of up to 0.086 parts per million (ppm) (not including 0.100 ppm).[7] The lead (2008 standard) designation is unclassified and listed as an impact to part of the County. The design value for lead (2008 standard) is 0.15 micrograms per cubic meter (mg/m^3). This level is then averaged over a three-year period.[8]

Design Value – a statistic describing the air quality status of a location relative to the level of the National Ambient Air Quality Standards (NAAQS).

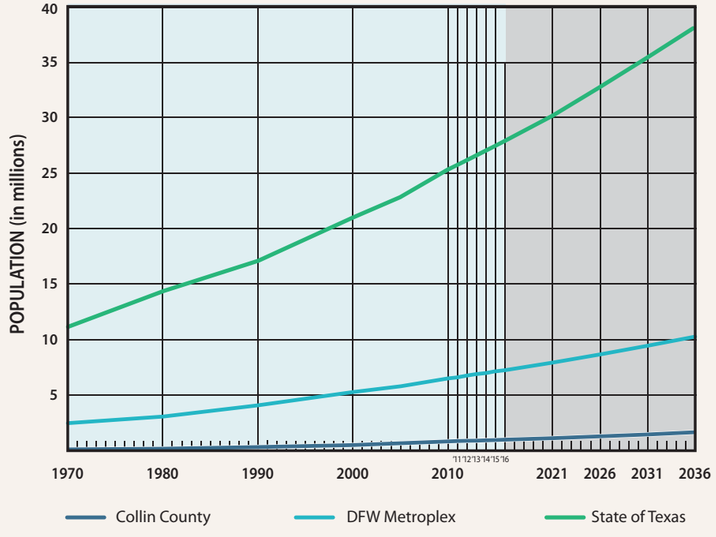
BIOLOGICAL RESOURCES

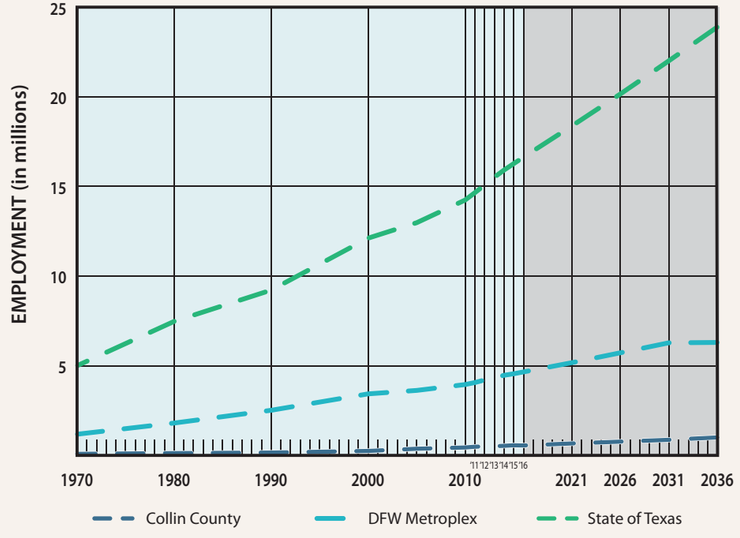
U.S. Fish and Wildlife Service (USFWS) is charged with overseeing the requirements of the *Endangered Species Act* (ESA), specifically Section 7, which sets forth requirements for consultation to determine if a proposed action "may affect" a federally endangered or threatened species. If an agency determines that an action "may affect" a federally protected species, then Section 7(a)(2) requires the agency to consult with USFWS to ensure that any action the agency authorizes, funds, or carries out is not likely to jeopardize the continued existence of any federally-listed endangered or threatened species, or result

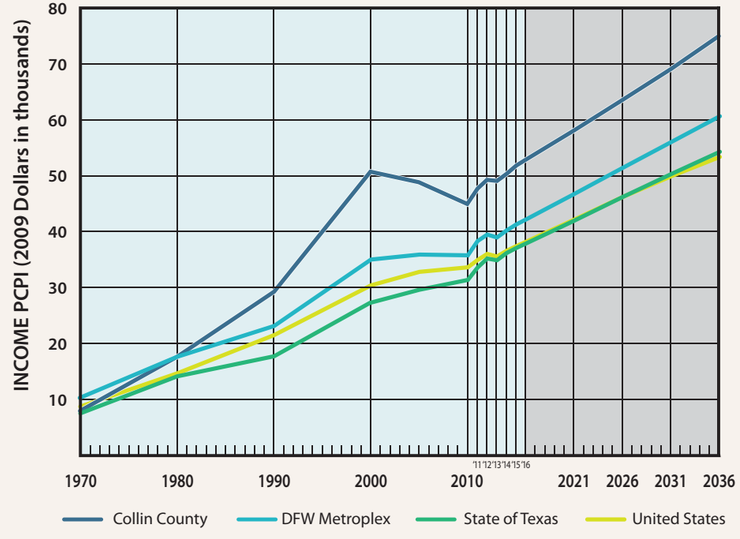
[7] https://www.epa.gov/green-book/ozone-designation-and-classification-information
[8] https://www.gpo.gov/fdsys/pkg/FR-2011-11-22/pdf/2011-29460.pdf#page=1

	HISTORICAL													PROJECTED				
	1970	1980	1990	2000	2005	2010	2011	2012	2013	2014	2015	2016	CAGR 2010-2016	2021	2026	2031	2036	CAGR 2016-2036
Population																		
Collin County	67,567	146,573	266,856	499,118	647,187	788,568	814,738	837,476	858,711	885,241	910,066	936,253	2.90%	1,078,176	1,239,518	1,420,907	1,620,367	2.75%
DFW Metroplex MSA	2,437,470	3,057,014	4,043,744	5,235,385	5,776,543	6,452,725	6,574,866	6,710,066	6,823,113	6,954,330	7,074,933	7,202,994	1.85%	7,877,428	8,607,941	9,387,510	10,193,675	1.73%
State of Texas	11,258,475	14,337,818	17,056,755	20,944,499	22,778,123	25,245,717	25,657,477	26,094,422	26,505,637	26,956,958	27,370,346	27,811,299	1.63%	30,127,388	32,624,041	35,272,724	37,988,744	1.56%
United States	203,982,313	227,225,622	249,622,814	282,162,411	295,516,599	309,347,057	311,721,632	314,112,078	316,497,531	318,856,967	321,545,081	324,506,944	0.80%	339,812,108	355,802,071	372,071,198	387,690,418	0.88%
Employment																		
Collin County	18,446	39,015	116,796	246,228	361,673	449,203	471,392	493,922	515,784	535,712	553,096	570,693	4.07%	663,011	765,697	879,267	1,004,171	2.81%
DFW Metroplex MSA	1,192,712	1,795,111	2,522,314	3,436,648	3,641,300	3,948,869	4,088,782	4,209,496	4,338,058	4,464,570	4,568,696	4,672,385	2.84%	5,193,598	5,738,031	6,299,453	6,874,365	1.89%
State of Texas	5,045,480	7,495,949	9,242,894	12,139,164	13,040,924	14,291,032	14,719,187	15,126,531	15,563,453	15,981,821	16,333,786	16,683,175	2.61%	18,425,339	20,231,603	22,081,828	23,968,203	1.77%
United States	91,277,573	113,983,152	138,330,928	165,370,857	172,557,332	173,034,656	176,278,657	179,081,633	182,390,004	185,798,752	188,866,185	191,870,817	1.74%	206,283,698	220,485,615	235,183,042	247,548,008	1.22%
Income - PCPI ($2009)																		
Collin County	$17,357	$25,672	$35,823	$54,642	$52,954	$49,687	$51,912	$53,310	$53,097	$54,210	$55,505	$56,437	2.15%	$61,019	$65,778	$70,601	$75,667	1.44%
DFW Metroplex MSA	$19,316	$25,736	$30,474	$40,836	$41,609	$41,498	$43,721	$44,733	$44,281	$45,374	$46,318	$47,089	2.13%	$51,027	$55,155	$59,174	$63,187	1.44%
State of Texas	$16,844	$22,621	$25,750	$34,121	$36,126	$37,659	$39,592	$40,995	$40,724	$41,857	$42,641	$43,342	2.37%	$46,915	$50,635	$54,181	$57,644	1.38%
United States	$18,777	$23,086	$29,050	$36,812	$38,916	$39,622	$40,762	$41,713	$41,310	$42,207	$42,928	$43,613	1.61%	$47,080	$50,611	$53,837	$56,840	1.26%

PCPI - Per Capita Personal Income **CAGR**: Compound Annual Growth Rate







Source: Woods & Poole Complete Economic and Demographic Data Source (CEEDS) 2016

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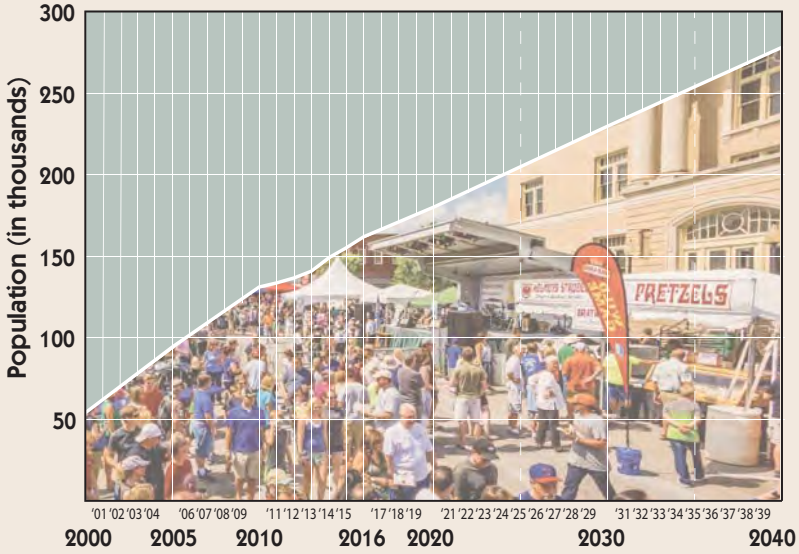
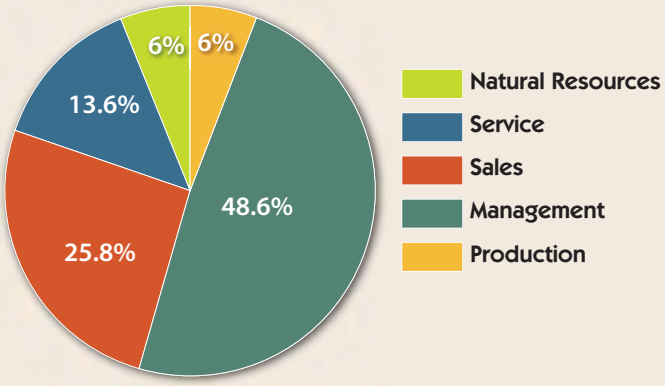
POPULATION GROWTH



TOP OCCUPATIONS



MAJOR EMPLOYERS

Employer		Number of Employees
Raytheon	Raytheon	3,600
McKinney ISD	McKinney ISD	3,147
Collin County	Collin County	1,823
Medical Center of McKinney	Medical Center of McKinney	1,071
Encore Wire	Encore Wire	1,050
City of McKinney	City of McKinney	975
Torchmark Corporation	Torchmark Insurance	860
W&C	Watson & Chalin	800
Baylor Health Care System	Baylor Medical Center	575
Collin College	Collin College	555

Source: City of McKinney Planning Department Photo Credit: McKinney Annual Report; Brad Clawson Photography

in the destruction or adverse modification of critical habitat. If a species has been listed as a candidate species, Section 7(a)(4) states that each agency must confer with USFWS.

Additional federal laws protecting fish, wildlife, and plants include the *Migratory Bird Treaty Act* (MBTA), which prohibits activities that would harm migratory birds, their eggs, or nests, and the *Bald and Golden Eagle Protection Act* (BaGEPA), which prohibits the take (defined as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb") of bald and golden eagles, including their parts, nests, or eggs, without a permit. Executive Order (E.O.) 13312, *Invasive Species* aims to prevent the introduction of invasive species because of a proposed action. (E.O. 11990, *Protection of Wetlands* is discussed under the *Water Resources* section of this report.)

During an Environmental Assessment (EA) completed in June 2007, a field evaluation report showed that the project area, which included the Airport property and immediately adjacent lands, consists of grassland with forested areas primarily confined to rivers, streams, and drainages. The report concluded that the dominant plant species includes little bluestem, indiangrass, Bermuda grass, and bahaigrass. The woody vegetation found in the forested area includes post oak, blackjack oak, water oak, winged elm, hackberry, and yaupon. During the time of this EA, no sensitive biotic communities, federally threatened, endangered plant or animal species, or habitat for federally protected species was identified. The Texas Parks and Wildlife Department's (TPWD) Texas Ecosystem Analytical Mapper (TEAM) (2015) identified that Blackland Prairie and row crops also surround the Airport.

A USFWS Information for Planning and Conservation (IPaC) report indicates that there are four protected species potentially occurring at the Airport. TPWD also maintains a list of federally, state, and candidate-listed species in Texas.

- Least Tern – *Sterna antillarum* (bird, endangered)
- Piping Plover – *Charadrius melodus* (bird, threatened)
- Red Knot – *Calidris canutus rufa* (bird, threatened)
- Whooping Crane – *Grus americana* (bird, endangered)

Table 1K lists bird species protected under the MBTA and *Bald and Golden Eagle Protection Act* that may be affected by activities at the Airport; it is not an exhaustive list of every bird species potentially found at this location. The Heard Natural Science Museum and Wildlife Sanctuary is a wildlife preserve near the Airport, approximately two miles southwest along Wilson Creek. The Heard Natural Science Museum and Wildlife Sanctuary is a 289-acre, privately-owned, natural science museum with the primary purpose of educating the public (specifically children) about nature. This Wildlife Sanctuary is home to many birds, butterflies, native plants, and snakes.[9]

[9] http://www.heardmuseum.org/

TABLE 1K
Birds Protected Under the *Migratory Bird Treaty Act* and *Bald and Golden Eagle Protection Act*

Protected Species (*Scientific name*)	Season Present
Bald Eagle (*Haliaeetus leucocephalus*)[1]	Wintering
Bell's Vireo (*Vireo bellii*)	Breeding
Dickcissel (*Spiza americana*)	Breeding
Fox Sparrow (*Passerella iliaca*)	Wintering
Golden Eagle (*Aquila chrysaetos*)	Wintering
Harris's Sparrow (*Zonotrichia querula*)	Wintering
Hudsonian Godwit (*Limosa haemastica*)	Migrating
Lark Bunting (*Kalamospiza melanocorys*)	Wintering
Le Conte's Sparrow (*Ammodramus leconteii*)	Wintering
Least Bittern (*Lxobrychus exilis*)	Breeding
Little Blue Heron (*Egretta caerulea*)	Breeding
Loggerhead Shrike (*Lanius ludovicianus*)	Year-Round
Mississippi Kite (*Ictinia mississippiensis*)	Breeding
Orchard Oriole (*Lcterus spurius*)	Breeding
Painted Bunting (*Passerina ciris*)	Breeding
Prothonotary Warbler (*Protonotaria citreat*)	Breeding
Red-headed Woodpecker (*Melanerpes erythrocephalus*)	Breeding
Rusty Blackbird (E*uphagus carolinus*)	Year-Round
Scissor-tailed Flycatcher (*Tyrannus forficatus*)	Breeding
Short-eared Owl (*Asio flammeus*)	Wintering
Sprague's Pipit (*Anthus spragueii*)	Wintering

[1] Listed as a threatened species by the Texas Parks and Wildlife Department (July 2016)
Source: USFWS Information for Planning and Conservation (accessed February 2017)

CLIMATE

According to the U.S. EPA, the transportation sector is one of the largest contributors to U.S. greenhouse gas (GHG) emissions. The *Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990-2014*, found that transportation represented 26 percent of the total U.S. GHG emissions in 2014. Transportation sources include cars, trucks, ships, trains, and planes. Over 90 percent of the fuel used for transportation is petroleum-based, which includes gasoline and diesel.[10] In addition to transportation-related emissions, **Figure 2** shows all GHG emissions in the U.S. by source.

Increasing concentrations of GHGs can affect global climate by trapping heat in the Earth's atmosphere. Scientific measurements have shown that Earth's climate is warming, with concurrent impacts, including warmer air temperatures, rising sea levels, increased storm activity, and greater intensity in precipitation

[10] https://www.epa.gov/ghgemissions/us-greenhouse-gas-inventory-report-1990-2014

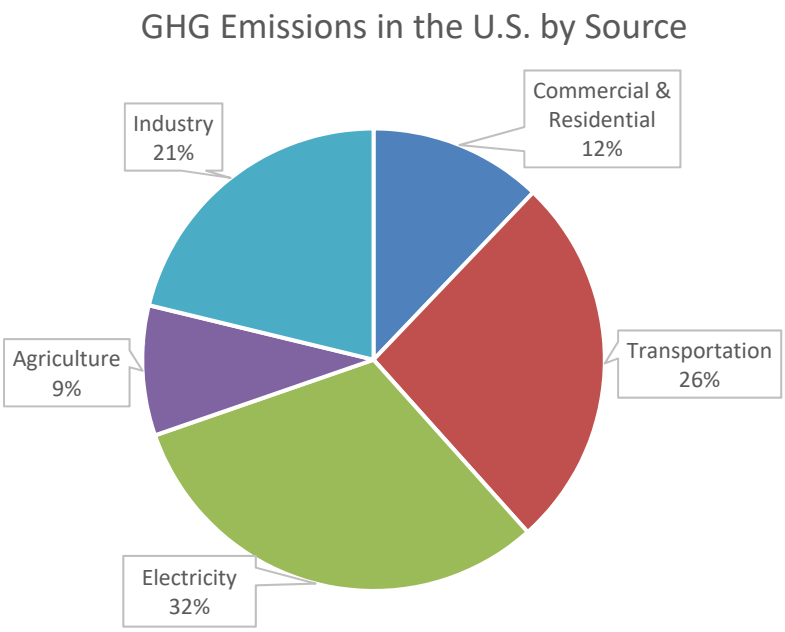


FIGURE 2 GHG EMISSIONS IN THE U.S. BY SOURCE
SOURCE: U.S. EPA (2014)

events. This climate change is a global phenomenon that can also have local impacts (IPCC 2014). GHGs, such as water vapor (H_2O), carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and ozone (O_3), are both naturally occurring and anthropogenic (man-made).

Research has also shown a direct correlation between fuel combustion and GHG emissions. GHGs from anthropogenic sources include CO_2, CH_4, N_2O, hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). CO_2 is the most important anthropogenic GHG because it is a long-lived gas that remains in the atmosphere for up to 100 years.

To date, there are no federal standards for aviation-related emissions. However, on August 4, 2016, the President's Council on Environmental Quality (CEQ) issued final GHG guidance directing federal agencies to consider the effects of climate change in NEPA reviews. The final GHG guidance does not include a static threshold for regulating GHG emissions, but rather states that projects should evaluate GHG emissions as they would with other reasonably foreseeable impacts from a proposed federal action. The final guidance from CEQ also suggests that federal agencies include GHG emissions impacts related to direct and indirect actions (i.e., the exploration and production of coal (direct) versus the combustion of coal (indirect).

COASTAL RESOURCES

Federal activities involving or affecting coastal resources are governed by the *Coastal Barriers Resource Act*, the *Coastal Zone Management Act*, and E.O. 13089, *Coral Reef Protection*. The Airport is in northern Texas, which is inland and approximately 290 miles north of the nearest ocean. The Airport is thus not subject to regulation under this resource category.

DEPARTMENT OF TRANSPORTATION (DOT) ACT: SECTION 4(f)

Section 4(f) of the DOT Act, which was recodified and renumbered as Section 303(c) of Title 49 United States Code (USC), states that the Secretary of Transportation shall not approve any program or project that requires the use of any publicly owned land from a historic site, public park, recreation area, or

waterfowl or wildlife refuge of national, state, regional, or local importance unless there is no feasible and prudent alternative to the use of such land, and the project includes all possible planning to minimize harm resulting from the use.

The term "use" includes not only the physical taking of such lands, but "constructive use" of such lands. "Constructive use" of lands occurs when "a project's proximity impacts are so severe that the protected activities, features, or attributes that qualify a resource for protection under Section 4(f) are substantially impaired" (Title 23 Code of Federal Regulations [CFR] Section 771.135).

There are three properties listed on the National Register of Historic Properties (NRHP) within one-and-one-half miles of the Airport.

- Crouch-Perkins House, 0.96 miles west from the Airport
- McKinney Cotton Mill Historic District, 0.77 miles west from the Airport
- Hill-Webb Grain Elevator, 1.1 miles west from the Airport[11]

There are three public parks within 1.5 miles from the Airport – Cottonwood Park on 212 McMakin Street (west of the Airport), Mouzon Park located at 1307 E. Greenville Avenue (northwest of the Airport), and Fitzhugh Park at 700 Fitzhugh Street (northwest of the Airport).

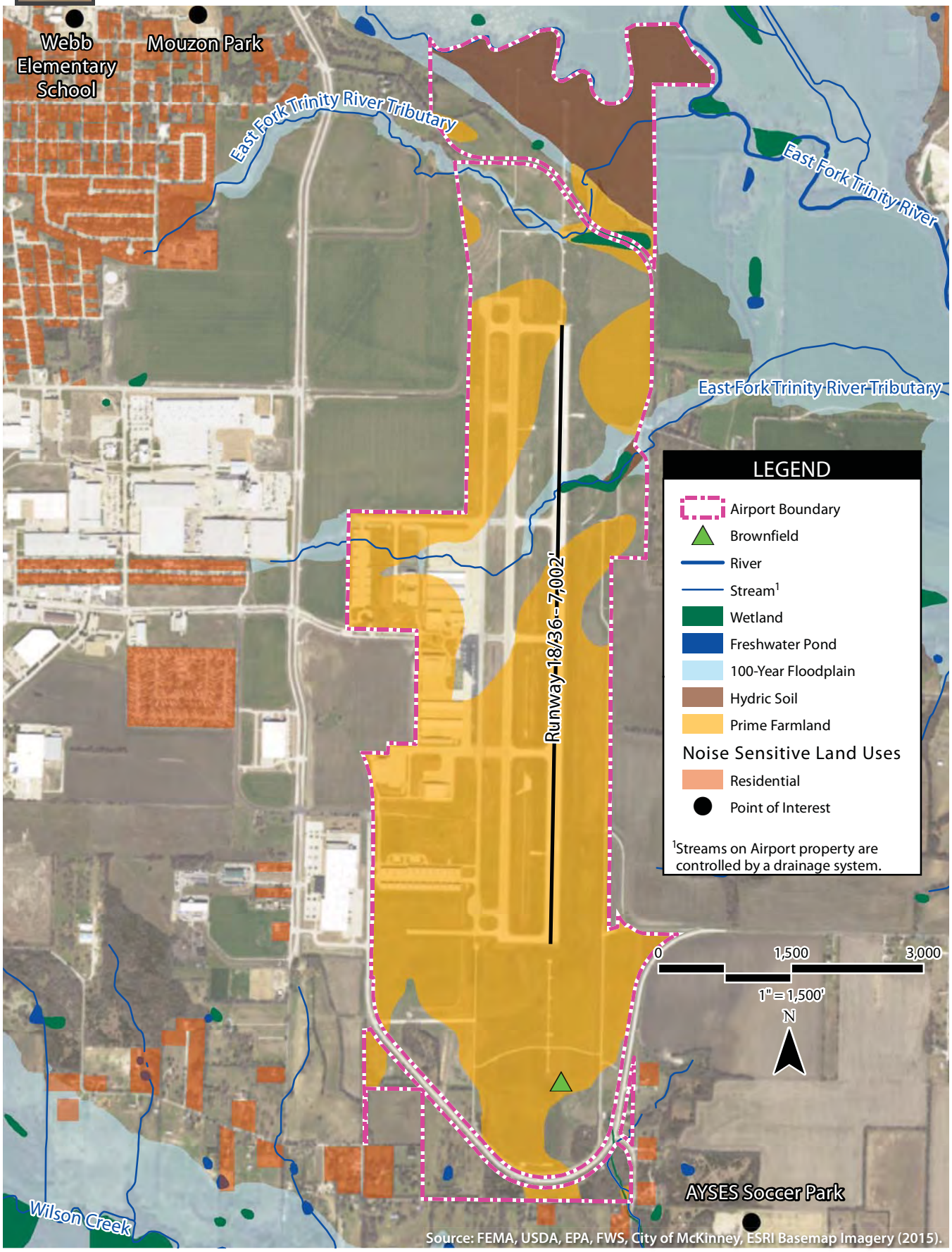
There are no wildlife refuges, recreation areas, or wilderness areas within 35 miles of the Airport.

FARMLANDS

The *Farmland Protection Policy Act* (FPPA) is intended to minimize the impact federal programs have on the unnecessary and irreversible conversion of farmland to nonagricultural uses. For FPPA, farmland includes prime farmland, unique farmland, and land of statewide or local importance. Farmland subject to FPPA requirements does not have to be currently used for cropland. It can also be forest land, pastureland, or other land, but not water or urban built-up land.

The U.S. Department of Agriculture, Natural Resources Conservation Service (USDA-NRCS) Web Soil Survey is a common source of information for soil types within mapped areas. According to the tool, 444 acres (60.6 percent) of Airport property is considered prime farmland. The remaining 288 acres of Airport property is not considered prime farmland. Airport property contains no soils considered unique farmland or land of statewide or local importance. These soils are shown on **Exhibit 1Q**.

[11] USGS website. *The National Atlas of the United States*. Shapefiles accessed February 2017.


Webb Elementary School
Mouzon Park
East Fork Trinity River Tributary
East Fork Trinity River
East Fork Trinity River Tributary
Runway 18/36 - 7,002'
LEGEND
Airport Boundary
Brownfield
River
Stream[1]
Wetland
Freshwater Pond
100-Year Floodplain
Hydric Soil
Prime Farmland
Noise Sensitive Land Uses
Residential
Point of Interest
[1]Streams on Airport property are controlled by a drainage system.
0
1,500
3,000
1" = 1,500'
N
AYSES Soccer Park
Wilson Creek
Source: FEMA, USDA, EPA, FWS, City of McKinney, ESRI Basemap Imagery (2015).

HAZARDOUS MATERIALS, SOLID WASTE, AND POLLUTION PREVENTION

Federal, state, and local laws, including the *Resource Conservation Recovery Act* (RCRA) and the *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA), as amended (also known as the Superfund), regulate hazardous materials use, storage, transport, and disposal. These laws may extend to past and future landowners of properties containing these materials. Disturbing areas that contain hazardous materials or contaminants can cause significant impacts to soil, surface water, groundwater, air quality, and the organisms using these resources.

There is one brownfield on Airport property (EPA Registry ID: 110057002880). The history of the property shows that it was once a gas station, which is the likely cause of contamination. The media affected at this site include air, sediments, soil, drinking water, ground water, surface water, building materials, and indoor air. The following classes of contaminants have been found: controlled substances, petroleum products, asbestos, lead, polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), volatile organic compounds (VOCs), selenium, iron, arsenic, cadmium, chromium, copper, mercury, nickel, pesticides, and semi-volatile organic compounds (SVOCs). The site assessment was completed on July 30, 2012; however, it is still unknown if further cleanup will be required at this property. This property is shown on **Exhibit 1Q**.

The McKinney Landfill was formerly located approximately one mile west of the Airport. Despite only two reported bird strikes by the Airport over a ten-year period, the North Texas Municipal Water District (NTMWD), who owned and operated McKinney Landfill, agreed to relocate it to mitigate bird and wildlife hazards to TKI. The new waste disposal facility was moved to 3802 Highway 121 North in the City of Melissa, approximately eight miles northeast of the Airport.

The Airport has spill response procedures in place that meet Texas Administrative Code (TAC) 327.5(a) requirements. The procedures in place apply to all spills, leaks or discharges of oil, petroleum products, and other hazardous substances at the Airport. TKI has a policy that spills of all sizes must be reported to each of the following:

- McKinney Fire Department: 9-1-1
- Airport Administration: 972-562-4214
- McKinney Air Center: 972-547-3401

The Airport also has a Stormwater Pollution Prevention Plan in place. The Airport is identified as a Standard Industrial Classification (SIC) Code 4581 Airports, Flying Fields, and Airport Terminal Services, and qualifies under Sector S Industrial Activity from Vehicle Maintenance Areas, Equipment Cleaning Areas, or Deicing Areas Located at Air Transportation Facilities of the Texas Pollutant Discharge Elimination System (TPDES) General Permit for coverage.

HISTORICAL, ARCHITECTURAL, ARCHAEOLOGICAL, AND CULTURAL RESOURCES

Determination of a project's environmental impact to historic and cultural resources is made under guidance in the *National Historic Preservation Act* (NHPA) *of 1966*, as amended, the *Archaeological and Historic Preservation Act* (AHPA) *of 1974*, the *Archaeological Resources Protection Act* (ARPA), and the *Native American Graves Protection and Repatriation Act* (NAGPRA) *of 1990*, among others. Impacts can occur when a proposed project causes an adverse effect on a property which has been identified (or is unearthed during construction) as having historical, architectural, archaeological, or cultural significance.

As previously mentioned, there are three properties listed on the National Register of Historic Properties (NRHP) within two miles of the Airport.

- Crouch-Perkins House, 0.96 miles west from the Airport
- McKinney Cotton Mill Historic District, 0.77 miles west from the Airport
- Hill-Webb Grain Elevator, 1.1 miles west from the Airport[12]

The U.S. Department of the Interior Bureau of Indian Affairs (BIA) maintains a Federal Register of Indian entities that are recognized and eligible to receive services from the BIA. The most recent Federal Register (Volume 81, Number 86) published in May 2016, lists three Indian entities in Texas, all of which are located over 250 miles away from the Airport.

- Alabama-Coushatta Tribe of Texas
- Kickapoo Traditional Tribe of Texas
- Ysleta Del Sur Pueblo

LAND USE

Compatible land use evaluations for airports must consider the land uses nearby to ensure those uses do not adversely affect safe aircraft operations. In addition, if an airport action would result in impacts exceeding FAA thresholds of significance which have land use ramifications, such as disruption of communities, relocation of businesses or residences, or socioeconomic impacts, the effects of the land use impacts should be discussed.

As mentioned earlier in the chapter and shown on **Exhibit 1B**, TKI is surrounded primarily by open, vacant land used mostly for agricultural purposes. Industrial uses are concentrated to the west, and pockets of single- and multi-family residential developments are scattered around the Airport, with the heaviest concentrations to the northwest. The Airport is classified as an Airport Zone by the City of McKinney's Codes of Ordinances, indicating the area is strictly designed for airports, heliports, and landing areas for other types of aircraft (Subpart B, Chapter 146, Article III, Section 146-92).

[12] USGS website. *The National Atlas of the United States*. Shapefiles accessed February 2017.

NATURAL RESOURCES AND ENERGY SUPPLY

The FAA has not established a significance threshold for the Natural Resources and Energy Supply impact category. However, a factor to consider is if an action has the potential to cause demand to exceed available or future natural resources or energy supplies (FAA Order 1050.1F, Exhibit 4-1).

The City of McKinney is a member of the NTMWD, which is made up of 13 cities (including McKinney). The NTMWD was formed 65 years ago in response to concerns about diminishing ground water in the North Texas region. The City of McKinney provides water and wastewater services to the Airport. This water comes from Lake Lavon, Jim Chapman Lake, Lake Tawakoni, Lake Fork, and Lake Texoma. Water from these lakes is pumped into the water treatment plants overseen by the NTMWD, which is then treated and filtered before being provided to the cities in the NTMWD.[13] Given the Airport's location, Lake Lavon is the primary waterbody that supplies the Airport and City of McKinney's water supply.

Energy usage at the Airport includes the consumption of aviation fuel (Jet A and 100LL), gasoline and diesel fuel for vehicles and maintenance equipment, and electricity. Energy is provided to the Airport by Atmos Energy (natural gas) and various electricity providers (TXU Energy Inc., Reliant Oncore Electric, and more). Information regarding specific aviation fuel storage and dispersal systems at the Airport is included earlier in this chapter.

NOISE AND COMPATIBLE LAND USE

Federal land use compatibility guidelines are established under 14 CFR 150, *Airport Noise Compatibility Planning*. Per 14 CFR 150, residential land uses and schools are noise-sensitive land uses that are not considered compatible with a 65 decibel (dB) Day-Night Average Sound Level (DNL).[14] Other noise-sensitive land uses (such as religious facilities, hospitals, or nursing homes), if located within a 65 dB DNL contour, are generally compatible when an interior noise level reduction of 25 dB is incorporated into the design and construction of the structure. Special consideration also needs to be given to noise-sensitive areas within Section 4(f) properties where the land use compatibility guidelines in 14 CFR 150 do not account for the value, significance, and enjoyment of the area in question (FAA 2015).

TKI voluntarily completed a 14 CFR Part 150 Noise Study in November 2004 to examine the noise impact of aircraft operations to the surrounding communities. The noise exposure contours prepared as part of the study indicate that the 65 DNL noise contour largely remains on Airport property. Therefore, no noise abatement measures were included in the Airport's Noise Compatibility Program. To educate pilots

[13] https://www.ntmwd.com/

[14] Noise-sensitive land uses are generally residences, churches/places of worship, hospitals and health care facilities, and educational facilities. Churches/places of worship are defined as permanently established facilities intended solely for use as places of worship and not meant to be converted to other potential uses. For a hospital/health care facility to be considered a noise-sensitive medical facility, it must provide for overnight stays or provide for longer recovery periods, where rest and relaxation are key considerations for use of the facility. Schools are facilities that provide full time use for instruction and training to students.

regarding noise-sensitive areas near the Airport, a Flying Friendly Initiative was developed, which outlines voluntary measures to reduce noise.

The Airport has a 24-hour hotline, available at 972-547-7399, which was established in 2003 to better facilitate communication with nearby residents. Although the Airport has no regulatory authority over aircraft in flight and does not control flight paths, it maintains a record of complaints, investigates atypical noise events, and encourages pilots to fly friendly over the area. Note that only the FAA has regulatory jurisdiction over aircraft in flight and aircraft believed to be in violation of Federal Aviation Regulations (FARs) can be reported to the FAA's Dallas Flight Standards District Office at 214-277-8500. Noise-sensitive land uses near the Airport are shown on **Exhibit 1Q** and listed below.

- Single- and multi-family residential developments to the north, west, and south within ¾-mile from the Airport (including a permanent mobile home park).
- Mouzon Park, approximately 0.8 miles northwest from Runway 18.
- Webb Elementary School, about one mile northwest of Runway 18.
- YAYSES Soccer Park, approximately 0.6 miles south of Runway 36.

SOCIOECONOMIC IMPACTS, ENVIRONMENTAL JUSTICE, AND CHILDREN'S ENVIRONMENTAL HEALTH AND SAFETY RISKS

FAA Order 1050.1F specifically requires that a federal action causing disproportionate impacts to an environmental justice population (i.e., a low-income or minority population) be considered, as well as an evaluation of environmental health and safety risks to children.

TABLE 1L
Race Makeup of Census Tract 309 (Collin County)

Race	Total
Not Hispanic or Latino	
White alone	2,517
Black or African American alone	1,266
American Indian and Alaska Native alone	7
Asian alone	25
Native Hawaiian & other Pacific Islander alone	0
Some other race alone	17
Two or more races	105
Hispanic or Latino	
White alone	5,488
Black or African American alone	42
American Indian and Alaska Native alone	19
Asian alone	0
Native Hawaiian & other Pacific Islander alone	0
Some other race alone	559
Two or more races	57

Source: 2011-2015 American Community Survey five-year Estimates.

According to the U.S. Census Bureau, the Airport is located in Census Tract 309, which has an estimated population of 10,102 people (2011-2015 American Community Survey [ACS] Estimates). The 2011-2015 ACS five-year estimates report that almost six percent of the employable population in this tract (ages 16 years and over) is unemployed. Further, it is estimated that 890 people, or almost nine percent, of those residing in this tract are living below the poverty level. **Table 1L** provides a breakdown of the race make-up of the population in Census Tract 309.

As previously discussed, there are residential land uses, an elementary school, and public parks located within one mile of the Airport.

VISUAL RESOURCES

FAA has not established a significance threshold for light emissions or visual resources/visual character. However, the degree or extent to which the action would have the potential to create the following items should be considered prior to approval of airport development projects (i.e., would the project …)

- Create annoyance or interfere with normal activities from light emissions;
- Affect the visual character of the area, including the importance, uniqueness, and aesthetic value of the affected visual resources;
- Contrast with the visual resources and/or visual character in the study area; or
- Block or obstruct the views of visual resources, including whether these resources would still be viewable from other locations?

The City of McKinney regulates lighting in its Code of Ordinances (Subpart A, Chapter 58), stating that the "standards for controlling lighting and glare are set forth to reduce the annoyance and inconvenience to property owners and traffic hazards to motorists." In Section 58-3 of Chapter 58-Lighting, navigation and airport lighting required by the FAA for the operation of airplanes is listed as an exception to the lighting ordinances.

Preservation and enhancement of McKinney's scenic view sheds is cited numerous times in the *City of McKinney's Comprehensive Plan* (as amended June 2015); however, scenic view sheds are only mentioned in the context of open space, and future residential and commercial development.

WATER RESOURCES

All water resources are shown on **Exhibit 1Q**.

Wetlands: Certain drainages (both natural and human-made) that are considered "waters of the U.S." come under the purview of the U.S. Army Corps of Engineers (USACE) under Sections 401 and 404 of the *Clean Water Act*; wetlands are also protected. In addition, E.O. 11990, *Protection of Wetlands* provides definitions and calls for safeguarding wetlands. Wetlands typically exhibit three characteristics: hydrology, hydrophytes (plants able to tolerate various degrees of flooding or frequent saturation), and poorly drained or "hydric" soils.

DRAINAGE DITCH

According to USFWS National Wetlands Inventory, there are three wetlands on Airport property. Two of the wetlands are north of Runway 18 near the East Fork of the Trinity River. There is also a wetland that breaches Runway 18-36 just north of Taxiway B2. Almost nine percent (65.6 acres) of Airport property is made up of hydric soils. These soils are found primarily north of Runway 18, with a small section around Taxiway B2.

There is a sophisticated man-made drainage system at the Airport to control water on and around the Airport, sections of which are shown in the photos to the right.

DRAINAGE DITCH

Floodplains: E.O. 11988, *Floodplain Management* directs federal agencies to take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health, and welfare, and to restore and preserve the natural and beneficial values served by the floodplains. The limits of base floodplains are determined by Flood Insurance Rate Maps (FIRMs) prepared by Federal Emergency Management Agency (FEMA). The flood maps that encompass the Airport are FIRMs 48085C0280J and 48085C0290J. Both FIRMs were updated as of June 2, 2009.

The 100-year floodplain represents an area where there is a one percent annual chance of a flood occurring. There are three incidents of this type of floodplain on or near Airport property. There is an expansive 100-year floodplain along East Trinity Fork River north of Runway 18. This floodplain also crosses Runway 18-36 where it follows along a tributary of the East Fork of the Trinity River. There is another 100-year floodplain southwest of the Airport that runs along Wilson Creek.

Surface Waters: Surface waters include rivers, streams, creeks, lakes, and reservoirs. The primary uses of surface water are for drinking water and other public uses, irrigation, and for industrial purposes (i.e., cooling electricity-generating equipment at a power plant).

As mentioned above, the East Fork of the Trinity River runs along the northern part of the Airport (both on- and off-Airport property) and Wilson Creek along the southern Airport property boundary (entirely off Airport property). There are also several, small ponds scattered around the Airport; however, only one is on Airport property, tucked in the southwest corner of the property line. As discussed in more detail in the Natural Resources and Energy Supply section, the Airport receives its water from the NTMWD, whose water supply comes primarily from five lakes in the North Texas region.

The Airport has proactive stormwater management practices implemented to reduce the amount of pollution that enters the East Fork of the Trinity River, as well as Wilson Creek and Lake Lavon. The Airport maintains a Stormwater Pollution Prevention Plan (SWPPP) that calls for participation of all facilities at the Airport to keep the Airport's stormwater pollutant-free. Given the proximity of Lake Lavon,

TKI takes stormwater pollution prevention very seriously and lists several tips on its website that the Airport and its users can put into practice to reduce individual contribution to stormwater pollution.

Groundwater: According to the Texas Water Development Board (TWDB), the Airport sits atop one of the nine major aquifers in Texas – the Northern portion of the Trinity Aquifer System. The Trinity Aquifer extends across central and northeastern Texas, and is composed of several smaller aquifers. The smaller aquifers include the Antlers, Glen Rose, Paluxy, Twin Mountains, Travis Peak, Hensell, and Hosston aquifers. These aquifers are composed of limestones, sands, clays, gravels, and conglomerates, and have a combined freshwater saturation thickness of 600 feet in North Texas and 1,900 feet in Central Texas.

Wild and Scenic Rivers: Wild and scenic rivers refer to designations within the National Park Services' Nationwide Rivers Inventory. Public Law 90-542 states that such rivers are free flowing and possess "outstanding remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural or other similar values" (National Wild and Scenic Rivers System website). There are no Wild and Scenic Rivers near the Airport.

REFERENCES

- U.S. Environmental Protection Agency, *EJSCREEN*
- U.S. Fish and Wildlife Service Information for Planning and Conservation
- U.S. Department of Agriculture Natural Resources Conservation Service's Web Soil Survey
- U.S. Census Bureau
- U.S. Department of the Interior Bureau of Indian Affairs
- U.S. Fish and Wildlife Service National Wetlands Inventory
- Federal Emergency Management Agency Flood Insurance Rate Maps
- Airport Website: www.flytki.com
- Previous TKI Master Plan (2006): http://www.flytki.com/DocumentCenter/Home/View/28
- McKinney Comprehensive Plan (Adopted March 2004; Amended June 2015)
- Collin County: http://www.collincountytx.gov/Pages/default.aspx
- City of McKinney: https://www.mckinneytexas.org/

Chapter Two

Forecasts

The definition of demand that may reasonably be expected to occur during the useful life of an airport's key components (e.g., runways, taxiways, terminal buildings, etc.) is an important factor in facility planning. In airport master planning, this involves projecting potential aviation activity for at least a 20-year timeframe. Aviation demand forecasting for McKinney National Airport (TKI or Airport) will focus on demand indicators, such as based aircraft, based aircraft fleet mix, annual aircraft operations, and peaking operational periods. In addition, potential commercial service demand indicators will be examined to evaluate the Airport's opportunity to support commercial passenger services.

The Federal Aviation Administration (FAA) has oversight responsibility to review and approve aviation forecasts developed in conjunction with airport planning studies. In addition, aviation activity forecasts may be an important input to future benefit-cost analyses associated with airport development, and the FAA reviews these analyses when federal funding requests are submitted. In Texas, the Texas Department of Transportation – Aviation Division (TxDOT) has the authority to approve general aviation forecasts within certain parameters. As such, these forecasts will first be submitted to TxDOT and may need to be forwarded to the FAA for approval.

The FAA will review individual airport forecasts with the objective of comparing them to its *Terminal Area Forecast* (TAF) and the *National Plan of Integrated Airport Systems* (NPIAS). Even though the TAF is updated annually, in the past there was almost always a disparity between the TAF and master planning forecasts. This was primarily because the TAF forecasts did not consider local conditions or recent trends. In recent years, however, the FAA has improved its forecast model to be a demand-driven forecast for aviation services based upon local and national economic conditions, as well as conditions within the aviation industry.

Only two components of a Master Plan are approved by the FAA and TxDOT: the aviation demand forecasts and the Airport Layout Plan (ALP). The ALP will be updated later in this study. As stated, in FAA Order 5090.3C, *Field Formulation of the National Plan of Integrated Airport Systems*, forecasts should be:

- Realistic;
- Based on the latest available data;
- Reflective of current conditions at the airport (as a baseline);
- Supported by information in the study; and
- Able to provide adequate justification for airport planning and development.

The forecast process for an Airport Master Plan consists of a series of basic steps that vary in complexity depending upon the issues to be addressed and the level of effort required. The steps include a review of previous forecasts, determination of data needs, identification of data sources, collection of data, selection of forecast methods, preparation of the forecasts, and evaluation and documentation of the results. FAA Advisory Circular (AC) 150/5070-6C, *Airport Master Plans*, outlines seven standard steps involved in the forecast process, including:

1) **Identify Aviation Activity Measures**: The level and type of aviation activities likely to impact facility needs. For general aviation, this typically includes based aircraft and operations.

2) **Review Previous Airport Forecasts**: May include the FAA *Terminal Area Forecast*, state or regional system plans, and previous master plans.

3) **Gather Data**: Determine what data are required to prepare the forecasts, identify data sources, and collect historical and forecast data.

4) **Select Forecast Methods**: There are several appropriate methodologies and techniques available, including regression analysis, trend analysis, market share or ratio analysis, exponential smoothing, econometric modeling, comparison with other airports, survey techniques, cohort analysis, choice and distribution models, range projections, and professional judgment.

5) **Apply Forecast Methods and Evaluate Results**: Prepare the actual forecasts and evaluate for reasonableness.

6) **Summarize and Document Results**: Provide supporting text and tables as necessary.

7) **Compare Forecast Results with FAA's TAF**: Follow guidance in FAA Order 5090.3C, *Field Formulation of the National Plan of Integrated Airport Systems*. In part, the Order indicates that forecasts should not vary significantly (more than 10 percent) from the TAF. When there is a greater than 10 percent variance, supporting documentation should be supplied to the FAA. (FAA Central Region has provided additional guidance indicating forecasts are consistent with the TAF when they differ by less than 10 percent in the first five years, and less than 15 percent in the 10-year period.)

Aviation activity can be affected by many influences on the local, regional, and national levels, making it virtually impossible to predict year-to-year fluctuations of activity over 20 years with any certainty. Therefore, it is important to remember that forecasts are to serve only as guidelines, and planning must remain flexible enough to respond to a range of unforeseen developments.

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The following forecast analysis for TKI was produced following these basic guidelines. Existing forecasts are examined and compared against current and historic activity. The historical aviation activity is then examined along with other factors and trends that can affect demand. The intent is to provide an updated set of aviation demand projections for TKI that will permit airport management to make planning adjustments as necessary to maintain a viable, efficient, and cost-effective facility.

NATIONAL AVIATION TRENDS AND FORECASTS

Each year, the FAA updates and publishes a national aviation forecast. Included in this publication are forecasts for the large air carriers, regional/commuter air carriers, general aviation, and FAA workload measures. The forecasts are prepared to meet budget and planning needs of the FAA and to provide information that can be used by state and local authorities, the aviation industry, and the general public. The current edition when this chapter was prepared was FAA *Aerospace Forecasts – Fiscal Years 2016-2036*, published in March 2016. The FAA primarily uses the economic performance of the United States as an indicator of future aviation industry growth. Similar economic analyses are applied to the outlook for aviation growth in international markets. The following discussion is summarized from the FAA Aerospace Forecasts.

Since its deregulation in 1978, the U.S. commercial air carrier industry has been characterized by boom-to-bust cycles. The volatility that was associated with these cycles was thought by many to be a structural feature of an industry that was capital intensive but cash poor. However, the great recession of 2007-09 marked a fundamental change in the operations and finances of U.S. airlines. Air carriers fine-tuned their business models to minimize losses by lowering operating costs, eliminating unprofitable routes, and grounding older, less fuel-efficient aircraft. To increase operating revenues, carriers initiated new services that customers were willing to purchase and started charging separately for services that were historically bundled in the price of a ticket. The industry experienced an unprecedented period of consolidation with four major mergers in five years. These changes, along with capacity discipline exhibited by carriers, resulted in a fifth consecutive year of profitability for the industry in 2015. Looking ahead, there is optimism that the industry has been transformed from that of a boom-to-bust cycle to one of sustainable profits.

U.S. ECONOMIC OUTLOOK

According to the FAA forecast report, as the economy recovers from the most serious economic downturn and slow recovery since the Great Depression, aviation will continue to grow over the long run. Fundamentally, demand for aviation is driven by economic activity. As economic growth picks up, so will growth in aviation activity. The FAA forecast calls for passenger growth over the next 20 years to average 2.1 percent annually. The steep decline in the price of oil in 2015 was a catalyst for a short-lived uptick in passenger growth; however, growth is anticipated to be somewhat muted, primarily due to the uncertainty that surrounds the U.S. and global economies.

Employee wages in 2015 continued to stagnate, household income growth was weak, the housing market's recovery was patchy across the country, and government spending at the federal and local levels remained stagnant and are projected to remain so for the next few years. Despite these dire statistics, the unemployment rate fell, consumer spending was up, and many urban housing markets have been strongly revived. U.S. economic performance in 2015 is estimated to have grown in real GDP to 16.3 trillion (inflation adjusted to 2009 dollars) and is forecast to grow at an average annual growth rate of 2.3 percent through 2036. Oil prices should remain below $50 per barrel through 2016, but are projected to grow at an annual average growth rate of 4.8 percent, reaching over $150 per barrel by 2036. Although the U.S. economy has managed to avoid a recession, a prolonged period of faster economic growth (e.g., > 3.0 percent) may not be forthcoming.

U.S. TRAVEL DEMAND

Mainline and regional carriers offer domestic and international passenger service between the U.S. and foreign destinations, although regional carrier international service is confined to the border markets in Canada, Mexico, and the Caribbean. Twenty-nine all-cargo carriers were providing domestic and/or international air cargo service at the end of 2015.

