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 Chandler Municipal Airport (CHD) will primarily consider based aircraft, aircraft operations, and peak activity periods.

The Federal Aviation Administration (FAA) has oversight responsibility to review and approve aviation forecasts developed in conjunction with airport planning studies. FAA will review individual airport forecasts with the objective of comparing them to its *Terminal Area Forecasts* (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 are the result of a top-down model that does not consider local conditions or recent trends. While the TAF forecasts are to be a point of comparison for master plan forecasts, they serve other purposes, such as asset allocation by the FAA.

CHANDLER MUNICIPAL AIRPORT CHD

When reviewing a sponsor's forecast (from the master plan), the FAA must ensure that the forecast is based on reasonable planning assumptions, uses current data, and is developed using appropriate forecast methods. As stated in FAA Order 5090.3C, *Field Formulation of the National Plan of Integrated Airport Systems* (NPIAS), 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 documentation and evaluation 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**: Based aircraft and total operations are considered consistent with the TAF if they meet the following criteria:
    - Forecasts differ by less than 10 percent in the five-year forecast period, and 15 percent in the 10-year forecast period, or
    - Forecasts do not affect the timing or scale of an airport project, or
    - Forecasts do not affect the role of the airport as defined in the current version of FAA Order 5090.3, *Field Formulation of the National Plan of Integrated Airport Systems*.

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.

The following forecast analysis for the airport 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 the airport that will permit airport management to make planning adjustments as necessary to maintain a viable, efficient, and cost-effective facility.

The forecasts for this master plan will utilize a base year of 2019 with a long-range forecast out to 2040.

NATIONAL AVIATION TRENDS

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 the 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 upon preparation of this chapter was FAA *Aerospace Forecasts – Fiscal Years 2019-2039*, published in April 2019. 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. Since the end of the recession in 2009, U.S. airlines revamped 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 three major mergers in five years. The results of these efforts have been impressive: 2018 marked the tenth consecutive year of profitability for the U.S. airline industry. Prior to the COVID-19 pandemic, there was confidence that U.S. airlines have finally transformed from a capital intensive, highly cyclical industry to an industry that generates solid returns on capital and sustained profits.

The biggest factor affecting aviation trends currently is the COVID-19 pandemic. The effect of the pandemic on the aviation industry has been most devastating to the commercial airline operators with segments of the general aviation industry, such as charters, air taxi, and fractionals, appearing to maintain pre-pandemic levels and in many cases, showing increases as people sought alternatives to flying commercial. At this point, uncertainty persists on what the long-term impacts of the pandemic will be on the aviation industry.

ECONOMIC ENVIRONMENT

According to the FAA forecast, the economic growth of the U.S. is projected to increase by 2.9 percent in 2019 and 2.8 percent in 2020. Over the next 20 years, the annual gross domestic product (GDP) of the U.S. is expected to increase by 1.8 percent. U.S. carrier profitability is projected to remain steady or increase as demand supported by a stable economy offsets rising energy and labor costs. Over the long term, the aviation industry is expected to remain competitive and profitable with an increasing demand for air travel and airfares growing more slowly than inflation.

Prior to the COVID-19 pandemic, the economy was recovering from the most serious economic downturn and slow recovery since the Great Depression. Fundamentally, demand for aviation is driven by economic activity. As economic growth picks up, so will growth in aviation activity. Overall, the FAA forecast calls for passenger growth over the next 20 years to average 1.8 percent annually. Oil prices averaged $64 per barrel in 2018, edging down to $61 in 2019, and the forecast assumed continued increases reaching $98 per barrel by the end of the forecast period in 2039. It remains to be seen how the FAA will adjust these projections based on the impacts of COVID-19.

FAA GENERAL AVIATION FORECASTS

The long-term outlook for general aviation is stable to optimistic, as growth at the high-end offsets continuing retirements at the traditional low end of the segment. The active general aviation fleet is forecast to remain relatively stable between 2019 and 2039. 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 forecast.

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.

Table 2A shows the primary general aviation demand indicators as forecast by the FAA. Since the FAA forecast period extends to 2039, the data was extrapolated to generate estimates for 2040 to match up with the long-range period of this master plan.

TABLE 2A
FAA General Aviation Forecast

Demand Indicator	2019	2040*	CAGR
General Aviation Fleet			
Total GA Fleet	213,375	212,065	-0.03%
Total Fixed Wing Piston	142,295	116,266	-0.96%
Total Fixed Wing Turbine	24,895	36,519	1.84%
Total Helicopters	10,895	15,429	1.67%
Total Other (experimental, light sport, etc.)	35,290	43,851	1.04%
General Aviation Operations			
Total GA Operations	26,895,650	28,625,434	0.30%
Local	12,672,345	13,571,495	0.33%
Itinerant	14,223,305	15,053,939	0.27%

* 2040 data was extrapolated since FAA forecasts only go through 2039.
CAGR: compound annual growth rate (2019-2040)
Source: FAA Aerospace Forecast - Fiscal Years 2019-2039

General Aviation Aircraft Fleet Mix

For 2019, the FAA estimated there were 142,295 piston-powered aircraft in the national fleet. The total number of piston-powered aircraft in the fleet is forecast to decline by 0.96 percent from 2019-2040, resulting in 116,266 by 2040. This includes a decline of 1.0 percent annually for single engine pistons and 0.4 percent for multi-engine pistons.

Total turbine aircraft are forecast to grow at an annual growth rate of 1.8 percent through 2040. The FAA estimates there were 24,895 fixed-wing turbine-powered aircraft in the national fleet in 2019, and there will be 36,519 by 2040. This includes annual growth rates of 1.3 percent for turboprops and 2.2 percent for business jets.

Total helicopters are forecast to grow at an annual growth rate of 1.7 percent annually through 2040. The FAA estimates there were 10,895 helicopters in 2019, which are forecast to grow to 15,429 by 2040. This includes annual growth rates of 1.9 percent for piston helicopters and 1.6 percent for turbine helicopters.

The FAA also forecasts experimental aircraft, light sport aircraft, and others. Combined, there were 35,290 other aircraft in 2019 that are forecast to grow to 43,835 by 2040 for an annual growth rate of 1.0 percent.

While the fleet remains level, the number of general aviation operations at towered airports is projected to increase from 26.9 million in 2017 to 30.3 million in 2039 with an average increase of 0.8 percent per year as growth in turbine, rotorcraft, and experimental hours more than offset a decline in fixed-wing piston hours.

General Aviation Operations

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 2040, total general aviation operations are forecast to grow 0.30 percent annually. This includes annual growth rates of 0.33 percent for local general aviation operations and 0.27 percent for itinerant general aviation operations. Itinerant general aviation operations are expected to increase from 14.2 million in 2019 to 15.1 million in 2040. Local general aviation operations are expected to grow from 12.7 million in 2019 to 13.6 million in 2040.

Exhibit 2A presents the historical and forecast U.S. active general aviation aircraft and operations.

General Aviation Aircraft Shipments and Revenue

The 2008-2009 economic recession 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 shown since 2011. **Table 2B** presents historical data related to general aviation aircraft shipments.

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

Year	Total	SEP	MEP	TP	J	Net Billings ($millions)
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	24,129
2016	2,267	890	129	582	666	20,432
2017	2,325	936	149	563	677	20,201
2018	2,443	954	185	601	703	20,564

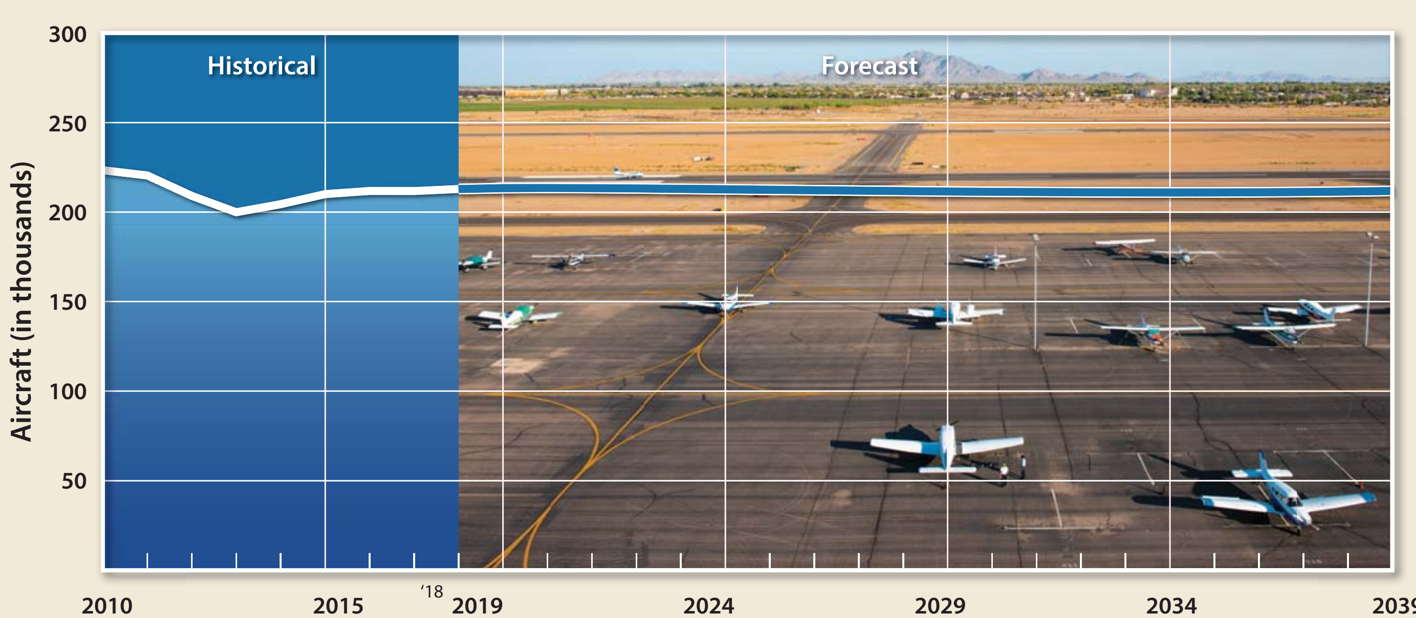
SEP - Single Engine Piston; MEP - Multi-Engine Piston; TP - Turboprop; J - Turbofan/Turbojet
Source: General Aviation Manufacturers Association *2018 Annual Report*

Worldwide shipments of general aviation airplanes increased in 2018 with a total of 2,443 units delivered around the globe compared to 2,325 units in 2017. Worldwide general aviation billings also increased. In 2018, $20.5 billion in new general aviation aircraft were shipped compared to $20.20 billion in 2017.

Business Jets: General aviation manufacturers delivered 703 business jets in 2018, as compared to 677 units in 2017. The industry's continued investment in new products helped maintain the delivery rate for business jets. Nearly two-thirds of business jet shipments were to North American customers in 2018.

U.S. ACTIVE GENERAL AVIATION AIRCRAFT

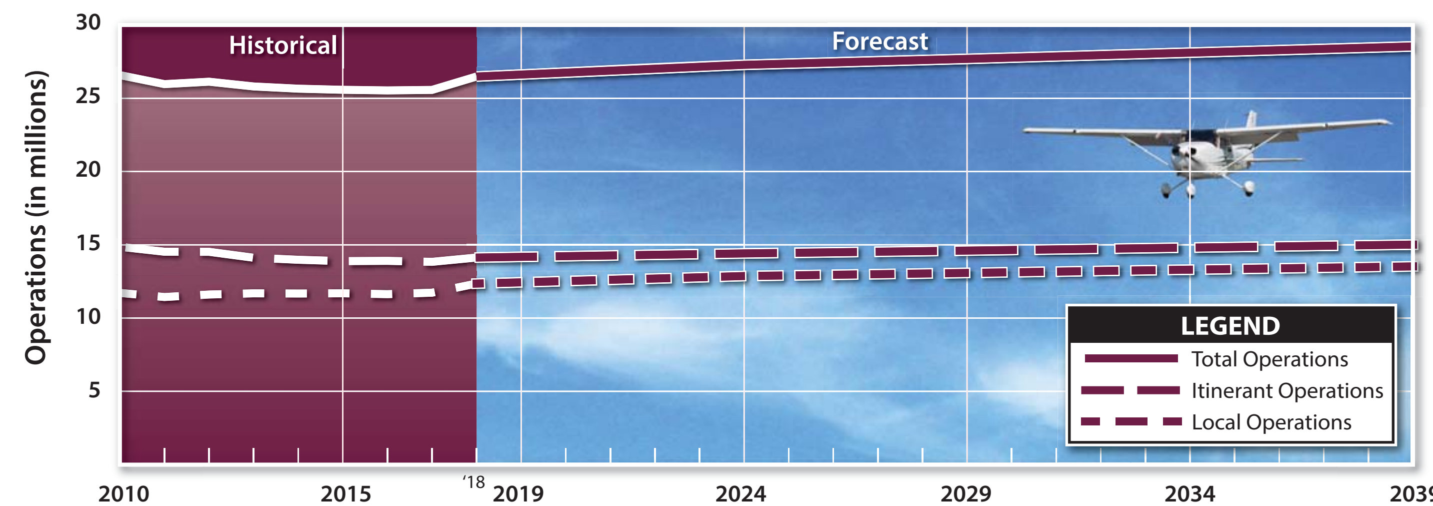
	2018E	2024	2029	2039	AAGR 2019-2039
Fixed Wing					
Piston					
Single Engine	129,885	123,145	116,360	105,195	-1.0%
Multi-Engine	13,040	12,805	12,575	12,085	-0.4%
Turbine					
Turboprop	9,925	10,135	10,770	12,810	1.3%
Turbojet	14,585	17,025	19,110	23,050	2.2%
Rotorcraft					
Piston	3,335	3,775	4,150	4,950	1.9%
Turbine	7,370	8,075	8,700	10,225	1.6%
Experimental					
	27,365	29,465	30,880	33,040	0.9%
Sport Aircraft					
	2,665	3,420	4,100	5,555	3.5%
Other					
	4,715	4,820	4,865	4,890	0.2%
Total Pistons	**146,260**	**139,725**	**133,085**	**122,230**	**-0.9%**
Total Turbines	**31,880**	**35,235**	**38,580**	**46,085**	**1.8%**
Total Fleet	**212,885**	**212,665**	**211,510**	**211,800**	**0.0%**



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 2019-2039*

U.S. GENERAL AVIATION OPERATIONS

	2018E	2024	2029	2039	AAGR 2019-2039
Itinerant					
	14,130,000	14,412,000	14,606,000	15,012,000	0.3%
Local					
	12,354,000	12,870,000	13,081,000	13,526,000	0.3%
Total GA Operations	**26,485,000**	**27,282,000**	**27,687,000**	**28,538,000**	**0.3%**



U.S. AIR TAXI

	2018E	2024	2029	2039	AAGR 2019-2039
Air Taxi/Commuter Operations					
Itinerant	7,126,000	5,484,000	5,752,000	6,361,000	-0.6%

Turboprops: In 2018, 601 turboprop airplanes were delivered to customers around the world, an increase from the 563 that were delivered in 2017. Overall, the turboprop market is still significantly stronger over the past five years compared to years prior to 2011. Approximately 50 percent of turboprop shipments were to North American customers.

Pistons: Single-engine piston deliveries increased slightly from 936 units during 2017 to 954 in 2018. Multi-engine piston deliveries also increased from 149 in 2017 to 185 in 2018. Approximately 62 percent of piston airplane shipments were to North American customers in 2018.

U.S. PILOT POPULATION

There were 633,317 active pilots certificated by the FAA at the end of 2018. All pilot categories, except for rotorcraft-only and recreational-only certificates, continued to increase. With the exception of student pilots and airline transport pilots (ATP), the number of active general aviation pilots is projected to decrease about 13,250 (down 0.2 percent annually) between 2018 and 2039. The ATP category is forecast to increase by 25,755 (up 0.7 percent annually). The FAA has currently suspended the student pilot forecast for the second year in a row.

RISKS TO THE FORECAST

While the FAA is confident that its forecasts for aviation demand and activity can be reached, this is dependent on several factors, including the strength of the global economy, security (including the threat of international terrorism), and oil prices. Higher oil prices could lead to further shifts in consumer spending away from aviation, dampening a recovery in air transport demand.

As stated previously, the rapid spread of the COVID-19 that began in early 2020 now presents a new risk without clear historical precedent. It is not known at this point how the virus will affect aviation in the long-term; however, impacts were felt in 2020 and have carried over into 2021. The long-term impact of COVID-19 on the aviation industry will not be understood until the full spread or intensity of the human consequences, as well as the breadth and depth of possible economic fallout, is known.

FORECASTING APPROACH

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. The most reliable approach to estimating aviation demand is through the utilization of more than one analytical technique. Methodologies frequently considered include trend line/time-series projections, correlation/regression analysis, and market share analysis. The forecast analyst may elect to not use certain techniques depending on the reasonableness of the forecasts produced using other techniques.

Trend line/time-series projections are probably the simplest and most familiar of the forecasting techniques. By fitting growth curves to historical data, 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.

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

Regression analysis measures statistical relationships between dependent and independent variables, yielding a "correlation coefficient." The correlation coefficient (Pearson's "r") measures association between the changes in the dependent variable and the independent variable(s). If the "r^2" value (coefficient determination) is greater than 0.95, it indicates good predictive reliability. A value less than 0.95 may be used, but with the understanding that the predictive reliability is lower.

Market share analysis involves a historical review of the airport 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.

Forecasts will age the farther one is from the base year and the less reliable a forecast may become, particularly due to changing local and national conditions. Nonetheless, the FAA requires that a 20-year forecast be developed for long-range airport planning. Facility and financial planning usually require at least a ten-year view, since it often takes more than five years to complete a major facility development program. However, it is important to use forecasts which do not overestimate revenue-generating capabilities or understate demand for facilities needed to meet public (user) needs.

A wide range of factors is known to influence the aviation industry and can have significant impacts on the extent and nature of aviation activity in both the local and national markets. Historically, the nature and trend of the national economy has had a direct impact on the level of aviation activity. Recessionary periods have been closely followed by declines in aviation activity. Nonetheless, over time, trends emerge and provide the basis for airport planning.

Future facility requirements, such as hangar, apron, and terminal needs, are derived from projections of various aviation demand indicators. Using a broad spectrum of local, regional, and national socioeconomic and aviation information, and analyzing the most current aviation trends, forecasts are presented for the following aviation demand indicators:

- Based Aircraft
- Based Aircraft Fleet Mix
- General Aviation Operations
- Air Taxi and Military Operations
- Operational Peaks

EXISTING FORECASTS

Consideration is given to any forecasts of aviation demand for the airport that have been completed in the recent past. For CHD, the previous forecasts reviewed are those in the FAA *Terminal Area Forecast* (TAF) and the 2007 master plan.