According to the FAA, three distinct trends are shaping today's commercial air carrier industry: (1) continuing industry consolidation and restructuring; (2) continued capacity discipline in response to external shocks; and (3) the proliferation of ancillary revenues.

The restructuring and consolidation of the U.S. airline industry that began in the aftermath of the terror attacks of September 11, 2001 continued in 2015. American and US Airways combined their networks and reservation systems to form the world's largest airline with the last U.S. Airways flight occurring in October 2015. Consequently, there are now only four dominant airlines in the U.S. – American, Delta, Southwest, and United – controlling approximately 76 percent of the domestic market. It is highly unlikely the U.S. Government will approve any further mergers among these four due to anti-trust regulations. In 2005, there were 12 major mainline airlines.

The mergers and increasing market presence of low cost carriers like Frontier, JetBlue, and Southwest have had clear implications on the fares, size of the aircraft being used, and the load factors.

One of the most striking outcomes of industry restructuring has been the unprecedented period of capacity discipline (achieving higher passenger loads through scheduled flight and fleet mix consolidation primarily), especially in domestic markets. Between 1978 and 2000, available seat miles (ASMs) in domestic markets increased at an average annual rate of four percent per year, recording only two years of decline. Even though domestic ASMs shrank by 6.9 percent in FY 2002, following the events of September 11, 2001, growth resumed and by FY 2007, domestic ASMs were 3.6 percent above the FY 2000 level. However, U.S. domestic ASMs are still down 1.2 percent when compared to 2007 as the industry responded first to the sharp rise in oil prices (up 155 percent between 2004 and 2008) and then the global recession that followed (2009 to the present). 2015 is the first year showing strong growth in ASMs (4.6 percent) since 2004.

The reduction in domestic capacity since 2007 has not been shared equally between the mainline carriers and their regional counterparts. To better match demand to capacity, the mainline carriers contracted out "thin" routes to their regional counterparts because they could provide lift at a lower cost, or simply removed the capacity altogether. In 2015, the mainline carrier group provided 0.9 percent less capacity than it did in 2007 (but carried 2.1 percent more passengers). Capacity flown by the regional group has shrunk by 3.0 percent over the same period (with passengers carried decreasing by 2.1 percent).

The regional market has continued to shrink as the regionals compete for even fewer contracts with the remaining dominant carriers; this has meant slow growth in enplanements and yields. The regionals have less leverage with the mainline carriers than they have had in the past and are facing large pilot shortages and tighter regulations regarding pilot training. Their capital costs have increased in the short-term as they continue to replace their 50-seat regional jets with more fuel efficient 70-seat jets. This move to the larger aircraft will prove beneficial in the future, however, since their unit costs are lower.

The regionals have less leverage with the mainline carriers than they have had in the past and are facing large pilot shortages and tighter regulations regarding pilot training. Their capital costs have increased in the short-term as they continue to replace their 50-seat regional jets with more fuel efficient 70-seat jets.

Another continuing trend is that of ancillary revenues. Carriers generate ancillary revenues by selling products and services beyond that of an airplane ticket to customers. This includes the un-bundling of services previously included in the ticket price, such as checked bags and on-board meals, and by adding new services, such as boarding priority. As a result of very low oil prices and ancillary revenue sources, U.S. passenger carriers posted net profits for the sixth consecutive year in 2015.

FAA COMMERCIAL SERVICE FORECASTS

U.S. commercial air carriers' total number of domestic departures continued the downward trend that started in 2008, while ASMs, revenue passenger miles (RPMs), and enplanements all showed a rebound; these trends underlie the expanding size of aircraft and higher load factors. In 2015, the domestic load

factor reached a historic high of 84.5 for commercial air carriers. In such an uncertain but slowly improving economic environment, industry capacity growth was somewhat restrained (up 3.9 percent in 2015), after only a 2.3 percent increase in 2014. U.S. mainline carrier capacity is projected to grow 3.8 percent in 2016, while capacity for regional carriers is forecast to remain static through 2016. Passenger demand growth is in line with capacity growth in 2016, with system RPMs forecast to grow 3.8 percent. Supported by a growing U.S. and world economy, year-over-year RPM growth is forecast to be 2.7 percent on average over the period from 2015-2036. Over the same time period, system capacity growth averages 2.1 percent per year. System passengers are projected to increase an average of 2.0 percent a year, with mainline carriers growing at 2.0 percent a year, slightly higher than their regional counterparts (up 1.8 percent). By 2036, U.S. commercial air carriers are projected to fly 1.81 trillion ASMs and transport 1.24 billion enplaned passengers – a total of 1.53 trillion passenger miles.

Planes will remain crowded, with load factors projected to grow moderately during the early years of the forecast period, then tapering off during the mid-to-latter years to 84.7 percent in 2036 (up 1.3 points compared to the beginning of the forecast period in 2015). The FAA forecasts indicate that enplanements are forecast to grow (up 4.2 percent) in 2016, following a 3.8 percent increase in 2015. Over the forecast period, domestic enplanements are projected to grow at an average annual rate of 2.0 percent, with mainline and regional carriers growing at the same rate. **Exhibit 2A** presents the annual historical and forecast enplanement totals for both large air carriers and commuter airlines in the U.S. as forecast by the FAA.

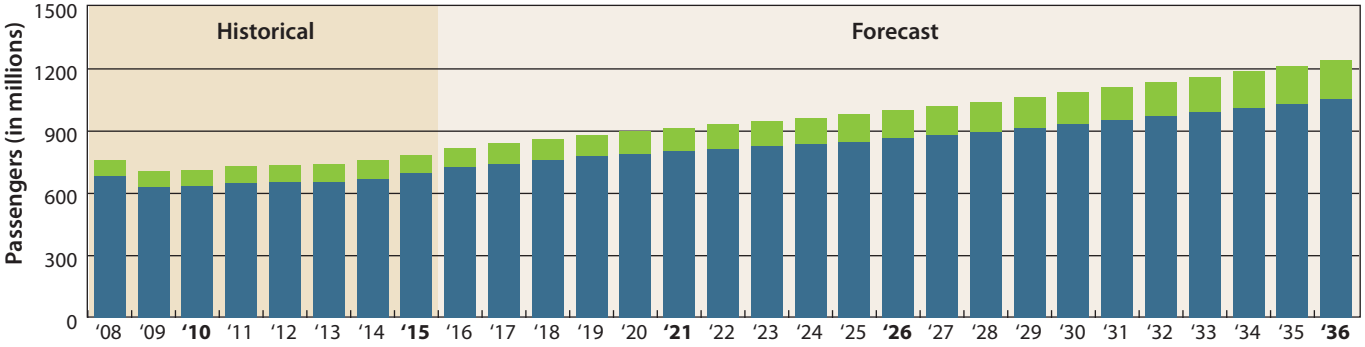
FAA COMMERCIAL AIRCRAFT FLEET FORECAST

The commercial passenger carrier fleet is undergoing transformation. The mainline carriers are retiring older, less fuel-efficient aircraft (e.g., 737-300/400/500, 757/767, and MD-80) and replacing them with more technologically advanced A319/320 and 737-700/800/900 aircraft. The regional carriers are growing their fleet of 70-90 seat regional jet aircraft and reducing their fleet of 50-seat jet aircraft. Between 2015 and 2036, the number of jets in the U.S. mainline carrier fleet is forecast to grow from 3,946 to 5,339, an average of 66 aircraft a year. The regional carrier fleet is forecast to decline from 2,144 aircraft in 2015 to 1,961 in 2036 as the fleet shrinks by 21 percent (448 aircraft) between 2015 and 2022. **Exhibit 2B** presents the FAA commercial aircraft fleet forecast through 2036.

FAA GENERAL AVIATION FORECASTS

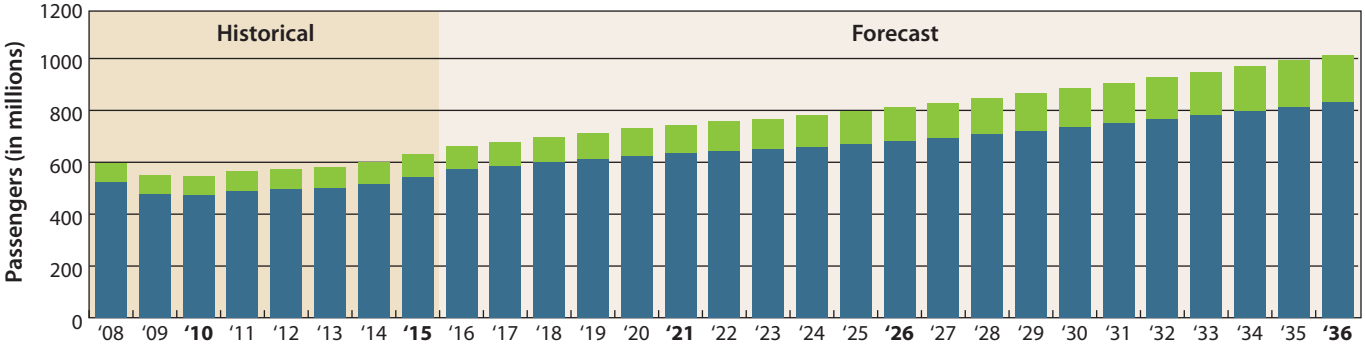
The FAA forecasts the fleet mix and hours flown for single engine piston aircraft, multi-engine piston aircraft, turboprops, business jets, piston and turbine helicopters, light sport, experimental, and others (gliders and balloons). The FAA forecasts “active aircraft,” not total aircraft. An active aircraft is one that is flown at least one hour during the year. From 2010 through 2013, the FAA undertook an effort to have all aircraft owners re-register their aircraft. This effort resulted in a 10.5 percent decrease in the number of active general aviation aircraft, mostly in the piston category.

U.S. AIR CARRIER PASSENGER ENPLANEMENTS[1]



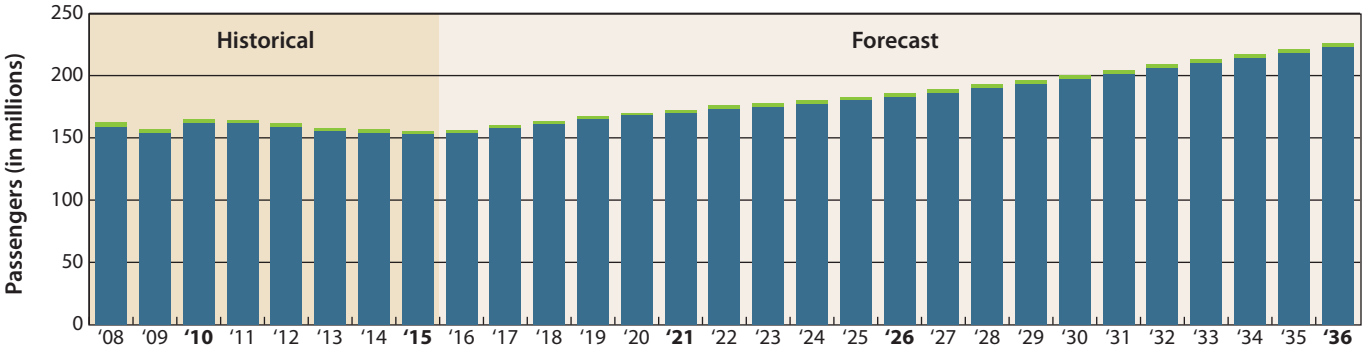
SOURCE	2015	2021	2026	2036	AAGR 2015-2036
Domestic Revenue Enplanements	696	803	863	1,052	2.0%
International Revenue Enplanements	89	113	135	188	3.6%
TOTAL	786	916	998	1,240	2.2%

U.S. MAINLINE AIR CARRIER PASSENGER ENPLANEMENTS



SOURCE	2015	2021	2026	2036	AAGR 2015-2036
Domestic Revenue Enplanements	543	633	680	829	2.0%
International Revenue Enplanements	87	111	132	185	3.6%
TOTAL	631	743	812	1,014	2.3%

U.S. REGIONAL AIR CARRIER PASSENGER ENPLANEMENTS



SOURCE	2015	2021	2026	2036	AAGR 2015-2036
Domestic Revenue Enplanements	153	170	183	223	1.8%
International Revenue Enplanements	2	2	3	3	1.8%
TOTAL	155	173	185	226	1.8%

Source: FAA Aerospace Forecast - Fiscal Years 2016-2036

Note: All figures measured in millions

The long term outlook for general aviation is favorable, led by gains in turbine aircraft activity.

The long term outlook for general aviation is favorable, led by gains in turbine aircraft activity. The active general aviation fleet is forecast to increase 0.2 percent per year between 2015 and 2036, equating to an absolute increase in the fleet of about 7,000 units. While steady growth in both GDP and corporate profits results in continued growth of the turbine and rotorcraft fleets, the largest segment of the fleet – fixed-wing piston aircraft - continues to shrink over the FAA's forecast.

In 2015, the general aviation industry experienced its first decline in aircraft deliveries since 2010. While the single engine piston aircraft deliveries by U.S. manufacturers continued to grow and business jet deliveries recorded a very modest increase compared to the previous year, turboprop deliveries declined by 10 percent, and the much smaller category of multi-engine piston deliveries declined 40 percent.

In 2015, the FAA estimated there were 138,135 piston-powered aircraft in the national fleet. The total number of piston-powered aircraft in the fleet is forecast to decline by 0.7 percent from 2015-2036, resulting in 118,855 by 2036. This includes -0.7 percent annually for single engine pistons and -0.5 percent for multi-engine pistons.

Total turbine aircraft are forecast to grow at an annual growth rate of 2.1 percent through 2036. The FAA estimates there were 29,040 turbine-powered aircraft in the national fleet in 2015, and there will be 44,655 by 2036. This includes annual growth rates of 1.3 percent for turboprops, 2.5 percent for business jets, and 2.3 percent for turbine helicopters.

While comprising a much smaller portion of the general aviation fleet, experimental aircraft, typically identified as home-built aircraft, are projected to grow annually by 0.9 percent through 2036. The FAA estimates there were 26,435 experimental aircraft in 2016, and these are projected to grow to 31,640 by 2036. Sport aircraft are forecast to grow 4.5 percent annually through the long term, growing from 2,410 in 2015 to 6,100 by 2036. **Exhibit 2C** presents the historical and forecast U.S. active general aviation aircraft.

The FAA also forecasts total operations based upon activity at control towers across the U.S. Operations are categorized as air carrier, air taxi/commuter, general aviation, and military. General aviation operations, both local and itinerant, declined significantly as a result of the 2008-2009 recession and subsequent slow recovery. Through 2036, total general aviation operations are forecast to grow 0.3 percent annually. Air taxi/commuter operations are forecast to decline by 3.4 percent through 2025, and then increase slightly through the remainder of the forecast period. Overall, air taxi/commuter operations are forecast to decline by 1.1 percent annually from 2015 through 2036.

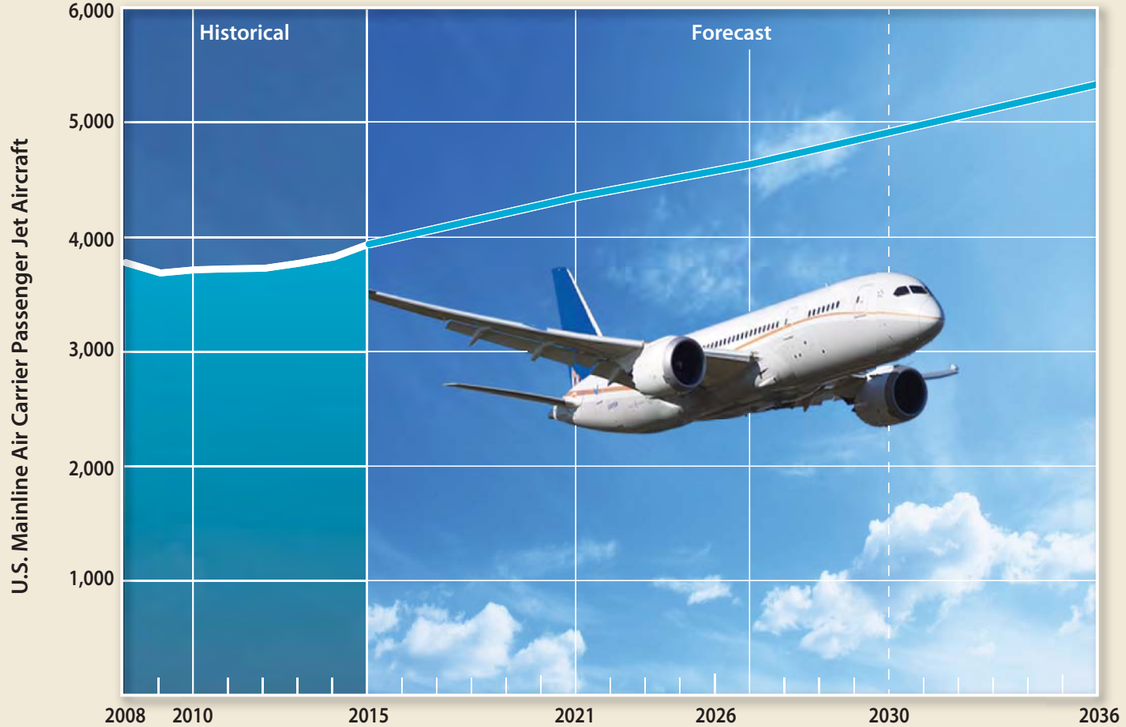
U.S. MAINLINE AIR CARRIER PASSENGER JET AIRCRAFT

	2015	2021	2026	2036	AAGR 2015-2036
Large Narrow Body					
2 Engine	3,322	3,603	3,828	4,314	1.3%
3-4 Engines	2	2	0	0	0.0%
Large Wide Body					
2 Engine	492	586	636	840	2.6%
3-4 Wide Body Engines	31	0	0	0	N/A
Total Large Jets	**3,847**	**4,191**	**4,464**	**5,154**	**1.4%**
Total Regional Jets	**99**	**169**	**181**	**185**	**3.0%**
Total Mainline Passenger Jets	**3,946**	**4,360**	**4,645**	**5,339**	**1.5%**

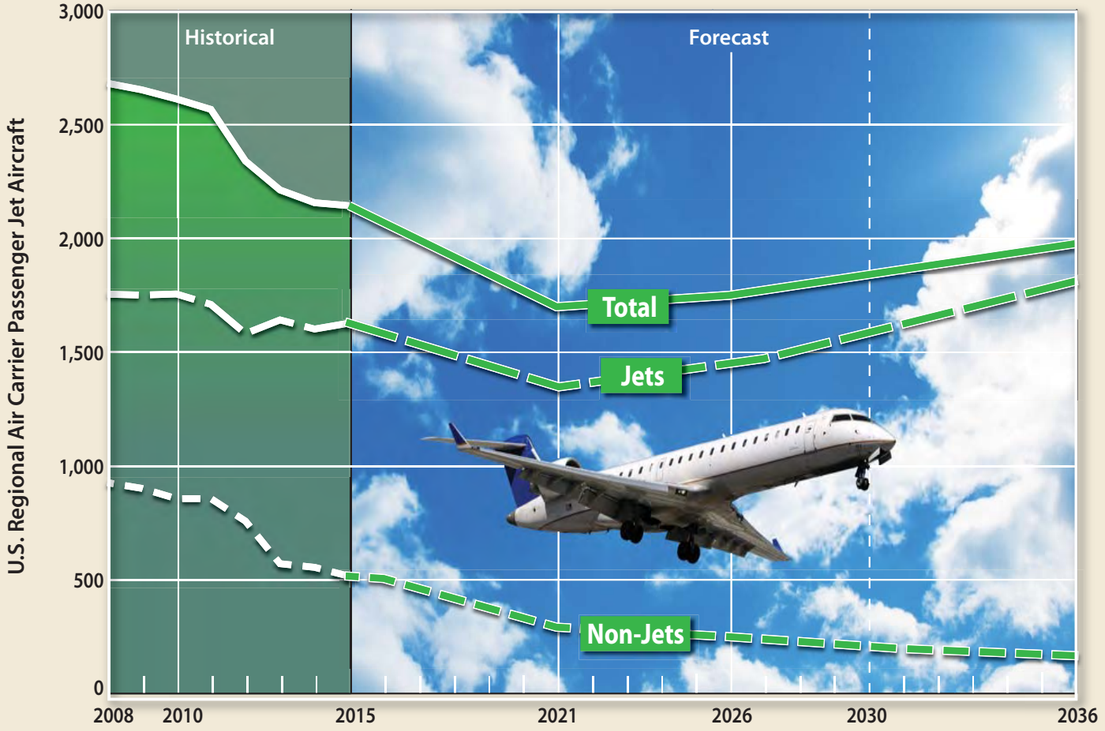
U.S. REGIONAL AIR CARRIER PASSENGER JET AIRCRAFT

	2015	2021	2026	2036	AAGR 2015-2036
Less than 30 Seats					
Turboprop	427	234	181	74	-7.2%
31-40 Seats					
Turboprop	32	25	19	8	-6.4%
Over 40 Seats					
Turboprop	57	69	78	93	2.4%
Jet	1,628	1,384	1,460	1,786	0.4%
Non-Jet Total	**516**	**328**	**278**	**175**	**-5.0%**
Jet Total	**1,628**	**1,384**	**1,460**	**1,786**	**0.4%**
Total Regional Passenger Aircraft	**2,144**	**1,712**	**1,738**	**1,961**	**-0.4%**

Total Mainline Passenger Jets



Total Regional Passenger Aircraft



Source: FAA Aerospace Forecast - Fiscal Years 2016-2036

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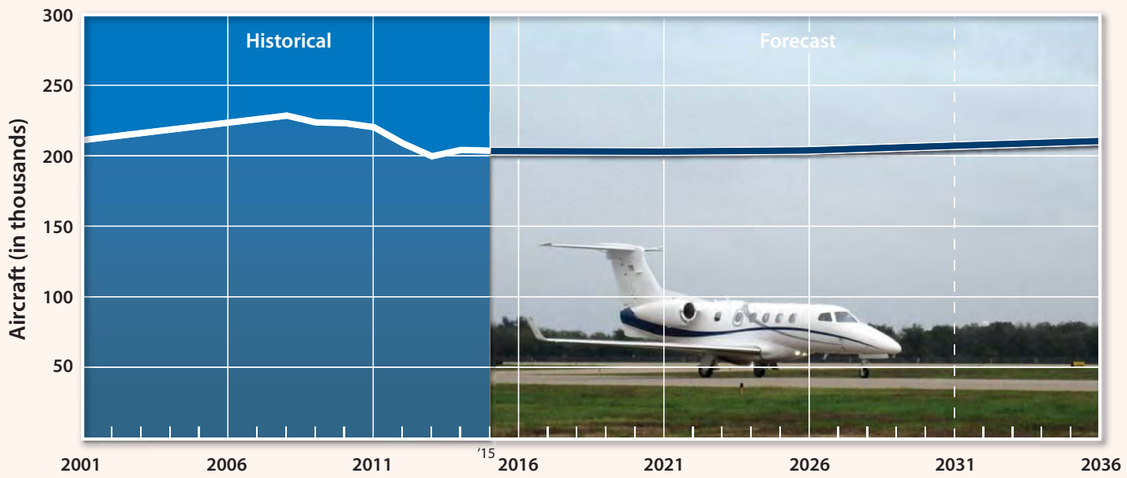
U.S. ACTIVE GENERAL AVIATION AIRCRAFT

	2015	2021	2026	2036	AAGR 2015-2036
Fixed Wing					
Piston					
Single Engine	125,050	119,585	115,045	107,160	-0.7%
Multi-Engine	13,085	12,760	12,480	11,695	-0.5%
Turbine					
Turboprop	9,570	9,215	9,775	12,635	1.3%
Turbojet	12,475	13,975	15,735	20,770	2.5%
Rotorcraft					
Piston	3,245	3,770	4,170	5,005	2.1%
Turbine	6,995	8,215	9,185	11,250	2.3%
Experimental					
	26,435	27,690	28,735	31,640	0.9%
Sport Aircraft					
	2,410	3,490	4,410	6,100	4.5%
Other					
	4,615	4,525	4,495	4,440	-0.2%
Total Pistons	141,380	136,115	131,695	123,860	-0.6%
Total Turbines	29,040	31,405	34,695	44,655	2.1%
Total Fleet	203,880	203,225	204,030	210,695	0.2%

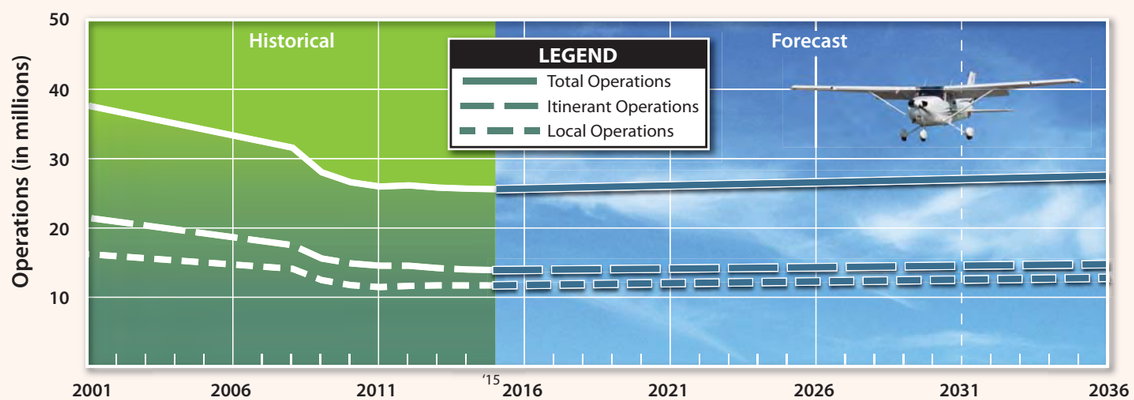


Notes: An active aircraft is one that has a current registration and was flown at least one hour during the calendar year.

Source: FAA Aerospace Forecast - Fiscal Years 2016-2036

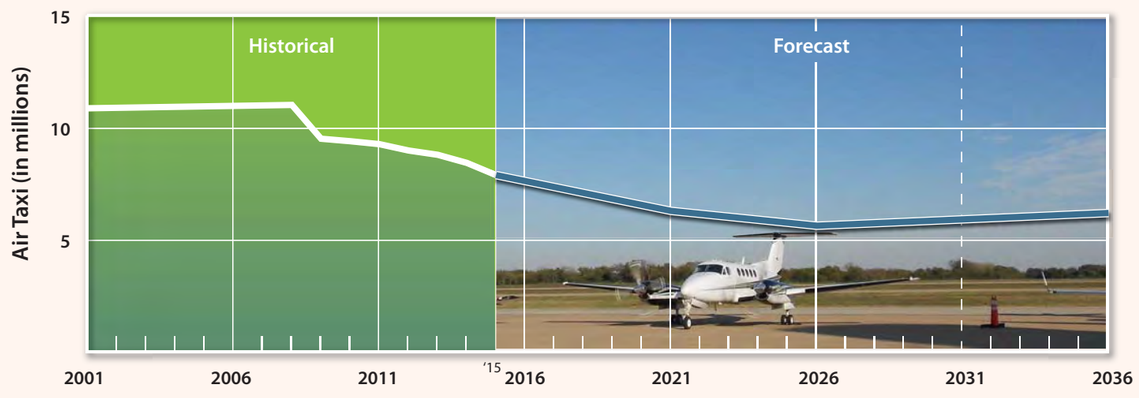
U.S. GENERAL AVIATION OPERATIONS

	2015	2021	2026	2036	AAGR 2015-2036
Itinerant					
	13,887,000	14,103,000	14,309,000	14,742,000	0.3%
Local					
	11,691,000	12,011,000	12,255,000	12,772,000	0.4%
Total GA Operations	**25,578,000**	**26,114,000**	**26,564,000**	**27,514,000**	**0.3%**



U.S. GENERAL AVIATION AIR TAXI

	2015	2021	2026	2036	AAGR 2015-2036
Air Taxi/Commuter Operations					
Itinerant	7,895,000	6,294,000	5,631,000	6,199,000	-1.1%



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GENERAL AVIATION AIRCRAFT SHIPMENTS AND REVENUE

As previously discussed, the 2008-2009 economic recession has had a negative impact on general aviation aircraft production, and the industry has been slow to recover. Aircraft manufacturing declined for three straight years from 2008 through 2010. According to the General Aviation Manufacturers Association (GAMA), there is optimism that aircraft manufacturing will stabilize and return to growth, which has been evidenced since 2011. **Table 2A** presents historical data related to general aviation aircraft shipments.

TABLE 2A
Annual General Aviation Airplane Shipments
Manufactured Worldwide and Factory Net Billings

Year	Total	SEP	MEP	TP	J	Net Billings ($millions)
1994	1,132	544	77	233	278	3,749
1995	1,251	605	61	285	300	4,294
1996	1,437	731	70	320	316	4,936
1997	1,840	1043	80	279	438	7,170
1998	2,457	1508	98	336	515	8,604
1999	2,808	1689	112	340	667	11,560
2000	3,147	1,877	103	415	752	13,496
2001	2,998	1,645	147	422	784	13,868
2002	2,677	1,591	130	280	676	11,778
2003	2,686	1,825	71	272	518	9,998
2004	2,962	1,999	52	319	592	12,093
2005	3,590	2,326	139	375	750	15,156
2006	4,054	2,513	242	412	887	18,815
2007	4,277	2,417	258	465	1,137	21,837
2008	3,974	1,943	176	538	1,317	24,846
2009	2,283	893	70	446	874	19,474
2010	2,024	781	108	368	767	19,715
2011	2,120	761	137	526	696	19,042
2012	2,164	817	91	584	672	18,895
2013	2,353	908	122	645	678	23,450
2014	2,454	986	143	603	722	24,499
2015	2,331	946	110	557	718	24,120

SEP - Single Engine Piston; MEP - Multi-Engine Piston; TP - Turboprop; J - Turbofan/Turbojet
Source: General Aviation Manufacturers Association *2015 General Aviation Statistical Databook & 2016 Industry Outlook*

Worldwide shipments of general aviation airplanes decreased in 2015 with a total of 2,331 units delivered around the globe compared to 2,454 units in 2014. Worldwide general aviation billings were also lower than the previous year. In 2015, $24 billion in new general aviation aircraft were shipped, but yearend results were mixed across the market segments. Results were impacted by economic uncertainty in key markets, including Brazil, Europe, and China; however, the U.S. experienced stronger delivery numbers, which is cause for cautious optimism.

Business Jets: General aviation manufacturers delivered 718 business jets in 2015, as compared to 722 units in 2014. The industry's continued investment in new products helped maintain the delivery rate for business jets.

Turboprops: In 2015, 557 turboprop airplanes were delivered to customers around the world, a decline from the 603 delivered in 2014. Overall, the turboprop market is still significantly stronger over the past five years compared to years prior to 2011.

Pistons: Piston deliveries declined from 1,129 units during 2014 to 1,056 in 2015. Two-thirds of piston shipments were to North American customers, a significant increase from the 2014 North American market share of 55.1 percent.

AIRPORT SERVICE AREA

The initial step in determining the aviation demand for an airport is to define its generalized service area for various segments of aviation. The service area is determined primarily by evaluating the location of competing airports, their capabilities, their services, and their relative attraction and convenience. In determining the aviation demand for an airport, it is necessary to identify the role of the airport, as well as the specific areas of aviation demand the airport is intended to serve. For TKI, the primary role is to accommodate general aviation demand in the region. TKI is classified as a reliever airport within the NPIAS, meaning that one of its main purposes is to relieve general and corporate aviation activity at Dallas/Fort Worth International Airport (DFW) and Dallas Love Field (DAL).

The service area for an airport is a geographic region from which an airport can be expected to attract the largest share of its activity. The definition of the service area can then be used to identify other factors, such as socioeconomic and demographic trends, which influence aviation demand at an airport. Aviation demand will be impacted by the proximity of competing airports, the surface transportation network, and the strength of commercial airline and/or general aviation services provided by an airport and competing airports.

As in any business enterprise, the more attractive the facility is in terms of service and capabilities, the more competitive it will be in the market. If an airport's attractiveness increases in relation to nearby airports, so will the size of its service area. If facilities and services are adequate and/or competitive, some level of aviation activity might be attracted to an airport from more distant locales.

As a general rule, an airport's service area extends for approximately 30 miles. There are 19 public-use airports within 30 nautical miles of TKI; however, over half of these facilities provide limited aviation services to small general aviation aircraft only. Eight airports are included in the NPIAS, including DFW and DAL which focus primarily on scheduled commercial passenger service, although DAL does cater to corporate general aviation activity also. The six other NPIAS airports provide various levels of general aviation services. Of these six, Addison Airport (ADS), Denton Enterprise Airport (DTO), and Mesquite

Metro Airport (HQZ) are also classified as general aviation reliever airports. **Table 2B** presents information related to TKI and the eight NPIAS airports in proximity.

TABLE 2B
Regional Airports

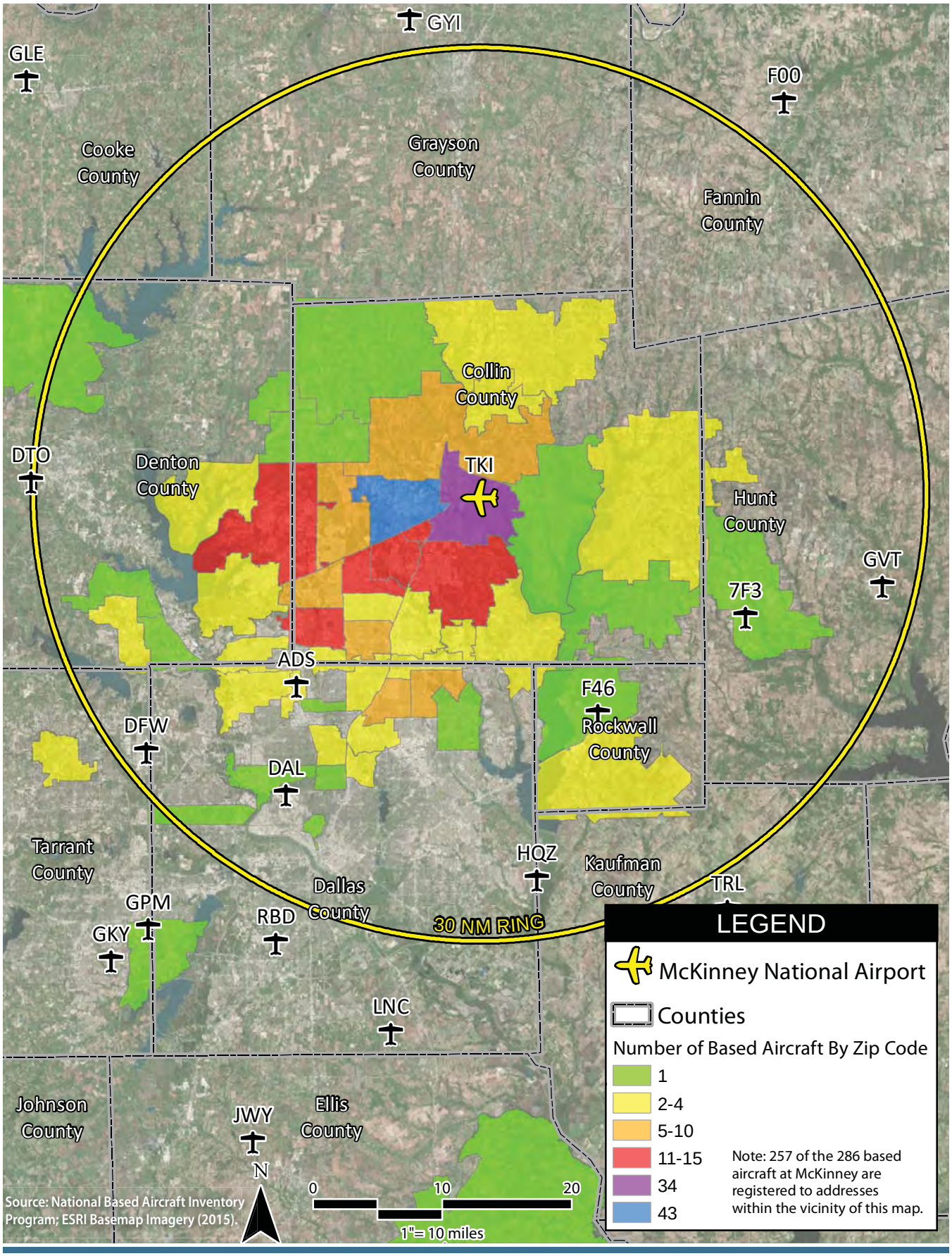
Airport	Distance from TKI (nm)	NPIAS Service Level	Based Aircraft	Annual Operations	Longest Runway (feet)	Lowest Visibility Minimums
McKinney National (TKI)	0	GA-R	286	120,470	7,002	½-mile
Ralph M. Hall - Rockwall (F46)	17 SE	GA	67	38,020	3,373	1-mile
Addison (ADS)	18 SW	GA-R	550	96,476	7,203	1-mile
Caddo Mills Municipal (7F3)	19 SE	GA	17	14,000	4,000	1-mile
Dallas Love Field (DAL)	24 SW	CS	259	223,997	8,800	½-mile
Mesquite Metro (HQZ)	26 S	GA-R	168	71,118	5,999	¾-mile
Majors - Greenville (GVT)	27 SE	GA	40	19,135	8,030	1-mile
Dallas/Fort Worth Int'l (DFW)	28 SW	CS	0	676,890	13,401	½-mile
Denton Enterprise (DTO)	30 W	GA-R	458	165,052	7,002	½-mile

GA-R: General Aviation Reliever; GA: General Aviation; CS: Commercial Service; nm: nautical mile
Source: FAA Form 5010-1, *Airport Master Record*; www.airnav.com

The previously mentioned airports' available levels of service and facilities will play a role in limiting TKI's service area, especially in areas to the south, east, and west of the Airport. Although not previously mentioned, North Texas Regional Airport (GYI), located in Sherman/Denison, is situated approximately 32 miles north of TKI and further limits the Airport's service area to the north. Historically, TKI has remained a very important facility meeting the needs of general aviation operators in the region. The Airport is a hub for business and recreational aircraft activity. In addition, the Airport is a designated reliever airport. In this capacity, the Airport should continue to fare well in its ability to compete for general aviation activity considering the services and amenities it has to offer.

As a general aviation reliever airport, TKI's service area is also driven by aircraft owners/operators and where they choose to base their aircraft. The primary consideration of aircraft owners/operators when choosing where to base their aircraft is convenience (i.e., easy access and proximity to the airport). Under this circumstance, the most effective method of defining an airport's service area is by examining the based aircraft by their registered address. **Exhibit 2D** presents the number of TKI based aircraft located within the region by their associated zip code. It should be noted that 29 based aircraft are registered to addresses outside the regional area, many of which are registered out-of-state. It is not uncommon for an aircraft based in one location to be registered in another, especially for corporate aircraft which typically are registered by the controlling ownership entity, such as a bank. While the most concentrated areas of based aircraft ownership are located within Collin County, based aircraft are also spread throughout several communities in the greater DFW Metroplex.

As depicted on the exhibit, the majority of based aircraft owners are located in the Collin County area near the city of McKinney. This data shows that a high percentage of TKI based aircraft owners reside


GYI
GLE
F00
Cooke County
Grayson County
Fannin County
Collin County
DTO
Denton County
TKI
Hunt County
GVT
7F3
ADS
F46
Rockwall County
DFW
DAL
Tarrant County
HQZ
Kaufman County
TRL
Dallas County
GPM
RBD
GKY
30 NM RING
LNC
Johnson County
JWY
Ellis County
N
0
10
20
1"= 10 miles
Source: National Based Aircraft Inventory Program; ESRI Basemap Imagery (2015).
LEGEND
McKinney National Airport
Counties
Number of Based Aircraft By Zip Code
1
2-4
5-10
11-15
34
43
Note: 257 of the 286 based aircraft at McKinney are registered to addresses within the vicinity of this map.

or do business in close proximity to the Airport. The remainder of the based aircraft owners are spread around the county and into neighboring Dallas, Denton, Rockwall, and Hunt counties. Considering all previous factors, the primary service area for TKI can be defined as being Collin County and, more broadly defined, as the north DFW Metroplex region as the secondary service area.

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SOCIOECONOMIC TRENDS

Socioeconomic conditions also provide an important baseline for preparing aviation demand forecasts. Local socioeconomic variables, such as population and employment, are indicators for understanding the dynamics of the community and can relate to local trends in aviation activity. Analysis of the demographics of the airport service area will give a more comprehensive understanding of the socioeconomic situations influencing the region which support TKI. The following is a summary of the demographic and socioeconomic data presented in Chapter One, as well as forecasts of those socioeconomic characteristics.

Table 2C summarizes historical and forecast population, employment, and income estimates for Collin County and the Dallas-Fort Worth-Arlington Metropolitan Statistical Area (MSA), which includes Collin, Dallas, Denton, Ellis, Hunt, Hood, Johnson, Kaufman, Parker, Rockwall, Somervell, Tarrant, and Wise counties. Also depicted in the table are historical and forecast figures for the State of Texas and the United States. Over the next 20 years, the population of Collin County is projected to add approximately 684,000 people. The DFW Metroplex, as a whole, is projected to add approximately 2.9 million people. These projections equate to compound annual growth rates (CAGRs) of 2.75 percent and 1.73 percent, respectively. Employment projections are also strong for the area as Collin County is forecast to see employment gains of 2.81 percent annually. Income for Collin County and the DFW Metroplex is projected to grow slightly above the statewide and national growth rate at 1.44 percent annually.

AVIATION FORECAST METHODOLOGY

The development of aviation forecasts proceeds through both analytical and judgmental processes. A series of mathematical relationships is tested to establish statistical logic and rationale for projected growth. However, the judgment of the forecast analyst, based upon professional experience, knowledge of the aviation industry, and assessment of the local situation is important in the final determination of the preferred forecast.

By developing several projections for each aviation demand indicator, a reasonable planning envelope, or range of forecasts, will emerge. The selected forecast may be one of the individual projections or a combination of several projections based on local conditions. The selected forecast will almost always

fall within the planning envelope. Some combination of the following forecasting techniques is utilized to develop the planning envelope for each demand indicator.

TABLE 2C
Socioeconomic History and Projections

	HISTORICAL				PROJECTIONS			
	2000	2010	2016	CAGR (2000-2016)	2021	2026	2036	CAGR (2016-2036)
Collin County								
Population	499,118	788,568	936,253	4.01%	1,078,176	1,239,518	1,620,367	2.75%
Employment	246,228	449,203	570,693	5.39%	663,011	765,697	1,004,171	2.81%
Income (PCPI)	$54,642	$49,687	$56,437	0.20%	$61,019	$65,778	$75,667	1.44%
Dallas-Fort Worth-Arlington Metropolitan Statistical Area (DFW Metroplex)								
Population	5,235,385	6,452,725	7,207,994	2.02%	7,877,428	8,607,941	10,193,675	1.73%
Employment	3,436,648	3,948,869	4,672,385	1.94%	5,193,598	5,738,031	6,874,365	1.89%
Income (PCPI)	$40,836	$41,498	$47,089	0.89%	$51,027	$55,155	$63,187	1.44%
State of Texas								
Population	20,944,499	25,245,717	27,811,299	1.79%	30,127,388	32,624,041	37,988,744	1.56%
Employment	12,139,164	14,291,032	16,683,175	2.01%	18,425,339	20,231,603	23,968,203	1.77%
Income (PCPI)	$34,121	$37,659	$43,342	1.51%	$46,915	$50,635	$57,644	1.38%
United States								
Population	282,162,411	309,347,057	324,506,944	0.88%	339,812,108	355,802,071	387,690,418	0.88%
Employment	165,370,857	173,034,656	191,870,817	0.93%	220,485,615	235,183,042	247,548,008	1.22%
Income (PCPI)	$36,812	$39,622	$43,613	1.07%	$47,080	$50,611	$56,840	1.26%

CAGR - Compound Annual Growth Rate
PCPI - Per Capita Personal Income (adjusted to 2009 dollars)
Dallas-Fort Worth-Arlington Metropolitan Statistical Area (DFW Metroplex) includes Collin, Dallas, Denton, Ellis, Hunt, Hood, Johnson, Kaufman, Parker, Rockwall, Somervell, Tarrant, and Wise Counties

Source: U.S. Census Bureau; Woods & Poole Complete Economic and Demographic Data Source (CEDDS) 2016

Trend line projections are probably the simplest and most familiar of the forecasting techniques. By fitting growth curves to historical demand data and then extending them into the future, a basic trend line projection is produced. A basic assumption of this technique is that outside factors will continue to affect aviation demand in much the same manner as in the past. As broad as this assumption may be, the trend line projection does serve as a reliable benchmark for comparing other projections.

Market share analysis involves a historical review of aviation activity as a percentage, or share, of a larger regional, state, or national aviation market. A historical market share trend is determined, providing an expected market share for the future. These shares are then multiplied by the forecasts of the larger geographical area to produce a market share projection. This method has the same limitations as trend line projections, but can provide a useful check on the validity of other forecasting techniques.

Historical growth analysis is a simple forecasting method in which the historical annual growth rate is identified and then extended out to forecast years. This analysis method assumes factors that impacted growth in the past will continue into the future.

Correlation analysis provides a measure of the direct relationship between two separate sets of historic data. If there is a reasonable correlation between the data, further evaluation using regression analysis may be employed.

Regression analysis is a statistical technique used to measure the relationship between variables. This technique yields an r-squared (r^2) value which shows the level of correlation between the variables. If the r^2 value is greater than 0.95, it indicates a strong predictive reliability.

Beyond five years, the predictive reliability of the forecasts can diminish. Therefore, it is prudent for the airport to update the forecasts, reassess the assumptions originally made, and revise the forecasts based on the current airport and industry conditions. Facility and financial planning usually requires at least a 10-year purview since it often takes several years to complete a major facility development program.

Another consideration is that technological advances in aviation have historically altered, and will continue to change, the growth rates in aviation demand over time. The most obvious example is the impact of jet aircraft on the aviation industry, which resulted in a growth rate that far exceeded expectations. Such changes are difficult, if not impossible, to predict and there is no mathematical way to estimate their impacts. It is important to use forecasts which do not overestimate revenue-generating capabilities or understate demand for facilities needed to meet public (user) needs.

Forecasts of aviation demand for TKI have been developed utilizing statistical methods, available existing forecasts, and analyst expertise. The following section presents the aviation demand forecasts and includes activity in two broad categories: based aircraft and annual operations.

AVIATION FORECASTS

The following forecast analysis examines each of the aviation demand categories expected at TKI over the next 20 years. Each segment will be examined individually, and then collectively, to provide an understanding of the overall aviation activity at the Airport through 2036.

The need for airport facilities at TKI can best be determined by accounting for forecasts of future aviation demand. Forecasts for airport activities include the following:

For a reliever airport such as TKI, based aircraft, annual aircraft operations, and peak activity levels are the most important indicators of aviation demand that need to be fore-

- Registered Aircraft
- Based Aircraft
- Based Aircraft Fleet Mix
- Annual Aircraft Operations
- Peaking Characteristics
- Annual Instrument Approaches

For a reliever airport such as TKI, based aircraft, annual aircraft operations, and peak activity levels are the most important indicators of aviation demand that need to be forecast. Future facility requirements,

such as hangars and apron area, are derived from the general aviation forecasts. In addition, analysis in this study will consider commercial passenger activity projections as the Airport is served by an on-demand, scheduled charter service. As such, passenger enplanement forecasts have been developed to identify facility needs based upon the potential for growth in on-demand service, or possibly the entry of regularly scheduled charter/mainline commercial service operator activities, at TKI.

FAA *TERMINAL AREA FORECAST*

As previously discussed, on an annual basis the FAA publishes the TAF for each airport included in the NPIAS. The TAF is a generalized forecast of airport activity used by FAA for internal planning purposes. It is available to airports and consultants to use as a point of comparison for development of local forecasts. **Table 2D** presents the *Terminal Area Forecast* for TKI.

TABLE 2D
2017 FAA Terminal Area Forecast
McKinney National Airport

	2016	2021	2026	2036	CAGR (2016 - 2036)
ENPLANEMENTS					
Air Carrier	0	0	0	0	0.00%
Commuter	0	0	0	0	0.00%
Total	***0***	***0***	***0***	***0***	***0.00%***
ANNUAL OPERATIONS					
Itinerant					
Air Carrier	2	2	2	2	0.00%
Air Taxi	2,324	2,324	2,324	2,324	0.00%
General Aviation	38,882	41,000	42,036	44,191	0.64%
Military	57	57	57	57	0.00%
Total Itinerant	41,265	43,383	44,419	46,574	0.61%
Local					
General Aviation	77,309	78,913	79,383	80,332	0.19%
Military	20	20	20	20	0.00%
Total Local	77,329	78,933	79,403	80,352	0.19%
Total Operations	***118,594***	***122,316***	***123,822***	***126,926***	***0.34%***
Based Aircraft	***299***	***308***	***319***	***339***	***0.63%***

Source: FAA *Terminal Area Forecast* (January 2017)

As presented in the table, the TAF projects minimal growth in activity at the Airport over the next 20 years. Given that there is currently no commercial service activity at TKI, the TAF does not reflect any existing and/or forecast commercial airline passenger enplanements or aircraft operation. Operations are forecast to continue to be dominated by general aviation operations. The TAF also accounts for air taxi and military activity; however, it provides a flat-line forecast for these aviation segments after 2016. Because of the potential for a rapidly changing military mission, it is common to implement a flat-line forecast for military activity. Based aircraft are forecast to increase by 40 additional aircraft over the next 20 years. As noted previously, the FAA and TxDOT will examine the new forecasts developed for

this Master Plan in light of the TAF. A comparison between the Master Plan forecasts and TAF is detailed later in this chapter.