FAA *TERMINAL AREA FORECAST* (TAF February 2019)

On an annual basis, the FAA publishes the TAF for each airport included in the *National Plan of Integrated Airport Systems* (NPIAS). The TAF is a generalized forecast of airport activity used by FAA for internal planning purposes primarily. It is available to airports and consultants to use as a baseline projection and important point of comparison while developing local forecasts. The TAF was published in February 2019 and is based on the federal fiscal year (October-September).

Table 2C presents the 2019 TAF for CHD. It is important to note that the TAF based aircraft count is significantly lower than the current FAA-validated count from the based aircraft registry. The TAF reflects 160 based aircraft, while the registry reflects 441 based aircraft. The total operations count used in the TAF, however, is only 346 operations less than what was reported by the CHD ATCT for 2019 (ATCT reported 220,662 operations in 2019). The FAA may choose to submit the forecasts developed for this master plan to headquarters to update the TAF.

TABLE 2C
2019 FAA Terminal Area Forecast
Chandler Municipal Airport

	2019	2025	2030	2040	CAGR 2019-2040
ANNUAL OPERATIONS					
Itinerant					
Air Carrier	0	0	0	0	--
Air Taxi	2,784	2,784	2,784	2,784	0.0%
General Aviation	68,293	68,706	69,916	72,402	0.3%
Military	213	213	213	213	0.0%
Total Itinerant	71,290	71,703	72,913	75,399	0.3%
Local					
General Aviation	148,964	151,488	153,378	157,233	0.3%
Military	62	62	62	62	0.0%
Total Local	149,026	151,550	153,440	157,295	0.3%
Total Operations	***220,316***	***223,253***	***226,353***	***232,694***	0.3%
BASED AIRCRAFT					
Based Aircraft	***160***	***193***	***224***	***301***	3.1%

Source: FAA Terminal Area Forecast (TAF), February 2019

The TAF for CHD shows total operations increasing from 220,316 annually to 232,694 by 2040 for an annual growth rate of 0.3 percent. Air taxi and military categories show a flat-line projection. CHD does not report any air carrier operations now or in the future. Based aircraft are projected in the TAF to grow at a CAGR of 3.1 percent through 2040 adding 141 new planes.

PREVIOUS FORECASTS

Forecasts of aviation activity at CHD were previously prepared within the 2007 Airport Master Plan and the 2018 *Arizona State Aviation System Plan* (SASP). **Table 2D** summarizes both forecasts of operations and based aircraft at CHD. Regarding the previous master plan, the CHD ATCT counts for 2019 report a total of 220,662 operations and the based aircraft count is at 441, which are lower than the base year of the last master plan. As has been previously noted, since the completion of the previous master plan, a national recession caused a significant reduction in aviation activity not only at CHD but across the country. As a result, the projections from the previous master plan are no longer relevant.

TABLE 2D
Previous Forecasts
Chandler Municipal Airport

Year	Itinerant Operations	Local Operations	Total Operations	Based Aircraft
2007 Airport Master Plan (2005 Base Year)				
2005	65,606	169,505	235,111	457
2010	74,939	193,661	268,600	515
2015	85,625	221,275	306,900	581
2020	97,817	252,783	350,600	656
2025	111,767	288,833	400,600	740
2018 *Arizona State Aviation System Plan* Update (2016 Base Year)				
2016	78,750	142,180	220,930	440
2021	89,880	162,290	252,170	481
2026	102,590	185,230	287,820	524
2036	133,650	241,310	374,960	619

Sources: 2007 Master Plan; 2018 Arizona State Aviation System Plan Update

The SASP projections were prepared more recently accounting for the effects of the recession. The SASP forecasted operations to grow by approximately 32,000 and based aircraft to grow by 41 by 2021. Through 2019, activity at CHD has not met these projections with operations remaining relatively static in the 220,000 range and the number of based aircraft declining from the figure reported for 2016 in the SASP. Based on recent activity trends at CHD and the time that has passed since the preparation of these previous forecasts, it is necessary to develop new forecasts utilizing the most current information available.

GENERAL AVIATION FORECASTS

General aviation encompasses all portions of civil aviation except commercial service and military operations. To determine the types and sizes of facilities that should be planned to accommodate general aviation activity at the airport, certain elements of this activity must be forecast. These indicators of general aviation demand include based aircraft, aircraft fleet mix, operations, and annual operations.

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 demand indicators 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. An initial forecast of county-wide registered aircraft is developed and will be used as one data point to arrive at a based aircraft forecast for the airport.

BASED AIRCRAFT FORECAST

Forecasts of based aircraft may directly influence needed facilities and the applicable design standards. The needed facilities may include hangars, aprons, taxilanes, etc. The applicable design standards may include separation distances and object-clearing surfaces. The size and type of based aircraft are also an important consideration. The addition of numerous small aircraft may have no effect on design standards, while the addition of a few larger business jets can have a substantial impact on applicable design standards.

Because of the numerous variables known to influence aviation demand, several separate forecasts of based aircraft are developed. Each of the forecasts is then examined for reasonableness and any outliers are discarded or given less weight. The remaining forecasts collectively will create a planning envelope. A single planning forecast is then selected for use in developing facility needs for the airport. The selected forecast of based aircraft can be one of the several forecasts developed or, based on the experience and judgement of the forecaster, it can be a blend of the forecasts.

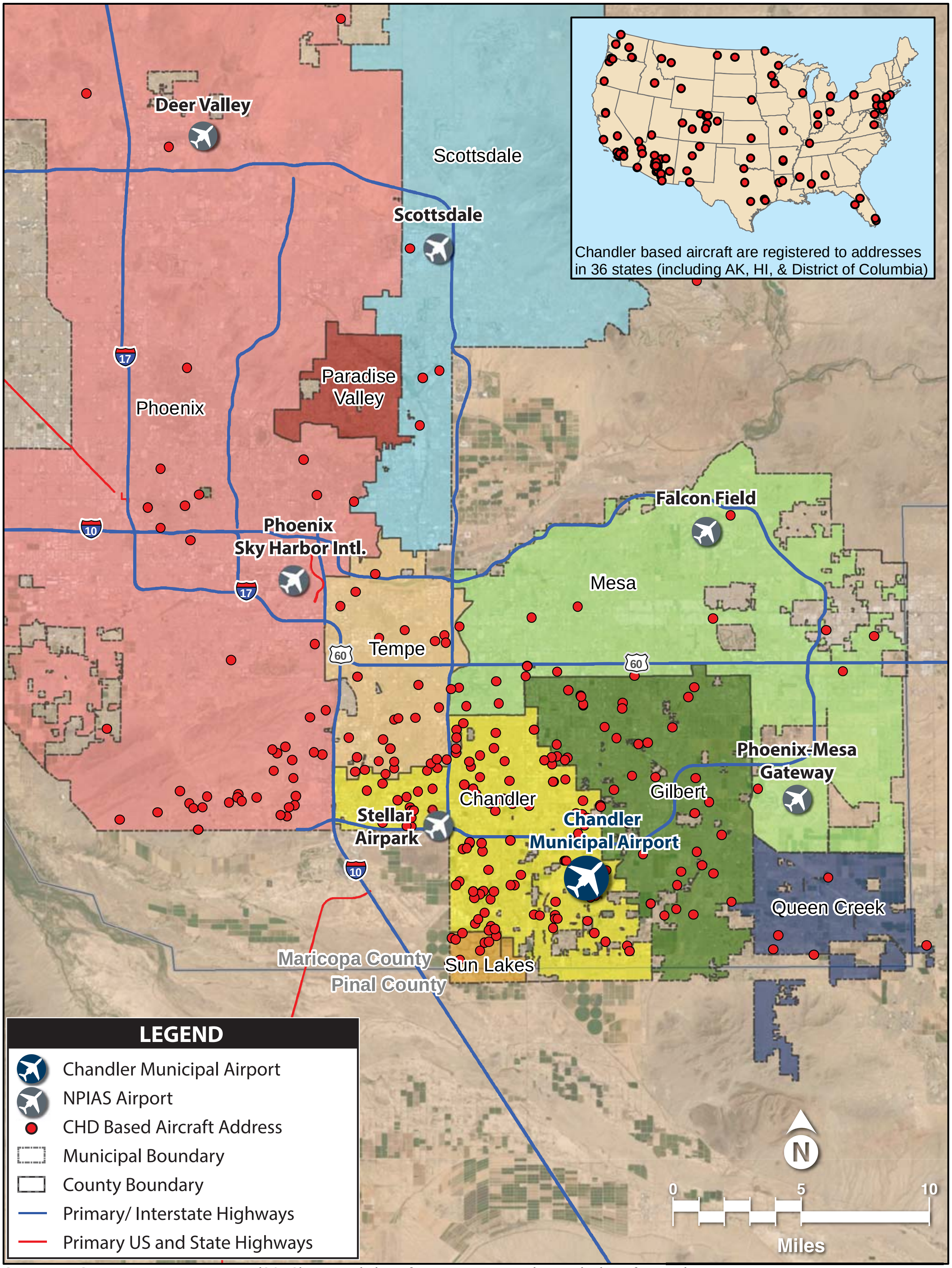
Based Aircraft Inventory

Documentation of the historical number of based aircraft at the airport has been somewhat intermittent. For many years, the FAA did not require airports to report the number of based aircraft. It is only in recent years that the FAA has established a based aircraft inventory in which it is possible to cross-reference based aircraft claimed by one airport with other airports. The FAA is now utilizing this based aircraft inventory as a baseline for determining how many and what type of aircraft are based at any individual airport. This database evolves daily as aircraft are added or removed, and it does not provide an annual history of based aircraft. It is the responsibility of the sponsor (owner) of each airport to input based aircraft information into the FAA database (www.basedaircraft.com).

Airport staff has undertaken a comprehensive physical count and submitted the count to the FAA for validation. The FAA has validated 441 based aircraft (including helicopters) at CHD. The mix of aircraft is comprised of 379 single-engine pistons, 26 multi-engine piston aircraft, six (6) multi-engine turboprops, eight (8) business jets, and 22 helicopters.

As shown on **Exhibit 2B**, based aircraft at CHD are registered to addresses spread throughout the Phoenix metropolitan area and across 36 different states throughout the country. Approximately 74 percent of based aircraft at CHD are registered to addresses in the metropolitan area. Within the communities that make up the metropolitan area, based aircraft are distributed as follows:

- Chandler – 137
- Gilbert – 48
- Phoenix – 46
- Tempe – 31



Source: ESRI Basemap Imagery (2018), BasedAircraft.com, FAA Registered Aircraft Database

Exhibit 2B
BASED AIRCRAFT DISTRIBUTION

- Mesa – 23
- Sun Lakes – 9
- Scottsdale – 6
- Queen Creek – 3

Despite competing with five other reliever airports[1] and five general aviation airports[2] in the region, CHD has managed to attract users from across the metropolitan area. For this reason, the Phoenix metropolitan area is considered CHD's based aircraft service area for purposes of this study.

Registered Aircraft Forecast

Aircraft ownership trends for the primary service area (Phoenix metropolitan area) typically dictate the based aircraft trends for an airport. Since aircraft registration data is only available at the county level, aircraft registration data from Maricopa County will be used to represent the service area. The metropolitan area also extends into Pinal County; however, the overwhelming majority of based aircraft are registered within Maricopa County, so Pinal County has been excluded. As such, a forecast of registered aircraft in Maricopa County is developed for use as an input to the subsequent based aircraft forecast.

In addition to the projections summarized below, several regressions were also prepared considering independent variables ranging from population, income, and employment. None of the resulting regressions produced an r^2 value of better than 0.70, which indicates poor correlation. Therefore, the regressions were not included in the discussion to follow.

Table 2E presents the history of registered aircraft in Maricopa County from 2009 through 2019. These figures are derived from the FAA aircraft registration database that categorizes 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.

Over the ten-year period, aircraft registrations in Maricopa County have declined from almost 5,000 in 2009 to 3,744 in 2019, a drop of 24.9 percent. The fleet mix breakout shows that single-engine piston aircraft, while still accounting for most registered aircraft, has dropped by the largest total number of aircraft. The multi-engine piston category has dropped by the largest percentage (42.2 percent), which matches the national trend. Jet aircraft is the only category that had growth over the period, growing from 296 in 2009 to 305 in 2019. Like most areas of the country, the decline in registered aircraft since 2009 is in part attributable to two primary factors: the impact of the 2008-2009 recession and FAA's re-registration process, which took place between 2010 and 2013. Now that the actual number of registered aircraft has been identified, several projections of future registered aircraft are considered for the 20-year planning horizon.

[1] Falcon Field; Scottsdale Airport; Glendale Municipal; Phoenix Goodyear; and Phoenix Deer Valley
[2] Stellar Airpark; Memorial Airfield; Sky Ranch; Pleasant Valley Airport; and Buckeye Municipal

TABLE 2E
Registered Aircraft Fleet Mix in Maricopa County
Chandler Municipal Airport

Year	Single-Engine Piston	Multi-Engine Piston	Turboprop	Jet	Helicopter	Total
2009	3,723	438	160	296	370	4,987
2010	3,680	439	141	288	351	4,899
2011	3,608	419	130	293	353	4,803
2012	3,215	360	137	314	302	4,328
2013	2,937	337	142	337	265	4,018
2014	2,927	332	134	204	257	3,854
2015	2,949	314	130	220	242	3,855
2016	3,006	316	157	249	246	3,974
2017	3,005	302	139	261	250	3,957
2018	2,824	254	153	274	231	3,736
2019	2,831	253	139	305	216	3,744
10 year % Change	-24.0%	-42.2%	-13.1%	3.0%	-41.6%	-24.9%
Compound Annual Growth Rate from 2009 to 2019:						**-2.8%**

Source: FAA Aircraft Registry Database; FAA Census of U.S. Civil Aircraft

Trend Line/Historic Growth Rate Projection

Utilizing the last 10 years of registered aircraft data, a trendline projection was completed. This resulted in 822 registered aircraft by 2040 (-2.83% CAGR). A five-year trend projection was also prepared, which eliminates years (2010-2013) when there were fluctuations due to the FAA changing aircraft registration requirements. The five-year trendline projection results in 3,233 registered aircraft by 2040 (-0.7% CAGR).

Over the last five years, the number of registered aircraft in Maricopa County has a CAGR of -0.6 percent. By applying this CAGR to the current number of registered aircraft, a forecast emerges resulting in 3,315 by 2040.

Share of U.S. Active General Aviation Aircraft

Maricopa County's 3,744 registered aircraft in 2019 represents approximately 1.755 percent of the U.S. active general aviation fleet of aircraft. If the county maintained a constant market share, it would result in 3,721 registered aircraft by 2040 (-0.03% CAGR). Since the historic trend reflects a decreasing market share, another projection that maintains this trend was prepared, which results in registered aircraft declining to 2,718 by 2040 (-1.51% CAGR). The market share of U.S. active general aviation aircraft projections is included in **Table 2F**.

TABLE 2F
Registered Aircraft Projections – Market Share of U.S. Active GA Aircraft
Chandler Municipal Airport

Year	Registered Aircraft	U.S. Active GA Aircraft	% of U.S. Active GA Aircraft
2009	4,987	223,876	2.228%
2010	4,899	223,370	2.193%
2011	4,803	220,453	2.179%
2012	4,328	209,034	2.070%
2013	4,018	199,927	2.010%
2014	3,854	204,408	1.885%
2015	3,855	210,031	1.835%
2016	3,974	211,794	1.876%
2017	3,957	211,757	1.869%
2018	3,736	212,885	1.755%
2019	3,744	213,375	1.755%
Constant Market Share			
2025	3,728	212,435	1.755%
2030	3,709	211,355	1.755%
2040	3,721	212,065	1.755%
Decreasing Market Share			
2025	3,476	212,435	1.636%
2030	3,209	211,355	1.518%
2040	2,718	212,065	1.282%

Sources: FAA Aerospace Forecasts 2019-2039; Coffman Associates analysis

Ratio of Registered Aircraft to Population

The number of registered aircraft in an area often fluctuates based upon population trends. In 2019, Maricopa County had 0.86 registered aircraft per 1,000 residents. Over the past 10 years, this ratio has declined slightly as a result of a growing population and a decline in total registered aircraft. Two projections have been prepared based upon maintaining the current ratio constant over the forecast period and continuing the trend of a declining ratio. Maintaining the constant ratio (0.86) through 2040 results in 4,896 registered aircraft (1.29% CAGR). A decreasing ratio projection is a more likely scenario since population growth typically outpaces registered aircraft growth. This scenario results in 4,175 registered aircraft by 2040 (0.52% CAGR).

Registered Aircraft Forecast Summary

Table 2G summarizes the seven registered aircraft forecasts for Maricopa County. Five of the seven resulted in a declining CAGR, which based on recent history is not an unreasonable scenario. However, since the end of 2013, which is when the effects of the FAA's new aircraft registration requirements were most greatly felt, registrations have had as many years of increasing numbers as decreasing (three up and three down). The down years were much more drastic than the up years, but it also provides some confidence that aircraft registrations may be stabilizing with potential to grow in the future assuming population growth occurs as forecast and economic conditions continue to improve. As mentioned, it is common for population growth to outpace registered aircraft growth; therefore, for this reason, the decreasing ratio of registered aircraft per 1,000 population will be carried forward as the selected forecast. This modestly optimistic forecast results in 3,841 registered aircraft in 2025; 3,935 in 2030, and 4,175 in 2040.

TABLE 2G
Registered Aircraft Forecast Summary
Chandler Municipal Airport

Projection Sources	2025	2030	2040	CAGR 2019-2040
5-Year Trend	3,629	3,497	3,233	-0.70%
10-Year Trend	2,768	2,119	822	-6.97%
5-Year Growth Rate	3,616	3,513	3,315	-0.58%
Constant % of U.S. Active Aircraft	3,728	3,709	3,721	-0.03%
Decreasing % of U.S. Active Aircraft	3,476	3,209	2,718	-1.51%
Constant Aircraft per 1,000 Population	4,098	4,378	4,896	1.29%
Decreasing Aircraft per 1,000 Population	**3,841**	**3,935**	**4,175**	**0.52%**

Boldface indicates selected forecast.
CAGR: Compound annual growth rate
Source: Coffman Associates analysis

Based Aircraft Market Share of Registered Aircraft Forecast

Utilizing the forecast of registered aircraft in Maricopa County, a market share forecast of based aircraft at CHD has been developed. In 2019, the 441 aircraft based at CHD represented 11.78 percent of the aircraft registered in Maricopa County. By maintaining this market share as a constant through the planning years, a forecast emerges resulting in 492 based aircraft by 2040 (0.5% CAGR). An evaluation of various historical points (2005, 2009, and 2016) indicates that CHD's market share has grown slightly over time. Therefore, an increasing market share projection was also prepared with the assumption that this historic trend would continue to the point that CHD's market share would reach 16 percent of county registrations. This increasing share projection results in 668 based aircraft by 2040 (2.0% CAGR). **Table 2H** presents the two market share projections.