In 2016, the Airport experienced 120,470 operations, as counted by the TKI airport traffic control tower (ATCT), which is slightly above the base year TAF operations count. The TAF also presents a total of 299 based aircraft for 2016; however, Airport records show that there are 286 based aircraft as of 2016. Obviously, the TAF is outdated and should be updated. Once the forecasts presented here are approved by TxDOT and/or the FAA, the FAA could update the TAF to reflect the selected forecasts.

REGISTERED AIRCRAFT

The number of based aircraft is the most basic indicator of general aviation demand. By first developing a forecast of based aircraft for the Airport, other general aviation activity and demand can be projected. The process of developing forecasts of based aircraft begins with an analysis of aircraft ownership in the primary general aviation service area through a review of historical aircraft registrations. As previously discussed, a large majority of based aircraft ownership at TKI resides in Collin County.

A large majority of based aircraft ownership at TKI resides in Collin County.

Table 2E presents historical data regarding aircraft registered in Collin County since 1997. These figures are derived from the FAA aircraft registration database that categorized registered aircraft by county based on the zip code of the registered aircraft. Although this information generally provides a correlation to based aircraft, it is not uncommon for some aircraft to be registered in the county, but based at an airport outside the county or vice versa.

Between 2008 and 2014, two factors contributed to the decline in registered aircraft nationally: 1) the 2008-2009 national recession and subsequent slow recovery; and 2) FAA required all aircraft to be re-registered from 2010-2013, which removed nearly 30 percent of previously registered active general aviation aircraft. As presented in the table, Collin County experienced a decline in registered aircraft during this timeframe and that was likely attributed to a combination of the factors mentioned. With these two major factors now in the past, it is reasonable to anticipate a return to more normal growth trends.

As presented in the table, Collin County registered aircraft between 1997 and 2016 ranged between a low of 510 in 1997 to a high of 919 in 2008. The table also includes the type of aircraft registered in Collin County. As is typical for nearly all areas in the United States, single engine piston aircraft dominate the total aircraft numbers. In 2016, for example, there were 880 aircraft registered in the county, of which 667 were single engine piston aircraft. Aircraft registrations in 2016 also included 48 multi-engine piston aircraft, 19 turboprop aircraft, 59 jets, and 17 helicopters. There were also 70 aircraft included in the "other" category which can include gliders and ultralights.

TABLE 2E
Historical Aircraft Registration by Type
Collin County

Year	SEP	MEP	Turboprop	Jet	Helicopter	Other[1]	Total
1997	393	48	6	8	19	36	**510**
1998	418	55	10	8	21	38	**550**
1999	487	60	13	13	21	43	**637**
2000	511	59	7	17	19	48	**661**
2001	528	51	39	12	21	47	**698**
2002	539	51	39	12	22	47	**710**
2003	578	40	58	81	15	47	**819**
2004	597	40	59	89	12	44	**841**
2005	586	37	60	87	13	48	**831**
2006	620	73	16	46	13	52	**820**
2007	664	70	17	71	11	68	**901**
2008	667	54	22	99	11	66	**919**
2009	679	53	18	40	14	66	**870**
2010	692	46	19	40	12	67	**876**
2011	689	47	19	38	13	66	**872**
2012	644	42	23	40	13	75	**837**
2013	624	36	25	38	13	65	**801**
2014	673	45	22	53	15	72	**880**
2015	686	48	18	56	15	66	**889**
2016	667	48	19	59	17	70	**880**

[1]"Other" category consists of gliders and ultralight aircraft.
SEP - Single Engine Piston
MEP - Multi-Engine Piston
Source: FAA Aircraft Registration Database

Table 2F presents five different projections of registered aircraft for Collin County, two market share forecasts, two ratio projections, and a projection based upon the historical aircraft registration growth rate for Collin County. The first market share forecast considers the relationship between registered aircraft located within Collin County and active aircraft within the United States. In 2016, Collin County held 0.43 percent of the U.S. active aircraft. By keeping this market share constant, a forecast emerges that shows very modest growth in registered aircraft. This forecast method results in only 911 registered aircraft over the next 20 years and produces a compound annual growth rate (CAGR) of 0.18 percent.

The second forecast considers an increasing market share percentage of local registered aircraft to the number of national active aircraft. As evidenced in the table, since 1997 the county generally gained market share of the U.S. active fleet, increasing from 0.27 percent in 1998 to 0.43 percent in 2016. A continued increasing forecast model having the county market share of U.S. active aircraft rising to 0.57 percent in 2036, generates 1,201 registered aircraft at a CAGR of 1.57 percent.

TABLE 2F
Registered Aircraft Projections
Collin County

Year	County Registrations[1]	U.S. Active Aircraft[2]	Market Share of U.S. Aircraft	Collin County Population[3]	Aircraft per 1,000 Residents
1997	510	192,414	0.27%	408,371	1.25
1998	550	204,710	0.27%	438,214	1.26
1999	637	219,464	0.29%	468,620	1.36
2000	661	217,533	0.30%	499,118	1.32
2001	698	211,446	0.33%	534,642	1.31
2002	710	211,244	0.34%	563,565	1.26
2003	819	209,606	0.39%	589,394	1.39
2004	841	219,319	0.38%	617,802	1.36
2005	831	224,257	0.37%	647,187	1.28
2006	820	221,942	0.37%	683,935	1.20
2007	901	231,606	0.39%	714,330	1.26
2008	919	228,664	0.40%	741,264	1.24
2009	870	223,876	0.39%	765,791	1.14
2010	876	223,370	0.39%	788,568	1.11
2011	872	220,453	0.40%	814,738	1.07
2012	837	209,034	0.40%	837,476	1.00
2013	801	199,927	0.40%	858,711	0.93
2014	880	204,408	0.43%	885,241	0.99
2015	889	203,880	0.44%	910,066	0.98
2016	880	203,425	0.43%	936,253	0.93
Constant Market Share of U.S. Active Aircraft (CAGR = 0.18%)					
2021	879	203,225	0.43%	1,078,176	0.82
2026	883	204,030	0.43%	1,239,518	0.71
2036	911	210,695	0.43%	1,620,367	0.56
Increasing Market Share of U.S. Active Aircraft (CAGR = 1.57%)					
2021	945	203,225	0.47%	1,078,176	0.88
2026	1,041	204,030	0.51%	1,239,518	0.84
2036	1,201	210,695	0.57%	1,620,367	0.74
Constant Ratio Projection per 1,000 County Residents (CAGR = 2.73%)					
2021	1,003	203,225	0.49%	1,078,176	0.93
2026	1,153	204,030	0.56%	1,239,518	0.93
2036	1,507	210,695	0.72%	1,620,367	0.93
Decreasing Ratio Projection per 1,000 County Residents (CAGR = 1.63%)					
2021	960	203,225	0.47%	1,078,176	0.89
2026	1,041	204,030	0.51%	1,239,518	0.84
2036	1,215	210,695	0.58%	1,620,367	0.75
Historical Aircraft Registration Growth Rate (CAGR = 2.60%)					
2021	1,008	203,225	0.50%	1,078,176	0.93
2026	1,155	204,030	0.57%	1,239,518	0.93
2036	1,477	210,695	0.70%	1,620,367	0.91
Selected Registered Aircraft Forecast (CAGR = 1.69%)					
2021	***950***	203,225	0.47%	1,078,176	0.88
2026	***1,040***	204,030	0.51%	1,239,518	0.84
2036	***1,230***	210,695	0.58%	1,620,367	0.76

Source:
[1]FAA Aircraft Registration Database
[2]*FAA Aerospace Forecasts - Fiscal Years 2016-2036*
[3]U.S. Census Bureau; Woods & Poole Complete Economic and Demographic Data Source (CEDDS) 2016

In addition to the market share forecasts, two ratio projection forecasts were generated. In 2016, the county had 0.93 registered aircraft per 1,000 Collin County residents. The first ratio projection holds this ratio constant while it is applied to the population forecast of Collin County. This forecast results in 1,507 registered aircraft and a CAGR of 2.73 percent. A second ratio projection considers a decrease in the number of aircraft per 1,000 residents in Collin County. This has been the general trend over the past several years, primarily due to strong population growth outpacing growth in registered aircraft. When the decreasing ratio projection of registered aircraft per 1,000 residents is applied to the forecast population of the county, 1,215 registered aircraft are projected at a CAGR of 1.63 percent.

Finally, the historic aircraft registration growth rate was examined for Collin County. Based upon aircraft registrations beginning in 1997, the county had a total of 510 registered aircraft. This number grew to a total of 880 in 2016, at a CAGR of 2.60 percent. When this 20-year historic growth rate is projected to year 2036, a forecast of 1,477 registered aircraft emerges.

It should be noted that regression and time-series analyses were considered. Because of the overall declining trend in certain variables, including registered aircraft in recent years and U.S. active aircraft, regression and time-series analyses did not result in reliable forecasts. As a result, these analytical methods were not considered further.

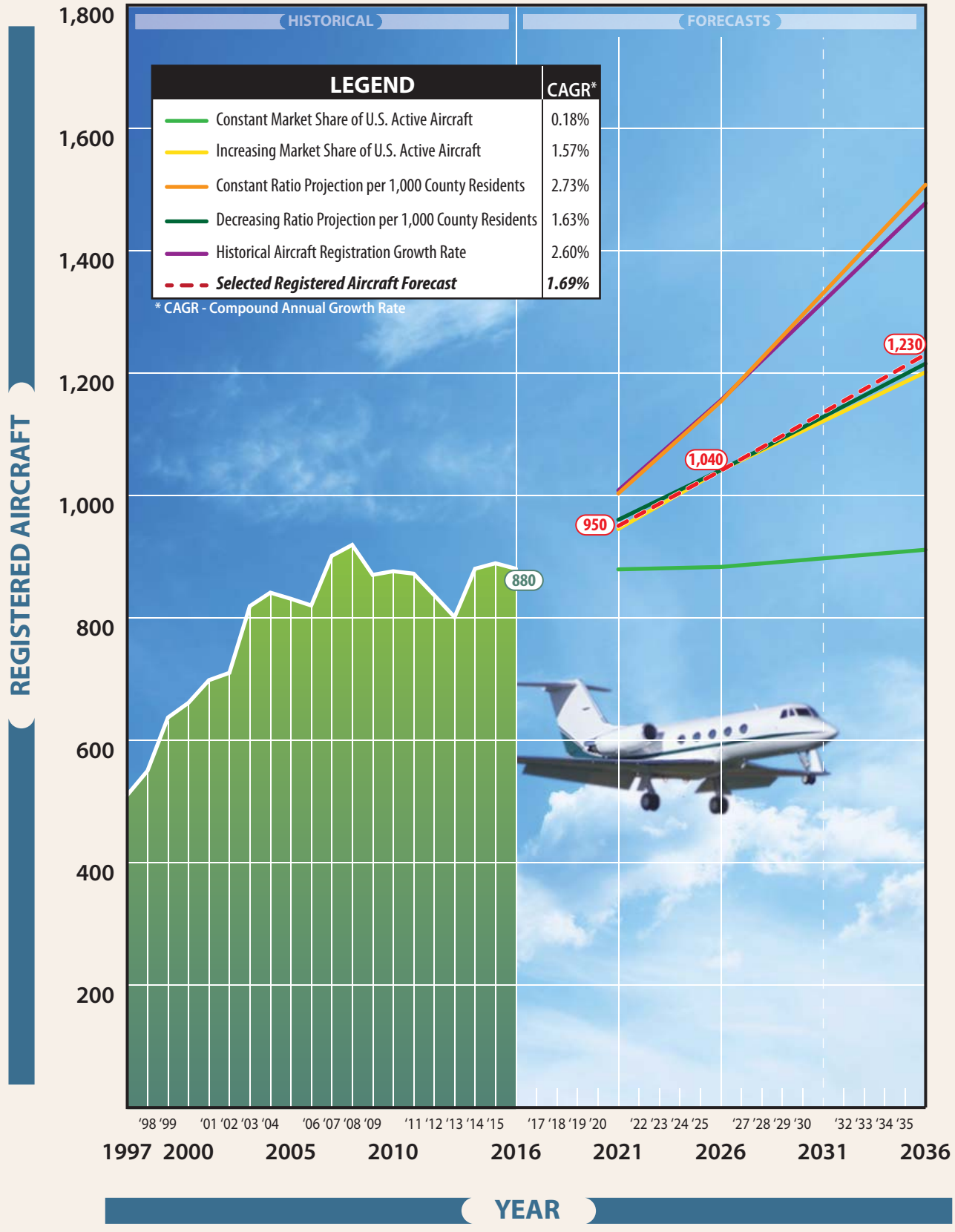
Exhibit 2E summarizes the registered aircraft forecasts for Collin County. The registered aircraft forecasts produced a high range of 1,507 registered aircraft and a low range of 911 registered aircraft. Recent declines in registered aircraft and U.S. active aircraft following the 2008-2009 recession have slowly leveled off and are projected to return to growth over time. Ultimately, the increasing market share of U.S. active aircraft and decreasing ratio projection of aircraft per 1,000 county residents are considered the most reasonable forecasts as they follow trends that have occurred over the past 20 years, while accounting for significant growth in population projected in Collin County during the forecast period. In 2021, registered aircraft are forecast to increase to 950. By 2036, registered aircraft for the county are forecast to reach 1,230. Over the next 20 years, registered aircraft within the county are forecast to grow at a CAGR of 1.69 percent annually.

The increasing market share of U.S. active aircraft and decreasing ratio projection of aircraft per 1,000 county residents are considered the most reasonable forecasts as they follow trends that have occurred over the past 20 years, while accounting for significant growth in population projected in Collin County during the forecast period.

The registered aircraft projection is one data point to be used in the development of a based aircraft forecast. The following section will present several potential based aircraft forecasts, as well as the selected based aircraft forecast, to be utilized in this study.

BASED AIRCRAFT

Determining the number of based aircraft at an airport can be a challenging task. Aircraft storage can be somewhat transient in nature, meaning aircraft owners can and do move their aircraft. Some aircraft owners may store their aircraft at an airport for only part of the year. For many years, the FAA did not require based aircraft records; therefore, historical records are often incomplete or non-existent.



Source: FAA Aircraft Registration Database

The current based aircraft count at TKI was compiled using the FAA National Based Aircraft Inventory Program as reported by airport management. Based on Airport records, including specified aircraft registration numbers in 2016, there were 286 based aircraft at the Airport. Historic based aircraft figures were provided by airport management, who is now required to monitor based aircraft activity at the Airport and provide periodic updates to the FAA. It is important to note that historical based aircraft counts could not be verified from 2003 through 2009; therefore, these years were not considered in this analysis.

Table 2G presents several based aircraft forecasts for TKI. The first method used to project based aircraft examined the Airport's share of registered aircraft in Collin County. As shown, the Airport captured 32.50 percent of aircraft registered in the county in 2016. The first forecast assumes a constant market share of 32.50 percent. This yields 400 aircraft by 2036, equating to a 1.69 percent CAGR. The second projection assumes the Airport's market share will increase throughout the planning period, similar to what has occurred over the past several years, according to based aircraft data provided by airport management. This projection would yield 492 based aircraft by the year 2036, resulting in a growth rate of 2.75 percent annually.

Trends comparing the number of based aircraft with the Collin County population were also analyzed. A constant ratio of based aircraft per 1,000 people results in based aircraft growing at the same rate as the county population. This yields 502 based aircraft by 2036, which is an annual growth rate of 2.86 percent. In comparison, an increasing ratio projection generates a forecast of 583 based aircraft and CAGR of 3.63 percent. A third ratio projection was analyzed which considers the historical average ratio of 0.28 based aircraft per 1,000 residents. When this forecast is applied, 460 based aircraft are projected at a CAGR of 2.40 percent.

As a point of comparison, the FAA TAF projects a total of 339 based aircraft by 2036. When considering the current number of based aircraft at the Airport, the TAF represents a 0.85 percent CAGR. The TAF's annual growth rate is actually lower when taking into account that this forecast considers an existing based aircraft count of 299 at TKI as previously detailed. As such, the TAF projection is considered too conservative based on the ability of the Airport to sustain increasing market shares of based aircraft over the past several years.

Finally, the based aircraft forecast from the *Collin County Regional Airport at McKinney Airport Layout Plan Update* (2012) study was also examined. It should be noted that this study utilized a base year of 2011. As such, the forecast growth rate of 2.80 percent was adapted to this master planning forecast horizon and carried forward to the year 2036. Ultimately, this forecast yields a based aircraft count of 495 by year 2036.

Similar to the registered aircraft projections, based aircraft forecasts considered regression and time-series analyses techniques. Due to the lack of verified based aircraft data, as well as contradicting trends in based aircraft and other variables, these techniques did not result in reliable forecasts.

TABLE 2G
Based Aircraft Forecasts
McKinney National Airport

Year	McKinney National Airport Based Aircraft[1]	Collin County Registered Aircraft[2]	Market Share of Registered Aircraft	Collin County Population[3]	Based Aircraft per 1,000 Residents
2002	162	710	22.82%	563,565	0.29
2010	204	876	23.29%	788,568	0.26
2011	210	872	24.08%	814,738	0.26
2012	218	837	26.05%	837,476	0.26
2013	239	801	29.84%	858,711	0.28
2014	265	880	30.11%	885,241	0.30
2015	296	889	33.30%	910,066	0.33
2016	286	880	32.50%	936,253	0.31
Constant Market Share Projection of Registered Aircraft (CAGR = 1.69%)					
2021	309	950	32.50%	1,078,176	0.29
2026	338	1,040	32.50%	1,239,518	0.27
2036	400	1,230	32.50%	1,620,367	0.25
Increasing Market Share Projection of Registered Aircraft (CAGR = 2.75%)					
2021	323	950	34.00%	1,078,176	0.30
2026	380	1,040	36.50%	1,239,518	0.31
2036	492	1,230	40.00%	1,620,367	0.30
Constant Ratio Projection per 1,000 County Residents (CAGR = 2.86%)					
2021	334	950	35.18%	1,078,176	0.31
2026	384	1,040	36.95%	1,239,518	0.31
2036	502	1,230	40.84%	1,620,367	0.31
Increasing Ratio Projection per 1,000 County Residents (CAGR = 3.63%)					
2021	345	950	36.32%	1,078,176	0.32
2026	421	1,040	40.52%	1,239,518	0.34
2036	583	1,230	47.43%	1,620,367	0.36
Historical Average Ratio Projection per 1,000 County Residents (CAGR = 2.40%)					
2021	306	950	32.24%	1,078,176	0.28
2026	352	1,040	33.86%	1,239,518	0.28
2036	460	1,230	37.42%	1,620,367	0.28
FAA Terminal Area Forecast (CAGR = 0.85%)					
2021	308	950	32.42%	1,078,176	0.29
2026	319	1,040	30.67%	1,239,518	0.26
2036	339	1,230	27.56%	1,620,367	0.21
Airport Layout Plan Update (2012) Growth Rate (CAGR = 2.80%)					
2021	328	950	34.53%	1,078,176	0.30
2026	377	1,040	36.25%	1,239,518	0.30
2036	495	1,230	40.24%	1,620,367	0.31
Selected Based Aircraft Forecast (CAGR = 2.40%)					
2021	***325***	950	34.21%	1,078,176	0.30
2026	***370***	1,040	35.58%	1,239,518	0.30
2036	***460***	1,230	37.40%	1,620,367	0.28

Note: Based aircraft totals for years 2003 through 2009 are not verified by airport management and, therefore, not used in this analysis.

Source:
[1]Airport Master Plan Update (2006); Airport Layout Plan Update (2012); Airport Records
[2]FAA Aircraft Registration Database
[3]U.S. Census Bureau; Woods & Poole Complete Economic and Demographic Data Source (CEDDS) 2016

The forecasts previously discussed in **Table 2G** and further depicted on **Exhibit 2F** represent a reasonable planning envelope. The selected forecast falls between the historical average ratio projection per 1,000 county residents and increasing market share projections of registered aircraft in the county. As such, it considers the Airport experiencing an increase in market share through the planning period. In the next five years, 325 aircraft are projected. In 10 years, 370 aircraft are projected and by 2036, 460 based aircraft are projected. This forecast results in a 2.40 percent CAGR through the long term planning period.

It is also important to note that historical trends in based aircraft at the Airport have closely mirrored overall population growth trends in Collin County. From 2000 to 2016, population grew at 4.14 percent annually. Likewise, based aircraft at TKI from 2002 to 2016 grew at a very similar annual rate of nearly four percent. As previously detailed, population growth in Collin County is expected to remain relatively strong during the course of the planning period, growing at over 2.50 percent annually. This is similar to the selected based aircraft forecast, which expects a 2.40 percent CAGR.

Future aircraft basing at the Airport will depend on several factors, including the state of the economy, fuel costs, available facilities, competing airports, and adjacent development potential.

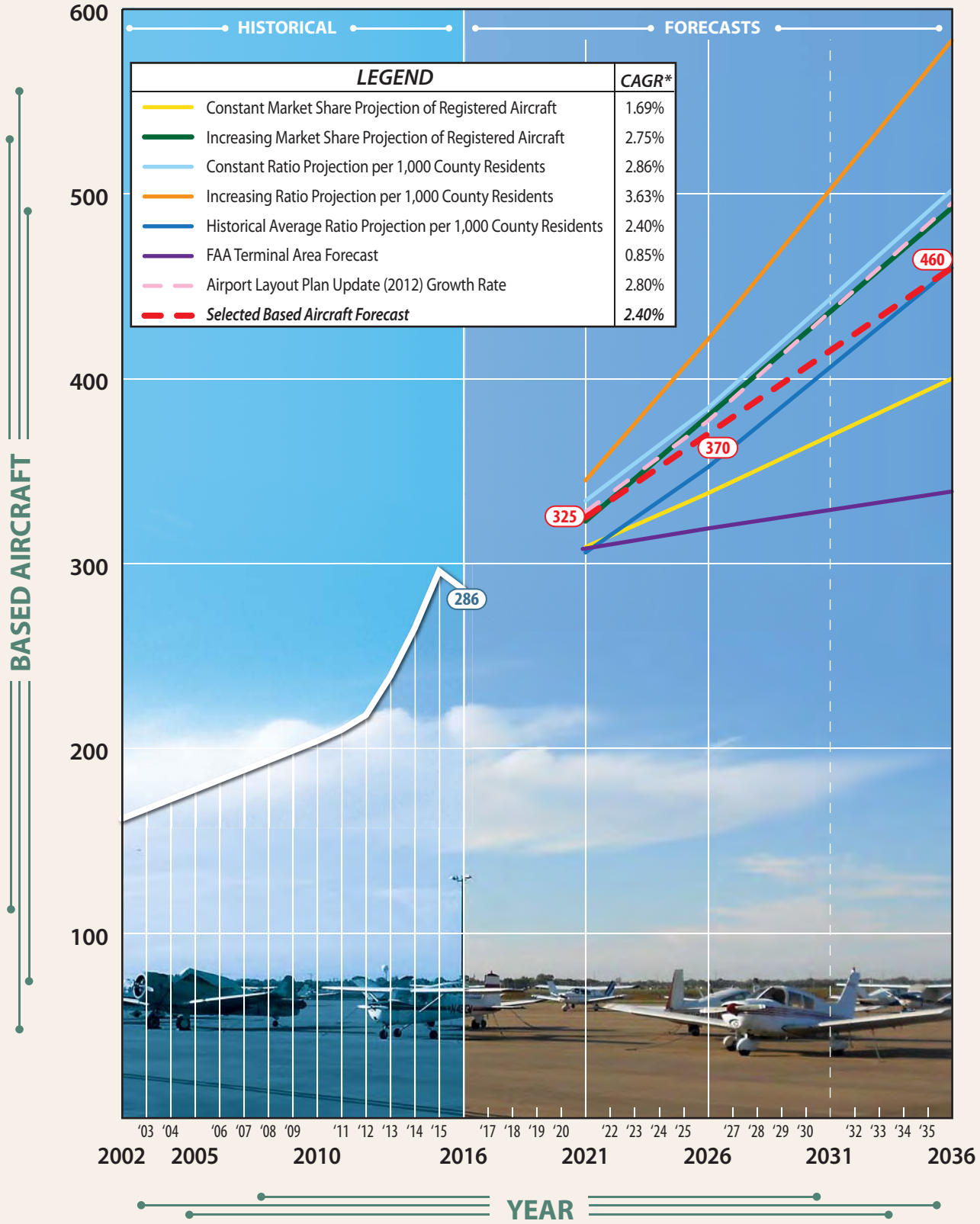
Future aircraft basing at the Airport will depend on several factors, including the state of the economy, fuel costs, available facilities, competing airports, and adjacent development potential. Forecasts assume a reasonably stable and growing economy, as well as reasonable development of Airport facilities necessary to accommodate aviation demand. Competing airports will play a role in deciding demand; however, TKI should fare well in this competition as it is served by a runway capable of handling the majority of general aviation aircraft and the Airport's capability of being expanded to meet future demand.

Consideration must also be given to the current and future aviation conditions at the Airport. TKI provides an array of aviation services and it has a runway that offers instrument approach capabilities which makes the facility accessible during poor weather conditions. In short, TKI will continue to be favored by aviation operators due to its location and available facilities. Furthermore, the City of McKinney has given every indication that it plans to continue strong support of TKI. Significant investments are currently being made to the facility and the Airport should continue to meet the needs of aircraft in the regional aviation system.

BASED AIRCRAFT FLEET MIX

The fleet mix of based aircraft is oftentimes more important to airport planning and design than the total number of aircraft. For example, the presence of one or a few business jets can impact the design standards more than a large number of smaller, single engine piston-powered aircraft.

Knowing the aircraft fleet mix expected to utilize TKI is necessary to properly plan for facilities that will best serve the level of activity and the type of activities occurring at the Airport. The existing fleet mix



Source: Airport Master Plan Update (2006); Airport Layout Plan Update (2012); Airport Records

of aircraft based at the Airport is comprised of 221 single engine piston aircraft, 19 multi-engine piston aircraft, 12 turboprops, 27 jets, and seven helicopters.

The based aircraft fleet mix, as presented on **Table 2H**, was compared to the existing and forecast U.S. general aviation fleet mix trends as presented in FAA *Aerospace Forecasts – Fiscal Years 2016-2036*, as well as to trends occurring at the Airport. The national trend in general aviation continues to be toward a greater percentage of larger, more sophisticated aircraft as part of the national fleet. While single engine piston-powered aircraft will continue to account for the largest share of based aircraft at the Airport, these aircraft are forecast to drop as a percentage of the fleet mix. Multi-engine piston-powered aircraft are expected to decrease in number and decrease as a percentage of the fleet mix during the planning period of the Master Plan.

Consistent with national aviation trends, real growth is anticipated to occur within the more sophisticated categories, including turboprop and jet categories.

Consistent with national aviation trends, real growth is anticipated to occur within the more sophisticated categories, including turboprop and jet categories. The turboprop category is projected to increase by 23 based aircraft over the next 20 years, while the jet category is projected to grow by 36 based aircraft. Helicopters are also considered a significant growth category, growing by 15 through 2036.

TABLE 2H
Based Aircraft Fleet Mix
McKinney National Airport

	Existing		Forecast					
Aircraft Type	**2016**	**Percent**	**2021**	**Percent**	**2026**	**Percent**	**2036**	**Percent**
Single Engine Piston	221	77.27%	243	74.77%	268	72.43%	323	70.22%
Multi-Engine Piston	19	6.64%	20	6.15%	19	5.14%	17	3.70%
Turboprop	12	4.20%	17	5.23%	25	6.76%	35	7.61%
Jet	27	9.44%	34	10.46%	43	11.62%	63	13.70%
Helicopter	7	2.45%	11	3.38%	15	4.05%	22	4.78%
Totals	**286**	**100%**	**325**	**100%**	**370**	**100%**	**460**	**100%**

Source: Airport Records: FAA National Based Aircraft Inventory Program; Coffman Associates analysis

ANNUAL AIRCRAFT OPERATIONS

Aircraft operations can be separated into distinct groups. For facilities such as TKI, operations typically include general aviation, air taxi, and military. General aviation operations are those conducted by private individuals or companies that are not associated with scheduled passenger services or non-scheduled transport services for hire. Air taxi refers to those operators who are certified in accordance with Title 14 Code of Federal Regulations (CFR) Part 135 and are authorized to provide on-demand public transportation of persons and property by aircraft. Military operations are those conducted by military personnel and aircraft. Air carrier operations are those conducted by commercial aircraft having a seating capacity of 60 or more and/or a maximum payload capacity of 18,000 pounds. TKI has experienced very few air carrier operations in previous years.

Aircraft operations are further classified by the ATCT as either local or itinerant. A local operation is a takeoff or landing performed by an aircraft that operates within sight of the airport or which executes simulated approaches or touch-and-go operations at the airport. Itinerant operations are those performed by aircraft with a specific origin or destination away from the airport. Generally, local operations are characterized by training operations. Typically, itinerant operations increase with business use.

Table 2J depicts the history of all aircraft operations at TKI since 2000. Itinerant operations have remained relatively consistent during this timeframe. In 2016, the Airport experienced 39,224 itinerant operations, which represents the highest count for a calendar year since 2000. The lowest count was experienced in 2010, as the ATCT logged 27,522 itinerant operations. Local operations have experienced significant fluctuations at the Airport since 2000. The highest number of local operations was experienced in 2001, when the Airport logged 124,783 operations. Local operations saw their lowest total in 2012, when the Airport experienced 52,545 operations. Since this time, the Airport has experienced positive growth in local operations. Overall, 2001 marked the highest number of total aircraft operations when the Airport experienced 160,798 operations. Conversely, the Airport experienced its lowest operational activity in 2010, when 81,957 aircraft operations were logged. From 2000 through 2016, the Airport averaged approximately 110,000 annual operations. General aviation operations (both itinerant and local) accounted for a vast majority of overall operations at over 98 percent during the timeframe.

TABLE 2J
Historical Aircraft Operations
McKinney National Airport

	Itinerant Operations					Local Operations			
Year	Air Carrier	Air Taxi	General Aviation	Military	Total Itinerant	General Aviation	Military	Total Local	Total Operations
2000	0	2	40,628	12	40,642	115,138	0	115,138	155,780
2001	0	141	35,825	49	36,015	124,773	10	124,783	160,798
2002	0	292	36,298	27	36,617	102,704	6	102,710	139,327
2003	0	235	32,783	25	33,043	87,077	4	87,081	120,124
2004	0	637	34,619	37	35,293	81,609	12	81,621	116,914
2005	0	540	33,070	52	33,662	64,332	32	64,364	98,026
2006	0	578	33,837	57	34,472	71,715	24	71,739	106,211
2007	0	906	30,449	94	31,449	64,437	34	64,471	95,920
2008	0	7,143	32,903	20	40,066	76,185	4	76,189	116,255
2009	0	1,132	27,631	41	28,804	56,752	24	56,776	85,580
2010	0	1,249	27,522	54	28,825	52,707	425	53,132	81,957
2011	1	1,328	28,857	36	30,222	52,700	16	52,716	82,938
2012	0	1,405	29,415	36	30,856	52,302	243	52,545	83,401
2013	15	1,464	31,429	42	32,950	55,243	16	55,259	88,209
2014	0	1,560	32,622	21	34,203	66,959	12	66,971	101,174
2015	0	2,042	35,349	35	37,426	71,234	15	71,249	108,675
2016	2	2,503	39,224	62	41,791	78,657	22	78,679	120,470

Source: FAA Air Traffic Activity Data System

These operational statistics are based on actual ATCT counts conducted when the tower is open and do not reflect operations that occur while the tower is closed. An adjustment will be added to the final operations forecast later in this chapter to account for operations that occur when the tower is closed. The operational mix at TKI has been approximately 68 percent local and 32 percent itinerant since 2000. Higher local operations at a general aviation airport typically indicates that the Airport is an important facility for flight training activity; however, significant itinerant operations at TKI also make the Airport a destination for businesses, as well as for personal and recreational activities.

Itinerant General Aviation Operations

Five forecasts of itinerant general aviation operations have been developed and are presented in **Table 2K**. The forecasts presented examine and/or manipulate variables, such as the TKI market share of itinerant operations, operations per based aircraft, and the FAA TAF. The first projection considers the Airport maintaining its market share of total U.S. itinerant general aviation operations at a constant level. In 2016, TKI accounted for 0.28 percent of U.S. itinerant operations. By carrying this percentage forward to the plan years of this study, a forecast emerges generating a CAGR of 0.26 percent and 41,278 itinerant general aviation operations by year 2036. The second forecast considers an increasing TKI market share of national itinerant general aviation operations and produces a CAGR of 2.06 percent and 58,968 operations by 2036.

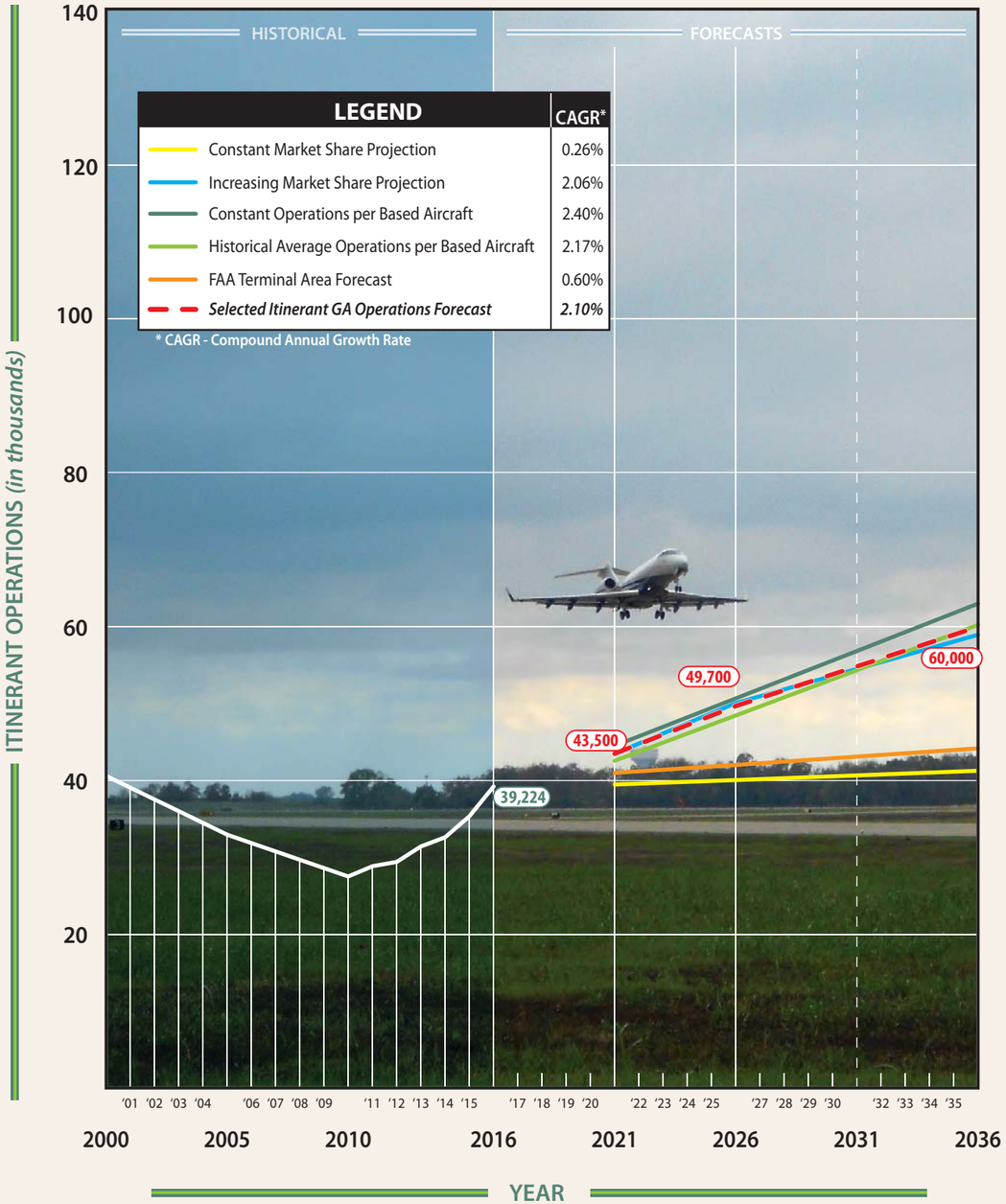
Additional forecasts were prepared by examining the Airport's operations per based aircraft. By maintaining the current ratio of operations per based aircraft constant at 137 through the planning period, a forecast of 63,020 itinerant general aviation operations by 2036 results. Alternatively, the historical average of operations per based aircraft from 2010 through 2016 (131) was considered, and forecasts a CAGR of 2.17 percent and 60,260 itinerant general aviation operations by the year 2036.

For comparison, the FAA TAF projections are presented in the table. With this forecast, the market share remains steady and operations per based aircraft reach very low numbers when compared to what the Airport has experienced in the past.

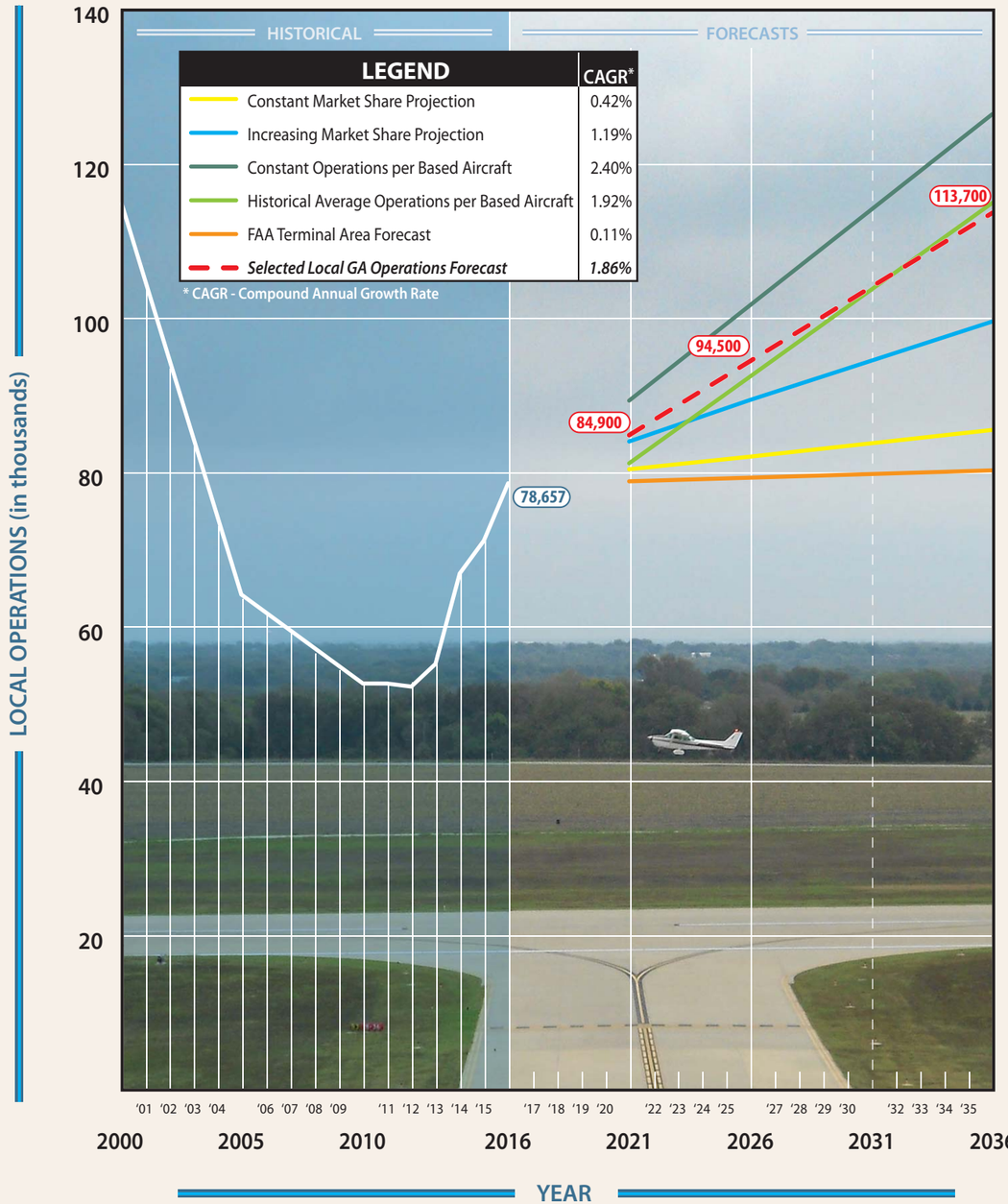
General aviation itinerant operations at TKI have been on the increase the last few years, and as the economy continues to improve as forecast, the selected itinerant aircraft operation projection continues a positive growth trend.

General aviation itinerant operations at TKI have been on the increase the last few years, and as the economy continues to improve as forecast, the selected itinerant aircraft operation projection continues a positive growth trend. The region's strong socioeconomic base and continued development potential will attribute to this projected growth. The selected forecast for itinerant operations at TKI would account for an increased market share as a percentage of total U.S. itinerant operations and a slight decrease in aircraft utilization per based aircraft. The selected forecast equates to a CAGR of 2.10 percent through the planning period. **Exhibit 2G** further presents the general aviation itinerant operations forecasts.

ITINERANT GENERAL AVIATION OPERATIONS



LOCAL GENERAL AVIATION OPERATIONS



Source: Historical data from ATCT as reported to the FAA

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TABLE 2K
Itinerant General Aviation Operations Forecasts
McKinney National Airport

Year	McKinney Itinerant GA Operations[1]	U.S. ATCT Itinerant GA Operations[2]	Market Share of Itinerant Operations	McKinney Based Aircraft[3]	Itinerant Operations per Based Aircraft
2000	40,628	22,844,000	0.18%		
2005	33,070	19,315,000	0.17%		
2010	27,522	14,864,000	0.19%	204	135
2011	28,857	14,528,000	0.20%	210	137
2012	29,415	14,522,000	0.20%	218	135
2013	31,429	14,117,000	0.22%	239	132
2014	32,622	13,979,000	0.23%	265	123
2015	35,349	13,887,000	0.25%	296	119
2016	39,224	13,903,000	0.28%	286	137
Constant Market Share Projection (CAGR = 0.26%)					
2021	39,488	14,103,000	0.28%	325	122
2026	40,065	14,309,000	0.28%	370	108
2036	41,278	14,742,000	0.28%	460	90
Increasing Market Share Projection (CAGR = 2.06%)					
2021	43,719	14,103,000	0.31%	325	135
2026	50,082	14,309,000	0.35%	370	135
2036	58,968	14,742,000	0.40%	460	128
Constant Operations per Based Aircraft (CAGR = 2.40%)					
2021	44,525	14,103,000	0.32%	325	137
2026	50,690	14,309,000	0.35%	370	137
2036	63,020	14,742,000	0.43%	460	137
Historical Average Operations per Based Aircraft (CAGR = 2.17%)					
2021	42,575	14,103,000	0.30%	325	131
2026	48,470	14,309,000	0.34%	370	131
2036	60,260	14,742,000	0.41%	460	131
FAA Terminal Area Forecast (CAGR = 0.60%)					
2021	41,000	14,103,000	0.29%	325	126
2026	42,036	14,309,000	0.29%	370	114
2036	44,191	14,742,000	0.30%	460	96
Selected Itinerant General Aviation Operations Forecast (CAGR = 2.10%)					
2021	***43,500***	14,103,000	0.31%	325	134
2026	***49,700***	14,309,000	0.35%	370	134
2036	***60,000***	14,742,000	0.41%	460	132

Source:
[1]Historical data from ATCT as reported to the FAA
[2]*FAA Aerospace Forecasts - Fiscal Years 2016-2036*
[3]Airport Layout Plan Update (2012); Airport Records

Local General Aviation Operations

A similar methodology was utilized to generate a planning forecast for local general aviation operations at TKI. Five forecasts have been developed and are presented in **Table 2L**. The TKI market share, as a percentage of total general aviation local operations at towered airports, has been on the rise since

2010. Also depicted in the table are the local operations per based aircraft ratios. These numbers have fluctuated since 2010, experiencing a high of 275 most recently in 2016.

TABLE 2L
Local General Aviation Operations Forecasts
McKinney National Airport

Year	McKinney Local GA Operations[1]	U.S. ATCT Local GA Operations[2]	Market Share of Local Operations	McKinney Based Aircraft[3]	Local Operations per Based Aircraft
2000	115,138	17,034,000	0.68%		
2005	64,332	14,846,000	0.43%		
2010	52,707	11,716,000	0.45%	204	258
2011	52,700	11,437,000	0.46%	210	251
2012	52,302	11,608,000	0.45%	218	240
2013	55,243	11,688,000	0.47%	239	231
2014	66,959	11,675,000	0.57%	265	253
2015	71,234	11,691,000	0.61%	296	241
2016	78,657	11,776,000	0.67%	286	275
Constant Market Share Projection (CAGR = 0.42%)					
2021	80,474	12,011,000	0.67%	325	248
2026	82,109	12,255,000	0.67%	370	222
2036	85,572	12,772,000	0.67%	460	186
Increasing Market Share Projection (CAGR = 1.19%)					
2021	84,077	12,011,000	0.70%	325	259
2026	89,462	12,255,000	0.73%	370	242
2036	99,622	12,772,000	0.78%	460	217
Constant Operations per Based Aircraft (CAGR = 2.40%)					
2021	89,375	12,011,000	0.74%	325	275
2026	101,750	12,255,000	0.83%	370	275
2036	126,500	12,772,000	0.99%	460	275
Historical Average Operations per Based Aircraft (CAGR = 1.92%)					
2021	81,250	12,011,000	0.68%	325	250
2026	92,500	12,255,000	0.75%	370	250
2036	115,000	12,772,000	0.90%	460	250
FAA Terminal Area Forecast (CAGR = 0.11%)					
2021	78,913	12,011,000	0.66%	325	243
2026	79,383	12,255,000	0.65%	370	215
2036	80,332	12,772,000	0.63%	460	175
Selected Itinerant General Aviation Operations Forecast (CAGR = 1.86%)					
2021	***84,900***	12,011,000	0.71%	325	261
2026	***94,500***	12,255,000	0.77%	370	255
2036	***113,700***	12,772,000	0.89%	460	247

Source:
[1] Historical data from ATCT as reported to the FAA
[2] *FAA Aerospace Forecasts - Fiscal Years 2016-2036*
[3] Airport Layout Plan (2012); Airport Records

The first forecast considers maintaining a constant 0.67 percent market share of national local operations, yielding a local annual operations projection of approximately 85,572 by 2036. The second forecast

applies an increasing market share of local operations throughout the planning horizon and yields 99,622 operations by 2036.

Constant and historical average operations per based aircraft forecasts were also prepared. These forecasts generated fairly aggressive CAGRs of 2.40 percent and 1.92 percent, respectively.

The FAA TAF projections are also presented in the table. Similar to itinerant operations, the TAF shows a significant decline in operations per based aircraft through the planning period, as well as a decline in the market share of national local operations. These are contrary to the trends being experienced at the Airport over the past several years. As such, the TAF will serve as the low end of the planning envelope.

The selected forecast for local general aviation operations at TKI is depicted on **Exhibit 2G** and at the bottom of **Table 2L**. Local general aviation operations are projected to increase through the planning period, at 1.86 percent annually, following gains in the economy and in total local general aviation operations per the FAA *Aerospace Forecast – Fiscal Years 2016-2036*. The level of local activity will continue to be dependent upon the operations of flight training, as well as aircraft basing at the Airport.

The level of local activity will continue to be dependent upon the operations of flight training, as well as aircraft basing at the Air-

Other Air Taxi Operations

Air taxi operations are those with authority to provide "on-demand" transportation of persons or property via aircraft with fewer than 60 passenger seats. Air taxi includes a broad range of operations, including some smaller commercial service aircraft, some charter aircraft, air cargo aircraft, many fractional ownership aircraft, and air ambulance services.

The history of air taxi operations is included in **Table 2M**. As presented, air taxi operations at the Airport have been increasing since 2010. In fact, air taxi operations have more than doubled over the term.

Air taxi operations have more than doubled over the term.

The FAA national air taxi forecast projects a 3.03 percent decrease in air taxi operations through 2026, followed by modest increases thereafter. The primary reason for this decrease is the transition by commuter airlines to larger aircraft with more than 60 passenger seats, which are then counted as air carrier operations. While air taxi operations that are represented by commuter airlines using aircraft with fewer than 60 seats are decreasing, the business jet segment of the air taxi category is expected to continue to grow nationally. The facilities and services available at TKI are especially accommodating to operators of business jets. Therefore, it is reasonable to expect the business jet component of air taxi activity to increase moderately over time at TKI. In addition, operators such as PHI Air Medical and CareFlite are currently based at the Airport.

It should be noted that another air taxi operator, Texas Air Shuttle, has previously conducted air activity at TKI and is planning to resume service at the Airport again in Spring 2017. This is a start-up operation and its effect on air taxi operations at TKI has not yet been realized. As such, a separate scenario for

based air taxi operations and enplanements forecast has been generated and will be discussed later in the chapter.