TABLE 2H
Based Aircraft Market Share of Registered Aircraft Forecast
Chandler Municipal Airport

Year	CHD Based Aircraft	Maricopa County Registered Aircraft	CHD Market Share %
2005	457	4,825	9.47%
2009	378	4,987	7.58%
2016	440	3,974	11.07%
2019	441	3,744	11.78%
Constant Market Share			
2025	452	3,841	11.78%
2030	463	3,935	11.78%
2040	492	4,175	11.78%
Increasing Market Share			
2025	493	3,841	12.83%
2030	547	3,935	13.89%
2040	668	4,175	16.00%

Source: Coffman Associates analysis

Statewide TAF Growth Rate Projection

For all NPIAS airports in Arizona, the FAA projects an annual growth rate in based aircraft of 1.49 percent. Assuming CHD's based aircraft count increases at the state's TAF rate, the count would reach 602 by 2040 (1.49% CAGR).

Historic Growth Rate Projection

According to based aircraft records, CHD's count has grown in the last 10 years from 378 in 2009 to 441 in 2019, which is a CAGR of 1.56 percent. Assuming CHD maintains this growth rate over the course of the forecast period, the count grows to 610 by 2040.

Socioeconomic Growth Projections

Based aircraft growth is often related to population and economic activity of the service area. For this reason, based aircraft projections tied to projected growth in population, employment, and gross regional product (GRP) for Maricopa County were also prepared. Through 2040, population in the county is projected to increase at a CAGR of 1.29 percent; employment is projected to have a CAGR of 1.79 percent; and GRP is projected to have a CAGR of 2.68 percent. Applying these CAGRs result in 577 based aircraft for population, 640 for employment, and 769 for GRP by 2040.

Selected Based Aircraft Forecast

Selecting a based aircraft forecast is ultimately based on the judgement of the forecast analyst. A selected forecast should be reasonable and based upon a sound methodology. The methodology presented in this analysis first examines the history of aircraft ownership in Maricopa County, the primary based aircraft service area. Utilizing the selected registered aircraft projection, a market share analysis was conducted based upon maintaining a constant market share and an increasing market share over the forecast period. Additional projections considered the FAA TAF's projection for based aircraft growth in the state, maintaining CHD's 10-year growth rate, and growth rates based on key socioeconomic indicators (population, employment, and GRP). Each of these seven projections are summarized in **Table 2J**.

Another important consideration is whether an airport has a hangar waiting list, which indicates what the current demand level is for new based aircraft. CHD maintains a current waiting list for hangar space that includes 112 individuals. Waiting lists are not verified so the actual demand is likely less than the total number of names on the list; however, this number indicates strong demand for new based aircraft. The selected based aircraft forecast should account for this potential growth plus room for additional demand that is not represented on the waiting list.

As has been mentioned previously, based aircraft levels are typically tied to economic conditions and availability of hangar space. CHD will likely not see significant based aircraft growth unless new hangar facilities are constructed. CHD has ample developable property for new hangars both on the north and south sides of the airfield so the potential for available hangar space should not be a limiting factor in future based aircraft levels. Economic conditions within the county are also projected to increase at strong rates. Therefore, the employment growth rate projection has been selected as the preferred forecast. The selected forecast is reasonably optimistic and assumes CHD can continue to gain market share of registered aircraft in the county and that continued employment growth in the local area will drive demand for more based aircraft.

Exhibit 2C graphically presents the seven based aircraft forecasts that comprise the planning envelope.

TABLE 2J
Based Aircraft Forecast Summary
Chandler Municipal Airport

Projection	2025	2030	2040	2019-2040 CAGR
10-Year Growth Rate	484	522	610	1.56%
Constant Market Share of County Registrations	452	463	492	0.52%
Increasing Market Share of County Registrations	493	547	668	2.00%
State TAF Growth Rate	482	519	602	1.49%
County Population Growth Rate	476	508	577	1.29%
County GRP Growth Rate	517	590	769	2.68%
County Employment Growth Rate	**490**	**540**	**640**	**1.79%**

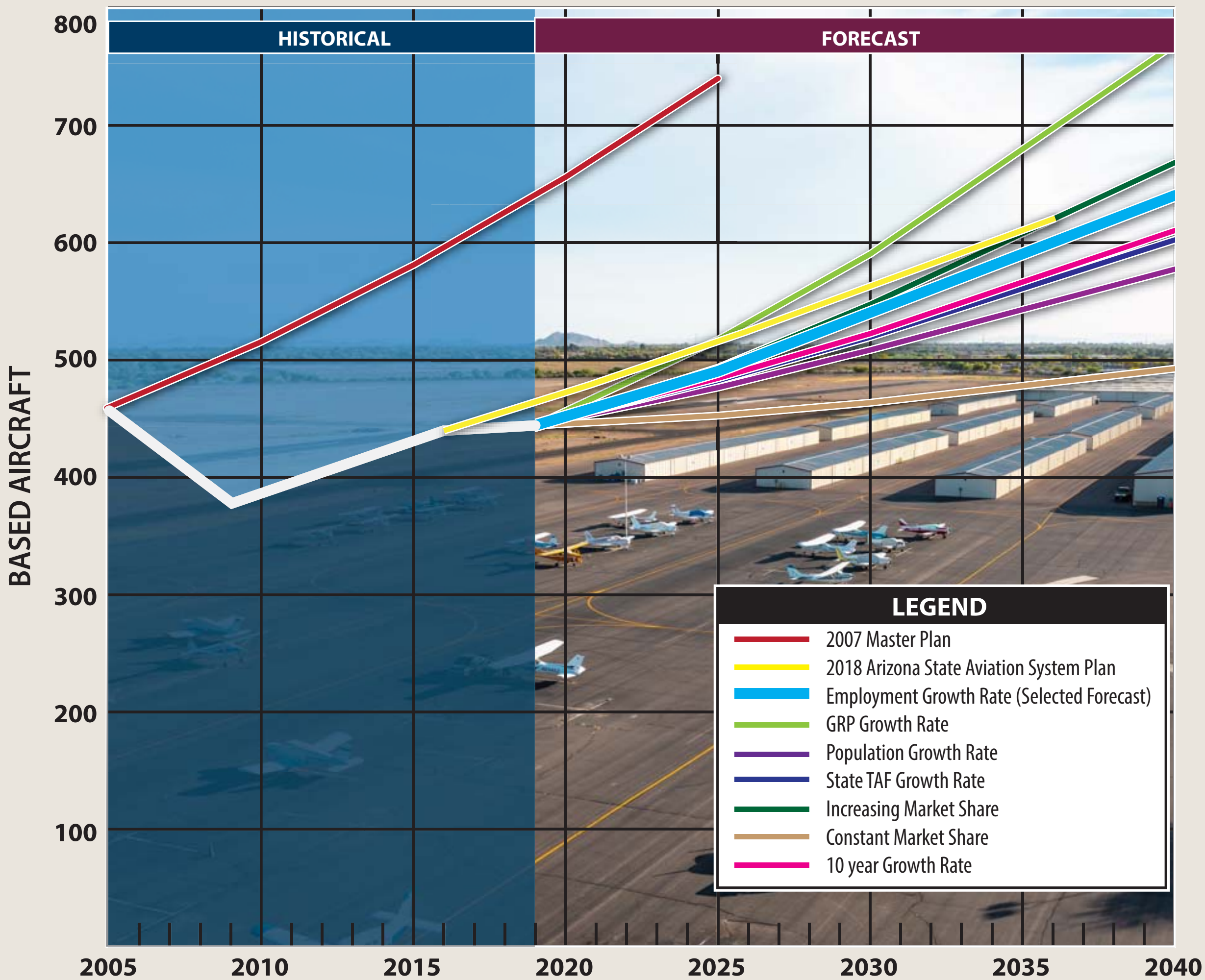
Boldface indicates selected forecast.
CAGR: Compound annual growth rate
Source: Coffman Associates analysis

BASED AIRCRAFT FLEET MIX FORECAST

It is important to understand the current and projected based aircraft fleet mix at an airport to ensure the planning of proper facilities. For example, the addition of one or several larger turboprop or business jet aircraft to the airfield can have a significant impact on the separation requirements and the various obstacle-clearing surfaces.

The current based aircraft fleet mix consists of 379 single-engine pistons, 26 multi-engine pistons, six turboprops, eight jets, and 22 helicopters. As a general aviation reliever airport with a significant level of flight training activities, CHD should continue to have a high level of piston-powered aircraft and helicopters; however, turbine aircraft are also becoming more prevalent. The forecasted growth trends in the CHD-based aircraft fleet mix are consistent with FAA projections of the national general aviation fleet mix. **Table 2K** presents the forecast fleet mix for based aircraft at CHD.