TABLE 2M
Other Air Taxi Operations Forecasts
McKinney National Airport

Year	McKinney Air Taxi Operations[1]	U.S. Air Taxi Operations[2]	Market Share of Air Taxi Operations
2010	1,249	9,410,000	0.013%
2011	1,328	9,279,000	0.014%
2012	1,405	8,994,000	0.016%
2013	1,464	8,803,000	0.017%
2014	1,560	8,440,000	0.018%
2015	2,042	7,895,000	0.026%
2016	2,503	7,499,000	0.033%
Constant Market Share Projection (CAGR = -0.95%)			
2021	2,101	6,294,000	0.033%
2026	1,880	5,631,000	0.033%
2036	2,069	6,199,000	0.033%
Increasing Market Share Projection (CAGR = 3.48%)			
2021	2,832	6,294,000	0.045%
2026	3,379	5,631,000	0.060%
2036	4,959	6,199,000	0.080%
FAA Terminal Area Forecast (CAGR = -0.37%)			
2021	2,324	6,294,000	0.037%
2026	2,324	5,631,000	0.041%
2036	2,324	6,199,000	0.037%
Selected Other Air Taxi Operations Forecast (CAGR = 2.98%)			
2021	***2,800***	6,294,000	0.044%
2026	***3,300***	5,631,000	0.059%
2036	***4,500***	6,199,000	0.073%

Source:
[1]Historical data from ATCT as reported to the FAA
[2]*FAA Aerospace Forecasts - Fiscal Years 2016-2036*

Table 2M presents three forecasts for other air taxi operations at the Airport. The first simply considers the Airport capturing a constant market share of national air taxi operations, which results in a decreasing number of other air taxi operations. This forecast is not thought to reflect the local condition at TKI, considering the air taxi operators currently basing at the Airport. The second forecast considers an increasing market share of air taxi operations, which produces a CAGR of 3.48 percent and 4,959 other air taxi operations by 2036.

The remaining forecast analyzes air taxi operations presented in the FAA TAF. The TAF projects a flat-line projection of 2,324 air taxi operations at TKI through 2036. This projection is less than what the TKI ATCT counted in 2016, thus representing a negative CAGR.

Other air taxi operations have been forecast to increase through the 20-year planning period, constituting a 2.98 percent CAGR. This operational level is conducive of a reliever airport supported by a variety of industrial and commercial business activities as currently exists, and is forecast to continue for areas adjacent to TKI.

Military Operations

TKI has experienced very little military activity in the past. Since 2000, military activity has averaged approximately 100 annual operations. Of these operations, approximately 50 percent were itinerant and 50 percent were local.

Forecasting for military activity is particularly challenging when there are no based military aircraft. The FAA has taken the position that it is inherently difficult to forecast military operations because of the variable nature of the military mission. Due to this unpredictability, military activity is forecast as a constant of 100 total operations annually for each planning period.

ATCT Count Adjustment and Total Operations

As previously mentioned, the TKI ATCT is not a 24-hour tower and, as such, its air traffic counts are not all-inclusive of aircraft operations at the Airport. Some aspects of the Master Plan require that all airport activity be considered. For these evaluations, it is necessary to estimate and adjust for operations that occur when the tower is closed. The TKI ATCT operates from 6:00 a.m. to 10:00 p.m. daily.

For planning purposes within this Master Plan, operations after the tower has closed are estimated at five percent of total operations.

For planning purposes within this Master Plan, operations after the tower has closed are estimated at five percent of total operations. This estimate is consistent with other facilities similar to TKI where after-hours operational counts have been conducted.

Table 2N presents a summary of the ATCT operations, as well as the adjusted operations, when considering the five percent increase for after-hours activity. When considering the five percent adjustment, total annual operations are estimated at 126,494 for 2016. Through the 20-year planning period, annual operations, including nighttime operations, are forecast to be 187,215. The operational projections equate to a 1.98 percent CAGR.

TABLE 2N
Forecast Adjustment for ATCT After-Hours Operations
McKinney National Airport

	2016	2021	2026	2036
ATCT OPERATIONS				
General Aviation				
Itinerant	39,224	43,500	49,700	60,000
Local	78,657	84,900	94,500	113,700
Total General Aviation Operations	117,881	128,400	144,200	173,700
Other Air Taxi	2,503	2,800	3,300	4,500
Military	86	100	100	100
Total ATCT Operations	***120,470***	***131,300***	***147,600***	***178,300***
ADJUSTED OPERATIONS				
General Aviation				
Itinerant	41,185	45,675	52,185	63,000
Local	82,590	89,145	99,225	119,385
Total General Aviation Operations	123,775	134,820	151,410	182,385
Other Air Taxi	2,628	2,940	3,465	4,725
Military	90	105	105	105
Total Adjusted Operations	***126,494***	***137,865***	***154,980***	***187,215***

Adjustment accounts for the hours (10:00 p.m. - 6:00 a.m.) when the ATCT is closed.

PEAKING CHARACTERISTICS

Many airport facility needs are related to the levels of activity during peak periods (busy times). The periods used in developing facility requirements for this study are as follows:

- **Peak Month** – The calendar month when peak aircraft operations occur.
- **Design Day** – The average day in the peak month. This indicator is derived by dividing the peak month operations by the number of days in the month.
- **Busy Day** – The busy day of a typical week in the peak month.
- **Design Hour** – The peak hour within the design day.

It is important to realize that only the peak month is an absolute peak within the year. Each of the other periods will be exceeded at various times during the year. However, each provides reasonable planning standards that can be applied without overbuilding or being too restrictive.

A review of ATCT reports shows that the peak month for operations has averaged 10.19 percent of total annual operations. This factor is carried to the plan years. The design day is simply the peak month divided by the number of days in that month (30).

Daily operational counts from the ATCT were utilized to determine a busy day peaking factor for general aviation activity. The peak day of each week has historically averaged 22 percent of weekly operations. Thus, to determine the typical busy day, the design day is multiplied by 1.54, which represents 22 percent of the days in a week (7 x 0.22). Design hour operations were determined to be approximately 15 percent of the design day operations. The peaking characteristics are summarized in **Table 2P** for each planning year period.

TABLE 2P
Peak Operations Forecast
McKinney National Airport

	2016	2021	2026	2036
Annual Operations	126,494	137,865	154,980	187,215
Peak Month	12,890	14,048	15,792	19,077
Design Day	430	468	526	636
Busy Day	662	721	811	979
Design Hour	56	61	68	83

Source: ATCT records; Coffman Associates analysis

ANNUAL INSTRUMENT APPROACHES

An instrument approach, as defined by the FAA, is "an approach to an airport with the intent to land by an aircraft in accordance with an Instrument Flight Rule (IFR) flight plan, when visibility is less than three miles and/or when the ceiling is at or below the minimum initial approach altitude." To qualify as an instrument approach, aircraft must land at the Airport after following one of the published instrument approach procedures in less than visual conditions. Forecasts of annual instrument approaches (AIAs) provide guidance in determining an airport's requirements for navigational aid facilities, such as an instrument landing system. It should be noted that practice or training approaches do not count as annual AIAs, nor do instrument approaches conducted in visual conditions.

During poor weather conditions, pilots are less likely to fly and rarely would perform training operations. As a result, an estimate of the total number of AIAs can be made based on a percentage of itinerant operations regardless of the frequency of poor weather conditions. An estimate of three percent of total itinerant (general aviation, other air taxi, and military) operations is utilized to forecast AIAs at TKI, as presented in **Table 2Q**.

TABLE 2Q
Annual Instrument Approaches (AIAs)
McKinney National Airport

Year	Annual Instrument Approaches	Itinerant Operations	Ratio
2016	1,316	43,863	3.00%
2021	1,460	48,665	3.00%
2026	1,671	55,700	3.00%
2036	2,033	67,775	3.00%

Source: Coffman Associates analysis

FORECAST COMPARISON TO THE FAA TAF

The FAA and TxDOT will review the forecasts presented in this Master Plan for consistency with the *Terminal Area Forecast*. Typically, the local FAA Airports District Office (ADO) or Regional Airports Division (RO) are responsible for forecast approvals but, as mentioned, TxDOT is the first level reviewer for Texas airports. When reviewing a sponsor's forecast, TxDOT/FAA must ensure that the forecast is based on reasonable planning assumptions, uses current data, and is developed using appropriate forecast methods. Forecasts of based aircraft and annual aircraft operations are considered consistent with the TAF if they differ by less than 10 percent in the five-year period and 15 percent in the 10-year forecast period. If the forecast is not consistent with the TAF, differences must be resolved if the forecast is to be used for TxDOT/FAA decision-making. The reason the FAA allows this differential is because the TAF forecasts are not meant to replace forecasts developed locally (i.e., in this Master Plan). While the TAF can provide a point of reference or comparison, their purpose is much broader in defining FAA national workload measures.

Table 2R presents the direct comparison of the master planning forecasts with the TAF published in January 2017. Regarding based aircraft, the Master Plan forecast for the five-year timeframe is 5.5 percent higher than the TAF and the forecast for the 10-year timeframe is 16.0 percent higher than the TAF. As previously detailed, the Master Plan considers an overall 2.40 percent CAGR in based aircraft through the 20-year planning period that accounts for historical trends in based aircraft and population growth in Collin County and the ability of the Airport to increase its market share as has been experienced in the past.

TABLE 2R
Master Plan Forecast Comparison to the Terminal Area Forecast
McKinney National Airport

Year	Airport Activity	FAA TAF	Percent Difference
BASED AIRCRAFT			
2016	286	299	-4.3%
2021	325	308	5.5%
2026	370	319	16.0%
2036	460	339	35.7%
CAGR	2.40%	0.63%	
ANNUAL AIRCRAFT OPERATIONS			
2016	126,494	118,594	6.7%
2021	137,865	122,316	12.7%
2026	154,980	123,822	25.2%
2036	187,215	126,926	47.5%
CAGR	1.98%	0.34%	

Source: FAA TAF (2017); Airport Records; Coffman Associates analysis

The total annual operations forecast in the Master Plan is 12.7 percent higher than the TAF in the five-year timeframe. The 10-year forecast is 25.2 percent higher than the TAF. The primary reason for this is that the TAF has a lower operations number than what was counted by the ATCT in 2016, in addition to the adjustment increase for after-hours activity when the ATCT is closed. Furthermore, the TAF is

calling for a minimal increase in annual aircraft activity through the planning period, and the Master Plan accounts for modest growth in aircraft operations through 2036. Overall, the Master Plan considers a 1.98 percent CAGR in annual aircraft operations through the 20-year planning period.

Exhibit 2H presents a summary of the Master Plan forecasts previously detailed in this chapter.

POTENTIAL COMMERCIAL PASSENGER SERVICE OPERATIONS AND ENPLANEMENTS

At present, TKI is a general aviation reliever airport with "on demand" passenger service offered via a variety of CFR Part 135 operators. These operators include general charter services, as well as scheduled service offered by Texas Air Shuttle, all operating small- to medium-sized corporate aircraft. In 2016, Texas Air Shuttle, a Part 135 commercial service operator, began providing scheduled air taxi and charter operations at McKinney National Airport. The service has been limited and has resulted in very few passengers. As previously discussed, this service is to resume operations in Spring 2017.

Commercial Passenger Service Influences

Historical planning efforts have routinely considered the long term potential for some level of commercial airline passenger services at TKI. These studies include previous master planning efforts, as well as specific and targeted air service studies.

The most thorough study was conducted in 2007 by Jacobs Consultancy entitled, *Airline Service Development Study*. This analysis efforted to determine if airline service was a realistic option at TKI considering a third party's desire to develop a commercial terminal complex at the Airport. Much of the study is now outdated due to many factors such:

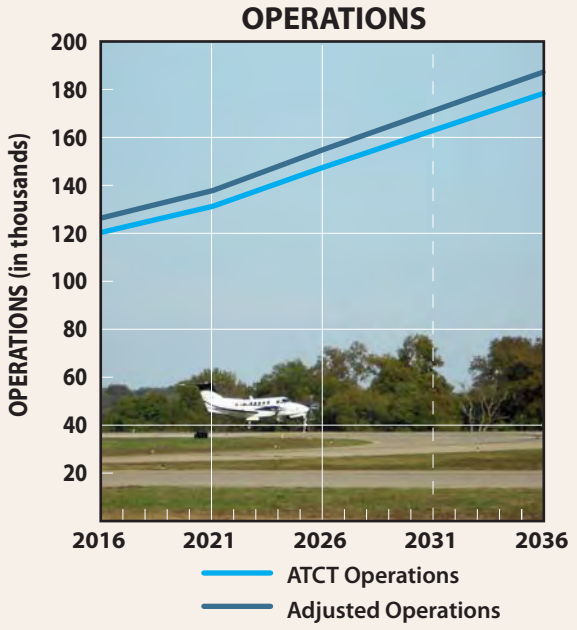
- Airline consolidation
- Airline financial health
- Economic conditions/Capacity Discipline
- Wright Amendment Repeal
- Dallas Love Field (DAL) Terminal and Dallas Fort Worth International Airport (DFW) Terminal Expansions

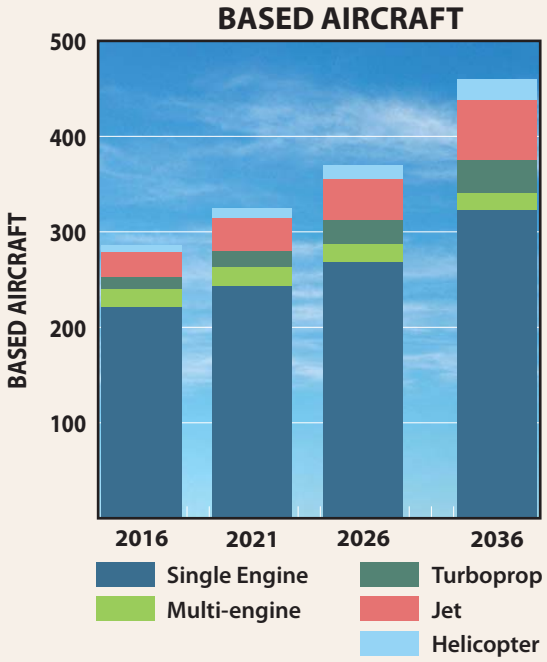
Several airlines considered feasible to serve TKI in 2007 are no longer operating due to bankruptcy and/or acquisition by another airline. For example, American Airlines has acquired US Airways, Southwest has acquired AirTran, and Delta has acquired Northwest Airlines. The 2007 study indicated that at least one of these three previously acquired airlines could provide potential commercial passenger service at TKI.

Financially, airlines are doing well at present as their business practices have changed. Most carriers now charge for checked luggage. Most also charge for defined "extras" or "perks," such as greater seat

	2016	2021	2026	2036
ATCT* OPERATIONS				
General Aviation				
Itinerant	39,224	43,500	49,700	60,000
Local	78,657	84,900	94,500	113,700
Total General Aviation Operations	117,881	128,400	144,200	173,700
Other Air Taxi	2,503	2,800	3,300	4,500
Military	86	100	100	100
Total ATCT Operations	*120,470*	*131,300*	*147,600*	*178,300*
ADJUSTED OPERATIONS**				
General Aviation				
Itinerant	41,185	45,675	52,185	63,000
Local	82,590	89,145	99,225	119,385
Total General Aviation Operations	123,775	134,820	151,410	182,385
Other Air Taxi	2,628	2,940	3,465	4,725
Military	90	105	105	105
Total Adjusted Operations	*126,494*	*137,865*	*154,980*	*187,215*
PEAK OPERATIONS FORECAST				
Annual Operations	126,494	137,865	154,980	187,215
Peak Month	12,890	14,048	15,792	19,077
Design Day	430	468	526	636
Busy Day	662	721	811	979
Design Hour	56	61	68	83
ANNUAL INSTRUMENT APPROACHES	1,316	1,460	1,671	2,033
BASED AIRCRAFT				
Single Engine Piston	221	243	268	323
Multi-Engine Piston	19	20	19	17
Turboprop	12	17	25	35
Jet	27	34	43	63
Helicopter	7	11	15	22
Totals	*286*	*325*	*370*	*460*

*ATCT - Airport Traffic Control Tower **Adjustment accounts for the hours (10:00 p.m. - 6:00 a.m.) when the ATCT is closed.





Source: ATCT records; Coffman Associates analysis

depth, expanded leg room, or window/aisle seats. These charges have generated significant profit centers for the airlines.

In 2007, the U.S. economy was just entering the most significant recession since the Great Depression. At present, economic conditions have improved with nominal growth rates annually since 2009. During the financial crisis of 2008-09, airlines slashed their flying capacities substantially in response to the sudden decline in demand for air travel. In the following years, even as the demand environment improved, network airlines did not add significant capacity. This was a practice commonly referred to as capacity discipline. The airlines held back increasing capacity until 2015, which resulted in increased profitability but fewer network flights and fewer new market routes added.

The full repeal of the Wright Amendment has had a significant impact on passenger airline service at Dallas Love Field (DAL). Originally, the Wright Amendment was put into place to limit passenger service at DAL to intrastate routes and routes to locations in contiguous states only. The full repeal occurred in October 2014. The repeal also carried with it a reduced gate limitation at DAL from 32 to 20. In 2015, passenger traffic nearly doubled that achieved in 2014 and years prior, which is directly attributable to the repeal of the Wright Amendment and new market options offered from DAL. **Table 2S** presents enplanements for all primary commercial service airports (those with greater than 10,000 enplanements) in the State of Texas.

In preparation of increased flight opportunities with the repeal of the Wright Amendment, the City of Dallas engaged in a complete passenger terminal renovation and expansion at DAL. The project expanded the terminal capacity to 20 gates. Most gates are leased and utilized by Southwest Airlines, with Virgin America also operating out of two gates. In addition, Dallas/Fort Worth International Airport (DFW) expanded to include a new $1.16 billion international Terminal D in 2005 and has since expanded and remodeled Terminals A, B, D, and E. Plans also include the construction of a new Terminal F. As such, both DAL and DFW have significantly increased capacity.

At present, commercial service options at TKI are more limited than in 2007. Both DFW and DAL have much greater capacity and have been modernized. Airlines have consolidated and are complacent in adding routes/new airports. The likelihood of any traditional mainline legacy carrier (American, Delta, and United) and/or Southwest Airlines moving into TKI is doubtful. These airlines are strong anchors at DFW and DAL and historic trends would suggest that moving to an outlying, tertiary market is unlikely. These carriers tend to favor the trappings of a larger hub airport as they depend upon the ability to link their passengers via the “hub-and-spoke” system. Moreover, the opportunity to attract regular scheduled commuter airline “feeder” service is equally dubious. The haul to DAL or DFW would not be equitable for the airlines as most are now utilizing regional jet aircraft. Extremely short hauls to DAL and DFW could not be profitable as these airlines already capture the same passengers via surface transportation modes.

Tertiary commercial service airports, as would be TKI if served, tend to be built around the origination and destination (O&D) passenger models. Hub and smaller regionalized commercial service airports served by the legacy carriers and Southwest Airlines tend to build their network around the hub and spoke system. As such, TKI’s greatest opportunity is, and will likely continue to be, non-traditional and/or

low-cost passenger airline options currently having limited or no operations at either DAL and/or DFW. Non-traditional airlines like Allegiant Airlines utilize an irregular schedule versus a daily departure schedule of the legacy carriers and Southwest Airlines. For example, Allegiant Airlines could serve a market departing Tuesday with a return on Saturday. Other low cost options like Frontier, Spirit, Virgin America, etc. may offer daily departures but very limited schedule options.

TABLE 2S
Primary Commercial Service Airport Enplanements in Texas

State/U.S. Rank		Airport Name	Hub	CY 14 Enplanements	CY 15 Enplanements	% Change	% of State
1	4	Dallas/Fort Worth International	L	30,804,567	31,589,839	2.55%	39.7%
2	12	George Bush Intercontinental/Houston	L	19,772,087	20,595,881	4.17%	25.9%
3	31	Dallas Love Field	M	4,522,341	7,040,950	55.69%	8.8%
4	33	William P Hobby	M	5,800,726	5,937,990	2.37%	7.5%
5	34	Austin-Bergstrom International	M	5,219,982	5,797,562	11.06%	7.3%
6	45	San Antonio International	M	4,046,856	4,091,434	1.10%	5.1%
7	76	El Paso International	S	1,395,363	1,381,392	-1.00%	1.7%
8	117	Midland International	S	547,355	518,509	-5.27%	0.7%
9	126	Lubbock Preston Smith International	S	451,238	443,239	-1.77%	0.56%
10	135	McAllen Miller International	N	385,631	391,687	1.57%	0.49%
11	146	Rick Husband Amarillo International	N	362,412	341,132	-5.87%	0.43%
12	147	Corpus Christi International	N	347,977	338,312	-2.78%	0.42%
13	167	Valley International	N	293,306	259,864	-11.40%	0.33%
14	191	Killeen-Fort Hood Regional	N	189,529	176,895	-6.67%	0.22%
15	205	Brownsville International	N	183,604	143,353	-21.92%	0.18%
16	219	Laredo International	N	116,565	110,368	-5.32%	0.14%
17	235	Easterwood Field	N	91,127	89,844	-1.41%	0.11%
18	239	Abilene Regional	N	93,656	86,000	-8.17%	0.11%
19	251	Tyler Pounds Regional	N	86,625	72,294	-16.54%	0.09%
20	266	San Angelo Regional	N	65,973	63,842	-3.23%	0.08%
21	268	Waco Regional	N	66,631	62,882	-5.63%	0.08%
22	286	Sheppard AFB/Wichita Falls	N	46,906	44,262	-5.64%	0.06%
23	307	Jack Brooks Regional	N	38,213	33,747	-11.69%	0.04%
24	343	East Texas Regional	N	21,867	20,968	-4.11%	0.03%

Source: Federal Aviation Administration
Hub: (L) Large; (M) Medium; (S) Small; (N) Non-hub primary

There are many non-traditional or low-cost carrier options but most are in relative infancy. The most likely option for TKI based on market opportunities could be Allegiant Airlines, which currently has most proximate service out of Austin, Shreveport, and Oklahoma City. Frontier Airlines and Virgin America could also be options but both currently operate limited flights out of DFW and DAL, respectively. New market entrants using non-traditional models including “clubs,” “memberships,” and the like are options

as well. Airlines such as or new entrants like Texas Air Shuttle, Surf Air, Jet Suite X, and others could become potential carriers for TKI if they survive infancy. As such, this study effort should identify airline passenger potentials so that proper facility planning can be accomplished.

It should be noted that these non-traditional or low-cost carriers tend to generate a demand of specific users, most commonly leisure travelers desiring low airfares. The users are willing to sacrifice things, such as schedule frequency and traditional perks associated with airline reward programs, in favor of low fares. Business travelers tend not to use these airlines as they are less reliable and offer fewer connections. Generally, local passenger demand for these airlines is limited when compared to a legacy carrier or Southwest Airlines.

Given that Texas Air Shuttle service is still in its infancy at TKI, operational and enplanement forecasts are extremely limited and offer no forecasting value. Estimating the number of scheduled commercial service operations is a function of the type of aircraft in use and the load factors. In the following sections, enplanement and commercial operations that may result from this and other potential commercial service operators will be presented. These forecasts are simply being conducted to offer long term potential and will be considered separate from the planning forecasts presented earlier in this chapter. The primary purpose of this analysis is to provide the Airport with important facility planning information should commercial service grow at TKI.

Potential Scheduled Commercial Service Enplanements

Due to a lack of consistent passenger service history, it is challenging to develop a reasonable forecast of future passenger enplanements. Traditional trend-line and regression analyses do not generate a reasonable forecast as there is no history to examine. The method employed here is to examine comparable markets throughout the State of Texas with similar-size city populations and other similar characteristics, such as proximity to a regional and larger hub airport and regional airport enplanement levels. The relationship between a service area's population and enplanements is called the travel propensity factor (TPF).

The TPF is predominantly impacted by the proximity of an airport to other regional airports with higher levels of service or "hub" airports. Regional airports with higher TPF ratios tend to be located farther from hub airports in relatively isolated areas. These airports generally have a service area that extends into adjacent, well-populated regions or have some type of air service advantage that attracts more of those passengers that might otherwise choose to drive to a more distant hub airport. Generally, the higher the TPF, the more likely air travelers are to utilize the local airport for commercial service.

Table 2T presents eight Texas markets having limited commercial service options. Each is within a manageable driving distance to a larger hub airport but each also is the only commercial service option for the regional community. The table presents the 2010 enplanements at each of the communities at their local airport. A TPF is then determined by dividing the community population with the 2010 enplanements. The TPF is also calculated utilizing the 2015 community population and enplanement levels. The

distance from each city and its corresponding airport and the closest commercial service or hub airport and the distance to that airport are then considered.

TABLE 2T
Travel Propensity Factor and Comparable Markets

Texas Small Markets	2010 Population	2010 Enp.	2010 TPF	2015 Population	2015 Enp.	2015 TPF	Miles to Airport	Miles to Nearest Hub
Abilene Regional (ABI) – Abilene, TX	117,463	73,605	0.627	121,721	86,000	0.706	5	150 - Lubbock (LBB)
Easterwood Field (CLL) - College Station, TX	94,525	72,188	0.764	107,889	89,844	0.833	3	70 - Houston (IAH)
Jack Brooks Regional (BPT) - Beaumont/Port Arthur, TX	117,371	17,394	0.148	118,129	33,747	0.286	11	70 - Houston (IAH)
East Texas Regional (GGG) - Longview, TX	80,586	21,830	0.271	82,287	20,968	0.255	9	125 - Dallas (DAL)
San Angelo Regional/Mathis Field (SJT) - San Angelo, TX	93,644	56,021	0.598	100,450	63,842	0.636	7	110 - Midland (MAF)
Tyler Pounds Regional (TYR) – Tyler, TX	97,237	74,357	0.765	103,700	72,294	0.697	6	95 - Dallas (DAL)
Waco Regional (ACT) - Waco, TX	125,420	61,401	0.490	132,356	62,882	0.475	6	90 - Dallas (DAL)
Sheppard AFB/Wichita Falls Municipal (SPS) - Wichita Falls, TX	104,845	44,296	0.422	104,710	44,262	0.423	6	110 – Dallas/Fort Worth (DFW)

Sources: Enplanements – FAA Preliminary CY 2015 Passenger Boarding Data; Population – Woods & Poole CEDDS data.

In 2010, the average TPF of the airports serving the eight selected cities was 0.4538. By 2015, the average TPF had decreased slightly to 0.4310, with four cities increasing their TPF and four decreasing.

Table 2U presents three different potential enplanement forecast approaches based upon the TPF comparison analysis. The high, low, and average TPFs from the comparison analysis are applied to the population forecast of Collin County, which would be the primary service area for TKI enplanements. The first projection applies the lowest 2015 TPF from the comparison markets (East Texas Regional – 0.2548), which results in an enplanement projection of 412,870 by 2036. The second projection applies the average TPF of the comparison analysis (0.4310), which results in an enplanement projection of 698,378 by 2036. The third projection applies the high TPF of the comparison analysis (Easterwood Field – 0.8327), which results in an enplanement projection of 1,349,280 by 2036.

It should be noted that the projections presented in **Table 2U** are for comparative purposes only and do not serve as a viable potential enplanement forecast for TKI. The airports offered in the comparison are regionalized with regularly scheduled commuter airlines operators linking to hub airports. These markets are not served primarily and/or only by non-traditional charter or member airline operators.

A secondary consideration is to evaluate tertiary airports as done in the previous Jacobs' study. The study evaluated the following airports:

- Gary Chicago International Airport
- Pease International Airport

- Williams Gateway Airport
- Chicago Rockford International Airport
- Stockton Metropolitan Airport
- Westchester County Airport

TABLE 2U
Market Share and Travel Propensity Projections
McKinney National Airport

Year	TKI Enplanements	Collin County Population	Travel Propensity Factor	US Domestic Enplanements	Market Share
Low Travel Propensity Factor					
2021	274,719	1,078,176	0.2548	803,000,000	0.03%
2026	315,829	1,239,518	0.2548	863,000,000	0.04%
2036	412,870	1,620,367	0.2548	1,052,000,000	0.04%
Average Travel Propensity Factor					
2021	464,694	1,078,176	0.431	803,000,000	0.06%
2026	534,232	1,239,518	0.431	863,000,000	0.06%
2036	698,378	1,620,367	0.431	1,052,000,000	0.07%
High Travel Propensity Factor					
2021	897,797	1,078,176	0.8327	803,000,000	0.11%
2026	1,032,147	1,239,518	0.8327	863,000,000	0.12%
2036	1,349,280	1,620,367	0.8327	1,052,000,000	0.13%

Sources: Enplanements – FAA CY 2015 Passenger Boarding Data; Population – U.S. Census Bureau;

Table 2V presents historical enplanement information for each of these airports as well as other comparable examples.

Orlando Sandford International Airport is the most successful enplanement model of all airports examined. It is basically utilized as a hub by Allegiant Airlines for all Orlando flights, as well as for international charter airlines. There is no regularly scheduled service by legacy carriers, commuter airlines, or Southwest Airlines. Similarly, Williams Mesa Phoenix Gateway has experienced strong passenger growth since Allegiant Airlines began operating in mid-2000s. Both Orlando Sandford and Gateway are more traditional destination markets as compared to the Dallas Metroplex. As such, it is unlikely that Allegiant or like carriers could generate similar passenger demand as these two airports in Orlando and Phoenix.

TABLE 2V
Secondary/Tertiary Commercial Passenger Airport Enplanements

Name	2001	2003	2005	2007	2009	2011	2013	2015
Orlando Sanford	645,944	619,894	789,795	985,597	836,223	768,938	971,522	1,209,382
Westchester County	456,296	426,864	462,256	823,478	964,927	972,385	764,002	757,466
Williams Gateway	0	218	1,655	39,513	289,770	521,437	725,048	666,187
Bellingham International	93,643	66,437	101,228	238,452	326,850	515,402	596,142	447,693
Chicago Rockford International	9,133	16,982	82,282	110,835	96,812	102,559	109,384	108,379
Pease International Tradeport	37,235	27,096	7,312	58,057	17,079	2,012	22,540	45,933
Stockton Metropolitan	19,651	13,700	1,064	28,996	28,368	56,044	71,757	80,163
Gary/Chicago	21,194	831	17,935	16,223	1,633	1,420	9,745	2,560

The two airports in Chicago are likely more comparable, although Chicago Gary no longer is served by commercial passenger airlines. Chicago Rockford International Airport, however, has successfully transitioned from a general aviation airport to primary commercial service airport. The airport offers several domestic destinations via Allegiant Airlines, as well as irregular international charter operations. As noted, the airport enplanements reached a high of 110,830 in 2007 and have remained relatively constant since.

Westchester County and Bellingham are secondary/tertiary airports; however, both are also served by traditional carrier option(s) as well as low-cost/non-traditional carriers. As such, they offer a glimpse at enplanement levels for such markets. Pease International Tradeport is a tertiary airport served only by Allegiant Airlines.

As presented in the table, the non-traditional airline markets can generate up to one million passenger enplanements. The upper end of the envelope is represented primarily by O&D markets, which TKI is not. TKI is more similar to Chicago Rockford, a tertiary airport in the Chicago market. As such, TKI could generate 100,000 enplanements if similar service levels were provided. Moreover, if a regularly scheduled low-cost carrier were also to enter the market, the Airport could support enplanement levels similar to Bellingham, WA, which is served by both Allegiant and Alaska Airlines.

Potential Commercial Passenger Airline Enplanement and Operations Forecast

Another methodology for forecasting potential enplanements and commercial operations is by considering potential flight schedules and aircraft fleets of the on-demand and scheduled charter operators. The potential enplanement and operations estimates are based on a potential flight schedule, as well as a limited set of factors, primarily population and distance to a hub airport. Factors that may positively affect enplanement levels include reliability of the airline, frequency of the schedule, convenience, advertising budget, as well as an unlimited number of community factors, such as industry, businesses, places of higher education, and recreational attractions.

The purpose here is to identify multiple scenarios of potential enplanement and operational figures that can be refined at a later date if necessary. One additional factor to consider is the willingness of a passenger to drive a longer distance to a hub airport.

Table 2W presents three different potential commercial passenger enplanement and operations scenarios based on potential operator types: Texas Air Shuttle (and similar), Jet Suite X (and those similar) using regional jets, and irregularly scheduled carriers, such as Allegiant Airlines. The first scenario is strictly based on Texas Air Shuttle type operators to include Surf Air and others alike. This scenario uses the 7-seat Beechcraft King Air 200, which is the aircraft utilized by Texas Air Shuttle, at an estimated 80 percent boarding load factor (BLF). Weekly schedules considered 12, 24, and 48 weekly departures, which correlate to two, four, and eight departures daily Monday through Friday and one day (or halved each day) on weekend. Under these scenarios, TKI could experience an estimated annual enplanement level ranging between 4,380 and 14,976 enplanements and an annual commercial aircraft operations level between 1,248 and 4,992.

TABLE 2W
Enplanements and Operations Based on a Potential Flight Schedules
McKinney National Airport

SCENARIO I							
Aircraft Type	**ARC**	**Seats**	**BLF %**	**Occupied Seats**	**Departure Frequency**	**Total Enplanements**	**Total Operations**
TEXAS AIR SHUTTLE MODEL SCENERIOS							
King Air 200	B-II	7	80%	6	12 Weekly	4,380	1,248
King Air 200	B-II	7	80%	6	24 Weekly	7,488	2,496
King Air 200	B-II	7	80%	6	48 Weekly	14,976	4,992
REGIONAL JET OPERATOR SCENERIOS							
ERJ 145	C-II	50	80%	40	6x Weekly	12,480	624
ERJ 145	C-II	50	80%	40	12x Weekly	24,960	1,248
ERJ 145	C-II	50	80%	40	24x Weekly	49,920	2,496
ERJ 170	C-II	70	80%	40	6x Weekly	12,480	624
ERJ 170	C-II	70	80%	40	12x Weekly	24,960	1,248
ERJ 190	C-III	90	80%	72	6x Weekly	22,464	624
ERJ 190	C-III	90	80%	72	12x Weekly	44,928	1,248
IRREGULARLLY SCHEDULED CHARTER OPERATOR SCENERIOS							
MD-88	D-III	166	90%	150	2x Weekly	15,600	208
MD-88	D-III	166	90%	150	4x Weekly	31,200	416
MD-88	D-III	166	90%	150	8x Weekly	62,400	832
MD-88	D-III	166	90%	150	12x Weekly	93,600	1,248
MD-88	D-III	166	90%	150	16x Weekly	124,800	1,664
MD-88	D-III	166	90%	150	24x Weekly	187,200	2,496

Source: Coffman Associates analysis

The second scenario assumes a regional jet air carrier, such as Jet Suite X. The analysis offered three different aircraft models: the ERJ 145 with 50-passenger seats, the ERJ 170 having 70-passenger seats, and the ERJ 190 having 90-passenger seats. The daily departures considered were lower than the Texas Air Shuttle scenarios as the aircraft have higher seating capacities. Based on the analysis, the potential enplanements ranged from a low of 12,480 to a high of 44,928. Annual aircraft operations range from a low of 624 to a high of 2,496.

Finally, the third scenario assumes more significant operators, such as Allegiant Airlines. This model utilized the MD-88 aircraft, an aged aircraft still in use but likely to retire from the fleet in the next decade. While retiring, the seating capacity is similar to other models used by these carriers. As shown, the analysis considered a range of weekly departures from two to 24. Based on the factors presented, the enplanement range is between 15,600 to 187,200. Annual operations range from 208 to 2,496.

Potential Commercial Service Enplanements Summary

The analysis in this section presents various enplanement scenarios for TKI, as well as comparisons to enplanements in other similar markets. Due to the lack of historical context for commercial service activity, it is difficult to predict which of these scenarios is more likely to occur and, in fact, there is no guarantee that TKI will be able to develop and maintain consistent commercial service activity at all. For this reason, the enplanement projections are separated from the overall operations and based aircraft forecasts that will be submitted to TxDOT and the FAA for review and approval. The purpose of preparing enplanement projections is to provide the City with the ability to plan for facilities and services to accommodate commercial activities should they develop in the future.

The enplanement projection scenarios resulted in a wide range of possibilities for TKI, from less than 10,000 annual enplanements to over 500,000 enplanements annually, based on reasonable market comparisons. Likely enplanement potential for TKI is somewhere in between these high and low figures. Therefore, for the purposes of this study, an enplanement level of 300,000 generated in previous planning efforts and an annual operations level of 3,000 will be carried forward as the selected scenario when considering terminal building and support facility requirements. Again, this enplanement scenario is not intended to serve as a forecast of activity, but will be used to establish potential facility needs should commercial enplanements grow at TKI in the future.

Peaking Characteristics Based Upon Potential Enplanements and Operations

Table 2X outlines the peaking characteristics for the potential enplanement scenario of 300,000 annual enplanements. In general, airport capacity and facility needs related to specific activity types will typically consider the levels of activity during a peak or design period. Determination of peaking characteristics related to commercial activity is important for the planning and design of the passenger terminal building, as well as associated facilities and services. The analysis is commonly utilized as a basis for determining the appropriate size of the terminal building and the functional areas therein. Terminal building elements could include hold rooms, security checkpoints, concessions, restrooms, baggage claim area, etc. The peaking characteristics could also relate to aircraft gates, and apron space.

TABLE 2X
Potential Commercial Service Peaking Characteristics
McKinney National Airport

Peak Potential Enplanements	
Annual Enplanements	300,000
Peak Month	31,500
Design Day	1,050
Design Hour	166
Peak Potential Commercial Service Operations	
Annual Operations	3,000
Peak Month	315
Design Day	10
Design Hour	1

Source: Coffman Associates analysis

Given the lack of historical commercial enplanement and operational data, the peak month projections for commercial activity were calculated at an industry norm of 10.5 percent of the annual number. The peak potential enplanements for the design day are based upon an average day within a 30-day peak month. The potential enplanement design hour is based upon the seating capacity of the largest aircraft

included in the scenario, which is the MD-88 aircraft with 166 passenger seats. The peak potential operations were compiled similarly.

POTENTIAL COMMERCIAL AIR CARGO AIRLINE

Air cargo airline opportunities have also been studied for TKI in the past. Over the last two decades, air cargo carriers and their airport networks have consolidated and stabilized. The two largest domestic cargo airline companies, UPS and FedEx, are currently entrenched regionally at DFW and Forth Worth Alliance Airports. These carriers are not likely to shift or split operations to TKI. These carriers have historically proven that over-the-road movements in regional markets are much more cost-efficient than flying when within a three-hour drive. Given the locations of FedEx and UPS in the DFW Metroplex, neither carrier will be a likely candidate at TKI.

Other opportunities would be niche airlines or in support of just-in-time (JIT) cargo movements. JIT cargo operations are very common at three metroplex airports: Addison Airport, Arlington Municipal Airport, and Denton Enterprise Airport. JIT cargo at Arlington supports the General Motors automobile plant and, at Denton, supports the Peterbuilt truck plant. McKinney has a very diverse and thriving economy which could generate niche cargo and JIT airline operations. These cargo operations will likely be irregular; however, future planning should allow for areas to support such operations. Niche and JIT air cargo facility concepts will be considered in the long term planning portion in this study process.

AIRCRAFT/AIRPORT/RUNWAY CLASSIFICATION

The FAA has established several aircraft classification systems that group aircraft types based on their performance (approach speed in landing configuration) and design characteristics (wingspan and landing gear configuration). These classification systems are used to determine the appropriate airport design standards for specific airport elements, such as runways, taxiways, taxilanes, and aprons.

AIRCRAFT CLASSIFICATION

The selection of appropriate FAA design standards for the development and location of airport facilities is based primarily upon the characteristics of the aircraft which are currently using, or are expected to use, an airport.

The selection of appropriate FAA design standards for the development and location of airport facilities is based primarily upon the characteristics of the aircraft which are currently using, or are expected to use, an airport. The critical design aircraft is used to define the design parameters for an airport. The design aircraft may be a single aircraft type or, more commonly, is a composite aircraft representing a collection of aircraft with similar characteristics. The critical design aircraft is defined by three parameters: Aircraft Approach Category (AAC), Airplane Design Group (ADG), and Taxiway Design

Group (TDG). FAA AC 150/5300-13A, *Airport Design*, describes the following airplane classification systems, the parameters of which are presented on **Exhibit 2J**.

Aircraft Approach Category (AAC): A grouping of aircraft based on a reference landing speed (V_{REF}), if specified, or if V_{REF} is not specified, 1.3 times stall speed (V_{SO}) at the maximum certificated landing weight. V_{REF}, V_{SO}, and the maximum certificated landing weight are those values as established for the aircraft by the certification authority of the country of registry.

The AAC generally refers to the approach speed of an aircraft in landing configuration. The higher the approach speed, the more restrictive the applicable design standards. The AAC, depicted by a letter A through E, is the aircraft approach category and relates to aircraft approach speed (operational characteristic). The AAC generally applies to runways and runway-related facilities, such as runway width, runway safety area (RSA), runway object free area (ROFA), runway protection zone (RPZ), and separation standards.

Airplane Design Group (ADG): The ADG, depicted by a Roman numeral I through VI, is a classification of aircraft which relates to aircraft wingspan or tail height (physical characteristic). When the aircraft wingspan and tail height fall in different groups, the higher group is used. The ADG influences design standards for taxiway safety area (TSA), taxiway object free area (TOFA), apron wingtip clearance, and various separation distances.

Taxiway Design Group (TDG): A classification of airplanes based on outer-to-outer Main Gear Width (MGW) and Cockpit to Main Gear (CMG) distance. The TDG relates to the undercarriage dimensions of the design aircraft. The taxiway design elements determined by the application of the TDG include the taxiway width, taxiway edge safety margin, taxiway shoulder width, taxiway fillet dimensions, and, in some cases, the separation distance between parallel taxiways/taxilanes. Other taxiway elements, such as the TSA, TOFA, taxiway/taxilane separation to parallel taxiway/taxilanes or fixed or movable objects, and taxiway/taxilane wingtip clearances are determined solely based on the wingspan (ADG) of the design aircraft utilizing those surfaces. It is appropriate for taxiways to be planned and built to different TDG standards based on expected use.

Exhibit 2K presents the aircraft classification of the most common aircraft in operation today.

AIRPORT AND RUNWAY CLASSIFICATION

These classifications, along with the aircraft classifications defined previously, are used to determine the appropriate FAA design standards to which the airfield facilities are to be designed and built.

***Airport Reference Code (ARC)*:** An airport designation that signifies the airport's highest Runway Design Code (RDC), minus the third (visibility) component of the RDC. The ARC is used for planning and design only, and does not limit the aircraft that may be able to operate safely on the airport. The current ALP

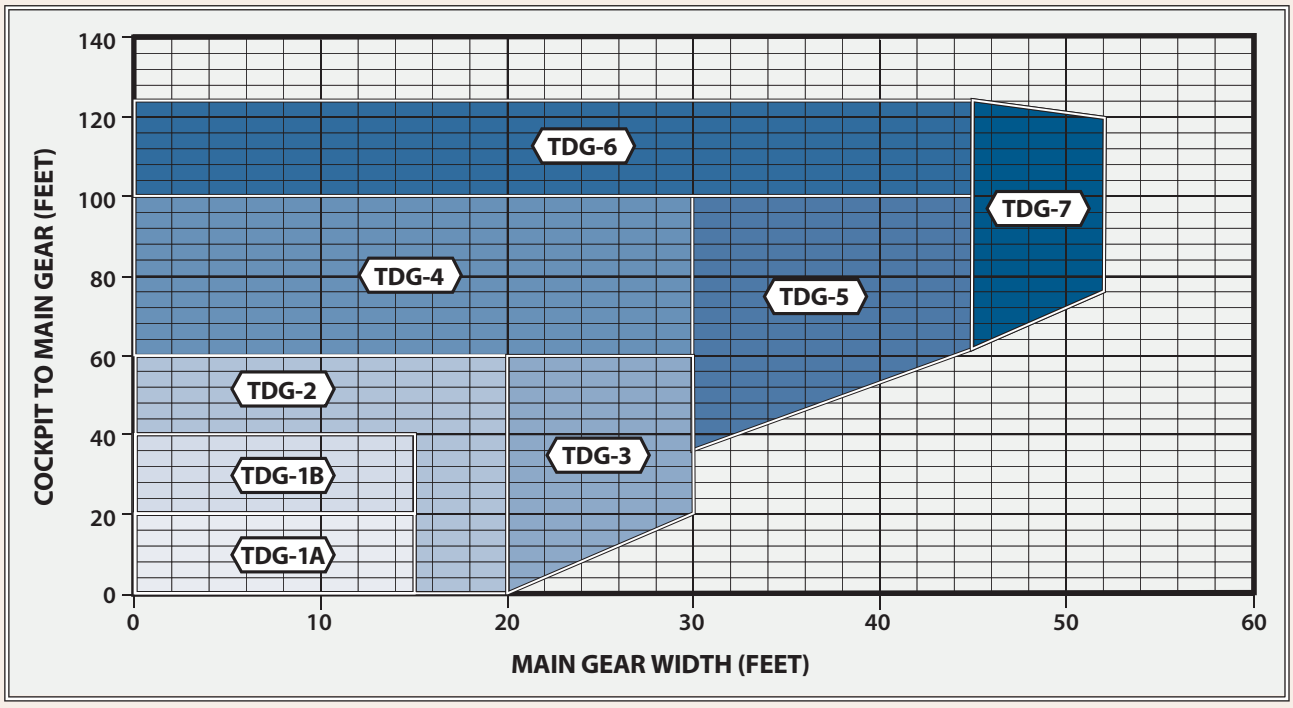
AIRCRAFT APPROACH CATEGORY (AAC)	
Category	**Approach Speed**
A	less than 91 knots
B	91 knots or more but less than 121 knots
C	121 knots or more but less than 141 knots
D	141 knots or more but less than 166 knots
E	166 knots or more

AIRPLANE DESIGN GROUP (ADG)		
Group #	**Tail Height (ft)**	**Wingspan (ft)**
I	<20	<49
II	20-<30	49-<79
III	30-<45	70-<118
IV	45-<60	118-<171
V	60-<66	171-<214
VI	66-<80	214-<262

VISIBILITY MINIMUMS	
RVR* (ft)	**Flight Visibility Category (statute miles)**
VIS	3-mile or greater visibility minimums
5,000	Not lower than 1-mile
4,000	Lower than 1-mile but not lower than ¾-mile
2,400	Lower than ¾-mile but not lower than ½-mile
1,600	Lower than ½-mile but not lower than ¼-mile
1,200	Lower than ¼-mile

***RVR**: Runway Visual Range

TAXIWAY DESIGN GROUP (TDG)



Source: FAA AC 150/5300-13A, Airport Design

A-I

- Beech Baron 55
- **Beech Bonanza**
- Cessna 150
- Cessna 172
- Cessna Citation Mustang
- Eclipse 500/550
- Piper Archer
- Piper Seneca

B-I

- Beech Baron 58
- Beech King Air A90/100
- Cessna 402
- **Cessna 421**
- Piper Navajo
- Piper Cheyenne
- Swearingen Metroliner
- Cessna Citation I (525)

B-II

- Super King Air 200
- Cessna 441
- DHC Twin Otter
- Super King Air 350
- Beech 1900
- Citation Excel (560), Sovereign (680)
- Falcon 50, 900, 2000
- **Citation Bravo (550)**
- Embraer 120

A-III, B-III

- DHC Dash 7
- **DHC Dash 8**
- DC-3
- Convair 580
- Fairchild F-27
- ATR 72
- ATP

C-I, D-I

- Beech 400
- **Lear 31, 35,** 45, 60
- Israeli Westwind

C-II, D-II

- **Cessna Citation X (750)**
- Gulfstream 100, 200,300
- Challenger 300/600
- ERJ-135, 140, 145
- CRJ-200/700
- Embraer Regional Jet
- Lockheed JetStar
- Hawker 800

C-III, D-III *less than 100,000 lbs.*

- ERJ-170
- CRJ 705, 900
- Falcon 7X
- **Gulfstream 500**, 550, 650
- Global Express, Global 5000
- Q-400

C-III, D-III *over 100,000 lbs.*

- ERJ-90
- Boeing Business Jet
- B-727
- **B-737**-300, **700,** 800
- MD-80, DC-9
- A319, A320

C-IV, D-IV

- **B-757**
- B-767
- C-130 Hercules
- DC-8-70
- MD-11

D-V

- **B-747-400**
- B-777
- B-787
- A-330, A-340

Note: Aircraft pictured is identified in bold type.

for TKI, which will be updated as part of this master planning effort, identifies an existing and future ARC of D-III.

Runway Design Code (RDC): A code signifying the design standards to which the runway is to be built. The RDC is based upon planned development and has no operational component.

The AAC, ADG, and runway visual range (RVR) are combined to form the RDC of a particular runway. The RDC provides the information needed to determine certain design standards that apply. The first component, depicted by a letter, is the AAC and relates to aircraft approach speed (operational characteristics). The second component, depicted by a Roman numeral, is the ADG and relates to either the aircraft wingspan or tail height (physical characteristics), whichever is most restrictive. The third component relates to the visibility minimums expressed by RVR values in feet of 1,200 (⅛-mile), 1,600 (¼-mile), 2,400 (½-mile), 4,000 (¾-mile), and 5,000 (1-mile). The RVR values approximate standard visibility minimums for instrument approaches to the runways. The third component should read "VIS" for runways designed for visual approach use only.

Approach Reference Code (APRC): A code signifying the current operational capabilities of a runway and associated parallel taxiway with regard to landing operations. Like the RDC, the APRC is composed of the same three components: the AAC, ADG, and RVR. The APRC describes the current operational capabilities of a runway under particular meteorological conditions where no special operating procedures are necessary, as opposed to the RDC, which is based upon planned development with no operational component. The APRC for a runway is established based upon the minimum runway to taxiway centerline separation.

Departure Reference Code (DPRC): A code signifying the current operational capabilities of a runway and associated parallel taxiway with regard to takeoff operations. The DPRC represents those aircraft that can takeoff from a runway while any aircraft are present on adjacent taxiways, under particular meteorological conditions with no special operating conditions. The DPRC is similar to the APRC, but is composed of two components: ACC and ADG. A runway may have more than one DPRC depending on the parallel taxiway separation distance.

CRITICAL DESIGN AIRCRAFT

The selection of appropriate FAA design standards for the development and location of airport facilities is based primarily upon the characteristics of the aircraft which are currently using, or are expected to use, an airport. The critical design aircraft is used to define the design parameters for an airport. The design aircraft may be a single aircraft or a composite aircraft representing a collection of aircraft classified by the three parameters: AAC, ADG, and TDG. In the case of an airport with multiple runways, a design aircraft is selected for each runway.

The first consideration is the safe operation of aircraft likely to use an airport. Any operation of an aircraft that exceeds design criteria of an airport may result in either an unsafe operation or a lesser safety

margin; however, it is not the usual practice to base the airport design on an aircraft that uses the airport infrequently.

The design aircraft is defined as the most demanding aircraft type, in grouping of aircraft with similar characteristics, that make regular use of the airport. Regular use is 500 annual operations, excluding touch-and-go operations. Planning for future aircraft use is of particular importance since the design standards are used to plan separation distances between facilities. These future standards must be considered now to ensure that short term development does not preclude the reasonable long range potential needs of the airport. Thus, if the critical design aircraft is anticipated to change within the near future, that aircraft (or family of aircraft), should be used as the current critical design aircraft.

According to FAA AC 150/5300-13A, *Airport Design*, "airport designs based only on existing aircraft can severely limit the ability to expand the airport to meet future requirements for larger, more demanding aircraft. Airport designs that are based on large aircraft never likely to be served by the airport are not economical." Selection of the current and future critical design aircraft must be realistic in nature and supported by current data and realistic projections.

AIRPORT CRITICAL DESIGN AIRCRAFT

TKI is served by an ATCT; however, the ATCT only logs aircraft operations by operational type (air taxi, general aviation, and military), but not by specific aircraft make and model. The FAA maintains the Traffic Flow Management System Count (TFMSC) database which documents certain aircraft operations at airports. Information is added to the TFMSC database when pilots file flight plans and/or when flights are detected by the National Airspace System, usually via radar. It includes documentation of commercial traffic (air carrier and air taxi), general aviation, and military aircraft. Due to factors, such as incomplete flight plans and limited radar coverage, TFMSC data does not account for all aircraft activity at an airport by a given aircraft type. Therefore, it is likely that there are more operations at the Airport than are captured by this methodology. TFMSC data is available for activity at TKI and was utilized in this analysis.

Current Critical Design Aircraft

Exhibit 2L presents the TFMSC operational mix at the Airport for jet aircraft operations for the last 10 years. As can be seen, the Airport experiences activity by a full range of business jets, including some of the largest in the national fleet. In addition, the Airport has experienced activity by commercial type aircraft, such as the Airbus A350/360. Activity by these larger commercial type aircraft is typically associated with non-scheduled charter flights.

Over the last 10 years, the Airport has averaged 2,242 annual jet operations in AAC B, 1,471 in AAC C, and 100 in AAC D. Most recently in 2016, TKI experienced 240 operations by aircraft in AAC D, according to TFMSC data. Although the Airport has not met the 500 annual operations threshold for AAC D aircraft

JET OPERATIONS BY AIRORT REFERENCE CODE

AAC-ADG	Aircraft Type	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
A-I	Cessna Citation Mustang	2	6	2	4	10	30	50	150	68	54
	Eclipse 400/500	2	4	0	20	8	32	40	38	36	66
	Total	4	10	2	24	18	62	90	188	104	120
B-I	Beechjet 400	208	108	146	278	394	348	180	74	82	54
	Cessna Citation I/SP	60	54	40	56	96	146	40	106	140	78
	Cessna CJ1	54	92	72	64	90	100	170	160	214	262
	Dassault Falcon/Mystère 10	86	78	8	4	16	16	22	10	6	4
	Embraer Phenom 100	0	0	6	24	34	30	46	28	54	44
	Hawker 400/MU-300	24	0	2	0	4	2	4	2	2	10
	Honda Jet	0	0	0	0	0	0	0	0	8	0
	L-39 Albatross	0	0	0	4	0	0	0	0	6	0
	N American Rockwell Sabre 40/60	4	8	2	0	2	0	0	4	12	8
	Raytheon Premier I	48	82	18	22	18	22	18	12	56	64
	Swearingen SJ-30	0	0	0	0	0	0	0	6	0	0
	Total	484	422	294	452	654	664	480	402	580	524
B-II	Cessna Citation Bravo/SP	600	556	412	184	176	170	160	148	106	142
	Cessna Citation Excel/XLS	58	142	220	424	406	340	364	348	392	420
	Cessna Citation III/VI/VII	18	22	66	34	38	42	82	40	252	242
	Cessna Citation Sovereign	8	20	30	40	26	22	24	40	22	30
	Cessna Citation V/Encore/Ultra	664	744	566	614	564	588	522	276	122	94
	Cessna CJ2, CJ3, CJ4	80	92	196	302	214	114	180	218	238	290
	Dassault Falcon 20/50	52	20	38	48	58	30	44	88	204	166
	Dassault Falcon 2000	10	20	22	16	104	108	76	116	122	130
	Dassault Falcon 900	10	6	6	18	10	4	12	10	4	14
	Dornier 328	0	0	0	0	4	0	0	0	0	0
	Embraer Legacy 500	0	0	0	0	0	0	0	0	0	2
	Embraer Phenom 300	0	0	0	0	2	20	134	556	676	958
	Total	1,500	1,622	1,556	1,680	1,602	1,438	1,598	1,840	2,138	2,488
C-I	BAE HS 125-1/2/3/125/400/600	244	410	388	374	394	206	118	142	116	230
	IAI 1124/1125 Westwind	238	170	138	196	236	40	12	44	184	152
	Learjet 20 Series	30	6	6	6	4	2	16	2	8	0
	Learjet 30 Series	68	46	72	42	42	26	26	64	26	66
	Learjet 40/45/60	234	152	108	136	244	298	286	342	456	466
	Learjet 55	6	16	8	0	4	6	12	8	12	8
	Total	820	800	720	754	924	578	470	602	802	922
C-II	Bombardier CRJ 100/200/700	2	0	0	0	4	0	0	0	0	0
	Cessna Citation X	68	98	86	118	88	74	40	56	78	62
	Challenger 300/600	252	196	146	136	276	170	184	142	232	306
	Embraer ERJ 135/140/145/Legacy	72	60	48	66	88	140	126	128	66	18
	Gulfstream 300	18	12	12	4	4	8	2	0	2	0
	Hawker 800/1000/4000	10	16	32	6	4	4	0	2	4	14
	IAI 1126 Galaxy	10	10	6	8	32	10	8	6	18	6
	Total		432	392	330	338	496	406	360	334	400
C-III	Boeing 727/737 Series	2	0	4	0	0	0	0	0	2	0
	Bombardier Global 5000	182	224	196	214	230	210	208	200	176	178
	Dassault Falcon 7X	0	0	2	0	2	0	6	2	4	0
	Gulfstream G550/650	282	358	220	214	112	24	20	34	40	48
	MD DC-9/MD-80 series	0	0	0	0	0	0	2	0	0	0
	Total	466	582	422	428	344	234	236	236	222	226

Source: Traffic Flow Management System Counts

JET OPERATIONS BY AIRORT REFERENCE CODE (continued)

AAC-ADG	Aircraft Type	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
C-IV	Boeing 707	0	0	0	0	0	10	2	4	2	6
	Boeing 757 200 Series	0	0	0	2	0	0	0	0	0	0
	Boeing 767 Series	0	0	0	0	0	0	0	2	0	0
	Total	0	0	0	2	0	10	2	6	2	6
D-I	F/A-18 Hornet	0	4	0	2	0	0	0	0	0	0
	F-22 Raptor	0	0	0	0	0	0	0	0	0	2
	Learjet 70 Series	0	0	0	0	0	0	0	0	0	4
	T-38 Talon	0	0	0	0	0	0	2	2	0	4
	Total	0	4	0	2	0	0	2	2	0	10
D-II	Gulfstream 200/400	94	92	28	60	78	70	30	46	124	172
	Gulfstream G-150	0	2	8	4	8	26	20	20	16	58
	Total	94	94	36	64	86	96	50	66	140	230
D-V	Airbus A350/360	0	2	2	0	0	0	0	0	0	0
	Total	0	2	2	0	0	0	0	0	0	0
E-I	F-16 Falcon	2	0	0	0	0	0	0	0	2	0
	Total	2	0	0	0	0	0	0	0	2	0
ANNUAL TOTAL OPERATIONS		3,802	3,928	3,362	3,744	4,124	3,488	3,288	3,676	4,390	4,932

AIRPORT REFERENCE CODE (ARC) OPERATIONS SUMMARY

ARC	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
A-I	4	10	2	24	18	62	90	188	104	120
B-I	484	422	294	452	654	664	480	402	580	524
B-II	1,500	1,622	1,556	1,680	1,602	1,438	1,598	1,840	2,138	2,488
C-I	820	800	720	754	924	578	470	602	802	922
C-II	432	392	330	338	496	406	360	334	400	406
C-III	466	582	422	428	344	234	236	236	222	226
C-IV	0	0	0	2	0	10	2	6	2	6
D-I	0	4	0	2	0	0	2	2	0	10
D-II	94	94	36	64	86	96	50	66	140	230
D-V	0	2	2	0	0	0	0	0	0	0
E-I	2	0	0	0	0	0	0	0	2	0
Total	3,802	3,928	3,362	3,744	4,124	3,488	3,288	3,676	4,390	4,932

JET OPERATIONS BY AIRCRAFT APPROACH CATEGORY (AAC)

AAC	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
A	4	10	2	24	18	62	90	188	104	120
B	1,984	2,044	1,850	2,132	2,256	2,102	2,078	2,242	2,718	3,012
C	1,718	1,774	1,472	1,522	1,764	1,228	1,068	1,178	1,426	1,560
D	94	100	38	66	86	96	52	68	140	240
E	2	0	0	0	0	0	0	0	2	0
Total	3,802	3,928	3,362	3,744	4,124	3,488	3,288	3,676	4,390	4,932

JET OPERATIONS BY AIRPLANE DESIGN GROUP (ADG)

ADG	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
I	1,310	1,236	1,016	1,232	1,596	1,304	1,042	1,194	1,488	1,576
II	2,026	2,108	1,922	2,082	2,184	1,940	2,008	2,240	2,678	3,124
III	466	582	422	428	344	234	236	236	222	226
IV	0	0	0	2	0	10	2	6	2	6
V	0	2	2	0	0	0	0	0	0	0
Total	3,802	3,928	3,362	3,744	4,124	3,488	3,288	3,676	4,390	4,932

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operations, TKI has one based AAC D aircraft (Gulfstream G-IV). Based on the regular use of this aircraft and the physical demand it places on the airfield system, it is reasonable to consider the Gulfstream G-IV as the current critical design aircraft in terms of AAC. **Thus, the Master Plan will consider AAC D as the current critical design AAC.**

Since 2007, the Airport has averaged 2,837 annual operations by jets in ADG II and 340 in ADG III. Similar to the AAC, the Airport does not meet the 500 annual operations threshold for ADG III aircraft operations; however, there are three based ADG III aircraft (Global Express) at TKI. As such, it is reasonable to consider the Global Express as the current critical design aircraft in terms of ADG. **Therefore, the Master Plan will consider ADG III as the current critical design ADG.**

The current ALP for the Airport defines Runway 18-36 as an existing and ultimate ARC D-III classification. (Note: the new AC would classify Runway 18-36 as an existing and ultimate RDC D-III.) Unless there is a discernable decreasing trend in operations by aircraft in this category, an airport should not be downgraded. In fact, the opposite is true for TKI as operations by these aircraft have been on the increase. **As such, this Master Plan will utilize the current RDC of D-III for Runway 18-36.**

This Master Plan will utilize the current RDC of D-III for Runway 18-36.

Future Design Aircraft

The aviation demand forecasts indicate the potential for growth in business jet aircraft at the Airport. This includes a forecast of 36 based business jets by the long term planning period. The types and sizes of business jets using an airport regularly can impact the design standards to be applied to the airport system. Therefore, it is important to have an understanding of what type of aircraft may use the airport in the future. Factors such as population and employment growth in the Airport's service area, the proximity and level of service at other regional airports, and development at the Airport can influence future activity.

The majority of operations throughout the planning period of this Master Plan are expected to be by aircraft within AACs B and C, and within ADGs I and II. However, the trend toward manufacturing of a larger percentage of medium and large business jets, those in AACs C and D, may lead to greater utilization of these aircraft at TKI by the long term horizon. Additionally, with the continued operational growth of the Gulfstream and Boeing family of business jet aircraft nationally, the Airport might experience increased usage by these aircraft within AAC C/D and ADG II/III. TKI is located within one of the largest population centers in the country and is well-suited to accommodate businesses that operate larger corporate aircraft. The Airport already has one based Gulfstream G-IV and three based Global Expresses and, with the projected growth in based jets, it is reasonable to consider aircraft such as the Boeing Business Jet as potentially basing at the Airport in the future as well. Thus, the Master Plan will consider aircraft such as the Gulfstream G-IV (ARC D-II), G-550 (ARC C-III), G-650 (ARC C-III), and the Boeing Business Jet (ARC C-III) as the future critical design

The future critical design aircraft for the Airport will continue to be best described as RDC D-III.

aircraft. **As such, the future critical design aircraft for the Airport will continue to be best described as RDC D-III.**

AIRPORT DESIGN SUMMARY

Each runway at an airport is assigned an RDC. The RDC relates to specific FAA design standards that should be planned in relation to each runway, regardless of whether or not the airport currently meets the appropriate design standards (to be discussed in Chapter Three).

Runway 18-36 is 7,002 feet long and 150 feet wide. This runway has a CAT-I instrument approach providing for visibility minimums as low as ½-mile. **Therefore, the existing and ultimate RDC for Runway 18-36 is D-III-2400.**

Table 2Y summarizes the design aircraft components to be applied at the Airport. Besides the RDC, the APRC and DPRC are also noted for the runway system.

TABLE 2Y
Design Aircraft Parameters
McKinney National Airport

Runway Design Parameters	Runway Design Code (RDC)	Approach Reference Code (APRC)	Departure Reference Code (DPRC)
EXISTING			
Runway 18-36 (400' runway/taxiway separation)	D-III-2400	D/IV/2400 D/V/2400	D/IV D/V
ULTIMATE			
Runway 18-36 (400' runway/taxiway separation)	D-III-2400	D/IV/2400 D/V/2400	D/IV D/V

Source: FAA AC 150/5300-13A, Change 1, *Airport Design*

SUMMARY

This chapter has outlined the various activity levels that might reasonably be anticipated over the next 10 years at McKinney National Airport. **Exhibit 2H** presents a summary of the aviation demand forecasts. The baseline year for forecast data is 2016. The forecasting effort extends 20 years to 2036.

Forecasts of aviation activity, including based aircraft and annual aircraft operations, is key to determining future facility requirements. There are currently 286 aircraft based at the Airport, and this is forecast to grow to 460 aircraft by 2036. When considering an adjustment to aircraft operations when the ATCT is closed, the Airport experienced approximately 126,500 operations in 2016. This is forecast to grow to approximately 187,200 operations annually by 2036.

The fleet mix operations, or type and frequency of aircraft use, is important in determining facility requirements and environmental impacts. While single engine piston-powered aircraft are expected to

represent the majority of based aircraft, the long term forecast considers increasing the number of turboprop and jet aircraft, as well as helicopters, in the fleet mix. In addition, scheduled charter operations are in the process of occurring at TKI, which brings the potential to grow enplanements and commercial activities at the Airport.

The next step in the Master Plan process is to use the forecasts to determine development needs for the Airport through 2036. Chapter Three will address airside elements, such as safety areas, runways, taxiways, lighting, and navigational aids, as well as landside requirements, including hangars, aircraft aprons, and support services. As a general observation, TKI is well-positioned for growth into the future. The remaining portions of the Master Plan will lay out how that growth can be accommodated in an orderly, efficient, and cost-effective manner.

Chapter Three

Facility Requirements

Proper airport planning requires the translation of forecast aviation demand into the specific types and quantities of facilities that can adequately serve the identified demand. This chapter will analyze the existing capacities of McKinney National Airport (TKI or Airport) facilities. The existing capacities will then be compared to the forecast activity levels prepared in Chapter Two to determine where facility deficiencies currently exist or may be expected to materialize in the future. This chapter will present the following elements:

- Planning Horizon Activity Levels
- Airfield Capacity and Delay
- Airport Physical Planning Criteria
- Airfield and Landside Facility Requirements

As indicated previously in Chapter One, TKI's facilities include both airfield and landside components. Airfield facilities include those that are related to the arrival, departure, and ground movement of aircraft. The components include:

- Runways
- Taxiways
- Navigational and Approach Aids
- Airfield Lighting, Marking, and Signage

Landside facilities are needed for the interface between air and ground transportation modes. The general aviation elements analyzed include:

- Terminal Services
- Aircraft Hangars
- Aircraft Parking Aprons
- Airport Support Facilities

The objective of this effort is to identify, in general terms, the adequacy of the existing airport facilities and outline what new facilities may be needed and when they may be needed to accommodate forecast demands. Having established these facility requirements, alternatives for providing the facilities will be evaluated to determine the most cost-effective and efficient means for implementation.

The facility requirements at TKI were evaluated using guidance contained in several Federal Aviation Administration (FAA) publications, including the following:

- Advisory Circular (AC) 150/5300-13A, *Airport Design*
- AC 150/5060-5, *Airport Capacity and Delay*
- AC 150/5325-4B (and Draft 4C), *Runway Length Requirements for Airport Design*
- Federal Aviation Regulation (FAR) Part 77, *Objects Affecting Navigable Airspace*
- FAA Order 5090.3C, *Field Formulation of the National Plan of Integrated Airport Systems (NPIAS)*

PLANNING HORIZONS

An updated set of aviation demand forecasts for TKI has been established. These activity forecasts include annual operations, based aircraft, based aircraft and operational fleet mix, and operational peaking characteristics. With this information, specific components of the airfield and landside system can be evaluated to determine their capacity to accommodate future demand.

Cost-effective, efficient, and orderly development of an airport should rely more upon actual demand at an airport than on a time-based forecast figure. In order to develop a Master Plan that is demand-based rather than time-based, a series of planning horizon milestones have been established for TKI that takes into consideration the reasonable range of aviation demand projections. The planning horizons for the Master Plan are the short term (years 1-5), intermediate term (years 6-10), and long term (years 11-20).

It is important to consider that the actual activity at the Airport will not follow a straight line as tend to be presented in forecast projections. More commonly, aviation activity will be higher or lower than what the annualized forecast portrays. By planning according to activity milestones, the resultant plan can accommodate unexpected shifts or changes in the area's aviation demand by allowing airport management the flexibility to make decisions and develop facilities according to need generated by actual demand levels, not based solely on dates in time. The demand-based schedule provides flexibility in development, as development schedules can be slowed or expedited according to demand at any given

The demand-based schedule provides flexibility in development, as development schedules can be slowed or expedited according to demand at any given time over the planning period.

time over the planning period. The resultant plan provides airport management with a financially responsible and needs-based program. **Table 3A** presents the short, intermediate, and long term planning horizon milestones for each aircraft activity level forecasted in Chapter Two.

TABLE 3A
Planning Horizon Activity Summary
McKinney National Airport

	Base Year (2016)	Short Term (1-5 years)	Intermediate Term (6-10 years)	Long Term (11-20 years)
BASED AIRCRAFT				
Single Engine Piston	221	243	268	323
Multi-Engine Piston	19	20	19	17
Turboprop	12	17	25	35
Jet	27	34	43	63
Helicopter	7	11	15	22
Total Based Aircraft	**286**	**325**	**370**	**460**
ANNUAL AIRCRAFT OPERATIONS*				
Itinerant	43,863	48,665	55,700	67,775
Local	82,631	89,200	99,280	119,440
Total Operations	**126,494**	**137,865**	**154,980**	**187,215**
ANNUAL INSTRUMENT APPROACHES				
Annual Estimate	1,316	1,460	1,671	2,033
PEAKING CHARACTERISTICS				
Peak Month	12,890	14,048	15,792	19,077
Design Day	430	468	526	636
Busy Day	662	721	811	979
Design Hour	56	61	68	83

*Includes ATCT After-Hours Adjustment
Source: Coffman Associates analysis

In addition to the general aviation activity forecasts pr7esented above, forecasts for potential commercial operations and enplanements were also detailed earlier in this study. Many assumptions were made to derive a potential demand level for future commercial service activities. As noted in the analysis, commercial service options, both passenger and cargo, are extremely limited due to the primary options being entrenched at Dallas Love Field, Dallas/Fort Worth International Airport (DFW), and Fort Worth Alliance. Based upon the analysis, it is determined that these types of aviation service segments would not likely materialize until at least the long term planning period of this study, if at all. Nonetheless, it is important to recognize the potential facility needs that would be required to accommodate commercial air carrier passenger and/or cargo service at the Airport. Facility needs will be based on the following long term commercial activity projections:

- Annual Passenger Enplanement Potential – 300,000
- Annual Commercial Aircraft Operations Potential – 3,000
- Commercial Air Cargo – Just-in-time (JIT) or niche irregular service

AIRFIELD CAPACITY AND DELAY

The annual service volume (ASV) is an annual level of service that may be used to define airfield capacity needs and is a reasonable estimate of the maximum level of aircraft operations that can be accommodated in a year without incurring significant delay factors.

Airfield capacity is measured in a variety of different ways. The **hourly capacity** of a runway measures the maximum number of aircraft operations that can take place in an hour. The **annual service volume** (ASV) is an annual level of service that may be used to define airfield capacity needs and is a reasonable estimate of the maximum level of aircraft operations that can be accommodated in a year without incurring significant delay factors. **Aircraft delay** is the total delay incurred by aircraft using the airfield during a given timeframe. The Federal Aviation Administration (FAA) Advisory Circular (AC) 150/5060-5, *Airport Capacity and Delay*, provides a methodology for examining the operational capacity of an airfield for planning purposes.

FACTORS AFFECTING ANNUAL SERVICE VOLUME

This analysis takes into account specific factors about the airfield, such as airfield layout, weather conditions, aircraft mix, and operations in order to calculate the Airport's ASV. These factors are depicted in **Exhibit 3A**. The following describes the input factors as they relate to TKI.

- **Runway Configuration –** The existing runway configuration consists of a single runway supported by a full-length parallel taxiway. Runway 18-36 is 7,002 feet long and 150 feet wide.

- **Runway Use –** Runway use in capacity conditions will be controlled by wind and/or airspace conditions. The direction of takeoffs and landings are generally determined by the direction of the wind. It is generally safest for aircraft to take off and land into the wind, in order to avoid crosswind (wind that is blowing perpendicular to the travel of the aircraft) or tailwind components. Based upon information from the Airport's automated surface observation system (ASOS), winds favor the use of Runway 18 most often.

  The availability of instrument approaches is also considered. While each runway end provides instrument approach capability, Runway 18 is primarily utilized in instrument weather conditions since it is equipped with a Category I instrument landing system (ILS), which provides visibility minimums down to ½-mile.

AIRFIELD LAYOUT

Runway Configuration

Runway Use

Number of Exits

WEATHER CONDITIONS

VMC
Visual Meteorological Conditions

IMC
Instrument Meteorological Conditions

PVC
Poor Visibility Conditions

AIRCRAFT MIX

Category A & B Aircraft

Category C Aircraft

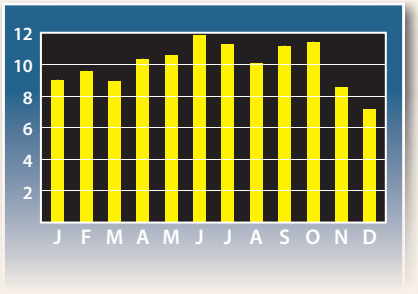
Category D Aircraft

OPERATIONS

Arrivals

Departures

Total Annual Operations



Touch-and-Go Operations

- **Exit Taxiways –** Exit taxiways have a significant impact on airfield capacity since the number and location of exits directly determine the occupancy time of an aircraft on the runway. The airfield capacity analysis gives credit to taxiway exits located within the prescribed range from a runway's threshold. This range is based upon the mix index of the aircraft that use the runways. Only exit taxiways located between 2,000 and 4,000 feet from the landing threshold count in the capacity determination. The exits must be at least 750 feet apart to count as separate exits. Under these criteria, Runway 18 is credited with two exit taxiways, and Runway 36 is also credited with two exit taxiways in this analysis.

- **Weather Conditions –** Weather conditions can have a significant impact on airfield capacity. Airport capacity is usually highest in clear weather, when flight visibility is at its best. Airfield capacity is diminished as weather conditions deteriorate and cloud ceilings and visibility are reduced. As weather conditions deteriorate, the spacing of aircraft must increase to provide allowable margins of safety and air traffic vectoring. The increased distance between aircraft reduces the number of aircraft which can operate at the airport during any given period, thus reducing overall airfield capacity.

  According to meteorological data collected from the ASOS, the Airport reported visual flight rule (VFR) conditions a large majority of the time, with 87.9 percent of total observations. VFR conditions exist whenever the cloud ceiling is greater than or equal to 1,000 feet above ground level (AGL) and visibility is greater than three statute miles. Instrument flight rule (IFR) conditions are defined when cloud ceilings are between 500 and 1,000 feet AGL or visibility is between one and three miles. According to the weather observations, IFR conditions accounted for 7.8 percent of weather observations. Poor visibility conditions (PVC) apply for cloud ceilings below 500 feet and visibility minimums below one mile. PVC constituted 4.3 percent of total observations over the 10-year timeframe. **Table 3B** summarizes the weather conditions experienced at the Airport over a 10-year period of time.

TABLE 3B
Weather Conditions
McKinney National Airport

Condition	Cloud Ceiling	Visibility	Observations	Percent of Total
VFR	≥ 1,000' AGL	> 3 statute miles	92,206	87.9%
IFR	≥ 500' AGL and < 1000' AGL	1-3 statute miles	8,226	7.8%
PVC	< 500' AGL	< 1 statute mile	4,496	4.3%

VFR - Visual Flight Rules
IFR - Instrument Flight Rules
PVC - Poor Visibility Conditions
AGL - Above Ground Level

Source: National Oceanic and Atmospheric Administration (NOAA) - National Climatic Data Center. Airport observations from 2007-2016.

- **Aircraft Mix –** The aircraft mix for the capacity analysis is defined in terms of four aircraft classes. Classes A and B consist of small and medium-sized propeller-driven aircraft and some smaller business jets, all weighing 12,500 pounds or less. These aircraft are associated primarily with general aviation activity, but do include some air taxi, air cargo, and commuter aircraft. Class C consists of

aircraft weighing between 12,500 pounds and 300,000 pounds. These aircraft include most business jets and some turboprop aircraft. Class D consists of large aircraft weighing more than 300,000 pounds. These aircraft are associated with major airline and air cargo activities, and include the Boeing 747 and 777, among others. The Airport does not currently nor is expected to experience operations by Class D aircraft unless passenger and/or cargo commercial service operators are attracted to the Airport. The most likely Class D aircraft could be a Boeing 757 which is classified as such not by weight, but by its wake turbulence generated. A description of the classifications and the percentage mix for each planning horizon is presented in **Table 3C**.

For the capacity analysis, the percentage of Class C aircraft operating at TKI is critical in determining the ASV as this class includes the larger and faster aircraft in the operational mix. The percentage of Class C aircraft operations at the Airport is expected to increase through the planning period as business and corporate use of jets increases.

TABLE 3C
Aircraft Operational Mix - Capacity Analysis
McKinney National Airport

Aircraft Classification	Base Year (2016)	Short Term (1-5 Years)	Intermediate Term (6-10 Years)	Long Term (11-20 Years)
Classes A & B	95.0%	94.3%	93.3%	91.8%
Class C	5.0%	5.7%	6.7%	8.2%
Class D	0%	0%	0%	0%

Class A - Small single engine aircraft with gross weights of 12,500 pounds or less
Class B - Small multi-engine aircraft with gross weights of 12,500 pounds or less
Class C - Large aircraft with gross weights over 12,500 pounds up to 300,000 pounds
Class D - Large aircraft with gross weights over 300,000 pounds

Source: Coffman Associates analysis

- **Percent Arrivals vs. Departures –** The aircraft arrival/departure split is typically 50/50 in the design hour. At TKI, traffic information indicated no major deviation from this pattern.

- **Touch-And-Go Activity –** A touch-and-go operation involves an aircraft making a landing and then an immediate takeoff without coming to a full stop or exiting the runway. As previously discussed in Chapter Two, these operations are normally associated with general aviation training activity and classified as a local operation. A high percentage of touch-and-go traffic normally results in a higher operational capacity because one landing and one takeoff occurs within a shorter time period than individual operations. Touch-and-go operations at TKI account for approximately 65 percent of total annual operations. A similar ratio is expected in the future.

- **Peak Period Operations –** Typical operations activity is important in the calculation of an airport's ASV as "peak demand" levels occur sporadically. The peak periods used in the capacity analysis are representative of normal operational activity and can be exceeded at various times throughout the year. For the airfield capacity analysis, average daily operations and average peak hour operations

during the peak month, as calculated in the previous chapter and detailed earlier in this chapter, are utilized.

CALCULATION OF ANNUAL SERVICE VOLUME

The preceding information was used in conjunction with the airfield capacity methodology developed by the FAA to determine airfield capacity for TKI.

Hourly Runway Capacity

The first step in determining ASV involves the computation of the hourly capacity of the runway configuration. The percentage use of the runway, the amount of touch-and-go activity, and the number and locations of runway exits are the important factors in determining hourly capacity.

Based upon these factors, the current and future hourly capacities for TKI were determined. As the operational mix of aircraft at the airport changes to include a higher percentage of large aircraft weighing over 12,500 pounds, the hourly capacity of the system declines slightly. This is a result of the additional spacing and time required by larger aircraft in the traffic pattern and on the runway. As indicated in **Table 3C**, the percentage of Class C aircraft is projected to increase in each planning horizon activity milestone. Class C aircraft at the Airport currently represents approximately 5.0 percent of the operational mix. This upward progression is in line with corporate aircraft operations' likely increase at a greater rate than other general aviation operations involving smaller aircraft.

The current and future weighted hourly capacities are depicted in **Table 3D**. Weighted hourly capacity is the measure of the maximum number of aircraft operations that can be accommodated on the airfield in a typical hour. It is a composite of estimated hourly capacities for different airfield operating configurations adjusted to reflect the percentage of time in an average year that the airfield operates under each specific configuration. The current weighted hourly capacity on the airfield is 106 operations; likewise, the capacity is expected to decline slightly to 100 operations by the long term horizon.

TABLE 3D
Airfield Capacity Summary
McKinney National Airport

	Base Year (2016)	Short Term (1-5 Years)	Intermediate Term (6-10 Years)	Long Term (11-20 Years)
Operational Demand				
Annual	126,494	137,865	154,980	187,215
Capacity				
Annual Service Volume	240,000	237,000	233,000	225,000
Percent Capacity	52.7%	58.2%	66.5%	83.2%
Weighted Hourly Capacity	106	105	102	100

Source: FAA AC 150/5060-5, *Airport Capacity and Delay*

Annual Service Volume

The ASV is determined by the following equation:

Annual Service Volume = C x D x H
C = weighted hourly capacity
D = ratio of annual demand to the average daily demand during the peak month
H = ratio of average daily demand to the design hour demand during the peak month

The current ASV for the airfield has been estimated at 240,000 operations. The increasing percentage of larger Class C aircraft over the planning period will attribute to a decline in ASV, lowering it to a level of approximately 225,000 operations by the end of the planning period. With operations in 2016 estimated at 126,494 (factoring a five percent adjustment for operations when the airport traffic control tower [ATCT] is closed), the airport is currently at 52.7 percent of its ASV. Long range annual operations are forecast to reach 187,215, which would equate to 83.2 percent of the Airport's ASV. **Table 3D** and **Exhibit 3B** summarize and compare the Airport's ASV and projected annual operations over the short, intermediate, and long range planning horizons.

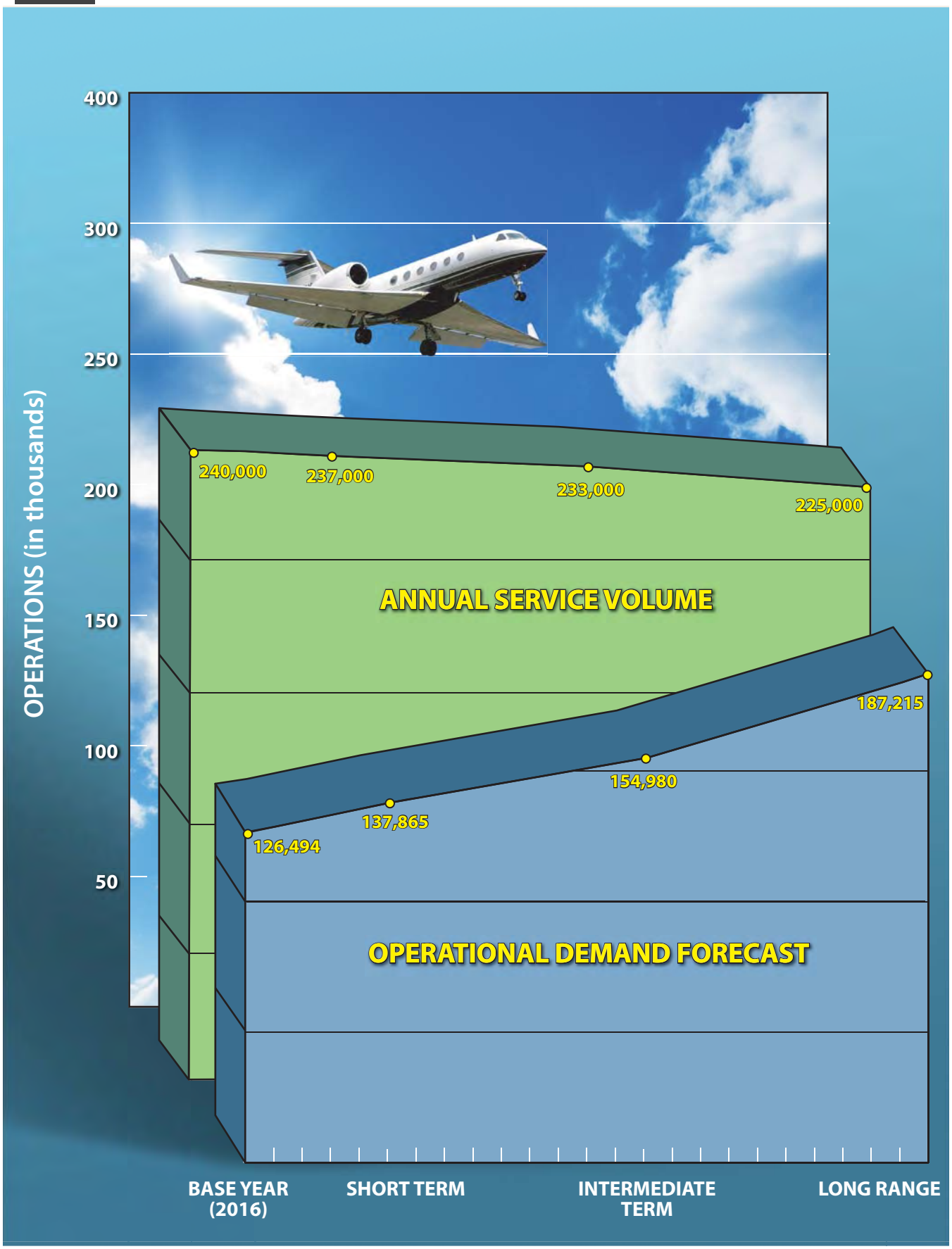
The current ASV for the airfield has been estimated at 240,000 operations. The increasing percentage of larger Class C aircraft over the planning period will attribute to a decline in ASV, lowering it to a level of approximately 225,000 operations by the end of the planning period.

AIRCRAFT DELAY

The affect that the anticipated ratio of demand to capacity will have on users of TKI can be measured in terms of delay. As the number of annual aircraft operations approaches the airfield's capacity, increasing operational delays begin to occur. Delays occur to arriving and departing aircraft in all weather conditions. Arriving aircraft delays result in aircraft holding outside the airport traffic pattern area. Departing aircraft delays result in aircraft holding at the runway end until they can safely takeoff.

Aircraft delay can vary depending on different operational activities at an airport. At airports where large air carrier aircraft dominate, delay can be greater given the amount of time these aircraft require in the traffic pattern and on approach to land. For airports that accommodate primarily small general aviation aircraft, experienced delay is typically less since these aircraft are more maneuverable and require less time in the airport traffic pattern.

Table 3E summarizes the potential aircraft delay for TKI. Estimates of delay provide insight into the impacts that steady increases in aircraft operations have on the airfield and also signify the Airport's ability to accommodate projected annual aircraft operations. The delay per operation represents an average delay per aircraft. It should be noted that delays of five to ten times the average could be experienced by individual aircraft during peak periods. As an airport's percent capacity increases toward


400
300
250
200
150
100
50
OPERATIONS (in thousands)
240,000
237,000
233,000
225,000
ANNUAL SERVICE VOLUME
187,215
154,980
137,865
126,494
OPERATIONAL DEMAND FORECAST
BASE YEAR (2016)
SHORT TERM
INTERMEDIATE TERM
LONG RANGE

the ASV, delay increases exponentially. Furthermore, complexities in the airspace system that surrounds an airport can also factor into additional delay experienced at the facility.

TABLE 3E
Airfield Delay Summary
McKinney National Airport

	Base Year (2016)	Short Term (1-5 years)	Intermediate Term (6-10 years)	Long Term (11-20 years)
Percent Capacity	52.7%	58.2%	66.5%	83.2%
Delay				
Per Operation (Minutes)	0.5	0.6	0.8	1.2
Total Annual (Hours)	1,054	1,379	2,066	3,744

Source: FAA AC 150/5060-5, *Airport Capacity and Delay*

Current annual delay is estimated at 0.5 minutes per aircraft operation or 1,054 annual hours. Analysis of delay factors for the long range planning horizon indicates that annual delays can be expected to reach 1.2 minutes per aircraft operation, or 3,744 annual hours.

CAPACITY ANALYSIS CONCLUSION

Exhibit 3B compares ASV to existing and forecast operational levels at TKI. The 2016 operations level equated to 52.7 percent of the airfield's ASV. By the long term planning horizon, total annual operations are expected to represent 83.2 percent of ASV.

FAA Order 5090.3C, *Field Formulation of the National Plan of Integrated Airport Systems*, indicates that improvements for airfield capacity purposes should be considered when operations reach 60 to 75 percent of the ASV. This is an approximate level to begin the detailed planning of capacity improvements. It is projected that this range could be met during the intermediate term planning horizon. When 80 percent of the ASV is reached, capacity improvement projects should become higher priority capital improvements. According to this analysis, it can be expected that the Airport will exceed this threshold during the long term planning horizon.

Since the projected operations will exceed 80 percent of the ASV by the long term, more significant options should be explored to improve airfield capacity. This includes the potential for a parallel runway at the Airport.

Actual implementation of capacity improvements may be deferred until such time that the improvement is considered timely and cost-beneficial. An example of a capacity improvement could include relatively minor improvements such as additional taxiway exits to more substantial improvements such as a parallel runway. While additional taxiway exits can improve capacity, they generally do not significantly reduce delay. Since the projected operations will exceed 80 percent of the ASV by the long term, more significant options should be explored to improve airfield capacity. This includes the potential for a parallel runway at the Airport. It is important

to note that TKI's current Airport Layout Plan (ALP) considers a future parallel runway located east of the existing runway. The Master Plan will further evaluate the potential for a parallel runway and its associated airfield requirements in the following sections.

Furthermore, in the event that the Airport attracts commercial service passenger and/or cargo operations by larger commercial service aircraft during the long term planning horizon, the ASV would be further reduced. These commercial aircraft would represent a higher percentage of Class C aircraft to be introduced into the mix of aircraft operations, increasing the classification to nearly 10 percent of the total operational mix. In doing so, the long term ASV would decrease to less than 210,000 and projected operations would exceed 90 percent of the ASV. This would create additional constraints on the efficiency of the airfield through the long term planning period and would provide additional justification for significant airfield capacity improvements, such as a parallel runway. Thus, options to improve airfield efficiency and capacity, including their feasibility and practicability, will be further evaluated in the next chapter.

AIRFIELD FACILITY REQUIREMENTS

Airfield facilities include those facilities related to the arrival, departure, and ground movement of aircraft. The adequacy of existing airfield facilities at TKI has been analyzed from a number of perspectives, including:

- Runways
- Safety Area Design Standards
- Runway Separation Standards
- Taxiways
- Navigational and Approach Aids
- Airfield Lighting, Marking, and Signage

RUNWAYS

Runway conditions such as orientation, length, width, and pavement strength at TKI were analyzed. From this information, requirements for runway improvements were determined for the Airport.

Runway Orientation

For the operational safety and efficiency of an airport, it is desirable for the primary runway to be oriented as close as possible to the direction of the prevailing wind. This reduces the impact of wind components perpendicular to the direction of travel of an aircraft that is landing or taking off. Runway 18-36 at TKI is orientated in a north-south manner.

FAA AC 150/5300-13A, *Airport Design,* recommends that a crosswind runway be made available when the primary runway orientation provides for less than 95 percent wind coverage for specific crosswind components. The 95 percent wind coverage is based on the crosswind component not exceeding 10.5 knots (12 mph) for Runway Design Code (RDC) A-I and B-I; 13 knots (15 mph) for RDC A-II and B-II; and 16 knots (18 mph) for RDC A-III, B-III, C-I through C-III, and D-I through D-III.

Weather data specific to the Airport was obtained from the National Oceanic Atmospheric Administration (NOAA) National Climatic Data Center. This data was collected from the on-field ASOS over a continuous time period from 2007 to 2016. A total of 104,928 observations of wind direction and other data points were made. Of the total number of observations, 12,722 were made in IFR conditions. As previously detailed, IFR conditions exist when the visibility is below three miles or the cloud ceilings are below 1,000 feet.

The existing runway orientation at TKI should be maintained as it is properly orientated to meet predominant winds, and a crosswind runway is not needed.

Exhibit 3C presents both the all-weather and IFR wind rose for the Airport. A wind rose is a graphic tool that gives a succinct view of how wind speed and direction are historically distributed at a particular location. The table at the top of each wind rose indicates the percent of wind coverage for the runway and specific wind intensity. In all-weather conditions, Runway 18-36 provides 96.99 percent wind coverage for 10.5 knot crosswinds, 98.50 percent coverage at 13 knots, 99.48 percent at 16 knots, and 99.82 percent at 20 knots. Under IFR conditions, the crosswind component coverages for the runway system are similar to the all-weather conditions and include 96.10 percent wind coverage for 10.5 knot crosswinds, 97.75 percent coverage at 13 knots, 99.97 percent at 16 knots, and 99.59 percent at 20 knots. Therefore, the existing runway orientation at TKI should be maintained as it is properly orientated to meet predominant winds, and a crosswind runway is not needed.

Runway Length

FAA AC 150/5325-4B, *Runway Length Requirements for Airport Design*, provides guidance for determining runway length needs. A draft revision to this AC is currently available (150/5325-4C) and the FAA is utilizing the draft revision in most cases when evaluating runway length needs for airports.

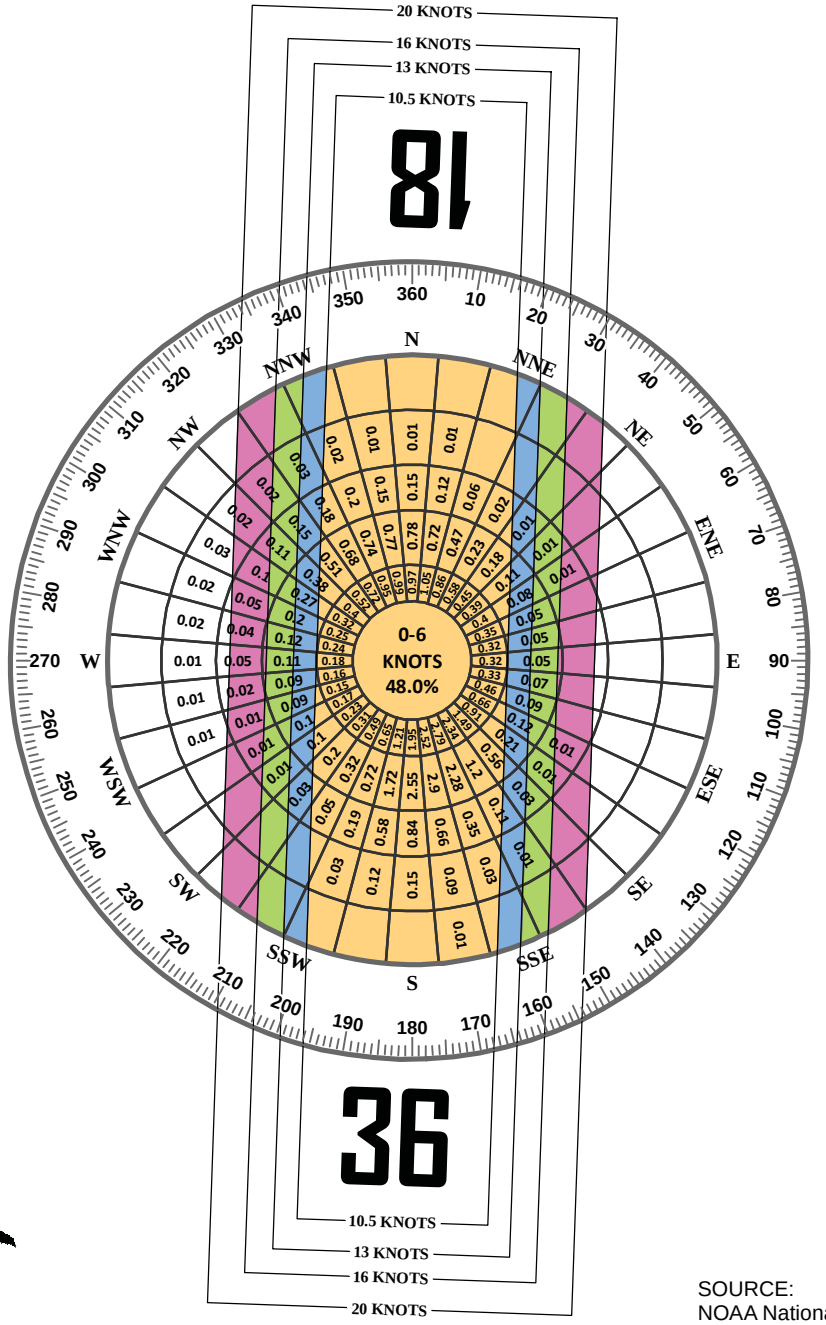
The determination of runway length requirements for TKI is based on five primary factors:

- Mean maximum temperature of the hottest month
- Airport elevation
- Runway gradient
- Critical aircraft type expected to use the runway
- Stage length of the longest nonstop destination (specific to larger aircraft)

Aircraft performance declines as elevations, temperature, and runway gradient factors increase. For TKI, the mean maximum daily temperature of the hottest month is 95.9 degrees Fahrenheit (F), which occurs

ALL WEATHER WIND COVERAGE

Runways	10.5 Knots	13 Knots	16 Knots	20 Knots
Runway 18-36	96.99%	98.50%	99.48%	99.82%



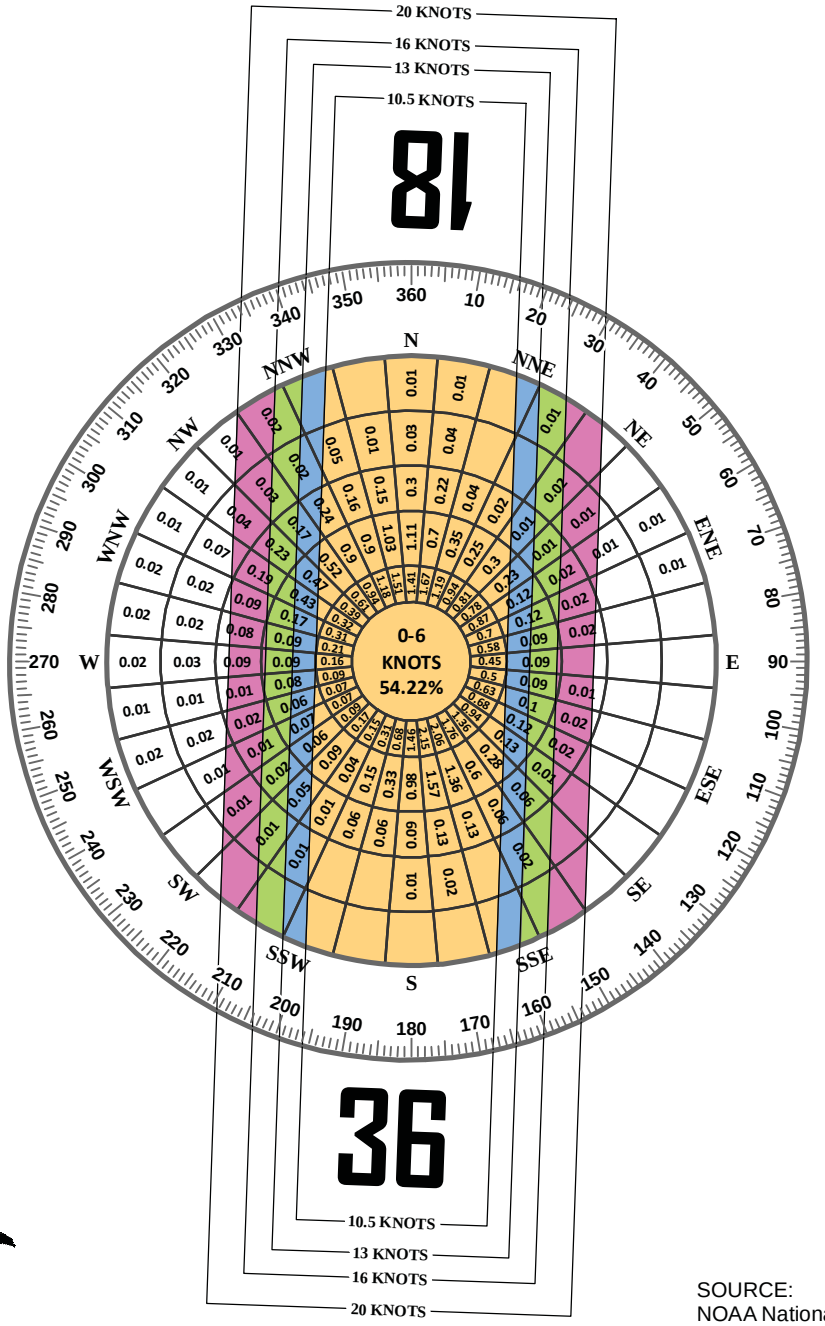
NORTH

Magnetic Declination
00° 03' 16" East (January 2017)
Annual Rate of Change
00° 00' 07" West (January 2017)

SOURCE:
NOAA National Climatic Center
Asheville, North Carolina
McKinney National Airport
McKinney, TX

OBSERVATIONS:
104,928 All Weather Observations
Jan. 1, 2007 - Dec, 31 2016

IFR WIND COVERAGE				
Runways	10.5 Knots	13 Knots	16 Knots	20 Knots
Runway 18-36	96.10%	97.75%	98.97%	99.59%



NORTH

Magnetic Declination
03° 16' 00" East (January 2017)
Annual Rate of Change
00° 07' 00" West (January 2017)

SOURCE:
NOAA National Climatic Center
Asheville, North Carolina
McKinney National Airport
McKinney, TX

OBSERVATIONS:
12,722 IFR Observations
Jan. 1, 2007 - Dec, 31 2016

in August. The Airport's elevation is 589 feet above mean sea level (MSL). The runway elevation difference is approximately 13 feet for Runway 18-36, which equates to a 0.19 percent gradient change. The gradient of the runway conforms to FAA design standards.