Based Aircraft



Based Aircraft Fleet Mix

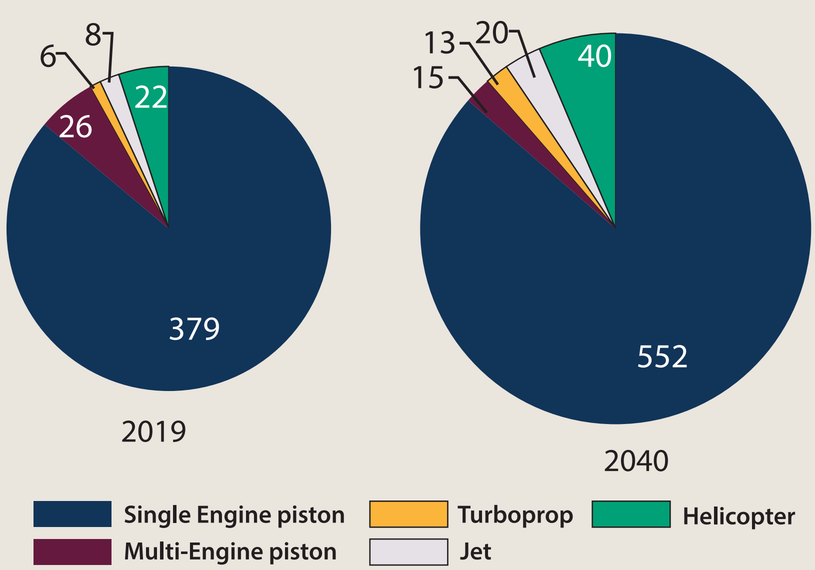


TABLE 2K
Based Aircraft Fleet Mix
Chandler Municipal Airport

Aircraft Type	2019[1]	Percent	2025	Percent	2030	Percent	2040	Percent
SEP	379	85.9%	424	86.5%	469	86.9%	552	86.3%
MEP	26	5.9%	24	4.9%	20	3.7%	15	2.3%
Turboprop	6	1.4%	7	1.4%	9	1.7%	13	2.0%
Jet	8	1.8%	10	2.0%	13	2.4%	20	3.1%
Helicopters	22	5.0%	25	5.1%	29	5.4%	40	6.3%
Total	441	100.0%	490	100.0%	540	100.0%	640	100.0%

SEP – Single-Engine Piston
MEP – Multi-Engine Piston
Sources: 2019 fleet mix - FAA Based Aircraft Registry; Projections - Coffman Associates analysis

OPERATIONS FORECAST

Operations at CHD are classified as either general aviation, air taxi, or military. General aviation operations include a wide range of activity from recreational use and flight training to business and corporate uses. Air taxi operations are those conducted by aircraft operating under FAR Part 135, otherwise known as "for-hire" or "on-demand" activity. Air taxi operations typically include commuter, air cargo, air ambulance, and many fractional ownership operations. Military operations include those operations conducted by various branches of the U.S. military.

It should be noted that the FAA's forecast of air taxi operations is lower than historic levels due to ongoing changes to the scheduled airline aircraft fleet mix. Airlines are transitioning away from 50-seat regional jets that are counted under the air taxi category to larger jets with seating capacities of 60 seats or more that are counted under the air carrier category. This airline fleet mix transition should have no impact on CHD air taxi operations.

Aircraft operations are further classified as local and itinerant. A local operation is a takeoff or landing performed by an aircraft that operates within sight of an airport, or which executes simulated approaches or touch-and-go operations at an airport. Generally, local operations are characterized by training activity. Itinerant operations are those performed by aircraft with a specific origin or destination away from an airport. Typically, itinerant operations increase with business and commercial use since business aircraft are used primarily to transport passengers from one location to another.

Several methods have been employed to develop a reasonable planning envelope. The following sections present several new operations forecasts. Counts from the CHD airport traffic control tower (ATCT) were utilized in this analysis.

Historic Growth Rate Projections

CHD's ATCT count indicate CAGRs of 0.3 percent for itinerant general aviation operations, 0.9 percent for local general aviation operations, and 3.4 percent for air taxi operations. Assuming these rates remain constant over the forecast period results in 2040 operations projections of 72,200 (itinerant general aviation), 181,900 (local general aviation), and 6,100 (air taxi).

Market Share Projections

Market share analysis compares known historical and forecast data points to arrive at a trend for the unknown variable (CHD operations). The first forecast considers the current market share of general aviation (itinerant and local) and air taxi operations at the airport as compared to the FAA national forecast for operations at towered airports. In 2019, CHD accounted for 0.476 percent of U.S. itinerant general aviation operations; 1.182 percent of U.S. local general aviation operations; and 0.042 percent of U.S. air taxi operations. By carrying these percentages forward to the plan years, a constant market share forecast emerges. **Table 2L** shows the results. The constant market share is considered a low-range projection since the historic data indicates that CHD's market share for each operational category is growing.

To carry forward historic trends, a mid-range increasing market share projection was prepared. The mid-range projection takes CHD's 2040 market share of itinerant general aviation operations to 0.580 percent, which is its 10-year high. CHD's 2040 market share of local general aviation operations is taken to 1.230 percent, which is also a 10-year high. CHD's 2040 market share of air taxi operations is taken to 0.061 percent, which reflects the increase in market share experienced between 2009 and 2019. The results of the mid-range projections are also shown on **Table 2L**.

High-range increasing market share projections were also prepared, which consider the potential for operations to exceed the peak periods and growth rates of the past ten years. The resulting projections take CHD's 2040 market shares to 0.600 percent (itinerant general aviation), 1.457 percent (local general aviation), and 0.080 percent (air taxi). The results of the high-range projections are shown on **Table 2L**.

TABLE 2L
Operations Market Share Projections
Chandler Municipal Airport

Year	General Aviation Itinerant			General Aviation Local			Air Taxi		
	CHD	U.S.	CHD Market %	CHD	U.S.	CHD Market %	CHD	U.S.	CHD Market %
2010	57,122	14,863,856	0.384%	106,197	11,716,274	0.906%	2,041	9,410,381	0.022%
2011	60,891	14,527,903	0.419%	98,068	11,437,028	0.857%	2,168	9,278,542	0.023%
2012	72,816	14,521,656	0.501%	121,951	11,608,306	1.051%	2,490	8,994,371	0.028%
2013	77,234	14,117,424	0.547%	131,231	11,688,301	1.123%	2,430	8,803,412	0.028%
2014	76,702	13,978,996	0.549%	138,887	11,675,040	1.190%	1,852	8,439,713	0.022%
2015	80,604	13,886,711	0.580%	137,425	11,691,338	1.175%	1,707	7,894,945	0.022%
2016	77,860	13,904,397	0.560%	141,586	11,632,078	1.217%	1,749	7,579,584	0.023%
2017	71,440	13,838,029	0.516%	119,204	11,731,596	1.016%	3,215	7,179,301	0.045%
2018	73,107	14,130,495	0.517%	151,972	12,354,014	1.230%	3,148	7,125,556	0.044%
2019	67,647	14,223,305	0.476%	149,754	12,672,345	1.182%	2,990	7,196,959	0.042%
Constant Market Share - Low Range									
2025	68,700	14,450,204	0.476%	152,600	12,911,636	1.182%	2,300	5,534,735	0.042%
2030	69,700	14,645,457	0.476%	155,100	13,124,605	1.182%	2,400	5,809,266	0.042%
2040	71,600	15,053,939	0.476%	160,400	13,571,495	1.182%	2,700	6,426,228	0.042%
CAGR	0.27%			0.33%			-0.48%		
Increasing Market Share - Mid Range									
2025	72,500	14,450,204	0.502%	154,100	12,911,636	1.194%	3,400	5,534,735	0.061%
2030	77,300	14,645,457	0.528%	158,300	13,124,605	1.206%	3,600	5,809,266	0.061%
2040	87,400	15,053,939	0.580%	166,900	13,571,495	1.230%	3,900	6,426,228	0.061%
CAGR	1.23%			0.52%			1.27%		
Increasing Market Share - High Range									
2025	73,200	14,450,204	0.507%	161,500	12,911,636	1.251%	3,900	5,534,735	0.070%
2030	78,800	14,645,457	0.538%	173,200	13,124,605	1.319%	4,400	5,809,266	0.075%
2040	90,300	15,053,939	0.600%	197,700	13,571,495	1.457%	5,100	6,426,228	0.080%
CAGR	1.38%			1.33%			2.58%		

CAGR – Compound Annual Growth Rate
Source: U.S. Operations – FAA Aerospace Forecasts 2019-2039 (2040 extrapolated); Historic CHD operations – CHD ATCT counts; CHD projections - Coffman Associates analysis.

Statewide TAF Growth Rate Forecast

FAA Order 5090.3C, *Field Formulation of the NPIAS,* provides a method for estimating future operations at an airport by applying the statewide TAF growth rate. While this is typically used for non-towered airports, it does provide a useful method for checking the reasonableness of other forecasts and, if determined to be the most reasonable, can be the selected forecast. For all NPIAS airports in Arizona, the FAA projects an annual growth rate of 0.16 percent for itinerant general aviation operations, 0.44 percent for local general aviation operations, and 0.57 percent for air taxi operations in the state. Applying these growth rates results in projections taking CHD's 2040 operations to 70,000 (itinerant general aviation), 164,300 (local general aviation), and 3,400 (air taxi).