Airplanes operate on a wide variety of available runway lengths. Many factors will govern the suitability of those runway lengths for aircraft, such as elevation, temperature, wind, aircraft weight, wing flap settings, runway condition (wet or dry), runway gradient, vicinity airspace obstructions, and any special operating procedures. Airport operators can pursue policies that can maximize the suitability of the runway length. Policies such as area zoning and height and hazard restrictions can protect an airport's runway length. Airport ownership (fee simple or easement) of land leading to the runway ends can reduce the possibility of natural growth or man-made obstructions. Planning of runways should include an evaluation of aircraft types expected to use the airport or a particular runway now and in the future. Future plans should be realistic and supported by the FAA approved forecasts and should be based on the critical design aircraft (or family of aircraft).

Many factors will govern the suitability of those runway lengths for aircraft, such as elevation, temperature, wind, aircraft weight, wing flap settings, runway condition (wet or dry), runway gradient, vicinity airspace obstructions, and any special operating procedures.

General Aviation Aircraft

The majority of operations at TKI are conducted using smaller single engine piston-powered aircraft weighing less than 12,500 pounds. Following guidance from AC 150/5325-4B, to accommodate 100 percent of these small aircraft, a runway length of 4,000 feet is recommended. For small aircraft with 10 or more passenger seats, 4,400 feet of runway length is recommended.

The Airport is also utilized by aircraft weighing more than 12,500 pounds, including small to medium sized business jet aircraft. Runway length requirements for business jets weighing less than 60,000 pounds have also been calculated. These calculations take into consideration the runway gradient and landing length requirements for contaminated runways (wet). Business jets tend to need greater runway length when landing on a wet surface because of their increased approach speeds. AC 150/5325-4B stipulates that runway length determination for business jets consider a grouping of airplanes with similar operating characteristics. The AC provides two separate "family groupings of airplanes," each based upon their representative percentage of aircraft in the national fleet. The first grouping is those business jets that make up 75 percent of the national fleet, and the second group is those making up 100 percent of the national fleet. **Table 3F** presents a partial list of common aircraft in each aircraft grouping. A third group considers business jets weighing more than 60,000 pounds. Runway length determination for these aircraft must be based on the performance characteristics of the individual aircraft.

TABLE 3F
Business Jet Categories for Runway Length Determination

75 percent of the national fleet	MTOW (lbs.)	75-100 percent of the national fleet	MTOW (lbs.)	Greater than 60,000 pounds	MTOW (lbs.)
Lear 35	20,350	Lear 55	21,500	Gulfstream II	65,500
Lear 45	20,500	Lear 60	23,500	Gulfstream IV	73,200
Cessna 550	14,100	Hawker 800XP	28,000	Gulfstream V	90,500
Cessna 560XL	20,000	Hawker 1000	31,000	Global Express	98,000
Cessna 650 (VII)	22,000	Cessna 650 (III/IV)	22,000		
IAI Westwind	23,500	Cessna 750 (X)	36,100		
Beechjet 400	15,800	Challenger 604	47,600		
Falcon 50	18,500	IAI Astra	23,500		

MTOW: Maximum Take-Off Weight

Source: FAA AC 150/5325-4B, *Runway Length Requirements for Airport Design*

Table 3G presents the results of the runway length analysis for business jets developed following the guidance provided in AC 150/5325-4B. To accommodate 75 percent of the business jet fleet at 60 percent useful load, a runway length of 5,500 feet is recommended. This length is derived from a raw length of 5,000 feet that is adjusted, as recommended, for runway gradient and consideration of landing length needs on a contaminated runway (wet and slippery). To accommodate 100 percent of the business jet fleet at 60 percent useful load, a runway length of 6,000 feet is recommended.

Utilization of the 90 percent category for runway length determination is generally not considered by the FAA unless there is a demonstrated need at an airport. This could be documented activity by a business jet operator that flies out frequently with heavy loads. To accommodate 75 percent of the business jet fleet at 90 percent useful load, a runway length of 7,300 feet is recommended. To accommodate 100 percent of business jets at 90 percent useful load, a runway length of 9,400 feet is recommended. It is important to note that the previous runway extension was also designed around larger general aviation business jets exhibiting the need for longer stage lengths from an airport.

TABLE 3G
Runway Length Requirements
McKinney National Airport

Airport Elevation	588.9 feet above mean sea level
Average High Monthly Temp.	95.9 degrees F (August)
Runway Gradient	13' Runway 18-36

Fleet Mix Category	Raw Runway Length from FAA AC	Runway Length with Gradient Adjustment (+130')	Wet Surface Landing Length for Jets (+15%)*	Final Runway Length
100% of small airplanes	4,000’	N/A	N/A	4,000’
100% of small airplanes (10+ seats)	4,400’	N/A	N/A	4,400’
75% of fleet at 60% useful load	4,860’	4,990’	5,500'	5,500’
100% of fleet at 60% useful load	5,900’	6,030’	5,500’	6,000’
75% of fleet at 90% useful load	7,200’	7,330’	7,000’	7,300’
100% of fleet at 90% useful load	9,300’	9,430’	7,000'	9,400’

*Max 5,500' for 60% useful load and max 7,000' for 90% useful load in wet conditions

Source: FAA AC 150/5325-4B, *Runway Length Requirements for Airport Design*

Another method to determine runway length requirements for jet aircraft at TKI is to examine aircraft flight planning manuals under conditions specific to the Airport. Several aircraft were analyzed for take-off length required with a design temperature of 95.9 degrees F at a field elevation of 589 feet MSL. **Exhibit 3D** provides a detailed runway length analysis for the most common business jet and turboprop aircraft in the national fleet. This data was obtained from Ultranav software which computes operational parameters for specific aircraft based on flight manual data. The analysis includes the maximum takeoff weight (MTOW) allowable and the percent useful load for both current runway lengths. This analysis shows that the runway length of 7,002 feet is capable of accommodating many of these business jet/turboprop aircraft during wet runway conditions with little or no limit to their MTOW. Larger business jets such as the Gulfstream G550 and certain models of the Global Express would be weight-restricted when using Runway 18-36.

Exhibit 3D also presents the runway length required for landing under three operational categories: Title 14 Code of Federal Regulations (CFR) Part 25, CFR Part 135, and CFR Part 91k. CFR Part 25 operations are those conducted by individuals or companies which own their aircraft. CFR Part 135 applies to all for-hire charter operations, including most fractional ownership operations. CFR Part 91k includes operations in fractional ownership which utilize their own aircraft under direction of pilots specifically assigned to said aircraft. The landing length analysis shows an average landing length of 5,800 feet for aircraft operating under CFR Part 91k during wet runway conditions and an average of 7,700 feet for aircraft operating under Part 135 during wet runway conditions. Certain aircraft, such as the Gulfstream IV that is based at the Airport as well as certain Cessna Citation aircraft models, require over 9,000 feet of runway length for landing when operating at maximum landing weight under Part 135 during wet runway conditions.

As previously noted, the FAA will typically only support runway length planning to the 60 percent useful load factor unless it can be demonstrated that business jets are frequently operating fully loaded (90 percent). Most business aircraft are capable of taking off on the primary runway at TKI at or above 90 percent useful load. For landing situations, the analysis showed that the Gulfstream IV and certain Cessna Citation models which frequent the Airport require additional runway length than what is currently available at TKI when operating under Part 135 under wet runway conditions.

Commercial/Air Charter Aircraft

Runway length needs for commercial service aircraft must factor the local operating conditions described above and the load carried. The aircraft load is dependent upon the payload of passengers and/or cargo, plus the amount of fuel it has on board. For departures, the amount of fuel varies depending upon the length of non-stop flight or trip length.

Texas Air Shuttle, which is a scheduled air charter operator that has operated at TKI in the past and is scheduled to resume operations again in the Spring of 2016, uses the Beechcraft King Air 200 aircraft to serve multiple destinations in Texas from TKI. The analysis in the previous section indicated that the King Air 200 is more than capable of operating fully loaded on the existing runway system at TKI.

Aircraft Name	Payload Available for Takeoff – Dry 7,002' Runway			Payload Available for Takeoff – Wet 7,002' Runway			Landing Distance Required (feet) – CFR Part 25		CFR Part 135		CFR Part 91K	
	MTOW Limit (lbs.)	Payload Available (lbs.)	% Payload Available	MTOW Limit (lbs.)	Payload Available (lbs.)	% Payload Available	Dry	Wet	Dry (.6)	Wet (.6)	Dry (.8)	Wet (.8)
Beechjet 400A	NL	5,315	100%	NL	5,315	100.00%	3,781	5,632	6,302	9,387	4,726	7,040
Citation 560XL	NL	7,300	100%	NL	7,300	100.00%	3,556	5,674	5,927	9,457	4,445	7,093
Citation X	NL	13,236	100%	34,040	11,576	87.46%	4,011	5,714	6,685	9,523	5,014	7,143
Citation Bravo	NL	5,475	100%	N/A	N/A	N/A	3,740	5,878	6,233	9,797	4,675	7,348
Citation Encore	NL	6,110	100%	NL	6,110	100.00%	3,178	4,765	5,297	7,942	3,973	5,956
Citation Encore Plus	NL	6,270	100%	NL	6,270	100.00%	3,177	4,826	5,295	8,043	3,971	6,033
Citation III	20,440	8,629	89%	18,670	6,859	70.79%	4,195	6,093	6,992	10,155	5,244	7,616
Challenger 300	NL	15,000	100%	NL	15,000	100.00%	2,636	5,052	4,393	8,420	3,295	6,315
Challenger 601	43,200	16,950	90%	N/A	N/A	N/A	3,366	4,039	5,610	6,732	4,208	5,049
CRJ-200	50,075	19,575	87%	49,040	18,540	82.40%	2,943	5,640	4,905	9,400	3,679	7,050
Falcon 7X	NL	33,400	100%	NL	33,400	100.00%	2,957	3,401	4,928	5,668	3,696	4,251
Falcon 2000	35,579	12,829	98%	35,401	12,651	96.94%	3,162	3,636	5,270	6,060	3,953	4,545
Falcon 50 EX	NL	18,000	100%	40,613	17,613	97.85%	2,962	3,406	4,937	5,677	3,703	4,258
Gulfstream G200	32,209	12,009	79%	31,754	11,554	75.76%	3,633	4,177	6,055	6,962	4,541	5,221
Gulfstream G100	24,006	9,371	94%	N/A	N/A	N/A	3,244	6,075	5,407	10,125	4,055	7,594
Gulfstream G150	NL	10,990	100%	25,215	10,115	91.95%	3,202	4,692	5,337	7,820	4,003	5,865
Gulfstream G350	NL	28,000	100%	NL	28,000	100.00%	3,299	3,794	5,498	6,323	4,124	4,743
Gulfstream G450	NL	31,400	100%	72,454	29,254	93.17%	3,299	5,749	5,498	9,582	4,124	7,186
GulfstreamG550	87,487	38,787	92%	86,672	37,972	89.77%	2,806	5,178	4,677	8,630	3,508	6,473

N/A = No wet data available **NL** = No Limit **MTOW** = Maximum Take Off Weight ***Source:*** Ultranav

Aircraft Name	Payload Available for Takeoff – Dry 7,002' Runway			Payload Available for Takeoff – Wet 7,002' Runway			Landing Distance Required (feet) – CFR Part 25		CFR Part 135		CFR Part 91K	
	MTOW Limit (lbs.)	Payload Available (lbs.)	% Payload Available	MTOW Limit (lbs.)	Payload Available (lbs.)	% Payload Available	Dry	Wet	Dry (.6)	Wet (.6)	Dry (.8)	Wet (.8)
Gulfstream IIB	NL	31,550	100%	67,204	29,054	92.09%	3,201	6,135	5,335	10,225	4,001	7,669
Gulfstream IV	73,461	29,561	96%	71,551	27,651	90.07%	3,663	7,022	6,105	11,703	4,579	8,778
Gulfstream IV/SP	NL	31,400	100%	68,520	25,320	80.64%	3,210	3,691	5,350	6,152	4,013	4,614
Global 5000	NL	41,659	100%	NL	41,659	100.00%	2,699	3,104	4,498	5,173	3,374	3,880
Global Express	95,514	44,314	95%	94,514	43,314	92.55%	2,699	3,104	4,498	5,173	3,374	3,880
Global XRS	95,515	44,315	95%	94,516	43,316	92.56%	2,699	3,104	4,498	5,173	3,374	3,880
Hawker 800	24,880	8,880	78%	N/A	N/A	N/A	2,990	3,850	4,983	6,417	3,738	4,813
Hawker 800XP	26,844	10,594	90%	26,820	10,570	89.96%	2,687	4,161	4,478	6,935	3,359	5,201
Hawker 900XP	NL	11,500	100%	NL	11,500	100.00%	2,687	4,024	4,478	6,707	3,359	5,030
Hawker 4000	NL	15,800	100%	NL	15,800	100.00%	3,322	3,820	5,537	6,367	4,153	4,775
King Air 200GT	12,053	3,273	88%	N/A	N/A	N/A	1,223	N/A	2,038	N/A	1,529	N/A
King Air 350	NL	5,115	100%	NL	5,115	100.00%	2,904	3,340	4,840	5,567	3,630	4,175
King Air C90B	NL	3,030	100%	N/A	N/A	N/A	1,262	N/A	2,103	N/A	1,578	N/A
Learjet 31A	NL	5,786	100%	N/A	N/A	N/A	3,067	4,294	5,112	7,157	3,834	5,368
Learjet 35A	17,700	6,900	78%	N/A	N/A	N/A	3,298	4,617	5,497	7,695	4,123	5,771
Learjet 45	21,411	7,411	99%	21,299	7,299	97.32%	2,881	3,683	4,802	6,138	3,601	4,604
Learjet 60	22,556	7,784	89%	21,740	6,968	79.84%	3,667	4,960	6,112	8,267	4,584	6,200
Premier 1A	NL	3,900	100%	NL	3,900	100.00%	3,437	4,433	5,728	7,388	4,296	5,541
Westwind I	20,593	7,593	77%	20,593	7,593	77.09%	2,510	2,890	4,183	4,817	3,138	3,613
Westwind II	22,168	8,918	87%	22,168	8,918	87.00%	2,430	2,800	4,050	4,667	3,038	3,500

N/A = No wet data available **NL** = No Limit **MTOW** = Maximum Take Off Weight ***Source:*** Ultranav

An analysis in Chapter Two considered the potential introduction of enhanced commercial activity at TKI in the future, including the utilization of larger commercial service aircraft. **Table 3H** presents the runway length needs for various commercial jet aircraft utilizing the maximum ambient temperature conditions available in each aircraft's operating manual. For many of these aircraft, the maximum temperature available for planning calculations is 84 degrees F. As previously detailed, the most demanding temperature at TKI is 95.9 degrees F in the month of August. As such, many of the runway length needs for these aircraft would likely increase based on the mean maximum temperature of 95.9 degrees F. The operating manuals for the Boeing Business Jet 1 and 2 provided a maximum temperature condition of 102 degrees F, thus exceeding the mean maximum temperature for TKI.

This analysis shows that many of these aircraft are capable of operating at 60 percent, 70 percent, and 80 percent useful loads on the current runway length based on an ambient temperature of 84 degrees F. Moving up to 90 percent and 100 percent useful loads, many aircraft would be weight restricted and require additional runway length to operate at MTOW. It should be noted that due to the age and efficiency of certain aircraft such as the MD-80 series and ERJ-145, many airline operators are phasing these aircraft out of their fleet mix and replacing them with newer and more efficient aircraft such as the A319, A320, and CRJ-700.

TABLE 3H
Runway Length Requirements for Select Commercial Aircraft
McKinney National Airport

Aircraft	Temp.	Aircraft Weights (lbs.)			Takeoff Wt. with % Payload (lbs.)					Runway Length (ft.) Needed at % Payload				
		MTOW	BOW/ OEW	Pay-load	60%	70%	80%	90%	100%	60%	70%	80%	90%	100%
Airbus A319	ISA +15c (84°f)	145,505	87,801	57,704	122,423	128,194	133,964	139,735	145,505	3,900	4,100	4,300	4,500	4,600
Airbus A320	ISA +15c (84°f)	157,630	91,150	66,480	131,038	137,686	144,334	150,982	157,630	4,000	4,200	4,900	5,200	5,500
Boeing Business Jet 1	ISA +25c (102°f)	171,000	92,345	78,655	139,538	147,404	155,269	163,135	171,000	5,100	6,400	7,000	7,300	8,300
Boeing Business Jet 2	ISA +25c (102°f)	174,200	96,727	77,473	143,211	150,958	158,705	166,453	174,200	6,200	6,700	7,600	8,100	9,900
Boeing 737-800	ISA +15c (84°f)	174,200	91,300	82,900	141,040	149,330	157,620	165,910	174,200	5,200	5,800	6,300	7,100	8,100
Embraer ERJ-145	ISA +15c (84°f)	48,502	26,707	21,795	39,784	41,964	44,143	46,323	48,502	4,100	4,400	4,600	5,300	6,800
Bombardier CRJ-700	ISA +15c (84°f)	75,000	44,245	30,755	62,698	65,774	68,849	71,925	75,000	4,200	4,550	4,900	5,300	5,800
McDonnell Douglas MD-81	ISA +15c (84°f)	140,000	77,888	62,112	115,155	121,366	127,578	133,789	140,000	4,600	5,300	6,000	6,700	7,700
McDonnell Douglas MD-83	ISA +15c (84°f)	160,000	79,686	80,314	127,874	135,906	143,937	151,969	160,000	4,900	5,600	6,100	7,100	8,400
Boeing 757	ISA +14c (84°f)	255,000	130,875	124,125	205,350	217,763	230,175	242,588	255,000	4,300	4,800	5,300	5,900	6,300

All MTOWs and BOWs/OEWs from aircraft operating manuals
Payload calculated from difference of MTOW and BOW/OEW
Zero slope runway, no-wind conditions assumed for all aircraft
MTOW - Maximum Takeoff Weight; BOW - Basic Operating Weight; OEW - Operating Empty Weight
Source: Aircraft Operating Manuals

Runway Length Summary

Many factors are considered when determining appropriate runway length for safe and efficient operations of aircraft at TKI. The Airport should strive to accommodate commercial service aircraft and business jets to the greatest extent possible as demand would dictate.

Runway 18-36 is currently 7,002 feet long and can accommodate a large majority of business jets on the market under moderate loading conditions, especially with shorter trip lengths and during cool to warm temperatures. It is the hot days and longer trip lengths which can limit business jets operating at TKI. It should be noted that larger aircraft, such as the Gulfstream IV and BBJ, could support a longer runway but would be dependent upon the specific make and model that the FAA agrees to consider as the critical design aircraft. The potential introduction of enhanced commercial passenger service in the future could also warrant a need for additional runway length.

Analysis in the next chapter will examine potential runway extensions that could be achieved at TKI to better accommodate the needs of larger aircraft during the 20-year planning period of this Master Plan.

Justification for any runway extension to meet the needs of business or commercial jets would require regular use on the order of 500 annual itinerant operations. This is the minimum threshold required to obtain FAA grant funding assistance. The existing length of Runway 18-36 does not fully provide for all jet activity, especially during hot weather conditions and when jet aircraft are carrying full useful loads due to long trip lengths. Furthermore, previous planning studies conducted for TKI as well as the existing ALP indicate a runway length of 8,500 feet be considered on the primary runway at the Airport. Analysis in the next chapter will examine potential runway extensions that could be achieved at TKI to better accommodate the needs of larger aircraft during the 20-year planning period of this Master Plan. The runway length analysis will evaluate extension scenarios on the existing runway and as well as examining a preferred length on the potential parallel runway in order to best meet the planned mix of aircraft.

Runway Width

Runway width design standards are primarily based on the critical aircraft, but can also be influenced by the visibility minimums of published instrument approach procedures. For Runway 18-36, RDC D-III design criteria stipulate a runway width of 100 feet unless the critical aircraft has a MTOW greater than 150,000 pounds. For ADG III aircraft with MTOWs greater than 150,000 pounds, the standard runway width is 150 feet.

The current width of Runway 18-36 is 150 feet. As detailed earlier in this study, the ultimate critical design aircraft could include larger jets up to and including the Boeing Business Jet, which has a MTOW over 170,000 pounds. Furthermore, the existing width provides added safety enhancements for existing operations by larger business jet aircraft that utilize the Airport. As such, it is recommended that the current width on Runway 18-36 be maintained in the future.

Similar to the existing runway, the width of a potential parallel runway would need to be based on the planned critical aircraft. In the event that a future parallel runway is justified, it could be initially designed to meet a smaller design aircraft and then upgraded as justification and demand warrants. At a minimum, the runway should initially meet runway design code (RDC) B-II design standards, which calls for a width of 75 feet. Ultimate planning for a potential parallel runway may consider larger aircraft up to RDC C/D-III standards which could necessitate a runway width of up to 150 feet. These considerations will be further explored in the next chapter.

Runway Pavement Strength

An important feature of airfield pavement is its ability to withstand repeated use by aircraft. The FAA reports the pavement strength for Runway 18-36 at 75,000 pounds single wheel loading (SWL), 150,000 pounds dual wheel loading (DWL), and 450,000 pounds double tandem wheel loading (DTWL). These strength ratings refer to the configuration of the aircraft landing gear. For example, SWL indicates an aircraft with a single wheel on each landing gear.

The strength rating of a runway does not preclude aircraft weighing more than the published strength rating from using the runway. The strength is based on design parameters which support a high volume of aircraft at or below the published weight, allowing the pavement to survive its intended useful life. Aircraft weighing more than the published weight could damage the runway in severe conditions, but more likely will simply reduce the life cycle of the pavement.

All federally obligated airports must remain open to the public, and it is typically up to the pilot of the aircraft to determine if a runway can support their aircraft safely. An airport sponsor cannot restrict an aircraft from using the runway simply because its weight exceeds the published strength rating. On the other hand, an airport sponsor has an obligation to properly maintain the runway and protect the useful life of the runway, typically for 20 years.

According to the FAA publication, *Airport/Facility Directory*, "Runway strength rating is not intended as a maximum allowable weight or as an operating limitation. Many airport pavements are capable of supporting limited operations with gross weights in excess of the published figures." The directory goes on to say that those aircraft exceeding the pavement strength should contact the airport sponsor for permission to operate at the airport.

The strength rating of a runway can change over time. Regular usage by heavier aircraft can decrease the strength rating, while periodic runway resurfacing or other maintenance methods can increase the strength rating. The current runway strength is adequate to accommodate the aircraft that currently operate at the Airport and most that are forecast to utilize the Airport in the future. The current ALP calls for an ultimate pavement design strength of 450,000 pounds DTWL for the existing runway as well as the proposed parallel runway. These strength levels would only be needed if the Airport attracts large commercial service aircraft for passenger use, but more likely are for cargo operators. As such, future

consideration should be given to maintaining the pavement strength on Runway 18-36, with ultimate consideration given to increasing if commercial operations dictate.

SAFETY AREA DESIGN STANDARDS

The FAA has established several imaginary surfaces to protect aircraft operational areas and keep them free from obstructions. These include the runway safety area (RSA), runway object free area (ROFA), runway obstacle free zone (ROFZ), and runway protection zone (RPZ).

The entire RSA, ROFA, and ROFZ must be under the direct ownership of the airport sponsor to ensure these areas remain free of obstacles and can be readily accessed by maintenance and emergency personnel. RPZs should also be under airport ownership. An alternative to outright ownership of the RPZ is the purchase of avigation easements (acquiring control of designated airspace within the RPZ) or having sufficient land use control measures in places which ensure the RPZ remains free of incompatible development. The various airport safety areas are presented on **Exhibit 3E**.

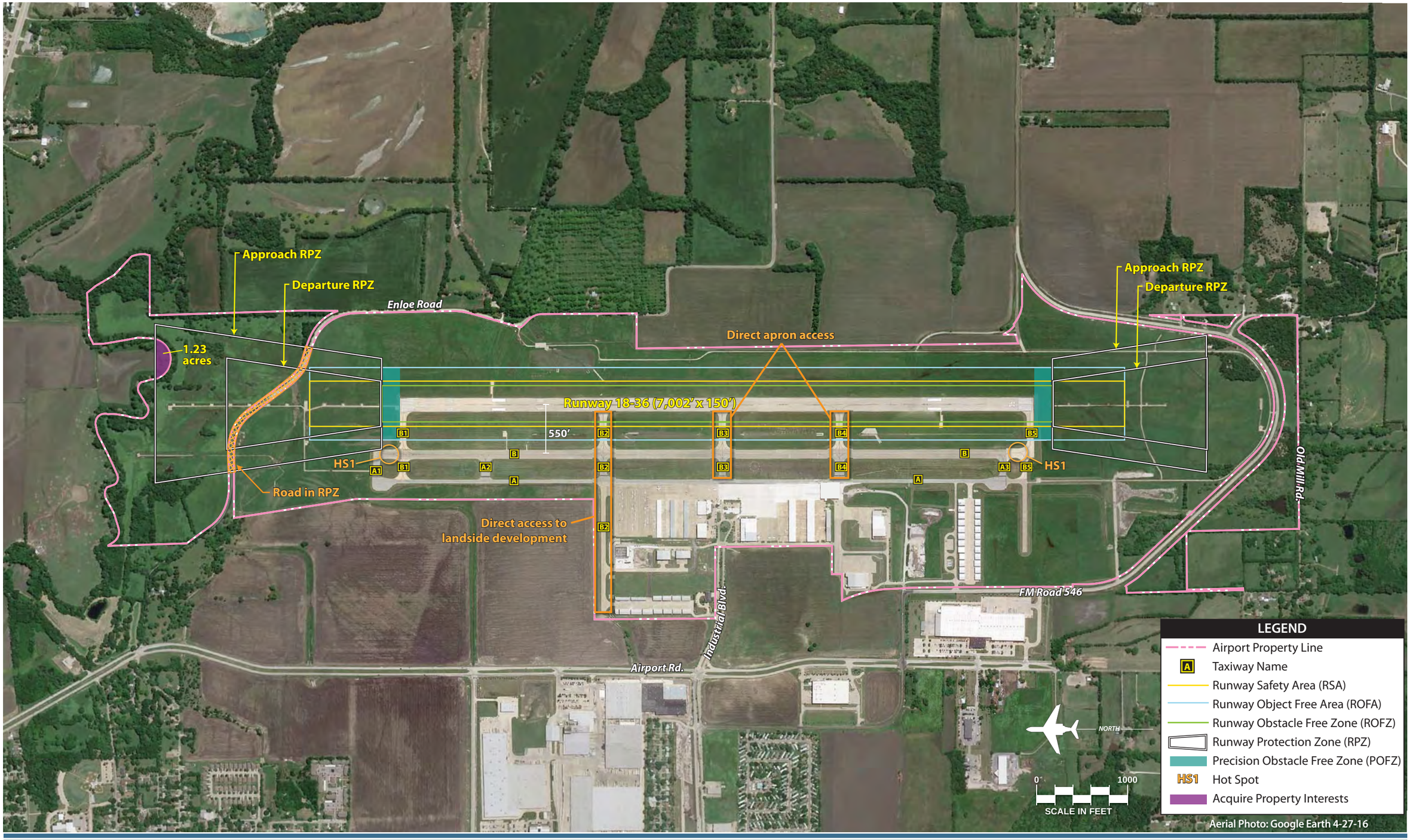
The entire RSA, ROFA, and ROFZ must be under the direct ownership of the airport sponsor to ensure these areas remain free of obstacles and can be readily accessed by maintenance and emergency personnel.

Dimensional standards for the various safety areas associated with the runway are a function of the type of aircraft using or expected to use the runway as well as the instrument approach capability. As previously identified, the current critical design aircraft is classified as D-III. The future design aircraft should remain in D-III. **Table 3J** presents the FAA design standards as they apply to Runway 18-36 at TKI both now and in the future. The potential for a future parallel runway will also be examined during this Master Plan. This runway could be designed to at least B-II standards initially, with the opportunity to ultimately conform to C/D-III standards.

Runway Safety Area

The RSA is defined in FAA AC 150/5300-13A, *Airport Design,* as a "surface surrounding the runway prepared or suitable for reducing the risk of damage to airplanes in the event of undershoot, overshoot, or excursion from the runway." The RSA is centered on the runway and dimensioned in accordance to the approach speed of the critical design aircraft using the runway. The FAA requires the RSA to be cleared and graded, drained by grading or storm sewers, capable of accommodating the design aircraft and fire and rescue vehicles, and free of obstacles not fixed by navigational purpose such as runway edge lights or approach lights.

The FAA has placed a higher significance on maintaining adequate RSA at all airports. Under Order 5200.8, effective October 1, 1999, the FAA established the *Runway Safety Area Program.* The Order


Approach RPZ
Departure RPZ
Enloe Road
1.23 acres
Direct apron access
Runway 18-36 (7,002' x 150')
550'
B1
B2
B3
B4
B5
A
A1
A2
A3
HS1
Road in RPZ
Direct access to landscape development
Approach RPZ
Departure RPZ
Old Mill Rd.
FM Road 546
Industrial Blvd.
Airport Rd.
NORTH
0
1000
SCALE IN FEET
LEGEND
Airport Property Line
Taxiway Name
Runway Safety Area (RSA)
Runway Object Free Area (ROFA)
Runway Obstacle Free Zone (ROFZ)
Runway Protection Zone (RPZ)
Precision Obstacle Free Zone (POFZ)
HS1 Hot Spot
Acquire Property Interests
Aerial Photo: Google Earth 4-27-16

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states, "The objective of the Runway Safety Area Program is that all RSAs at federally-obligated airports…shall conform to the standards contained in Advisory Circular 150/5300-13, *Airport Design*, to the extent practicable." Each Regional Airports Division of the FAA is obligated to collect and maintain data on the RSA for each runway at the airport and perform airport inspections.

TABLE 3J
Runway Design Standards
McKinney National Airport

	Existing/Ultimate Runway 18-36	Proposed Parallel Runway
RUNWAY CLASSIFICATION		
Runway Design Code	D-III	Up to C/D-III[1]
Visibility Minimums	½-mile (Rwy 18) / ¾-mile (Rwy 36)	Not lower than ¾-mile (Both Ends)
RUNWAY DESIGN		
Runway Width	150	150[2]
RUNWAY PROTECTION		
Runway Safety Area (RSA)		
Width	500	500
Length Beyond Departure End	1,000	1,000
Length Prior to Threshold	600	600
Runway Object Free Area (ROFA)		
Width	800	800
Length Beyond Departure End	1,000	1,000
Length Prior to Threshold	600	600
Runway Obstacle Free Zone (ROFZ)		
Width	400	400
Length Beyond End	200	200
Precision Obstacle Free Zone (POFZ)		
Width	800	800
Length	200	200
Approach Runway Protection Zone (RPZ)		
Length	2,500 / 1,700	1,700
Inner Width	1,000 / 1,000	1,000
Outer Width	1,750 / 1,510	1,510
Departure Runway Protection Zone (RPZ)		
Length	1,700 / 1,700	1,700
Inner Width	500 / 500	500
Outer Width	1,010 / 1,010	1,010
RUNWAY SEPARATION		
Runway Centerline to:		
Holding Position	256[3]	256[3]
Parallel Taxiway	400	400
Aircraft Parking Area	500	500

[1] Potential parallel runway could initially be planned to meet RDC B-II standards.
[2] For airplanes with maximum certificated takeoff weight of 150,000 pounds or less, the standard runway width is 100 feet.
[3] This distance is increased one foot for each 100 feet above sea level.
Note: All dimensions in feet

Source: FAA AC 150/5300-13A, Change 1, Airport Design

For RDC D-III design, the FAA calls for the RSA to be 500 feet wide and extend 1,000 feet beyond the runway ends. Analysis in the previous chapter indicated that Runway 18-36 should be planned to continue to accommodate aircraft in RDC D-III through the long term planning period. It should be noted that only 600 feet of RSA is needed prior to the landing threshold on each runway end under RDC D-III standards. An examination of the RSA for Runway 18-36 did not identify any current non-standard conditions. The RSA should be maintained through the planning period.

As previously mentioned, a parallel runway could be planned to at least meet B-II standards initially. RDC B-II standards for runways with not lower than ¾-mile visibility minimums require RSAs to be 150 feet wide, extending 300 feet beyond the runway end. Ultimate planning should consider the parallel runway meeting up to C/D-III standards, as outlined above.

Runway Object Free Area

The ROFA is "a two-dimensional ground area, surrounding runways, taxiways, and taxilanes, which is clear of objects except for objects whose location is fixed by function (i.e., airfield lighting)." The ROFA does not have to be graded and level like the RSA; instead, the primary requirement for the ROFA is that no object in the ROFA penetrates the lateral elevation of the RSA. The ROFA is centered on the runway, extending out in accordance to the critical design aircraft utilizing the runway.

For RDC D-III design, the FAA calls for the ROFA to be 800 feet wide, extending 1,000 feet beyond each runway end. Similar to the RSA, only 600 feet is needed prior to the landing threshold. Runway 18-36 currently meets this standard, and it should be maintained in the future.

A potential parallel runway that would initially meet B-II ROFA standards with not lower than ¾-mile visibility minimums would require the ROFA to be 500 feet wide and extend 300 feet beyond the runway end. Future C/D-III standards would necessitate an expansion of the ROFA similar to current ROFA standards associated with Runway 18-36.

Obstacle Free Zone

The ROFZ is an imaginary volume of airspace which precludes object penetrations, including taxiing and parked aircraft. The only allowance for ROFZ obstructions is navigational aids mounted on frangible bases which are fixed in their location by function, such as airfield signs. The ROFZ is established to ensure the safety of aircraft operations. If the ROFZ is obstructed, an airport's approaches could be removed or approach minimums could be increased.

The FAA's criterion for runways utilized by aircraft weighing more than 12,500 pounds requires a clear ROFZ to extend 200 feet beyond the runway ends and be 400 feet wide (200 feet on either side of the runway centerline). The ROFZ standards are met on Runway 18-36. The proposed parallel runway should also be designed to accommodate a 400-foot ROFZ width.

A precision obstacle free zone (POFZ) is further defined for runway ends with a precision approach, such as the ILS approach to Runway 18. The POFZ is 800 feet wide, centered on the runway, and extends from the runway threshold to a distance of 200 feet. The POFZ is in effect when the following conditions are met:

a) The runway supports a vertically guided approach.
b) Reported ceiling is below 250 feet or visibility is less than ¾-mile.
c) An aircraft is on final approach within two miles of the runway threshold.

When the POFZ is in effect, a wing of an aircraft holding on a taxiway may penetrate the POFZ; however, neither the fuselage nor the tail may infringe on the POFZ. POFZ standards currently apply to each end of Runway 18-36 as both runway ends allow for a vertically guided approach with instrument approach minimums below 250 feet or visibility minimums below ¾-mile.

Runway Protection Zone

The RPZ is a trapezoidal area centered on the runway, beginning 200 feet beyond the runway end. The RPZ has been established by the FAA to provide an area clear of obstructions and incompatible land uses, in order to enhance the protection of people and property on the ground. The RPZ is comprised of the central portion of the RPZ and the controlled activity area. The central portion of the RPZ extends from the beginning to the end of the RPZ, is centered on the runway, and is the width of the ROFA. The controlled activity area is any remaining portions of the RPZ. The dimensions of the RPZ vary per the visibility minimums serving the runway and the type of aircraft (design aircraft) operating on the runway.

While the RPZ is intended to be clear of incompatible objects or land uses, some uses are permitted with conditions and other land uses are prohibited. According to AC 150/5300-13A, the following land uses are permissible within the RPZ:

- Farming that meets the minimum buffer requirements,
- Irrigation channels as long as they do not attract birds,
- Airport service roads, as long as they are not public roads and are directly controlled by the airport operator,
- Underground facilities, as long as they meet other design criteria, such as RSA requirements, as applicable, and
- Unstaffed navigational aids (NAVAIDs) and facilities, such as required for airport facilities that are fixed by function in regard to the RPZ.

Any other land uses considered within RPZ land owned by the airport sponsor must be evaluated and approved by the FAA Office of Airports. The FAA has published *Interim Guidance on Land Uses within a Runway Protection Zone* (9.27.2012), which identifies several potential land uses that must be evaluated and approved prior to implementation. The specific land uses requiring FAA evaluation and approval include:

- Buildings and structures (Examples include, but are not limited to: residences, schools, churches, hospitals or other medical care facilities, commercial/industrial buildings, etc.)
- Recreational land use (Examples include, but are not limited to: golf courses, sports fields, amusement parks, other places of public assembly, etc.)
- Transportation facilities. Examples include, but are not limited to:
  - Rail facilities - light or heavy, passenger or freight
  - Public roads/highways
  - Vehicular parking facilities
- Fuel storage facilities (above and below ground)
- Hazardous material storage (above and below ground)
- Wastewater treatment facilities
- Above-ground utility infrastructure (i.e., electrical substations), including any type of solar panel installations.

The *Interim Guidance on Land within a Runway Protection Zone* states, "RPZ land use compatibility also is often complicated by ownership considerations. Airport owner control over the RPZ land is emphasized to achieve the desired protection of people and property on the ground. Although the FAA recognizes that in certain situations the airport sponsor may not fully control land within the RPZ, the FAA expects airport sponsors to take all possible measures to protect against and remove or mitigate incompatible land uses."

Currently, the RPZ review standards are applicable to any new or modified RPZ. The following actions or events could alter the size of an RPZ, potentially introducing an incompatibility:

- An airfield project (e.g., runway extension, runway shift),
- A change in the critical design aircraft that increases the RPZ dimensions,
- A new or revised instrument approach procedure that increases the size of the RPZ, and/or
- A local development proposal in the RPZ (either new or reconfigured).

Since the interim guidance only addresses a new or modified RPZ, existing incompatibilities are generally (but not always) grandfathered under certain circumstances. While it is still necessary for the airport sponsor to take all reasonable actions to meet the RPZ design standard, FAA funding priority for certain actions, such as relocating existing roads in the RPZ, will be determined on a case-by-case basis.

RPZs have been further designated as approach and departure RPZs. The approach RPZ is a function of the Aircraft Approach Category (AAC) and approach visibility minimums associated with the approach runway end. The departure RPZ is a function of the AAC and departure procedures associated with the runway. For a particular runway end, the more stringent RPZ requirements (usually associated with the approach RPZ) will govern the property interests and clearing requirements that the airport sponsor should pursue.

Currently, only a small portion (1.23 acres) of the approach RPZ serving Runway 18 extends beyond Airport property, as depicted on **Exhibit 3E**. Whenever possible, the Airport should maintain positive control over the RPZs through fee simple acquisition; however, avigation easements can be pursued if fee simple acquisition is not feasible.

Whenever possible, the Airport should maintain positive control over the RPZs through fee simple acquisition; however, avigation easements can be pursued if fee simple acquisition is not feasible.

On the north side of Runway 18-36, portions of Enloe Road traverse the approach and departure RPZs. The approach RPZ serving Runway 18 is larger than the approach RPZ serving Runway 36 due to the precision ILS instrument approach procedure providing visibility minimums down to ½-mile. On the south side of the runway system, the approach and departure RPZs are fully contained on Airport property and free from incompatibilities.

The proposed parallel runway should initially be planned for at least RDC B-II aircraft served by a runway with visual or not lower than ¾-mile visibility minimums. The corresponding RPZ has a dimension of 500-foot inner width, 700-foot outer width, extending 1,000 feet. Ultimate planning on the parallel runway should incorporate larger RPZs associated with lower than one-mile visibility minimum approaches. Further examination of the RPZs associated with each runway end will be undertaken later in this study. The potential for instrument approach procedures and their effects on RPZ dimensions will also be considered.

RUNWAY SEPARATION STANDARDS

There are several other standards related to separation distances from runways. Each of these is designed to enhance the safety of the airfield.

Runway/Taxiway Separation

The design standard for the separation between runways and parallel taxiways is a function of the critical design aircraft and the instrument approach visibility minimum. The separation standard for RDC D-III with lower than ¾-mile visibility minimums is 400 feet from the runway centerline to the parallel taxiway centerline. Parallel Taxiway B is 550 feet from the runway; therefore, the current location of the taxiway exceeds both current and proposed separation standards.

Regarding a potential parallel runway in the future, any proposed parallel taxiway development should not be nearer than 240 feet from the runway centerline in order to meet RDC B-II standards; however, the required separation is 400 feet to meet ultimate C/D-III standards. If a parallel runway is ultimately planned, the separation should conform to C/D-II/III standards to ensure its upgrade potential is preserved.

Holding Position Separation

Holding position markings are placed on taxiways leading to runways. When instructed, pilots are to stop short of the holding position marking line. For Runway 18-36, holding position marking lines are situated 250 feet from the runway centerline.

According to FAA AC 150/5300-13A, Change 1, *Airport Design*, the holding position marking line location may need to be increased based on an airport's elevation and the RDC of the runway. For RDC D-III, the holding position marking line should be increased one foot for every 100 feet above sea level. With TKI's elevation at 589 feet MSL, the hold lines for Runway 18-36 should be increased to be 256 feet from the runway centerline in order to meet RDC D-III standards.

The holding position markings associated with a proposed parallel runway should be planned at least 200 feet from the runway centerline in order to meet RDC B-II standards. Ultimate planning, however, should consider RDC D-III standards which entail a 256-foot separation between the parallel runway.

Aircraft Parking Area Separation

Aircraft parking areas should be at least 500 feet from the Runway 18-36 centerline. Currently, all aircraft parking areas exceed this standard as approximately 875 feet of separation exists between the runway and designated aircraft parking aprons farther west.

Aircraft parking separation associated with a potential parallel runway would need to consider at least 250 feet of separation in order to meet RDC B-II standards; however, prudent planning would further increase the separation to 500 feet in order to satisfy planning standards associated with ultimate RDC C/D-III design.

Parallel Runway Separation

FAA criteria requires a parallel runway be separated from an existing runway by at least 700 feet in order for aircraft to conduct simultaneous takeoffs and landings under VFR conditions. Analysis in the following chapter will present parallel runway development options that attempt to adhere to the safety design standards previously outlined.

TAXIWAYS

The design standards associated with taxiways are determined by the Taxiway Design Group (TDG) or the Airplane Design Group (ADG) of the critical design aircraft. As determined previously, the applicable ADG for Runway 18-36 is currently ADG III. Ultimate planning should also conform to ADG III for the runway. **Table 3K** presents the various taxiway design standards related to ADG III.

TABLE 3K
Taxiway Dimensions and Standards
McKinney National Airport

STANDARDS BASED ON WINGSPAN	*ADG II*	*ADG III*	*ADG IV*
Taxiway Protection			
Taxiway Safety Area width (feet)	79	118	171
Taxiway Object Free Area width (feet)	131	186	259
Taxilane Object Free Area width (feet)	115	162	225
Taxiway Separation			
Taxiway Centerline to:			
Fixed or Movable Object (feet)	65.5	93	129.5
Parallel Taxiway/Taxilane (feet)	105	152	215
Taxilane Centerline to:			
Fixed or Movable Object (feet)	57.5	81	112.5
Parallel Taxilane (feet)	97	140	198
Wingtip Clearance			
Taxiway Wingtip Clearance (feet)	26	34	44
Taxilane Wingtip Clearance (feet)	18	27	27
STANDARDS BASED ON TDG	*TDG 2*	*TDG 3*	*TDG 4*
Taxiway Width Standard (feet)	35	50	50
Taxiway Edge Safety Margin (feet)	7.5	10	10
Taxiway Shoulder Width (feet)	10	20	20

ADG: Airplane Design Group
TDG: Taxiway Design Group

Source: FAA AC 150/5300-13A, Change 1, *Airport Design*

The table also shows those taxiway design standards related to TDG. The TDG standards are based on the Main Gear Width (MGW) and Cockpit to Main Gear (CMG) distance of the critical design aircraft expected to use those taxiways. Different taxiway and taxilane pavements can and should be planned to the most appropriate TDG design standards based on usage.

The current taxiway design for Runway 18-36 should be TDG 3. As such, the taxiways on the airfield directly related to the runway system should be at least 50 feet wide. Ultimate planning also accounts for TDG 3 unless commercial passenger and/or cargo operators are attracted. Some aircraft which could be used for these activities would fall in TDG 4, also requiring a 50-foot wide taxiway surface. Furthermore, certain larger aircraft fall within TDG 5, which requires a 75-foot taxiway width. Thus, the taxiways associated with Runway 18-36 should continue to be planned to at least 50 feet in width to meet current standard with the understanding that the need for 75-foot wide taxiways could be needed to serve commercial carriers if the demand materializes.

The current taxiway system is composed of varying taxiway widths. Parallel Taxiway B serving Runway 18-36 is 100 feet wide. Entrance/exit Taxiways B1, B2, B3, B4, and B5 are 75 feet wide and serve to connect the runway and parallel taxiway, as well as allow access to landside development farther west. Taxiways B2 and B3 narrow to 70 feet in width as they transition west of Taxiway B and connect to

Taxiway A. Taxiway B4 increases to 100 feet in width as it connects to Taxiway A farther west. Taxiway A traverses the west side of the airfield at a distance of 850 feet from the runway centerline. The majority of this taxiway is designed to meet TDG II standards, as it is 40 feet wide. Connector Taxiways A1, A2, and A3 range in width from 70 feet to 100 feet.

While many of the taxiway widths exceed the current and projected design needs on the airfield, they could be maintained unless financial constraints dictate. As such, the widths should remain until such time as rehabilitation is needed and financial resources to support such are not available. FAA grant availability can only be provided if the project meets eligibility thresholds as determined by the FAA.

Taxiway Design Considerations

FAA AC 150/5300-13A, Change 1, *Airport Design*, provides guidance on recommended taxiway and taxilane layouts to enhance safety by avoiding runway incursions. A runway incursion is defined as "any occurrence at an airport involving the incorrect presence of an aircraft, vehicle, or person on the protected area of a surface designated for the landing and takeoff of aircraft."

The taxiway system at TKI generally provides for the efficient movement of aircraft; however, AC 150/5300-13A, Change 1, *Airport Design*, provides recommendations for taxiway design. The following is a list of the taxiway design guidelines and the basic rationale behind each recommendation.