Operations Forecast Summary

Table 2M summarizes each of the new projections prepared for itinerant and local general aviation operations and air taxi operations at CHD. The selected forecasts for each category represent healthy yet modest growth scenarios for CHD in which itinerant general aviation operations grow to 87,400 by 2040; local general aviation operations grow to 181,900 by 2040; and air taxi operations grow to 5,100 by 2040. **Exhibit 2D** graphically presents the operations projections that comprise the planning envelope. The FAA TAF is included for comparison.

TABLE 2M
Operations Forecast Summary
Chandler Municipal Airport

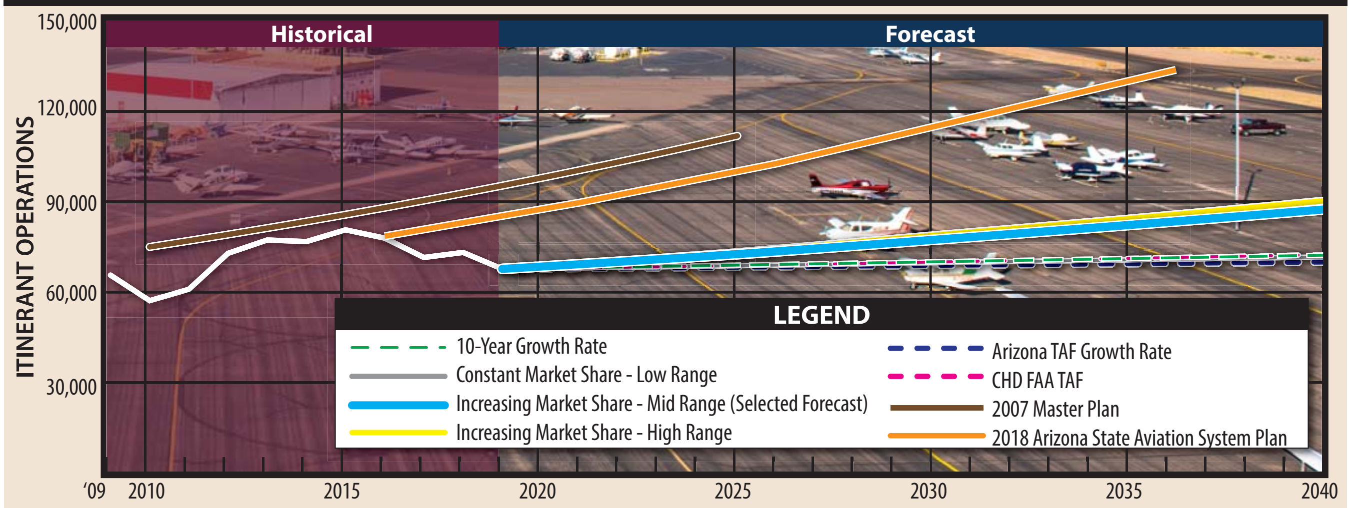
Projections	2019	2025	2030	2040	2019-2040 CAGR
Itinerant General Aviation					
10-Year Growth Rate	67,647	68,900	70,000	72,200	0.31%
Constant Market Share – Low-Range		68,700	69,700	71,600	0.27%
Increasing Market Share – Mid-Range		**72,500**	**77,300**	**87,400**	**1.23%**
Increasing Market Share – High-Range		73,200	78,800	90,300	1.38%
Arizona 2019 TAF Growth Rate		68,300	68,900	70,000	0.16%
CHD 2019 TAF		68,706	69,916	72,402	0.32%
Local General Aviation					
10-Year Growth Rate	149,754	**158,300**	**165,800**	**181,900**	**0.93%**
Constant Market Share – Low-Range		152,600	155,100	160,400	0.33%
Increasing Market Share – Mid-Range		154,100	158,300	166,900	0.52%
Increasing Market Share – High-Range		161,500	173,200	197,700	1.33%
Arizona 2019 TAF Growth Rate		153,800	157,200	164,300	0.44%
CHD 2019 TAF		151,488	153,378	157,233	0.23%
Air Taxi					
10-Year Growth Rate	2,990	3,700	4,300	6,100	3.45%
Constant Market Share – Low-Range		2,300	2,400	2,700	-0.48%
Increasing Market Share – Mid-Range		3,400	3,600	3,900	1.27%
Increasing Market Share – High-Range		**3,900**	**4,400**	**5,100**	**2.58%**
Arizona 2019 TAF Growth Rate		3,100	3,200	3,400	0.61%
CHD 2019 TAF		2,784	2,784	2,784	-0.34%

Boldface indicates selected forecast
CAGR – Compound Annual Growth Rate
Source: Coffman Associates Analysis

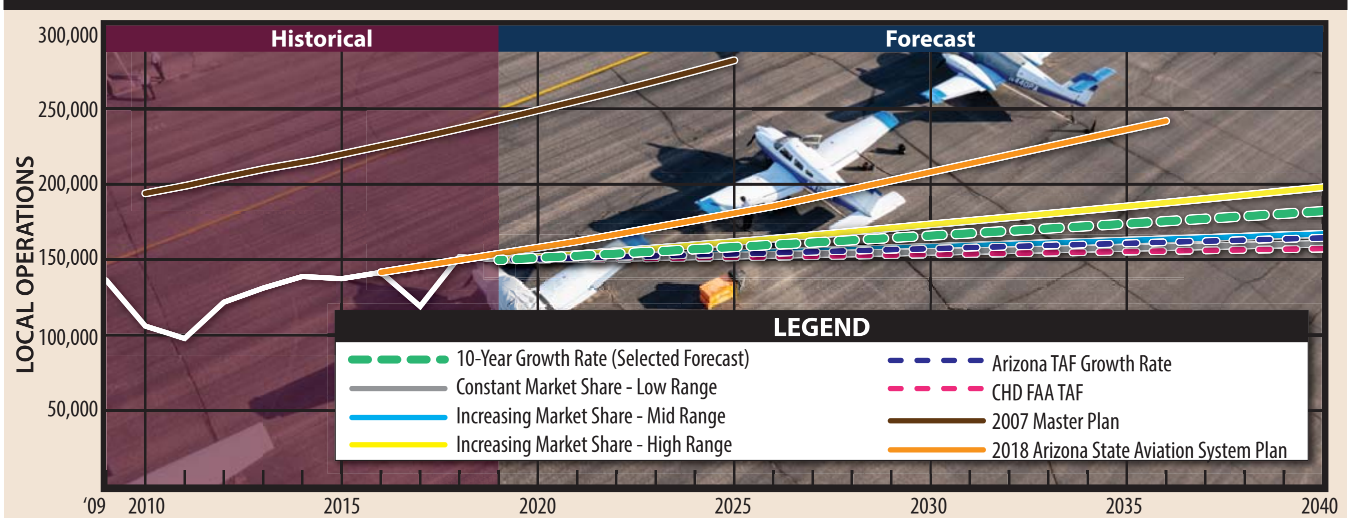
Military Operations Forecast

Military aircraft can and do utilize civilian airports across the country. CHD does, on occasion, have activity by military aircraft. Forecasts of military activity are inherently difficult to predict because of the national security nature of their operations and the fact that their missions can change without notice. Thus, it is typical for the FAA to use a flat-line forecast for military operations. For CHD, the FAA TAF projects itinerant military and local military operations to remain static at 213 and 62, respectively, over the forecast period. These TAF estimates are also utilized for the master plan forecast.

GENERAL AVIATION ITINERANT OPERATIONS FORECASTS



GENERAL AVIATION LOCAL OPERATIONS FORECASTS



AIR TAXI OPERATIONS FORECASTS

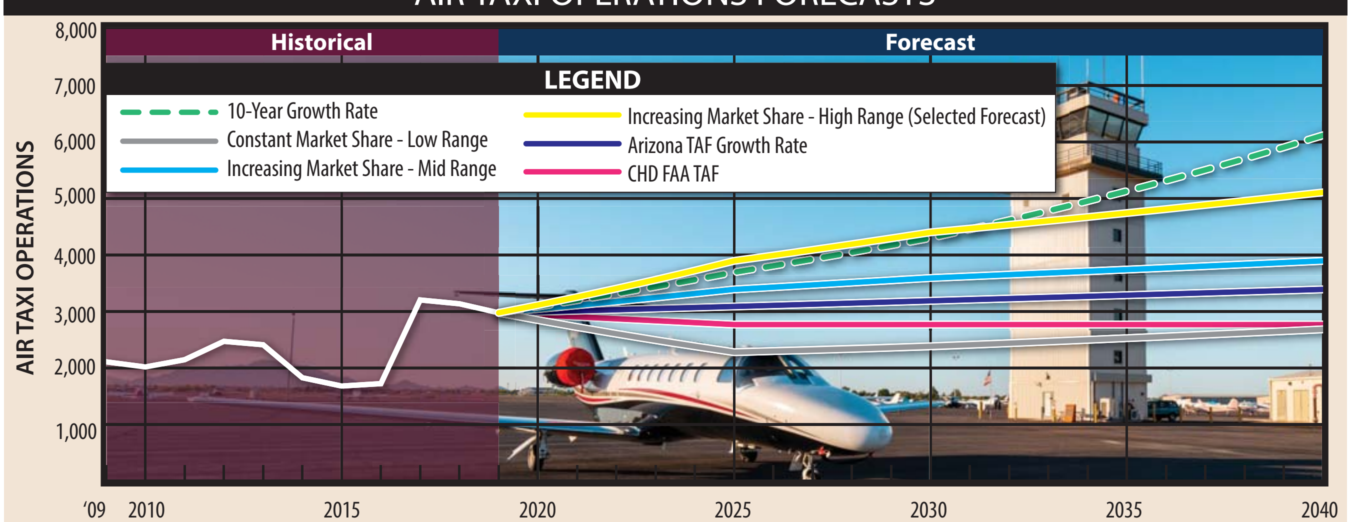


Exhibit 2D
OPERATIONS PROJECTIONS

Total Operations Forecast Summary

Table 2N presents the summary of the selected operations forecasts.