1. **Taxi Method**: Taxiways are designed for "cockpit over centerline" taxiing with pavement being sufficiently wide to allow a certain amount of wander. On turns, sufficient pavement should be provided to maintain the edge safety margin from the landing gear. When constructing new taxiways, upgrading existing intersections should be undertaken to eliminate "judgmental oversteering," which is where the pilot must intentionally steer the cockpit outside the marked centerline in order to assure the aircraft remains on the taxiway pavement.

2. **Steering Angle**: Taxiways should be designed such that the nose gear steering angle is no more than 50 degrees, the generally accepted value to prevent excessive tire scrubbing.

3. **Three-Node Concept**: To maintain pilot situational awareness, taxiway intersections should provide a pilot a maximum of three choices of travel. Ideally, these are right and left angle turns and a continuation straight ahead.

4. **Intersection Angles**: Turns should be designed to 90 degrees wherever possible. For acute angle intersections, standard angles of 30, 45, 60, 120, 135, and 150 degrees are preferred.

5. **Runway Incursions**: Taxiways should be designed to reduce the probability of runway incursions.
   - *Increase Pilot Situational Awareness*: A pilot who knows where he/she is on the airport is less likely to enter a runway improperly. Complexity leads to confusion. Keep taxiway systems simple using the "three node" concept.

- *Avoid Wide Expanses of Pavement*: Wide pavements require placement of signs far from a pilot's eye. This is especially critical at runway entrance points. Where a wide expanse of pavement is necessary, avoid direct access to a runway.
- *Limit Runway Crossings*: The taxiway layout can reduce the opportunity for human error. The benefits are twofold – through simple reduction in the number of occurrences, and through a reduction in air traffic controller workload.
- *Avoid "High Energy" Intersections*: These are intersections in the middle third of runways. By limiting runway crossings to the first and last thirds of the runway, the portion of the runway where a pilot can least maneuver to avoid a collision is kept clear.
- *Increase Visibility*: Right-angle intersections, both between taxiways and runways, provide the best visibility. Acute angle runway exits provide for greater efficiency in runway usage, but should not be used as runway entrance or crossing points. A right-angle turn at the end of a parallel taxiway is a clear indication of approaching a runway.
- *Avoid "Dual Purpose" Pavements*: Runways used as taxiways and taxiways used as runways can lead to confusion. A runway should always be clearly identified as a runway and only a runway.
- *Indirect Access*: Do not design taxiways to lead directly from an apron to a runway. Such configurations can lead to confusion when a pilot typically expects to encounter a parallel taxiway.
- *Hot Spots*: Confusing intersections near runways are more likely to contribute to runway incursions. These intersections must be redesigned when the associated runway is subject to reconstruction or rehabilitation. Other hot spots should be corrected as soon as practicable.

6. **Runway/Taxiway Intersections**:
   - *Right-Angle*: Right-angle intersections are the standard for all runway/taxiway intersections, except where there is a need for a high-speed exit. Right-angle taxiways provide the best visual perspective to a pilot approaching an intersection with the runway to observe aircraft in both the left and right directions. They also provide optimal orientation of the runway holding position signs so they are visible to pilots.
   - *Acute Angle*: Acute angles should not be larger than 45 degrees from the runway centerline. A 30-degree taxiway layout should be reserved for high-speed exits. The use of multiple intersecting taxiways with acute angles creates pilot confusion and improper positioning of taxiway signage.
   - *Large Expanses of Pavement*: Taxiways must never coincide with the intersection of two runways. Taxiway configurations with multiple taxiway and runway intersections in a single area create large expanses of pavement, making it difficult to provide proper signage, marking, and lighting.

7. **Taxiway/Runway/Apron Incursion Prevention**: Apron locations that allow direct access into a runway should be avoided. Increase pilot situational awareness by designing taxiways in such a manner that forces pilots to consciously make turns. Taxiways originating from aprons and forming a straight line across runways at mid-span should be avoided.
   - *Wide Throat Taxiways*: Wide throat taxiway entrances should be avoided. Such large expanses of pavement may cause pilot confusion and makes lighting and marking more difficult.

- *Direct Access from Apron to a Runway*: Avoid taxiway connectors that cross over a parallel taxiway and directly onto a runway. Consider a staggered taxiway layout that forces pilots to make a conscious decision to turn.
- *Apron to Parallel Taxiway End*: Avoid direct connection from an apron to a parallel taxiway at the end of a runway.

FAA AC 150/5300-13A, Change 1, *Airport Design*, states that "existing taxiway geometry should be improved whenever feasible, with emphasis on designated "hot spots." To the extent practicable, the removal of existing pavement may be necessary to correct confusing layouts. The FAA has identified the following "hot spots" at the Airport.

- **Hot Spot 1: Maintain vigilance, pilots incorrectly align to Taxiway B for landings/departures.** This proposed Hot Spot was created when the existing Runway 18-36 was constructed and the previous runway was converted to parallel Taxiway B. Due to the width of parallel Taxiway B, the FAA has alerted pilots to not confuse the taxiway as a runway.

For the most part, the taxiway system at TKI meets the recommended design and geometry standards set forth by the FAA. There are certain non-standard conditions that include:

- Taxiways B3 and B4 provide for direct access from aircraft parking aprons to Runway 18-36.
- Taxiway B2 extends farther west serving general aviation development areas while connecting directly to the runway system.

Exhibit 3E identifies these areas of interest. In the alternatives chapter, potential solutions to these non-standard conditions will be presented. Analysis in the next chapter will also consider improvements which could be implemented on the airfield to minimize runway incursion potential, improve efficiency, and conform to FAA standards for taxiway design. Any future taxiways planned with the proposed parallel runway will also take into consideration the taxiway design standards previously discussed.

Analysis in the next chapter will also consider improvements which could be implemented on the airfield to minimize runway incursion potential, improve efficiency, and conform to FAA standards for taxiway design.

Taxilane Design Considerations

Taxilanes are distinguished from taxiways in that they do not provide access to or from the runway system directly. Taxilanes typically provide access to hangar areas. As a result, taxilanes can be planned to varying design standards depending on the type of aircraft utilizing the taxilane. For example, a taxilane leading to a T-hangar area only needs to be designed to accommodate those aircraft typically accessing the T-hangar.

NAVIGATIONAL AND APPROACH AIDS

Navigational aids are devices that provide pilots with guidance and position information when utilizing the runway system. Electronic and visual guidance to arriving aircraft enhance the safety and capacity of the airfield. Such facilities are vital to the success of an airport and provide additional safety to passengers using the air transportation system. While instrument approach aids are especially helpful during poor weather, they are often used by pilots conducting flight training and operating larger aircraft when visibility is good. TKI employs the following navigational and approach aids.

Instrument Approach Aids

Instrument approaches are categorized as either precision or non-precision. Precision instrument approach aids provide an exact course alignment and vertical descent path for an aircraft on final approach to a runway, while non-precision instrument approach aids provide only course alignment information. In the past, most existing precision instrument approaches in the United States have been the ILS; however, with advances in global positioning system (GPS) technology, it can now be used to provide both vertical and lateral navigation for pilots under certain conditions.

TKI currently has straight-in instrument approach capabilities to each end of Runway 18-36. These include the ILS or localizer (LOC) approach to Runway 18, area navigation (RNAV) GPS approaches serving Runways 18 and 36, and a very high omnidirectional range (VOR) with distance measuring equipment (DME) approach. The ILS and RNAV GPS approaches to Runway 18 provide for the lowest minimums with ½-mile visibility and 200-foot cloud ceilings. The RNAV GPS approach serving Runway 36 allows for ¾-mile visibility minimums and 200-foot cloud ceilings. It should be noted that the VOR/DME approach is a circling approach only, allowing for minimums to either end of the runway environment.

Runway 18 is served by a medium intensity approach lighting system with runway alignment indicator lights (MALSR) as previously detailed. This approach lighting system enhances safety at the Airport, especially during inclement weather or nighttime activity. The MALSR, in conjunction with the localizer antenna and glide slope antenna, provides approach minimums on Runway 18 down to 200-foot cloud ceilings and ½-mile visibility minimums. A medium intensity approach lighting system (MALS) serves Runway 36 and allows for desirable visibility minimums to this runway end also.

Visual Approach Aids

In most instances, the landing phase of any flight must be conducted in visual conditions. To provide pilots with visual guidance information during landings to the runway, electronic visual approach aids are commonly provided at airports. Currently, both ends of Runway 18-36 are served by a four-box precision approach path indicator (PAPI-4). These approach aids should be maintained through the planning period.

Runway end identification lights (REILs) are flashing lights located at the runway threshold end that facilitate rapid identification of the runway end at night and during poor visibility conditions. REILs provide pilots with the ability to identify the runway thresholds and distinguish the runway end lighting from other lighting on the airport and in the approach areas. The FAA indicates that REILs should be considered for all lighted runway ends not planned for a more sophisticated approach lighting system. Currently, REILs are not provided on the runway system since each runway end is served by a more sophisticated approach lighting system, being the MALSR on Runway 18 and MALS on Runway 36.

Ultimate planning will also consider visual approach aids serving the potential parallel runway. At a minimum, prudent planning would recommend PAPIs serve each end of the runway. The implementation of REILs should also be planned depending on the presence of a more sophisticated approach lighting system.

Weather Reporting Aids

TKI has a lighted windcone and segmented circle, as well as additional supplemental windcones in various locations on the airfield. The windcones provide information to pilots regarding wind speed and direction. The segmented circle consists of a system of visual indicators designed to provide traffic pattern information to pilots. These should be maintained throughout the planning period.

The Airport is equipped with an ASOS which provides weather observations 24 hours per day. The system updates weather observations every minute, continuously reporting significant weather changes as they occur. This information is then transmitted at regular intervals (usually once per hour). Aircraft in the vicinity can receive this information if they have their radio tuned to the correct frequency (119.925 MHz). This system should be maintained through the planning period.

Communication Facilities

TKI has an operational ATCT located on the west side of Runway 18-36. The ATCT is staffed from 6:00 a.m. to 10:00 p.m. daily. The ATCT enhances safety at the Airport and should be maintained through the planning period.

AIRFIELD LIGHTING, MARKING, AND SIGNAGE

There are several lighting and pavement marking aids serving pilots using TKI. These aids assist pilots in locating the Airport and runway at night or in poor visibility conditions. They also assist in the ground movement of aircraft.

Airport Identification Lighting

The location of the airport at night is universally indicated by a rotating beacon. For civil airports, a rotating beacon projects two beams of light, one white and one green, 180 degrees apart. The existing beacon located atop the ATCT should be maintained through the planning period.

Runway and Taxiway Lighting

Runway lighting provides the pilot with positive identification of the runway and its alignment. Runway 18-36 is served by high intensity runway lighting (HIRL). This system should be maintained through the planning period as it complements the runway's instrument approach capabilities during poor visibility conditions.

Medium intensity taxiway lighting (MITL) is provided on parallel Taxiways A and B and all associated entrance/exit and connector taxiways serving the airfield system. This system is vital for safe and efficient ground movements and should be maintained in the future. Future planning should also consider MITL on future taxiways that directly support the runway system at the Airport. At a minimum, planning should also consider edge reflectors on more remote taxiways and taxilanes serving landside development areas.

Over time, the Airport should consider removing the incandescent airfield signage and runway and taxiway edge lighting systems, and replacing them with light emitting diode (LED) technology. LEDs have many advantages, including lower energy consumption, longer lifetime, tougher construction, reduced size, greater reliability, and faster switching. While a substantial initial investment is required upfront, the energy savings and reduced maintenance costs will outweigh any additional costs in the long run.

Over time, the Airport should consider removing the incandescent airfield signage and runway and taxiway edge lighting systems, and replacing them with light emitting diode (LED) technology.

Pavement Markings

Runway markings are typically designed to the type of instrument approach available on the runway. FAA AC 150/5340-1K, *Standards for Airport Markings*, provides guidance necessary to design airport markings.

Runway 18 is served by precision markings. This aids in accommodating the ILS approach to the runway end. Runway 36 currently has non-precision markings. All runway markings should be maintained through the long term planning period. In the event that Runway 36 is provided with enhanced instrument approach capabilities, precision markings should be considered on this runway end. The proposed parallel runway could be served with at least non-precision markings.

Airfield Signs

Airfield identification signs assist pilots in identifying their location on the airfield and directing them to their desired location. Lighted signs are installed on the runway and taxiway system on the airfield. The signage system includes runway and taxiway designations, holding positions, routing/directional, distance remaining, and runway exits. All of these signs should be maintained throughout the planning period.

A summary of the airfield facilities previously discussed at TKI is presented on **Exhibit 3F**.

LANDSIDE FACILITY REQUIREMENTS

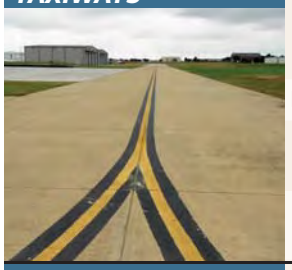
Landside facilities are those necessary for the handling of aircraft and passengers while on the ground. These facilities provide the essential interface between the air and ground transportation modes. The capacity of the various components of each element was examined in relation to projected demand to identify future landside facility needs. At TKI, this includes components for commercial service and general aviation needs such as:

- Potential Commercial Passenger Terminal Complex
- General Aviation Terminal Facilities
- Aircraft Hangars
- Aircraft Parking Aprons
- Airport Support Facilities

POTENTIAL COMMERCIAL PASSENGER TERMINAL COMPLEX

Components of the passenger terminal area complex include the terminal building, gate positions, aircraft apron area, vehicle parking, and surface access roads. Based upon the potential commercial enplanements and operations analysis conducted in Chapter Two, this section identifies potential passenger terminal facilities required to meet a scenario of 300,000 enplanements. The premise of this scenario is that at some point in the future, TKI would attract one or more scheduled commercial airline operators. It is important to note that this passenger terminal complex requirements analysis is based entirely on theoretical enplanement and operations levels. The purpose of this section is to simply provide the City of McKinney with an idea of what types and sizes of facilities would be needed should commercial service demand reach this level at TKI.

The review of the capacity and requirements for various terminal complex functional areas was performed with guidance from FAA AC 150/5360-13, *Planning and Design Guidelines for Airport Terminal Facilities*. Also sourced is *Airport Passenger Terminal Planning and Design, Report 25* published by the Airport Cooperative Research Program (ACRP). **Table 3L** summarizes the future capacity requirements for the terminal building.

	CURRENT	SHORT TERM	LONG TERM
RUNWAY 18-36	RDC D-III-2400	Maintain	Maintain
	7,002' x 150'	Maintain	Examine potential to extend to at least 8,500'
	75,000 lbs. SWL / 150,000 lbs. DWL / 450,000 lbs. DTWL	Maintain	Maintain
	Standard RSA/ROFA/ROFZ	Maintain	Maintain
	Runway 18 Approach RPZ extends beyond existing Airport property line	Consider acquisition of all property encompassed by Runway 18 Approach RPZ	Maintain
TAXIWAYS 	All taxiways 40' - 100' wide	Re-evaluate width during future rehabilitation projects (Minimum 50' wide)	Re-evaluate width during future rehabilitation projects (Minimum 50' wide)
	Rwy/Parallel Taxiway Separation - 550'	Maintain	Maintain
	Hot Spot #1 located at north and south ends of Taxiway B	Examine areas for enhanced safety	Maintain
	Non-standard conditions associated with Taxiways B2, B3, and B4	Examine taxiway system for safety, efficiency, and proper geometry	Examine taxiway system for safety, efficiency, and proper geometry
NAVIGATIONAL AND APPROACH AIDS	ILS or LOC - Runway 18	Maintain	Maintain
	RNAV (GPS) - Runway 18 and 36	Maintain	Maintain
	VOR/DME-A - Circling Approach	Maintain	Maintain
	ASOS, ATCT, Lighted Windcones	Maintain	Maintain
	PAPI-4 - Runway 18 and 36	Maintain	Maintain
	MALSR - Runway 18	Maintain	Maintain
	MALS - Runway 36	Maintain	Maintain
LIGHTING, MARKING, AND SIGNAGE	Rotating Beacon	Maintain	Maintain
	Precision Markings - Runway 18	Maintain	Maintain
	Non-Precision Markings - Runway 36	Maintain	Maintain
	HIRL - Runway 18-36	Consider gradual replacement with LED technology	Maintain
	MITL on Parallel, Entrance/Exit, and Connector Taxiways	Consider gradual replacement with LED technology	Maintain
	Hold lines 250' from runway centerline	Hold lines 256' from runway centerline	Maintain
	Lighted Airfield Signs	Consider gradual replacement with LED technology	Maintain
PROPOSED PARALLEL RUNWAY			RDC C/D-III-4000
			Examine potential length of at least 8,500'
			Parallel taxiway separation at least 400'
			Instrument approach capabilities
			PAPI-4 , REILs, HIRL

KEY:

ASOS - Automated Surface Observing System
ATCT - Airport Traffic Control Tower
DME - Distance Measuring Equipment
DTWL - Dual Tandem Wheel Loading
DWL - Dual Wheel Loading
GPS - Global Positioning System
HIRL - High Intensity Runway Lighting
ILS - Instrument Landing System
LED - Light Emitting Diode
LOC - Localizer
MALS - Medium Intensity Approach Lighting System
MALSR - MALS with Runway Alignment Indicator Lights
MITL - Medium Intensity Taxiway Lighting
PAPI - Precision Approach Path Indicator
RDC - Runway Design Code
REIL - Runway End Identification Light
RNAV - Area Navigation
ROFA - Runway Object Free Area
ROFZ - Runway Obstacle Free Zone
RPZ - Runway Protection Zone
RSA - Runway Safety Area
SWL - Single Wheel Loading
VOR - Very High Frequency Omnidirectional Range

Passenger terminal building requirements were developed for the following functional areas:

- Airline Ticketing and Operations
- Security Screening
- Departure Facilities
- Baggage Claim
- Terminal Services – Rental Cars and Concessions
- Public Use Areas – Restrooms and Lobby Areas
- Administration/Support
- Internal Facilities – Circulation, Mechanical, HVAC

Ticketing and Check-In

The first destination for enplaning passengers in the terminal building is usually the airline ticket counter. The ticketing area consists of the ticket counters, queuing area for passengers in line at the counters, and the ticket lobby which provides circulation.

The ticket lobby should be arranged so that the enplaning passenger has immediate access and clear visibility to the individual airline ticket counters upon entering the building. Circulation patterns should allow the option of bypassing the counters with minimum interference. Provisions for seating should be minimal to avoid congestion and to encourage passengers to proceed to the security checkpoint and gate area. Airline ticket counter frontage, counter area, counter queuing area, ticketing lobby and airline office and operations area requirements for the potential enplanement level have been calculated.

TABLE 3L
Potential Terminal Building Requirements
McKinney National Airport

	Potential Need
Terminal Building Requirements	
Ticketing/Check-In	
No. of Agent Positions	6
Counter Frontage (lf)	48
Ticket Lobby Queue (sf)	530
Ticket Office (sf)	1,970
Outbound Baggage (sf)	2,300
Subtotal Ticketing/Check-in	4,800
Airline Operations (sf)	
Counter Area	530
Airline Ops/Makeup	1,970
Subtotal Airline Operations	2,500
Security Screening	
Security Checkpoints	1
Checkpoint Station Area (sf)	360
Security Queue Area (sf)	530
Security Office Space (sf)	700
Subtotal Security Checkpoint (sf)	1,590
Departure Facilities	
Peak Occupants	166
Holdroom Area (sf)	5,320
Baggage Claim	
Claim Display (lf)	100
In-Bound Baggage	1,200
Claim Display floor area (sf)	500
Claim Lobby area (sf)	2,020
Total Bag claim area (sf)	2,520
Rental Car Counters	
Counter frontage (lf)	17
Counter Office Area (sf)	250
Counter Queue Area (sf)	130
Total Rental Car Area (sf)	380
Concessions (sf)	
Food and Beverage	3,600
Gift Shops	2,520
Total Concessions	6,120
Public Waiting Lobby/Circulation (sf)	
Total Public Waiting Lobby/Circulation	5,200
Restrooms (sf)	
Total Restroom Area	800
Subtotal Functional Space	**30,430**
Internal Facilities	
HVAC/Mechanical/Stairwells (sf)	3,540
Gross Terminal Building Space (sf)	**33,970**

lf: linear feet
sf: square feet
Source: Coffman Associates analysis

Under a scenario of 300,000 annual enplanements, a maximum of six ticket agent positions would be needed, requiring approximately 36 feet of linear ticket counter space. A ticket counter of this size would necessitate an estimated 530 square feet of queue area. All total, approximately 4,800 square feet of ticketing/check-in area would be needed.

Airline Operations

The airline operations area encompasses all space necessary for the processing of passengers and baggage. This includes the area behind the ticket counter, offices, and baggage make-up and storage areas. In total, the airline operations area would need to encompass approximately 2,500 square feet of space.

Security Screening

Security screening requirements are subject to Transportation Security Administration (TSA) regulations, and the level of security may be changed by TSA security directive if unusual levels of threat are perceived. The screening checkpoints are a regulated requirement and must be designed to meet the TSA mandates for operational space and equipment support as specified in TSA's *Security Checkpoint Design Guide,* February 2006.

The security checkpoint area can be functionally divided into three components: checkpoints, checkpoint area, and queue area. The appropriate size for the checkpoint area, where actual passenger screening takes place, is estimated by providing 360 square feet per checkpoint station. It is anticipated that one station will be needed.

The security checkpoint queue is the area that accommodates passengers as they wait in line to be screened. The queue line is calculated by providing 16 square feet per design hour enplaning passenger. Ultimate planning forecasts 530 square feet to be needed for the security line queue.

Space in the terminal building should also be provided for TSA personnel. This office space should be located away from the security screening functions. Potential planning considers 700 square feet of TSA office space per available security checkpoint. In the future, at least 700 square feet of office space could be provided for TSA office functions. Altogether, it is estimated that 1,590 square feet could be needed for security and security checkpoints under the given potential enplanement level.

Departure Gates and Holdrooms

The need for jetways is dependent upon the airline schedule and type of aircraft serving an airport. Under this enplanement scenario, within one hour, it is estimated that one aircraft may need access to a gate.

The secure hold room is the waiting area for passengers who have completed the screening process and are waiting to board the aircraft. Hold room space is calculated at 15 square feet per peak hour enplaned passenger plus 350 square feet per gate. At TKI, the potential peak hour is 166 passengers; therefore, a hold room of approximately 5,320 square feet is needed.

Baggage Claim

The passenger arrival process consists primarily of those facilities and functions that reunite the arriving passengers with their checked baggage. Passenger baggage claim facilities are estimated at 60 percent of peak hour deplaning passengers. The potential claim display need is 100 linear feet of baggage claim carousel.

The inbound baggage unloading area is designed to allow ground support equipment to pull into a covered sally-port where baggage is offloaded onto the baggage claim carousel. Potential inbound baggage unloading area needs are estimated at 12 square feet per linear foot of baggage carousel frontage need. This results in an estimated need 1,200 square feet.

Baggage claim floor area is calculated at five square feet per linear foot of claim display (carousel length). Based upon the 300,000 annual enplanement level, it is estimated that 500 square feet would be needed at peak periods.

The baggage claim lobby is determined by taking into consideration the number of deplaning passengers during the peak hour and the estimated number of visitors greeting arriving passengers. This planning scenario estimates a total area of approximately 2,520 square feet to be needed for the baggage claim area.

Terminal Services

Similar to airline ticketing, rental car counter facilities include office, counter area, and queue areas. Rental car facilities could provide approximately 17 linear feet of counter space, 250 square feet of office space, and 130 square feet for queuing area. Combined, rental car facilities would consist of an estimated 380 square feet.

In addition, many terminal buildings will provide food, beverage, and gift shop concessions in the unsecured and/or secured areas of the terminal building. Calculations for concessions are based primarily on annual enplanements. Under the estimated 300,000 annual enplanement scenario, total concessions area could include approximately 6,100 square feet.

Public Waiting and Greeting Lobby/Circulation

The public lobby and circulation areas are where passengers or visitors may comfortably relax while waiting for arrivals or departures. The greeting lobby area is typically immediately outside security stations. In today's post-9/11 environment, visitors must remain outside of the secure departure areas, so a public lobby is important. Public waiting and greeting lobby areas are based upon design hour passengers. For planning purposes, 35 square feet is allotted for 80 percent of the total design hour passengers. Based upon these planning techniques, approximately 5,200 square feet could be needed for public areas.

Restrooms

Restrooms should be planned for both the public areas and the secure areas of the terminal building. Potential public restroom space is a function of total peak hour passengers and visitors at the airport. The public restroom facilities should be planned at an estimated 800 square feet.

Internal Facilities

Internal facilities include mechanical/HVAC functions and stairwells. Potential needs for circulation are estimated at 11 percent of the total programmed terminal building space. Any additions to the terminal building should also take into consideration the internal facilities need.

Commercial Airline Terminal Building Requirements Summary

Altogether, under a 300,000 annual enplanement scenario, gross terminal building space requirements totals an estimated 33,970 square feet. It should be noted that terminal building space requirements are purely scenario-based and are for advisory purposes only.

Under a 300,000 annual enplanement scenario, gross terminal building space requirements totals an estimated 33,970 square feet. It should be noted that terminal building space requirements are purely scenario-based and are for advisory purposes only.

Terminal Access Roadway

The capacity of the airport access and terminal area roadways is the maximum number of vehicles that can pass over a given section of a lane or roadway during a given time period. It is normally preferred that a roadway operates below capacity to provide reasonable flow and minimize delay to the vehicles using it. Thus, prudent planning should be exercised when planning the location and roadway access to a potential future terminal building. Alternative analysis in the next chapter will further analyze this roadway access improvement based upon potential terminal locations.

Terminal Curb Frontage and Vehicle Parking

The curb element is the interface between the terminal building and the ground transportation system. The length of curb required for the loading and unloading of passengers and baggage is determined by the type and volume of ground vehicles anticipated in the peak period on the design day.

A typical problem for terminal curb capacity is the length of dwell time for vehicles utilizing the curb. At airports where the curb front has not been strictly patrolled, vehicles have been known to be parked at the curb while the driver and/or riders are inside the terminal checking in, greeting arriving passengers, or awaiting baggage pick-up. Since most curbs are not designed for vehicles to remain curbside for more than two to three minutes, capacity problems can ensue. Since the events of 9/11, most airports police the curb front much more strictly for security reasons. This alone has reduced the curb front capacity problems at most airports.

Potential enplaning curb length needs are estimated at 90 percent of peak hour enplanements, while potential deplaning curb needs are estimated at 105 percent of peak hour enplanements. **Table 3M** presents the terminal curb requirements as they would apply to the potential 300,000 annual enplanement scenario.

TABLE 3M
Airline Terminal Vehicle Requirements
McKinney National Airport

Terminal Curb	
Enplane Curb (ft)	80
Deplane Curb (ft)	170
Total Curb (ft)	250
Auto Parking	
Total Public Parking	329
Employee	53
Rental Car	16
Total All Parking	**398**

Vehicle parking in the airline passenger terminal area of an airport includes those spaces utilized by passengers, visitors, and employees of the airline terminal facilities. Parking spaces are classified as public, employee, and rental car.

Calculations of vehicle parking needs take into consideration estimates of the mode of transportation to and from the airport, peak hour enplanements, and annual enplanements. For TKI, it is estimated that 90 percent of passengers would arrive/depart by private automobile, five percent would utilize rental car services, and five percent would utilize a taxi service. Employee parking space requirements are estimated at five percent of total private automobile space requirements. Potential terminal parking requirements are shown in **Table 3M**.

GENERAL AVIATION TERMINAL FACILITIES

The general aviation terminal facilities at the Airport are often the first impression of the community that corporate officials and other visitors will encounter. General aviation terminal facilities at an airport provide space for passenger waiting, pilots' lounge, pilot flight planning, concessions, management, storage, and various other needs. This space is not necessarily limited to a single, separate terminal building, but can include space offered by fixed base operators (FBOs) and other specialty operators for these

functions and services. At TKI, general aviation terminal services are provided by McKinney Air Center, the only FBO located on the airfield.

The general aviation terminal facilities at the Airport are often the first impression of the community that corporate officials and other visitors will encounter.

The methodology used in estimating general aviation terminal facility needs was based upon the number of airport users expected to utilize general aviation facilities during the design hour. Space requirements for terminal facilities were based on providing 125 square feet per design hour itinerant passenger. A multiplier of 2.5 in the short term, increasing to 3.0 in the long term, was also applied to terminal facility needs in order to better determine the number of passengers associated with each itinerant aircraft operation. This increasing multiplier indicates an expected increase in business and recreational operations through the long term. These operations often support larger turboprop and jet aircraft which accommodate an increasing passenger load factor.

Table 3N outlines the space requirements for general aviation terminal services at TKI through the long term planning period. As shown in the table, up to 10,800 square feet of space could be needed in the long term for general aviation passengers. The amount of space currently offered by the FBO is approximately 6,000 square feet. These spaces include designated areas for a passenger waiting lobby, flight planning, pilots' lounge, restroom facilities, and other amenities.

TABLE 3N
General Aviation Terminal Area Facilities
McKinney National Airport

	Currently Available	Short Term Need	Intermediate Term	Long Term Need
General Aviation Services Facility Area (s.f.)	6,000[1]	6,900	8,600	10,800
Design Hour Passengers	49	56	69	90
Passenger Multiplier	2.5	2.6	2.8	3.0
Vehicle Parking Spaces	319[2]	202	231	292

[1]Includes approximate space offered by McKinney Air Center.
[2]Approximate number of total marked vehicle parking spaces at the Airport.
Source: Coffman Associates analysis

Other specialty aviation operators on the airfield also provide space for pilots and passengers. It can be assumed that adequate services and space is provided to accommodate their customers.

General aviation vehicular parking demands have also been determined for TKI. Space determinations for itinerant passengers were based on an evaluation of existing airport use, as well as standards set forth to help calculate projected terminal facility needs.

The parking requirements of based aircraft owners should also be considered. Although some owners prefer to park their vehicles in their hangar, safety can be compromised when automobile and aircraft movements are intermixed. For this reason, separate parking requirements, which consider one-half of

based aircraft at the Airport, were applied to general aviation automobile parking space requirements. Utilizing this methodology, parking requirements for general aviation activity call for approximately 202 spaces in the short term, increasing to approximately 292 spaces in the long term planning horizon. It is estimated that there are 319 marked vehicle parking spaces at TKI currently serving various airport activities, including the FBO, ATCT services, and other general aviation functions. Future consideration in the Master Plan will be given to providing vehicle parking to support additional development potential.

AIRCRAFT HANGARS

Utilization of hangar space varies as a function of local climate, security, and owner preferences. The trend in general aviation aircraft, whether single or multi-engine, is toward more sophisticated aircraft (and consequently, more expensive aircraft); therefore, many aircraft owners prefer enclosed hangar space to outside tiedowns.

The demand for aircraft storage hangars is dependent upon the number and type of aircraft expected to be based at the Airport in the future. For planning purposes, it is necessary to estimate hangar requirements based upon forecast operational activity. However, actual hangar construction should be based upon actual demand trends and financial investment conditions.

There are a variety of aircraft storage options typically available at an airport including shade hangars, T-hangars, linear box hangars, executive/box hangars, and bulk storage conventional hangars. Shade hangars are the most basic form of aircraft protection and are common in warmer climates. These structures provide a roof covering, but no walls or doors. There are no shade hangars at TKI, and for purposes of planning, any future shade hangars would be included in the T-hangar need forecast.

It is important to note that the types of hangars detailed in this section are categorized based on the proposed size and layout of the facility, and do not necessarily correspond with the locally-designated hangar facility categories discussed in Chapter One. There are certain categories, such as T-hangars and linear box hangars, which are consistent in this section versus what was presented earlier on. Other locally-designated hangar types presented in Chapter One, such as condominium box hangars, aircraft storage hangars, and specialized aviation service operator (SASO) hangars, correspond to executive and conventional style hangars detailed in this section.

T-hangars are intended to accommodate one small single engine piston aircraft or, in some cases, one multi-engine piston aircraft. T-hangars are so named because they are in the shape of a “T,” providing a space for the aircraft nose and wings, but no space for turning the aircraft within the hangar. Basically, the aircraft can be parked in only one position. T-hangars are commonly “nested” with several individual storage units to maximize hangar space. In these cases, taxiway access is needed on both sides of the nested T-hangar facility. T-hangars are popular with aircraft owners with tighter budgets as they tend to be the least expensive enclosed hangar space to build and lease. There are currently 92 T-hangar positions at TKI totaling 136,800 square feet of aircraft storage capacity.

Similar to the T-hangar style is the linear box hangar. Linear box hangars typically provide storage for a single aircraft and can be nested with multiple individual linear box hangars. Unlike the T-hangar, linear box hangars enable to user to store aircraft in more ways than one. Ultimately, this will allow the user to maximize aircraft storage space. At this time, there are approximately 36 linear box hangar units, totaling 82,000 square feet of aircraft storage space.

The next type of aircraft hangar common for storage of general aviation aircraft is the executive/box hangar. Executive/box hangars typically provide a larger space, generally with an area between 2,500 and 10,000 square feet. This type of hangar can provide for maneuverability within the hangar, can accommodate more than one aircraft, and may have a small office and utilities. Executive/box hangars may be connected in a row of units with doors facing a taxilane. Executive box hangars may also be stand-alone hangars. These hangars are typically utilized by a corporate/business entity or to support an on-airport business. TKI currently has 25 executive/box hangars, totaling 101,800 square feet of aircraft storage capacity.

Conventional hangars are the large, clear span hangars typically located facing the main aircraft apron at airports. These hangars provide for bulk aircraft storage and are often utilized by airport businesses, such as an FBO and/or aircraft maintenance business. Conventional hangars are generally larger than executive/box hangars and can range in size from 10,000 square feet to more than 20,000 square feet. Often, a portion of a conventional hangar is utilized for non-aircraft storage needs such as maintenance or office space. There are eight conventional hangars at TKI encompassing approximately 135,700 square feet.

Planning for future aircraft storage needs is based on typical owner preferences and standard sizes for hangar space. For determining future aircraft storage needs, a planning standard of 1,200 square feet per based aircraft is utilized for T-hangars. For executive and conventional hangars, a planning standard of 3,000 square feet is utilized for turboprop aircraft, 5,000 square feet is utilized for business jet aircraft, and 1,500 square feet is utilized for helicopter storage needs.

At TKI, with a total of 286 based aircraft, there are currently 67 aircraft owners utilizing outside aircraft tiedown positions. With the trend toward aircraft owners preferring enclosed aircraft storage space, minimal growth is projected for aircraft that utilize outside tiedowns. Providing a mix of aircraft storage options is preferred when planning storage needs, in order to meet the varied needs of aircraft owners. **Table 3P** provides a summary of the aircraft storage needs through the long term planning horizon.

It is expected that the aircraft storage hangar requirements will continue to be met through a combination of hangar types. The largest need could involve the construction of conventional-style hangars that are better suited to accommodate larger turboprop and jet aircraft.

The analysis shows that future hangar requirements indicate that there is a potential need for over 920,000 square feet of hangar storage space to be offered through the long term planning period. This includes a mixture of hangar and maintenance areas. Due to the projected increase in based aircraft, annual general aviation operations, and hangar storage

needs, facility planning will consider additional hangars at the Airport. It is expected that the aircraft storage hangar requirements will continue to be met through a combination of hangar types. The largest need could involve the construction of conventional-style hangars that are better suited to accommodate larger turboprop and jet aircraft.

TABLE 3P
Aircraft Hangar Requirements
McKinney National Airport

	Currently Available	Short Term Need	Intermediate Term Need	Long Term Need
Total Based Aircraft	286	325	370	460
Aircraft to be Hangared	219	257	304	390
Hangar Area Requirements				
T-Hangar/Shade Hangar Area (s.f.)	218,800	250,500	280,400	312,000
Executive Box Hangar Area (s.f.)	101,800	115,500	153,000	210,500
Conventional Hangar Area (s.f.)	135,700	176,000	232,000	332,500
Maintenance Area (s.f.)	--	48,700	55,500	69,000
	456,300*	**590,700**	**720,900**	**924,500**

Note: *Includes total hangar and maintenance area currently at the Airport
Source: Coffman Associates analysis

It should be noted that hangar requirements are general in nature and based on the aviation demand forecasts. The actual need for hangar space will further depend on the actual usage within hangars. For example, some hangars may be utilized entirely for non-aircraft storage, such as maintenance; yet from a planning standpoint, they have an aircraft storage capacity. Therefore, the needs of an individual user may differ from the calculated space necessary.

AIRCRAFT PARKING APRONS

FAA Advisory Circular 150/5300-13A, *Airport Design*, suggests a methodology by which transient apron requirements can be determined from knowledge of busy-day operations. At TKI, the number of itinerant spaces required was determined to be approximately 20 percent of the busy-day itinerant operations for general aviation operations. A planning criterion of 800 square yards per aircraft was applied to determine future transient apron requirements for single and multi-engine aircraft. For business jets (which can be much larger), a planning criterion of 1,600 square yards per aircraft position was used. In addition, TKI has based aircraft that utilize outside aircraft tiedowns for storage. It is assumed that these aircraft require less space than transient aircraft; therefore, a planning criterion of 650 square yards per aircraft was applied. For local tiedown needs, an additional 25 spaces are identified for maintenance activities. Apron parking requirements are presented in **Table 3Q**. Transient apron parking needs are divided into business jet needs and smaller single and multi-engine aircraft needs.

TABLE 3Q
Aircraft Parking Apron Requirements
McKinney National Airport

	Available	Short Term	Intermediate Term	Long Term
Transient Single and Multi-Engine Aircraft Positions		33	37	42
Apron Area (s.y.)		26,200	29,400	33,800
Transient Turboprop and Jet Positions		18	22	28
Apron Area (s.y.)		28,300	34,600	45,100
Locally-Based Aircraft Positions		93	91	94
Apron Area (s.y.)		33,500	32,800	33,800
Total Marked Positions		143	149	164
Total Apron Area (s.y.)	93,700	88,000	96,800	112,700

Source: Coffman Associates analysis

Currently, the existing aircraft parking aprons encompass approximately 93,700 square yards of space at the Airport. As shown in the table, future planning should account for an additional 20,000 square yards of parking apron space through the long term planning period.

In addition to fixed-wing aircraft parking, areas should also be dedicated for helicopter parking. Helicopters also operate on various apron areas shared by fixed-wing aircraft at TKI. Helicopter operations should be segregated to the extent practicable to increase safety and efficiency of aircraft parking aprons. Long term facility planning will continue to consider dedicated helicopter activity areas at the Airport.

AIRPORT SUPPORT FACILITIES

Various facilities that do not logically fall within classifications of airfield or landside facilities have also been identified. These other areas provide certain functions related to the overall operation of the Airport.

Fuel Storage

The Airport has six individual aviation fuel storage tanks providing a combined storage capacity for 56,000 gallons of Jet A fuel, which is used by turbine aircraft and 13,000 gallons of 100LL (AvGas), which is used by piston aircraft. Based upon historic fuel flowage records provided by airport management, in fiscal year 2016, the Airport pumped approximately 1,168,000 gallons of Jet A and 186,800 gallons of AvGas. Based upon the Traffic Flow Management System Count database, the reported number of turbine operations in 2016 totaled 6,803 and the total number of piston operations totaled 119,600. Dividing the total fuel flowage by the total number of operations provides a ratio of fuel flowage per operation. In 2016, the Airport pumped approximately 171.66 gallons of Jet A per turbine operation and 1.56

gallons of AvGas per piston operation. It is anticipated that over the course of the planning period, these ratios will gradually increase.

Maintaining a 14-day fuel supply would allow the Airport to limit the impact of a disruption of fuel delivery. Currently, the Airport has enough static fuel storage to meet the 14-day supply criteria for both Jet A and AvGas fuel. The forecasted fuel storage requirements are summarized in **Table 3R**.

TABLE 3R
Fuel Storage Requirements
McKinney National Airport

			Planning Horizon		
	Available	Current Need	Short Term	Intermediate Term	Long Term
Jet A					
Daily Usage (gal.)		3,200	4,000	4,900	7,100
14-Day Supply (gal.)	56,000	45,000	56,000	69,000	99,000
Annual Usage (gal.)		1,168,000	1,446,000	1,803,000	2,574,000
AvGas					
Daily Usage (gal.)		500	600	800	1,400
14-Day Supply (gal.)	13,000	7,000	8,000	11,000	20,000
Annual Usage (gal.)		186,800	227,000	290,000	521,000

Sources: Historic fuel flowage data provided by Airport Management; Fuel supply projections prepared by Coffman Associates.

In the future, based on these usage assumptions, additional fuel storage capacity will be needed to meet demand. The existing fuel farm consists of four fuel storage tanks with the capacity to accommodate an additional six tanks, so as demand dictates, new tanks can be added over time to the existing fuel farm.

Title 14 CFR Part 139 Certification of Airports

Based upon the potential commercial passenger enplanement scenario presented in the forecasting chapter of this study, TKI may be required to become a Title 14 CFR Part 139 certificated airport. The regulation (which implemented provisions of the *Airport and Airway Development Act of 1970*, as amended November 27, 1971) set standards for: the marking and lighting of areas used for operations, firefighting and rescue equipment and services, the handling and storing of hazardous materials, the identification of obstructions, and safety inspection and reporting procedures.

The Title 14 CFR Part 139 certification requirements applicable to TKI under this potential scenario relate to the type of aircraft serving the Airport. In helping to define the Airport's class, it is important to understand the distinction between the definition of large and small air carrier aircraft.

- A large air carrier aircraft is designed for 31 passenger seats or more.
- A small air carrier aircraft is designed for 10 to 30 passenger seats.

It should be noted that 14 CFR Part 139 does not apply to airports served by scheduled air carrier aircraft with nine seats or less and/or unscheduled air carrier aircraft with 30 seats or less.

Title 14 CFR Part 139 defines four airport classifications as follows:

- **Class I** - an airport certificated to serve scheduled operations of large air carrier aircraft that also can serve unscheduled passenger operations of large air carrier aircraft and/or scheduled operations of small air carrier aircraft. A Class I airport may serve any class of air carrier operations.
- **Class II** - an airport certificated to serve scheduled operations of small air carrier aircraft and the unscheduled passenger operations of large air carrier aircraft. A Class II airport cannot serve scheduled large air carrier aircraft.
- **Class III** - an airport certificated to serve scheduled operations of small air carrier aircraft. A Class III airport cannot serve scheduled or unscheduled large air carrier aircraft.
- **Class IV** - an airport certificated to serve unscheduled passenger operations of large air carrier aircraft. A Class IV airport cannot serve scheduled large or small air carrier aircraft.

Airports that meet the requirements for Part 139 certification are issued an Airport Operating Certificate (AOC). AOCs serve to ensure safety in air transportation. To obtain a certificate, an airport must agree to operational and safety standards and provide for certain safety services and facilities. These requirements vary depending on the size of the airport and the type of flights available. The regulation, however, does allow FAA to issue certain exemptions to airports that serve few passengers yearly and for which some requirements might create a financial hardship.

According to Title 14 CFR Part 139, the following steps would need to be taken in order for TKI to receive an AOC:

1. Prepare and submit an Airport Certification Manual (ACM) to the FAA.
2. Prepare ground vehicle operating rules and regulations.
3. Prepare a ground vehicle training program.
4. Prepare a training program for airport personnel involved with Part 139 implementation.
5. Ensure that FBOs comply with the fuel training requirements.
6. Develop a record-keeping system for the following:
    a. Personnel training (24 months)
    b. Emergency personnel training (24 months)
    c. Airport tenant fueling inspection (12 months)
    d. Airport tenant fueling agent training (12 months)
    e. Self-inspection (6 months)
    f. Movement areas and safety areas training (24 months)
    g. Accident and incident (12 months)
    h. Airport Condition (6 months)
7. Prepare and submit an Airport Emergency Plan to the FAA.
8. Acquire an aircraft rescue and firefighting (ARFF) vehicle and comply with ARFF training and operational requirements.

The ACM is a required document that defines the procedures to be followed in the routine operation of the airport and for response to emergency situations. The ACM is a working document that is updated annually. It reflects the current condition and operation of the airport and establishes the responsibility, authority, and procedures as required. There are required sections for the ACM covering administrative detail and procedural detail. Each section independently addresses: who (primary/secondary), what, how, and when as it relates to each element.

The administrative sections of the ACM cover such elements as the organizational chart, operational responsibilities, maps, descriptions, weather sensors, access, and cargo. The procedural elements cover such items as paved and unpaved areas, safety areas, lighting and marking, communications and navigational aids, ARFF, handling of hazardous material, utility protection, public protection, self-inspection program, ground vehicle control, obstruction removal, wildlife management, and construction supervision.

Aircraft Rescue and Firefighting

Part 139 airports are required to provide ARFF services during air carrier operations. Each certificated airport maintains equipment and personnel based on an ARFF index established according to the length of aircraft and scheduled daily flight frequency. In terms of flight frequency, an airport's ARFF index is determined by the longest aircraft conducting at least five or more daily departures. In terms of aircraft length, there are five indices, A through E, with A applicable to the smallest aircraft and E the largest.

The current ARFF equipment and staffing available at TKI generally meets ARFF Index B; however, it should be noted that ARFF capabilities are not currently a requirement for the Airport and are offered as a courtesy of the Airport.

The current ARFF equipment and staffing available at TKI generally meets ARFF Index B; however, it should be noted that ARFF capabilities are not currently a requirement for the Airport and are offered as a courtesy of the Airport. **Table 3S** presents the vehicle requirements and capacities for each index level.

The current unscheduled charter operators at TKI utilize a variety of aircraft, though most are by business jets or turboprops with less than 10 passenger seats, which do not count toward Part 139 certification. The scheduled charter operator (Texas Air Shuttle) that has historically operated at TKI utilizes the King Air 200, which also has less than 10 passenger seats. The potential enplanement scenario that was utilized to establish potential terminal building needs includes the MD-80 series (166 seats/Index C) or equivalent aircraft. If operations levels by these aircraft (excluding the King Air 200) exceed the five daily departures threshold, TKI would be required to meet that aircraft's associated index level.

TABLE 3S
ARFF Index Requirements

Index	Aircraft Length	Requirements
Index A	<90'	1. One ARFF vehicle with 500 lbs. of sodium-based dry chemical or 2. One vehicle with 450 lbs. of potassium-based dry chemical and 100 lbs. of water and AFFF for simultaneous water and foam application
Index B	90'-126'	1. One vehicle with 500 lbs. of sodium-based dry chemical and 1,500 gallons of water and AFFF or 2. Two vehicles, one with the requirements for Index A and the other with enough water and AFFF for a total quantity of 1,500 gallons
Index C	126'-159'	1. Three vehicles, one having Index A, and two with enough water and AFFF for all three vehicles to combine for at least 3,000 gallons of agent or 2. Two vehicles, one with Index B and one with enough water and AFFF for both vehicles to total 3,000 gallons
Index D	159'-200'	1. One vehicle carrying agents required for Index A and 2. Two vehicles carrying enough water and AFFF for a total quantity by the three vehicles of at least 4,000 gallons
Index E	>200'	1. One vehicle with Index A and 2. Two vehicles with enough water and AFFF for a total quantity of the three vehicles of 6,000 gallons

AFFF: Aqueous Film-Forming Foam
ARFF: Aircraft Rescue and Firefighting

Source: Title 14 Code of Federal Regulations Part 139

Maintenance Facilities

Airport maintenance activities are staged from a hangar bay in the 400-series linear box hangar complex. Future planning will consider other potential locations that could accommodate a maintenance facility in order to maximize space for aircraft storage needs and better segregate maintenance activities from the airfield.

A summary of the general aviation landside facilities previously discussed at TKI is presented on **Exhibit 3G**.

SUMMARY

This chapter has outlined the safety design standards and facilities required to meet potential aviation demand projected at TKI for the next 20 years. In an effort to provide a more flexible Master Plan, the yearly forecasts from Chapter Two have been converted to planning horizon levels. The short term roughly corresponds to a five-year timeframe, the intermediate term is approximately 10 years, and the long term is 20 years. By utilizing planning horizons, airport management can focus on demand indicators for initiating projects and grant requests rather than on specific dates in the future.

GENERAL AVIATION TERMINAL SERVICES

	AVAILABLE	SHORT TERM	INTERMEDIATE TERM	LONG TERM
General Aviation Services Facility Area (s.f.)	6,000[1]	6,900	8,600	10,800
Vehicle Parking Spaces	319[2]	202	231	292

AIRCRAFT STORAGE HANGAR REQUIREMENTS

Total Based Aircraft	286	325	370	460
Aircraft to be Hangared	219	257	304	390
T-Hangar/Linear Box Hangar (s.f.)	218,800	250,500	280,400	312,000
Executive Box Hangar (s.f.)	101,800	115,500	153,000	210,500
Conventional Hangar (s.f.)	135,700	176,000	232,000	332,500
Maintenance Area (s.f.)	--	48,700	55,500	69,000
Total Hangar Area (s.f.)	**456,300[3]**	**590,700**	**720,900**	**924,000**

AIRCRAFT PARKING APRON REQUIREMENTS

Transient Single and Multi-Engine Aircraft Positions	--	33	37	42
Apron Area (s.y.)	--	26,200	29,400	33,800
Transient Turboprop and Jet Aircraft Positions	--	18	22	28
Apron Area (s.y.)	--	28,300	34,600	45,100
Locally-Based Aircraft Positions	--	93	91	94
Apron Area (s.y.)	--	33,500	32,800	33,800
Total Marked Positions	--	143	149	164
Total Apron Area (s.y.)	**93,700**	**88,000**	**96,800**	**112,700**

SUPPORT FACILITIES

Fuel Storage - Jet A 14-Day Supply (gal.)	56,000	56,000	69,000	99,000
Fuel Storage - Jet A	13,000	8,000	11,000	20,000
Airport Maintenance	Airport Maintenance located in Linear Box Hangar	Potentially Relocate to Maximize Aircraft Storage Needs		
Airport Security	Security Fencing / Gates	Maintain		

[1] Includes approximate space offered by McKinney Air Center (FBO)
[2] Approximate number of total marked vehicle parking spaces at the Airport
[3] Includes estimated hangar and maintenance area currently at Airport

In Chapter Four, potential improvements to the airfield and landside systems will be examined through a series of airport development alternatives. Most of the alternatives discussion will focus on those capital improvements that would be eligible for federal and state grant funds. Other projects of local concern will also be presented. Ultimately, an overall development plan that presents a vision beyond the 20-year scope of this Master Plan will be developed for TKI.

Glossary of Terms

A

ABOVE GROUND LEVEL: The elevation of a point or surface above the ground.

ACCELERATE-STOP DISTANCE AVAILABLE (ASDA): See declared distances.

ADVISORY CIRCULAR: External publications issued by the FAA consisting of nonregulatory material providing for the recommendations relative to a policy, guidance and information relative to a specific aviation subject.

AIR CARRIER: An operator which: (1) performs at least five round trips per week between two or more points and publishes flight schedules which specify the times, days of the week, and places between which such flights are performed; or (2) transports mail by air pursuant to a current contract with the U.S. Postal Service. Certified in accordance with Federal Aviation Regulation (FAR) Parts 121 and 127.

AIRCRAFT: A transportation vehicle that is used or intended for use for flight.

AIRCRAFT APPROACH CATEGORY: A grouping of aircraft based on 1.3 times the stall speed in their landing configuration at their maximum certificated landing weight. The categories are as follows:

- Category A: Speed less than 91 knots.
- Category B: Speed 91 knots or more, but less than 121 knots.
- Category C: Speed 121 knots or more, but less than 141 knots.
- Category D: Speed 141 knots or more, but less than 166 knots.
- Category E: Speed greater than 166 knots.

AIRCRAFT OPERATION: The landing, takeoff, or touch-and-go procedure by an aircraft on a runway at an airport.

AIRCRAFT OPERATIONS AREA (AOA): A restricted and secure area on the airport property designed to protect all aspects related to aircraft operations.

AIRCRAFT OWNERS AND PILOTS ASSOCIATION: A private organization serving the interests and needs of general aviation pilots and aircraft owners.

AIRCRAFT RESCUE AND FIRE FIGHTING: A facility located at an airport that provides emergency vehicles, extinguishing agents, and personnel responsible for minimizing the impacts of an aircraft accident or incident.

AIRFIELD: The portion of an airport which contains the facilities necessary for the operation of aircraft.

AIRLINE HUB: An airport at which an airline concentrates a significant portion of its activity and which often has a significant amount of connecting traffic.

AIRPLANE DESIGN GROUP (ADG): A grouping of aircraft based upon wingspan. The groups are as follows:

- Group I: Up to but not including 49 feet.
- Group II: 49 feet up to but not including 79 feet.
- Group III: 79 feet up to but not including 118 feet.
- Group IV: 118 feet up to but not including 171 feet.
- Group V: 171 feet up to but not including 214 feet.
- Group VI: 214 feet or greater.

AIRPORT AUTHORITY: A quasi-governmental public organization responsible for setting the policies governing the management and operation of an airport or system of airports under its jurisdiction.

AIRPORT BEACON: A navigational aid located at an airport which displays a rotating light beam to identify whether an airport is lighted.

AIRPORT CAPITAL IMPROVEMENT PLAN: The planning program used by the Federal Aviation Administration to identify, prioritize, and distribute funds for airport development and the needs of the National Airspace System to meet specified national goals and objectives.

AIRPORT ELEVATION: The highest point on the runway system at an airport expressed in feet above mean sea level (MSL).

AIRPORT IMPROVEMENT PROGRAM: A program authorized by the Airport and Airway Improvement Act of 1982 that provides funding for airport planning and development.

AIRPORT LAYOUT DRAWING (ALD): The drawing of the airport showing the layout of existing and proposed airport facilities.

AIRPORT LAYOUT PLAN (ALP): A scaled drawing of the existing and planned land and facilities necessary for the operation and development of the airport.

AIRPORT LAYOUT PLAN DRAWING SET: A set of technical drawings depicting the current and future airport conditions. The individual sheets comprising the set can vary with the complexities of the airport, but the FAA-required drawings include the Airport Layout Plan (sometimes referred to as the Airport Layout Drawing (ALD), the Airport Airspace Drawing, and the Inner Portion of the Approach Surface Drawing, On-Airport Land Use Drawing, and Property Map.

AIRPORT MASTER PLAN: The planner's concept of the long-term development of an airport.

AIRPORT MOVEMENT AREA SAFETY SYSTEM: A system that provides automated alerts and warnings of potential runway incursions or other hazardous aircraft movement events.

AIRPORT OBSTRUCTION CHART: A scaled drawing depicting the Federal Aviation Regulation (FAR) Part 77 surfaces, a representation of objects that penetrate these surfaces, runway, taxiway, and ramp areas, navigational aids, buildings, roads and other detail in the vicinity of an airport.

AIRPORT REFERENCE CODE (ARC): A coding system used to relate airport design criteria to the operational (Aircraft Approach Category) to the physical characteristics (Airplane Design Group) of the airplanes intended to operate at the airport.

AIRPORT REFERENCE POINT (ARP): The latitude and longitude of the approximate center of the airport.

AIRPORT SPONSOR: The entity that is legally responsible for the management and operation of an airport, including the fulfillment of the requirements of laws and regulations related thereto.

AIRPORT SURFACE DETECTION EQUIPMENT: A radar system that provides air traffic controllers with a visual representation of the movement of aircraft and other vehicles on the ground on the airfield at an airport.

AIRPORT SURVEILLANCE RADAR: The primary radar located at an airport or in an air traffic control terminal area that receives a signal at an antenna and transmits the signal to air traffic control display equipment defining the location of aircraft in the air. The signal provides only the azimuth and range of aircraft from the location of the antenna.

AIRPORT TRAFFIC CONTROL TOWER (ATCT): A central operations facility in the terminal air traffic control system, consisting of a tower, including an associated instrument flight rule (IFR) room if radar equipped, using air/ground communications and/or radar, visual signaling and other devices to provide safe and expeditious movement of terminal air traffic.

AIR ROUTE TRAFFIC CONTROL CENTER: A facility which provides en route air traffic control service to aircraft operating on an IFR flight plan within controlled airspace over a large, multi-state region.

AIRSIDE: The portion of an airport that contains the facilities necessary for the operation of aircraft.

AIRSPACE: The volume of space above the surface of the ground that is provided for the operation of aircraft.

AIR TAXI: An air carrier certificated in accordance with FAR Part 121 and FAR Part 135 and authorized to provide, on demand, public transportation of persons and property by aircraft. Generally operates small aircraft "for hire" for specific trips.

AIR TRAFFIC CONTROL: A service operated by an appropriate organization for the purpose of providing for the safe, orderly, and expeditious flow of air traffic.

AIR ROUTE TRAFFIC CONTROL CENTER (ARTCC): A facility established to provide air traffic control service to aircraft operating on an IFR flight plan within controlled airspace and principally during the en route phase of flight.

AIR TRAFFIC CONTROL SYSTEM COMMAND CENTER: A facility operated by the FAA which is responsible for the central flow control, the central altitude reservation system, the airport reservation position system, and the air traffic service contingency command for the air traffic control system.

AIR TRAFFIC HUB: A categorization of commercial service airports or group of commercial service airports in a metropolitan or urban area based upon the proportion of annual national enplanements existing at the airport or airports. The categories are large hub, medium hub, small hub, or non-hub. It forms the basis for the apportionment of entitlement funds.

AIR TRANSPORT ASSOCIATION OF AMERICA: An organization consisting of the principal U.S. airlines that represents the interests of the airline industry on major aviation issues before federal, state, and local government bodies. It promotes air transportation safety by coordinating industry and governmental safety programs and it serves as a focal point for industry efforts to standardize practices and enhance the efficiency of the air transportation system.

ALERT AREA: See special-use airspace.

ALTITUDE: The vertical distance measured in feet above mean sea level.

ANNUAL INSTRUMENT APPROACH (AIA): An approach to an airport with the intent to land by an aircraft in accordance with an IFR flight plan when visibility is less than three miles and/or when the ceiling is at or below the minimum initial approach altitude.

APPROACH LIGHTING SYSTEM (ALS): An airport lighting facility which provides visual guidance to landing aircraft by radiating light beams by which the pilot aligns the aircraft with the extended centerline of the runway on his final approach and landing.

APPROACH MINIMUMS: The altitude below which an aircraft may not descend while on an IFR approach unless the pilot has the runway in sight.

APPROACH SURFACE: An imaginary obstruction limiting surface defined in FAR Part 77 which is longitudinally centered on an extended runway centerline and extends outward and upward from the primary surface at each end of a runway at a designated slope and distance based upon the type of available or planned approach by aircraft to a runway.

APRON: A specified portion of the airfield used for passenger, cargo or freight loading and unloading, aircraft parking, and the refueling, maintenance and servicing of aircraft.

AREA NAVIGATION: The air navigation procedure that provides the capability to establish and maintain a flight path on an arbitrary course that remains within the coverage area of navigational sources being used.

AUTOMATED TERMINAL INFORMATION SERVICE (ATIS): The continuous broadcast of recorded non-control information at towered airports. Information typically includes wind speed, direction, and runway in use.

AUTOMATED SURFACE OBSERVATION SYSTEM (ASOS): A reporting system that provides frequent airport ground surface weather observation data through digitized voice broadcasts and printed reports.

AUTOMATIC WEATHER OBSERVATION STATION (AWOS): Equipment used to automatically record weather conditions (i.e. cloud height, visibility, wind speed and direction, temperature, dew point, etc.)

AUTOMATIC DIRECTION FINDER (ADF): An aircraft radio navigation system which senses and indicates the direction to a non-directional radio beacon (NDB) ground transmitter.

AVIGATION EASEMENT: A contractual right or a property interest in land over which a right of unobstructed flight in the airspace is established.

AZIMUTH: Horizontal direction expressed as the angular distance between true north and the direction of a fixed point (as the observer's heading).

B

BASE LEG: A flight path at right angles to the landing runway off its approach end. The base leg normally extends from the downwind leg to the intersection of the extended runway centerline. See "traffic pattern."

BASED AIRCRAFT: The general aviation aircraft that use a specific airport as a home base.

BEARING: The horizontal direction to or from any point, usually measured clockwise from true north or magnetic north.

BLAST FENCE: A barrier used to divert or dissipate jet blast or propeller wash.

BLAST PAD: A prepared surface adjacent to the end of a runway for the purpose of eliminating the erosion of the ground surface by the wind forces produced by airplanes at the initiation of takeoff operations.

BUILDING RESTRICTION LINE (BRL): A line which identifies suitable building area locations on the airport.

C

CAPITAL IMPROVEMENT PLAN: The planning program used by the Federal Aviation Administration to identify, prioritize, and distribute Airport Improvement Program funds for airport development and the needs of the National Airspace System to meet specified national goals and objectives.

CARGO SERVICE AIRPORT: An airport served by aircraft providing air transportation of property only, including mail, with an annual aggregate landed weight of at least 100,000,000 pounds.

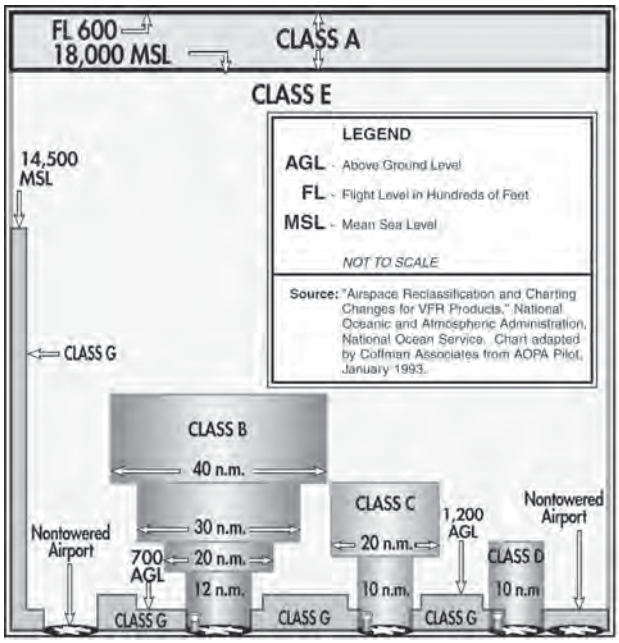
CATEGORY I: An Instrument Landing System (ILS) that provides acceptable guidance information to an aircraft from the coverage limits of the ILS to the point at which the localizer course line intersects the glide path at a decision height of 200 feet above the horizontal plane containing the runway threshold.

CATEGORY II: An ILS that provides acceptable guidance information to an aircraft from the coverage limits of the ILS to the point at which the localizer course line intersects the glide path at a decision height of 100 feet above the horizontal plane containing the runway threshold.

CATEGORY III: An ILS that provides acceptable guidance information to a pilot from the coverage limits of the ILS with no decision height specified above the horizontal plane containing the runway threshold.

CEILING: The height above the ground surface to the location of the lowest layer of clouds which is reported as either broken or overcast.

CIRCLING APPROACH: A maneuver initiated by the pilot to align the aircraft with the runway for landing when flying a predetermined circling instrument approach under IFR.



CLASS A AIRSPACE: See Controlled Airspace.

CLASS B AIRSPACE: See Controlled Airspace.

CLASS C AIRSPACE: See Controlled Airspace.

CLASS D AIRSPACE: See Controlled Airspace.

CLASS E AIRSPACE: See Controlled Airspace.

CLASS G AIRSPACE: See Controlled Airspace.

CLEAR ZONE: See Runway Protection Zone.

COMMERCIAL SERVICE AIRPORT: A public airport providing scheduled passenger service that enplanes at least 2,500 annual passengers.

COMMON TRAFFIC ADVISORY FREQUENCY: A radio frequency identified in the appropriate aeronautical chart which is designated for the purpose of transmitting airport advisory information and procedures while operating to or from an uncontrolled airport.

COMPASS LOCATOR (LOM): A low power, low/medium frequency radio-beacon installed in conjunction with the instrument landing system at one or two of the marker sites.

CONICAL SURFACE: An imaginary obstruction-limiting surface defined in FAR Part 77 that extends

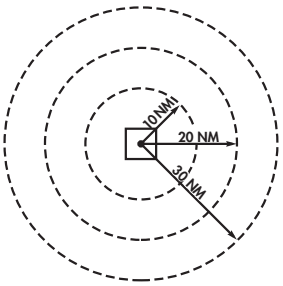
from the edge of the horizontal surface outward and upward at a slope of 20 to 1 for a horizontal distance of 4,000 feet.

CONTROLLED AIRPORT: An airport that has an operating airport traffic control tower.

CONTROLLED AIRSPACE: Airspace of defined dimensions within which air traffic control services are provided to instrument flight rules (IFR) and visual flight rules (VFR) flights in accordance with the airspace classification. Controlled airspace in the United States is designated as follows:

- **CLASS A**: Generally, the airspace from 18,000 feet mean sea level (MSL) up to but not including flight level FL600. All persons must operate their aircraft under IFR.

- **CLASS B**:



Generally, the airspace from the surface to 10,000 feet MSL surrounding the nation's busiest airports. The configuration of Class B airspace is unique to each airport, but typically consists of two or more layers of air space and is designed to contain all published instrument approach procedures to the airport. An air traffic control clearance is required for all aircraft to operate in the area.

- **CLASS C**: Generally, the airspace from the surface to 4,000 feet above the airport elevation (charted as MSL) surrounding those airports that have an operational control tower and radar approach control and are served by a qualifying number of IFR operations or passenger enplanements. Although individually tailored for each airport, Class C airspace typically consists of a surface area with a five nautical mile (nm) radius and an outer area with a 10 nautical mile radius that extends from 1,200 feet to 4,000 feet above the airport elevation. Two-way radio communication is required for all aircraft.

- **CLASS D**: Generally, that airspace from the surface to 2,500 feet above the air port elevation (charted as MSL) surrounding those airports that have an operational control tower. Class D airspace is individually tailored and configured to encompass published instrument approach procedure. Unless otherwise authorized, all persons must establish two-way radio communication.

- **CLASS E**: Generally, controlled airspace that is not classified as Class A, B, C, or D. Class E airspace extends upward from either the surface or a designated altitude to the overlying or adjacent controlled airspace. When designated as a surface area, the airspace will be configured to contain all instrument procedures. Class E airspace encompasses all Victor Airways. Only aircraft following instrument flight rules are required to establish two-way radio communication with air traffic control.

- **CLASS G**: Generally, that airspace not classified as Class A, B, C, D, or E. Class G airspace is uncontrolled for all aircraft. Class G airspace extends from the surface to the overlying Class E airspace.

CONTROLLED FIRING AREA: See special-use airspace.

CROSSWIND: A wind that is not parallel to a runway centerline or to the intended flight path of an aircraft.

CROSSWIND COMPONENT: The component of wind that is at a right angle to the runway centerline or the intended flight path of an aircraft.

CROSSWIND LEG: A flight path at right angles to the landing runway off its upwind end. See "traffic pattern."

D

DECIBEL: A unit of noise representing a level relative to a reference of a sound pressure 20 micro newtons per square meter.

DECISION HEIGHT/ DECISION ALTITUDE: The height above the end of the runway surface at which a decision must be made by a pilot during the ILS or Precision Approach Radar approach to either continue the approach or to execute a missed approach.

DECLARED DISTANCES: The distances declared available for the airplane's takeoff runway, takeoff distance, accelerate-stop distance, and landing distance requirements. The distances are:

- **TAKEOFF RUNWAY AVAILABLE (TORA):** The runway length declared available and suitable for the ground run of an airplane taking off.

- **TAKEOFF DISTANCE AVAILABLE (TODA):** The TORA plus the length of any remaining runway and/or clear way beyond the far end of the TORA.

- **ACCELERATE-STOP DISTANCE AVAILABLE (ASDA):** The runway plus stopway length declared available for the acceleration and deceleration of an aircraft aborting a takeoff.

- **LANDING DISTANCE AVAILABLE (LDA):** The runway length declared available and suitable for landing.

DEPARTMENT OF TRANSPORTATION: The cabinet level federal government organization consisting of modal operating agencies, such as the Federal Aviation Administration, which was established to promote the coordination of federal transportation programs and to act as a focal point for research and development efforts in transportation.

DISCRETIONARY FUNDS: Federal grant funds that may be appropriated to an airport based upon designation by the Secretary of Transportation or Congress to meet a specified national priority such as enhancing capacity, safety, and security, or mitigating noise.

DISPLACED THRESHOLD: A threshold that is located at a point on the runway other than the designated beginning of the runway.

DISTANCE MEASURING EQUIPMENT (DME): Equipment (airborne and ground) used to measure, in nautical miles, the slant range distance of an aircraft from the DME navigational aid.

DNL: The 24-hour average sound level, in Aweighted decibels, obtained after the addition of ten decibels to sound levels for the periods between 10 p.m. and 7 a.m. as averaged over a span of one year. It is the FAA standard metric for determining the cumulative exposure of individuals to noise.

DOWNWIND LEG: A flight path parallel to the landing runway in the direction opposite to landing. The downwind leg normally extends between the crosswind leg and the base leg. Also see "traffic pattern."

E

EASEMENT: The legal right of one party to use a portion of the total rights in real estate owned by another party. This may include the right of passage over, on, or below the property; certain air rights above the property, including view rights; and the rights to any specified form of development or activity, as well as any other legal rights in the property that may be specified in the easement document.

ELEVATION: The vertical distance measured in feet above mean sea level.

ENPLANED PASSENGERS: The total number of revenue passengers boarding aircraft, including originating, stop-over, and transfer passengers, in scheduled and nonscheduled services.

ENPLANEMENT: The boarding of a passenger, cargo, freight, or mail on an aircraft at an airport.

ENTITLEMENT: Federal funds for which a commercial service airport may be eligible based upon its annual passenger enplanements.

ENVIRONMENTAL ASSESSMENT (EA): An environmental analysis performed pursuant to the National Environmental Policy Act to determine whether an action would significantly affect the environment and thus require a more detailed environmental impact statement.

ENVIRONMENTAL AUDIT: An assessment of the current status of a party's compliance with applicable environmental requirements of a party's environmental compliance policies, practices, and controls.

ENVIRONMENTAL IMPACT STATEMENT (EIS): A document required of federal agencies by the National Environmental Policy Act for major projects are legislative proposals affecting the environment. It is a tool for decision-making describing the positive and negative effects of a proposed action and citing alternative actions.

ESSENTIAL AIR SERVICE: A federal program which guarantees air carrier service to selected small cities by providing subsidies as needed to prevent these cities from such service.

F

FEDERAL AVIATION REGULATIONS: The general and permanent rules established by the executive departments and agencies of the Federal Government for aviation, which are published in the Federal Register. These are the aviation subset of the Code of Federal Regulations.

FEDERAL INSPECTION SERVICES: The provision of customs and immigration services including passport inspection, inspection of baggage, the collection of duties on certain imported items, and the inspections for agricultural products, illegal drugs, or other restricted items.

FINAL APPROACH: A flight path in the direction of landing along the extended runway centerline. The final approach normally extends from the base leg to the runway. See "traffic pattern."

FINAL APPROACH AND TAKEOFF AREA (FATO). A defined area over which the final phase of the helicopter approach to a hover, or a landing is completed and from which the takeoff is initiated.

FINAL APPROACH FIX: The designated point at which the final approach segment for an aircraft landing on a runway begins for a non-precision approach.

FINDING OF NO SIGNIFICANT IMPACT (FONSI): A public document prepared by a Federal agency that presents the rationale why a proposed action will not have a significant effect on the environment and for which an environmental impact statement will not be prepared.

FIXED BASE OPERATOR (FBO): A provider of services to users of an airport. Such services include, but are not limited to, hangaring, fueling, flight training, repair, and maintenance.

FLIGHT LEVEL: A measure of altitude used by aircraft flying above 18,000 feet. Flight levels are indicated by three digits representing the pressure altitude in hundreds of feet. An airplane flying at flight level 360 is flying at a pressure altitude of 36,000 feet. This is expressed as FL 360.

FLIGHT SERVICE STATION: An operations facility in the national flight advisory system which utilizes data interchange facilities for the collection and dissemination of Notices to Airmen, weather, and administrative data and which provides pre-flight and in-flight advisory services to pilots through air and ground based communication facilities.

FRANGIBLE NAVAID: A navigational aid which retains its structural integrity and stiffness up to a designated maximum load, but on impact from a greater load, breaks, distorts, or yields in such a manner as to present the minimum hazard to aircraft.

G

GENERAL AVIATION: That portion of civil aviation which encompasses all facets of aviation except air carriers holding a certificate of convenience and necessity, and large aircraft commercial operators.

GENERAL AVIATION AIRPORT: An airport that provides air service to only general aviation.

GLIDESLOPE (GS): Provides vertical guidance for aircraft during approach and landing. The glideslope consists of the following:

1. Electronic components emitting signals which provide vertical guidance by reference to airborne instruments during instrument approaches such as ILS; or

2. Visual ground aids, such as VASI, which provide vertical guidance for VFR approach or for the visual portion of an instrument approach and landing.

GLOBAL POSITIONING SYSTEM (GPS): A system of 48 satellites used as reference points to enable navigators equipped with GPS receivers to determine their latitude, longitude, and altitude.

GROUND ACCESS: The transportation system on and around the airport that provides access to and from the airport by ground transportation vehicles for passengers, employees, cargo, freight, and airport services.

H

HELIPAD: A designated area for the takeoff, landing, and parking of helicopters.

HIGH INTENSITY RUNWAY LIGHTS: The highest classification in terms of intensity or brightness for lights designated for use in delineating the sides of a runway.

HIGH-SPEED EXIT TAXIWAY: A long radius taxiway designed to expedite aircraft turning off the runway after landing (at speeds to 60 knots), thus reducing runway occupancy time.

HORIZONTAL SURFACE: An imaginary obstruction-limiting surface defined in FAR Part 77 that is specified as a portion of a horizontal plane surrounding a runway located 150 feet above the established airport elevation. The specific horizontal dimensions of this surface are a function of the types of approaches existing or planned for the runway.

I

INITIAL APPROACH FIX: The designated point at which the initial approach segment begins for an instrument approach to a runway.

INSTRUMENT APPROACH PROCEDURE: A series of predetermined maneuvers for the orderly transfer of an aircraft under instrument flight conditions from the beginning of the initial approach to a landing, or to a point from which a landing may be made visually.

INSTRUMENT FLIGHT RULES (IFR): Procedures for the conduct of flight in weather conditions below Visual Flight Rules weather minimums. The term IFR is often also used to define weather conditions and the type of flight plan under which an aircraft is operating.

INSTRUMENT LANDING SYSTEM (ILS): A precision instrument approach system which normally consists of the following electronic components and visual aids:

1. Localizer.
2. Glide Slope.
3. Outer Marker.
4. Middle Marker.
5. Approach Lights.

INSTRUMENT METEOROLOGICAL CONDITIONS: Meteorological conditions expressed in terms of specific visibility and ceiling conditions that are less than the minimums specified for visual meteorological conditions.

ITINERANT OPERATIONS: Operations by aircraft that are not based at a specified airport.

K

KNOTS: A unit of speed length used in navigation that is equivalent to the number of nautical miles traveled in one hour.

L

LANDSIDE: The portion of an airport that provides the facilities necessary for the processing of passengers, cargo, freight, and ground transportation vehicles.

LANDING DISTANCE AVAILABLE (LDA): See declared distances.

LARGE AIRPLANE: An airplane that has a maximum certified takeoff weight in excess of 12,500 pounds.

LOCAL AREA AUGMENTATION SYSTEM: A differential GPS system that provides localized measurement correction signals to the basic GPS signals to improve navigational accuracy integrity, continuity, and availability.

LOCAL OPERATIONS: Aircraft operations performed by aircraft that are based at the airport and that operate in the local traffic pattern or within sight of the airport, that are known to be departing for or arriving from flights in local practice areas within a prescribed distance from the airport, or that execute simulated instrument approaches at the airport.

LOCAL TRAFFIC: Aircraft operating in the traffic pattern or within sight of the tower, or aircraft known to be departing or arriving from the local practice areas, or aircraft executing practice instrument approach procedures. Typically, this includes touch and-go training operations.

LOCALIZER: The component of an ILS which provides course guidance to the runway.

LOCALIZER TYPE DIRECTIONAL AID (LDA): A facility of comparable utility and accuracy to a localizer, but is not part of a complete ILS and is not aligned with the runway.

LONG RANGE NAVIGATION SYSTEM (LORAN): Long range navigation is an electronic navigational aid which determines aircraft position and speed by measuring the difference in the time of reception of synchronized pulse signals from two fixed transmitters. Loran is used for en route navigation.

LOW INTENSITY RUNWAY LIGHTS: The lowest classification in terms of intensity or brightness for lights designated for use in delineating the sides of a runway.

M

MEDIUM INTENSITY RUNWAY LIGHTS: The middle classification in terms of intensity or brightness for lights designated for use in delineating the sides of a runway.

MICROWAVE LANDING SYSTEM (MLS): An instrument approach and landing system that provides precision guidance in azimuth, elevation, and distance measurement.

MILITARY OPERATIONS: Aircraft operations that are performed in military aircraft.

MILITARY OPERATIONS AREA (MOA): See special-use airspace

MILITARY TRAINING ROUTE: An air route depicted on aeronautical charts for the conduct of military flight training at speeds above 250 knots.

MISSED APPROACH COURSE (MAC): The flight route to be followed if, after an instrument approach, a landing is not affected, and occurring normally:

1. When the aircraft has descended to the decision height and has not established visual contact; or

2. When directed by air traffic control to pull up or to go around again.

MOVEMENT AREA: The runways, taxiways, and other areas of an airport which are utilized for taxiing/hover taxiing, air taxiing, takeoff, and landing of aircraft, exclusive of loading ramps and parking areas. At those airports with a tower, air traffic control clearance is required for entry onto the movement area.

N

NATIONAL AIRSPACE SYSTEM: The network of air traffic control facilities, air traffic control areas, and navigational facilities through the U.S.

NATIONAL PLAN OF INTEGRATED AIRPORT SYSTEMS: The national airport system plan developed by the Secretary of Transportation on a biannual basis for the development of public use airports to meet national air transportation needs.

NATIONAL TRANSPORTATION SAFETY BOARD: A federal government organization established to investigate and determine the probable cause of transportation accidents, to recommend equipment and procedures to enhance transportation safety, and to review on appeal the suspension or revocation of any certificates or licenses issued by the Secretary of Transportation.

NAUTICAL MILE: A unit of length used in navigation which is equivalent to the distance spanned by one minute of arc in latitude, that is, 1,852 meters or 6,076 feet. It is equivalent to approximately 1.15 statute mile.

NAVAID: A term used to describe any electrical or visual air navigational aids, lights, signs, and associated supporting equipment (i.e. PAPI, VASI, ILS, etc.)

NAVIGATIONAL AID: A facility used as, available for use as, or designed for use as an aid to air navigation.

NOISE CONTOUR: A continuous line on a map of the airport vicinity connecting all points of the same noise exposure level.

NON-DIRECTIONAL BEACON (NDB): A beacon transmitting nondirectional signals whereby the pilot of an aircraft equipped with direction finding equipment can determine his or her bearing to and from the radio beacon and home on, or track to, the station. When the radio beacon is installed in conjunction with the Instrument Landing System marker, it is normally called a Compass Locator.

NON-PRECISION APPROACH PROCEDURE: A standard instrument approach procedure in which no electronic glide slope is provided, such as VOR, TACAN, NDB, or LOC.

NOTICE TO AIRMEN: A notice containing information concerning the establishment, condition, or change in any component of or hazard in the National Airspace System, the timely knowledge of which is considered essential to personnel concerned with flight operations.

O

OBJECT FREE AREA (OFA): An area on the ground centered on a runway, taxiway, or taxilane centerline provided to enhance the safety of aircraft operations by having the area free of objects, except for objects that need to be located in the OFA for air navigation or aircraft ground maneuvering purposes.

OBSTACLE FREE ZONE (OFZ): The airspace below 150 feet above the established airport elevation and along the runway and extended runway centerline that is required to be kept clear of all objects, except for frangible visual NAVAIDs that need to be located in the OFZ because of their function, in order to provide clearance for aircraft landing or taking off from the runway, and for missed approaches.

ONE-ENGINE INOPERABLE SURFACE: A surface emanating from the runway end at a slope ratio of 62.5:1. Air carrier airports are required to maintain a technical drawing of this surface depicting any object penetrations by January 1, 2010.

OPERATION: The take-off, landing, or touch-and-go procedure by an aircraft on a runway at an airport.

OUTER MARKER (OM): An ILS navigation facility in the terminal area navigation system located four to seven miles from the runway edge on the extended centerline, indicating to the pilot that he/she is passing over the facility and can begin final approach.

P

PILOT CONTROLLED LIGHTING: Runway lighting systems at an airport that are controlled by activating the microphone of a pilot on a specified radio frequency.

PRECISION APPROACH: A standard instrument approach procedure which provides runway alignment and glide slope (descent) information. It is categorized as follows:

- **CATEGORY I (CAT I)**: A precision approach which provides for approaches with a decision height of not less than 200 feet and visibility not less than 1/2 mile or Runway Visual Range (RVR) 2400 (RVR 1800) with operative touchdown zone and runway centerline lights.
- **CATEGORY II (CAT II)**: A precision approach which provides for approaches with a decision height of not less than 100 feet and visibility not less than 1200 feet RVR.
- **CATEGORY III (CAT III)**: A precision approach which provides for approaches with minima less than Category II.

PRECISION APPROACH PATH INDICATOR (PAPI): A lighting system providing visual approach slope guidance to aircraft during a landing approach. It is similar to a VASI but provides a sharper transition between the colored indicator lights.

PRECISION APPROACH RADAR: A radar facility in the terminal air traffic control system used to detect and display with a high degree of accuracy the direction, range, and elevation of an aircraft on the final approach to a runway.

PRECISION OBJECT FREE AREA (POFA): An area centered on the extended runway centerline, beginning at the runway threshold and extending behind the runway threshold that is 200 feet long by 800 feet wide. The POFA is a clearing standard which requires the POFA to be kept clear of above ground objects protruding above the runway safety area edge elevation (except for frangible NAVAIDS). The POFA applies to all new authorized instrument approach procedures with less than 3/4 mile visibility.

PRIMARY AIRPORT: A commercial service airport that enplanes at least 10,000 annual passengers.

PRIMARY SURFACE: An imaginary obstruction limiting surface defined in FAR Part 77 that is specified as a rectangular surface longitudinally centered about a runway. The specific dimensions of this surface are a function of the types of approaches existing or planned for the runway.

PROHIBITED AREA: See special-use airspace.

PVC: Poor visibility and ceiling. Used in determining Annual Service Volume. PVC conditions exist when the cloud ceiling is less than 500 feet and visibility is less than one mile.

R

RADIAL: A navigational signal generated by a Very High Frequency Omni-directional Range or VORTAC station that is measured as an azimuth from the station.

REGRESSION ANALYSIS: A statistical technique that seeks to identify and quantify the relationships between factors associated with a forecast.

REMOTE COMMUNICATIONS OUTLET (RCO): An unstaffed transmitter receiver/facility remotely controlled by air traffic personnel. RCOs serve flight service stations (FSSs). RCOs were established to provide ground-to-ground communications between air traffic control specialists and pilots at satellite airports for delivering en route clearances, issuing departure authorizations, and acknowledging instrument flight rules cancellations or departure/ landing times.

REMOTE TRANSMITTER/RECEIVER (RTR): See remote communications outlet. RTRs serve ARTCCs.

RELIEVER AIRPORT: An airport to serve general aviation aircraft which might otherwise use a congested air-carrier served airport.

RESTRICTED AREA: See special-use airspace.

RNAV: Area navigation - airborne equipment which permits flights over determined tracks within prescribed accuracy tolerances without the need to overfly ground-based navigation facilities. Used en route and for approaches to an airport.

RUNWAY: A defined rectangular area on an airport prepared for aircraft landing and takeoff. Runways are normally numbered in relation to their magnetic direction, rounded off to the nearest 10 degrees. For example, a runway with a magnetic heading of 180 would be designated Runway 18. The runway heading on the opposite end of the runway is 180 degrees from that runway end. For example, the opposite runway heading for Runway 18 would be Runway 36 (magnetic heading of 360). Aircraft can takeoff or land from either end of a runway, depending upon wind direction.

RUNWAY ALIGNMENT INDICATOR LIGHT: A series of high intensity sequentially flashing lights installed on the extended centerline of the runway usually in conjunction with an approach lighting system.

RUNWAY DESIGN CODE: A code signifiying the design standards to which the runway is to be built.

RUNWAY END IDENTIFICATION LIGHTING (REIL): Two synchronized flashing lights, one on each side of the runway threshold, which provide rapid and positive identification of the approach end of a particular runway.

RUNWAY GRADIENT: The average slope, measured in percent, between the two ends of a runway.

RUNWAY PROTECTION ZONE (RPZ): An area off the runway end to enhance the protection of people and property on the ground. The RPZ is trapezoidal in shape. Its dimensions are determined by the aircraft approach speed and runway approach type and minima.

RUNWAY REFERENCE CODE: A code signifying the current operational capabilities of a runway and associated taxiway.

RUNWAY SAFETY AREA (RSA): A defined surface surrounding the runway prepared or suitable for reducing the risk of damage to airplanes in the event of an undershoot, overshoot, or excursion from the runway.

RUNWAY VISIBILITY ZONE (RVZ): An area on the airport to be kept clear of permanent objects so that there is an unobstructed line of- site from any point five feet above the runway centerline to any point five feet above an intersecting runway centerline.

RUNWAY VISUAL RANGE (RVR): An instrumentally derived value, in feet, representing the horizontal distance a pilot can see down the runway from the runway end.

S

SCOPE: The document that identifies and defines the tasks, emphasis, and level of effort associated with a project or study.

SEGMENTED CIRCLE: A system of visual indicators designed to provide traffic pattern information at airports without operating control towers.

SHOULDER: An area adjacent to the edge of paved runways, taxiways, or aprons providing a transition between the pavement and the adjacent surface; support for aircraft running off the pavement; enhanced drainage; and blast protection. The shoulder does not necessarily need to be paved.

SLANT-RANGE DISTANCE: The straight line distance between an aircraft and a point on the ground.

SMALL AIRCRAFT: An aircraft that has a maximum certified takeoff weight of up to 12,500 pounds.

SPECIAL-USE AIRSPACE: Airspace of defined dimensions identified by a surface area wherein activities must be confined because of their nature and/or wherein limitations may be imposed upon aircraft operations that are not a part of those activities. Special-use airspace classifications include:

- **ALERT AREA**: Airspace which may contain a high volume of pilot training activities or an unusual type of aerial activity, neither of which is hazardous to aircraft.
- **CONTROLLED FIRING AREA**: Airspace wherein activities are conducted under conditions so controlled as to eliminate hazards to nonparticipating aircraft and to ensure the safety of persons or property on the ground.
- **MILITARY OPERATIONS AREA (MOA)**: Designated airspace with defined vertical and lateral dimensions established outside Class A airspace to separate/segregate certain military activities from instrument flight rule (IFR) traffic and to identify for visual flight rule (VFR) traffic where these activities are conducted.
- **PROHIBITED AREA**: Designated airspace within which the flight of aircraft is prohibited.
- **RESTRICTED AREA**: Airspace designated under Federal Aviation Regulation (FAR) 73, within which the flight of aircraft, while not wholly prohibited, is subject to restriction. Most restricted areas are designated joint use. When not in use by the using agency, IFR/VFR operations can be authorized by the controlling air traffic control facility.
- **WARNING AREA:** Airspace which may contain hazards to nonparticipating aircraft.

STANDARD INSTRUMENT DEPARTURE (SID): A preplanned coded air traffic control IFR departure routing, preprinted for pilot use in graphic and textual form only.

STANDARD INSTRUMENT DEPARTURE PROCEDURES: A published standard flight procedure to be utilized following takeoff to provide a transition between the airport and the terminal area or en route airspace.

STANDARD TERMINAL ARRIVAL ROUTE (STAR): A preplanned coded air traffic control IFR arrival routing, preprinted for pilot use in graphic and textual or textual form only.

STOP-AND-GO: A procedure wherein an aircraft will land, make a complete stop on the runway, and then commence a takeoff from that point. A stop-and-go is recorded as two operations: one operation for the landing and one operation for the takeoff.

STOPWAY: An area beyond the end of a takeoff runway that is designed to support an aircraft during an aborted takeoff without causing structural damage to the aircraft. It is not to be used for takeoff, landing, or taxiing by aircraft.

STRAIGHT-IN LANDING/APPROACH: A landing made on a runway aligned within 30 degrees of the final approach course following completion of an instrument approach.

T

TACTICAL AIR NAVIGATION (TACAN): An ultrahigh frequency electronic air navigation system which provides suitably-equipped aircraft a continuous indication of bearing and distance to the TACAN station.

TAKEOFF RUNWAY AVAILABLE (TORA):
See declared distances.

TAKEOFF DISTANCE AVAILABLE (TODA):
See declared distances.

TAXILANE: The portion of the aircraft parking area used for access between taxiways and aircraft parking positions.

TAXIWAY: A defined path established for the taxiing of aircraft from one part of an airport to another.

TAXIWAY DESIGN GROUP: A classification of airplanes based on outer to outer Main Gear Width (MGW) and Cockpit to Main Gear (CMG) distance.

TAXIWAY SAFETY AREA (TSA): A defined surface alongside the taxiway prepared or suitable for reducing the risk of damage to an airplane unintentionally departing the taxiway.

TERMINAL INSTRUMENT PROCEDURES: Published flight procedures for conducting instrument approaches to runways under instrument meteorological conditions.

TERMINAL RADAR APPROACH CONTROL: An element of the air traffic control system responsible for monitoring the en-route and terminal segment of air traffic in the airspace surrounding airports with moderate to high levels of air traffic.

TETRAHEDRON: A device used as a landing direction indicator. The small end of the tetrahedron points in the direction of landing.

THRESHOLD: The beginning of that portion of the runway available for landing. In some instances the landing threshold may be displaced.

TOUCH-AND-GO: An operation by an aircraft that lands and departs on a runway without stopping or exiting the runway. A touch-and go is recorded as two operations: one operation for the landing and one operation for the takeoff.

TOUCHDOWN: The point at which a landing aircraft makes contact with the runway surface.

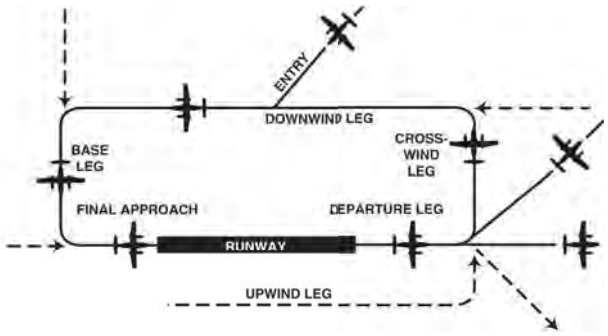
TOUCHDOWN AND LIFT-OFF AREA (TLOF): A load bearing, generally paved area, normally centered in the FATO, on which the helicopter lands or takes off.

TOUCHDOWN ZONE (TDZ): The first 3,000 feet of the runway beginning at the threshold.

TOUCHDOWN ZONE ELEVATION (TDZE): The highest elevation in the touchdown zone.

TOUCHDOWN ZONE (TDZ) LIGHTING: Two rows of transverse light bars located symmetrically about the runway centerline normally at 100- foot intervals. The basic system extends 3,000 feet along the runway.

TRAFFIC PATTERN: The traffic flow that is prescribed for aircraft landing at or taking off from an airport. The components of a typical traffic pattern are the upwind leg, crosswind leg, downwind leg, base leg, and final approach.



U

UNCONTROLLED AIRPORT: An airport without an air traffic control tower at which the control of Visual Flight Rules traffic is not exercised.

UNCONTROLLED AIRSPACE: Airspace within which aircraft are not subject to air traffic control.

UNIVERSAL COMMUNICATION (UNICOM):
A nongovernment communication facility which may provide airport information at certain airports. Locations and frequencies of UNICOM's are shown on aeronautical charts and publications.

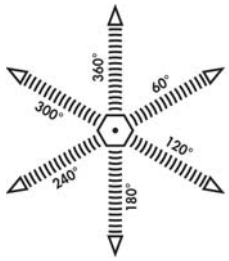
UPWIND LEG: A flight path parallel to the landing runway in the direction of landing. See "traffic pattern."

V

VECTOR: A heading issued to an aircraft to provide navigational guidance by radar.

VERY HIGH FREQUENCY/ OMNIDIRECTIONAL RANGE (VOR): A ground-based electronic navigation aid transmitting very high frequency navigation signals, 360 degrees in azimuth, oriented from magnetic north. Used as the basis for navigation in the national airspace system. The VOR periodically identifies itself by Morse Code and may have an additional voice identification feature.

VERY HIGH FREQUENCY OMNI-DIRECTIONAL RANGE/ TACTICAL AIR NAVIGATION (VORTAC): A navigation aid providing VOR azimuth, TACAN azimuth, and TACAN distance-measuring equipment (DME) at one site.



VICTOR AIRWAY: A control area or portion thereof established in the form of a corridor, the centerline of which is defined by radio navigational aids.

VISUAL APPROACH: An approach wherein an aircraft on an IFR flight plan, operating in VFR conditions under the control of an air traffic control facility and having an air traffic control authorization, may proceed to the airport of destination in VFR conditions.

VISUAL APPROACH SLOPE INDICATOR (VASI): An airport lighting facility providing vertical visual approach slope guidance to aircraft during approach to landing by radiating a directional pattern of high intensity red and white focused light beams which indicate to the pilot that he is on path if he sees red/ white, above path if white/white, and below path if red/red. Some airports serving large aircraft have three-bar VASI's which provide two visual guide paths to the same runway.

VISUAL FLIGHT RULES (VFR): Rules that govern the procedures for conducting flight under visual conditions. The term VFR is also used in the United States to indicate weather conditions that are equal to or greater than minimum VFR requirements. In addition, it is used by pilots and controllers to indicate type of flight plan.

VISUAL METEOROLOGICAL CONDITIONS:
Meteorological conditions expressed in terms of specific visibility and ceiling conditions which are equal to or greater than the threshold values for instrument meteorological conditions.

VOR: See "Very High Frequency Omnidirectional Range Station."

VORTAC: See "Very High Frequency Omnidirectional Range Station/Tactical Air Navigation."

W

WARNING AREA: See special-use airspace.

WIDE AREA AUGMENTATION SYSTEM: An enhancement of the Global Positioning System that includes integrity broadcasts, differential corrections, and additional ranging signals for the purpose of providing the accuracy, integrity, availability, and continuity required to support all phases of flight.

Abbreviations

AC: advisory circular

ADF: automatic direction finder

ADG: airplane design group

AFSS: automated flight service station

AGL: above ground level

AIA: annual instrument approach

AIP: Airport Improvement Program

AIR-21: Wendell H. Ford Aviation Investment and Reform Act for the 21st Century

ALS: approach lighting system

ALSF-1: standard 2,400-foot high intensity approach lighting system with sequenced flashers (CAT I configuration)

ALSF-2: standard 2,400-foot high intensity approach lighting system with sequenced flashers (CAT II configuration)

AOA: Aircraft Operation Area

APV: instrument approach procedure with vertical guidance

ARC: airport reference code

ARFF: aircraft rescue and fire fighting

ARP: airport reference point

ARTCC: air route traffic control center

ASDA: accelerate-stop distance available

ASR: airport surveillance radar

ASOS: automated surface observation station

ATCT: airport traffic control tower

ATIS: automated terminal information service

AVGAS: aviation gasoline - typically 100 low lead (100LL)

AWOS: automatic weather observation station

BRL: building restriction line

CFR: Code of Federal Regulation

CIP: capital improvement program

DME: distance measuring equipment

DNL: day-night noise level

DWL: runway weight bearing capacity of aircraft with dual-wheel type landing gear

DTWL: runway weight bearing capacity of aircraft with dual-tandem type landing gear

FAA: Federal Aviation Administration

FAR: Federal Aviation Regulation

FBO: fixed base operator

FY: fiscal year

GPS: global positioning system

GS: glide slope

HIRL: high intensity runway edge lighting

IFR: instrument flight rules (FAR Part 91)

ILS: instrument landing system

IM: inner marker

LDA: localizer type directional aid

LDA: landing distance available

LIRL: low intensity runway edge lighting

LMM: compass locator at middle marker

LOM: compass locator at outer marker

LORAN: long range navigation

MALS: medium intensity approach lighting system with indicator lights

MIRL: medium intensity runway edge lighting

MITL: medium intensity taxiway edge lighting

MLS: microwave landing system

MM: middle marker

MOA: military operations area

MSL: mean sea level

NAVAID: navigational aid

NDB: nondirectional radio beacon

NM: nautical mile (6,076.1 feet)

NPES: National Pollutant Discharge Elimination System

NPIAS: National Plan of Integrated Airport Systems

NPRM: notice of proposed rule making

ODALS: omnidirectional approach lighting system

OFA: object free area

OFZ: obstacle free zone

OM: outer marker

PAC: planning advisory committee

PAPI: precision approach path indicator

PFC: porous friction course

PFC: passenger facility charge

PCL: pilot-controlled lighting

PIW public information workshop

PLASI: pulsating visual approach slope indicator

POFA: precision object free area

PVASI: pulsating/steady visual approach slope indicator

PVC: poor visibility and ceiling

RCO: remote communications outlet

RRC: Runway Reference Code

RDC: Runway Design Code

REIL: runway end identification lighting

RNAV: area navigation

RPZ: runway protection zone

RSA: runway safety area

RTR: remote transmitter/receiver

RVR: runway visibility range

RVZ: runway visibility zone

SALS: short approach lighting system

SASP: state aviation system plan

SEL: sound exposure level

SID: standard instrument departure

SM: statute mile (5,280 feet)

SRE: snow removal equipment

SSALF: simplified short approach lighting system with runway alignment indicator lights

STAR: standard terminal arrival route

SWL: runway weight bearing capacity for aircraft with single-wheel tandem type landing gear

TACAN: tactical air navigational aid

TAF: Federal Aviation Administration (FAA) Terminal Area Forecast

TDG: Taxiway Design Group

TLOF: Touchdown and lift-off

TDZ: touchdown zone

TDZE: touchdown zone elevation

TODA: takeoff distance available

TORA: takeoff runway available

TRACON: terminal radar approach control

VASI: visual approach slope indicator

VFR: visual flight rules (FAR Part 91)

VHF: very high frequency

VOR: very high frequency omni-directional range

VORTAC: VOR and TACAN collocated