TABLE 2N
Total Operations Forecast Summary
Chandler Municipal Airport

	Itinerant					Local			
Year	Air Carrier	Air Taxi	General Aviation	Military	Total	General Aviation	Military	Total	Total Operations
2019	0	2,990	67,647	199	70,836	149,754	72	149,826	220,662
2025	0	3,900	72,500	213	76,613	158,300	62	158,362	234,975
2030	0	4,400	77,300	213	81,913	165,800	62	165,862	247,775
2040	0	5,100	87,400	213	92,713	181,900	62	181,962	274,675
CAGR	--	2.58%	1.23%	0.32%	1.29%	0.93%	-0.71%	0.93%	1.05%

CAGR = Compound annual growth rate

PEAKING CHARACTERISTICS

Many aspects of facility planning relate to levels of peaking activity – times when an airport is busiest. For example, the appropriate size of terminal facilities can be estimated by determining the number of people that could reasonably be expected to use the facility at a given time. The following planning definitions apply to the peak periods:

- **Peak Month** -- The calendar month when peak aircraft operations occur.
- **Design Day** -- The average day in the peak month.
- **Design Hour** -- The peak hour within the design day.

The peak month is an absolute peak within a given year. All other peak periods will be exceeded at various times during the year. The peak period forecasts represent reasonable planning standards that can be applied without overbuilding or being too restrictive.

Tower operations data provides an understanding of the peak operational periods for the airport. Over the last three years, the peak month has averaged 10.4 percent of annual operations. The design day is the peak month average divided by the number of days in the peak month. The peak months for the last three years have been a month with 31 days; thus, the peak month is divided by 31 days. The busy day during the average week of the peak month was 41 percent more than the design day. The design hour averaged 15.16 percent of design day operations. **Table 2P** summarizes the peaking operational characteristics for the airport.

TABLE 2P
Peaking Characteristics
Chandler Municipal Airport

Peak Period	2019	2023	2028	2038
Annual Operations	220,662	234,975	247,775	274,675
Peak Month	22,930	24,410	25,740	28,540
Busy Day	1,042	1,131	1,192	1,321
Design Day	740	803	846	938
Design Hour	115	125	132	146

Source: Coffman Associates analysis

FORECAST SUMMARY

This chapter has outlined the various activity levels that might reasonably be anticipated over the planning period. **Exhibit 2E** presents a summary of the aviation forecasts prepared in this chapter. The base year for these forecasts is 2019, with a 21-year planning horizon to 2040. The primary aviation demand indicators are based aircraft and operations. Based aircraft are forecast to increase from 441 in 2019 to 640 by 2040 (1.79% CAGR). Total operations are forecast to increase from 220,662 in 2019 to 274,675 by 2040 (1.05% CAGR).

Projections of aviation demand will be influenced by unforeseen factors and events in the future. Therefore, it is not reasonable to assume that future demand will follow the exact projection line, but over time, forecasts of aviation demand tend to fall within the planning envelope. The forecasts developed for this master planning effort are considered reasonable for planning purposes. The need for additional facilities will be based upon these forecasts; however, if demand does not materialize as projected, then implementation of facility construction can be slowed. Likewise, if demand exceeds these forecasts, then implementation of facility construction can be accelerated.

FORECAST COMPARISON TO THE TAF

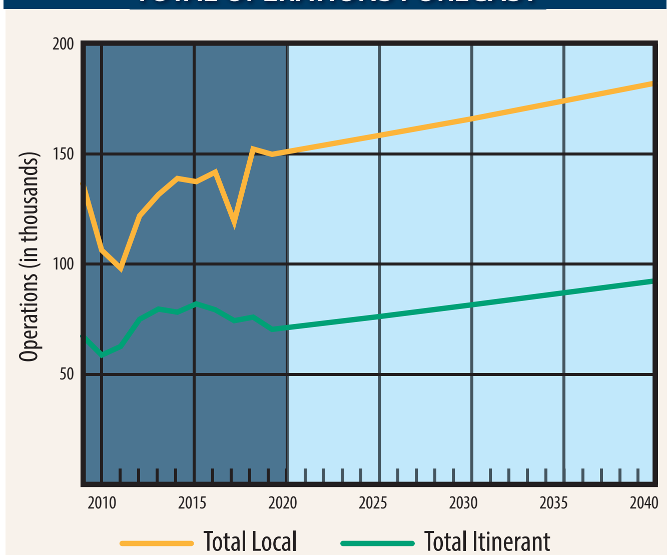
The FAA reviews the forecasts presented in this aviation planning study for comparison to the *Terminal Area Forecast*. The forecasts are considered consistent with the TAF if they meet the following criteria:

- Forecasts differ by less than 10 percent in the 5-year forecast period, and 15 percent in the 10-year forecast period, or
- Forecasts do not affect the timing or scale of an airport project, or
- Forecasts do not affect the role of the airport as defined in the current version of FAA Order 5090.3, *Field Formulation of the National Plan of Integrated Airport Systems*.

If the forecasts exceed these parameters, they may be sent to FAA headquarters in Washington, D.C. for further review. **Table 2Q** presents the direct comparison of the master planning forecasts with the TAF published in February 2019.

	2019	FORECAST 2025	FORECAST 2030	FORECAST 2040
AIRCRAFT OPERATIONS				
Itinerant				
Air Taxi	2,990	3,900	4,400	5,100
General Aviation	67,647	72,500	77,300	87,400
Military	199	213	213	213
Subtotal	***70,836***	***76,613***	***81,913***	***92,713***
Local				
General Aviation	149,754	158,300	165,800	181,900
Military	72	62	62	62
Subtotal	***149,826***	***158,362***	***165,862***	***181,962***
Total Operations	**220,662**	**234,975**	**247,775**	**274,675**
PEAKING				
Peak Month	22,930	24,410	25,740	28,540
Busy Day	1,042	1,131	1,192	1,321
Design Day	740	803	846	938
Design Hour	115	125	132	146
BASED AIRCRAFT				
Single-Engine Piston	379	424	469	552
Multi-Engine Piston	26	24	20	15
Turboprop	6	7	9	13
Jet	8	10	13	20
Helicopter	22	25	29	40
Total Based Aircraft	**441**	**490**	**540**	**640**

TOTAL OPERATIONS FORECAST



BASED AIRCRAFT FLEET MIX

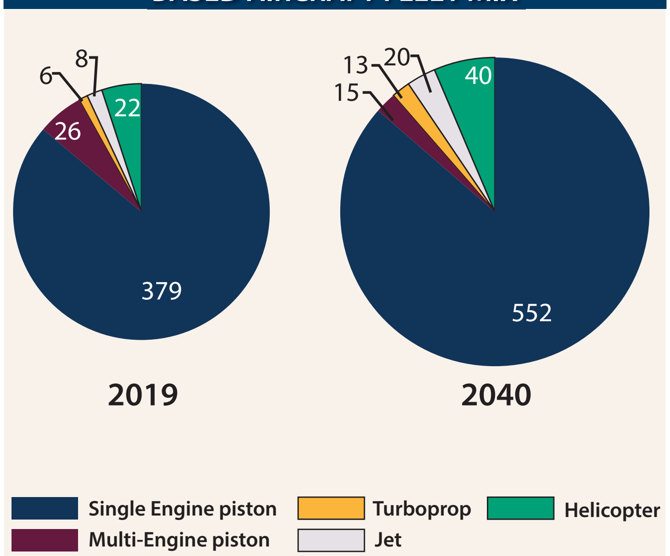


Exhibit 2E
FORECAST SUMMARY

TABLE 2Q
Forecast Comparison to the *Terminal Area Forecast*
Chandler Municipal Airport

	BASE YEAR	FORECAST		
	2019	2025	2030	2040
Operations				
Master Plan Forecast	220,662	234,975	247,775	274,675
2019 FAA TAF	220,316	223,253	226,353	232,694
% Difference	0.16%	5.12%	9.04%	16.55%
Based Aircraft				
Master Plan Forecast	441	490	540	640
2019 FAA TAF	160	193	224	301
% Difference	93.51%	86.97%	82.72%	72.05%

CAGR: Average annual growth rate
TAF: *Terminal Area Forecast* (published February 2019)

Total operations are within the FAA range for consistency. The based aircraft forecasts are higher than the TAF and are not within the FAA range for consistency. The baseline for based aircraft must be consistent with what is documented in the FAA based aircraft database (www.basedaircraft.com). Currently, there are 441 validated based aircraft at the airport, thus this is the starting point for the based aircraft forecast. The FAA should update the TAF to reflect the actual number of validated based aircraft.

The forecasts are not expected to affect the timing or scale of any major airport projects, and the role of the airport as a reliever general aviation facility is not expected to change.

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 critical design aircraft is used to define the design parameters for an airport. The design aircraft may be a single aircraft type or a composite aircraft representing a collection of aircraft with similar characteristics. The design aircraft is classified 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 2F.**

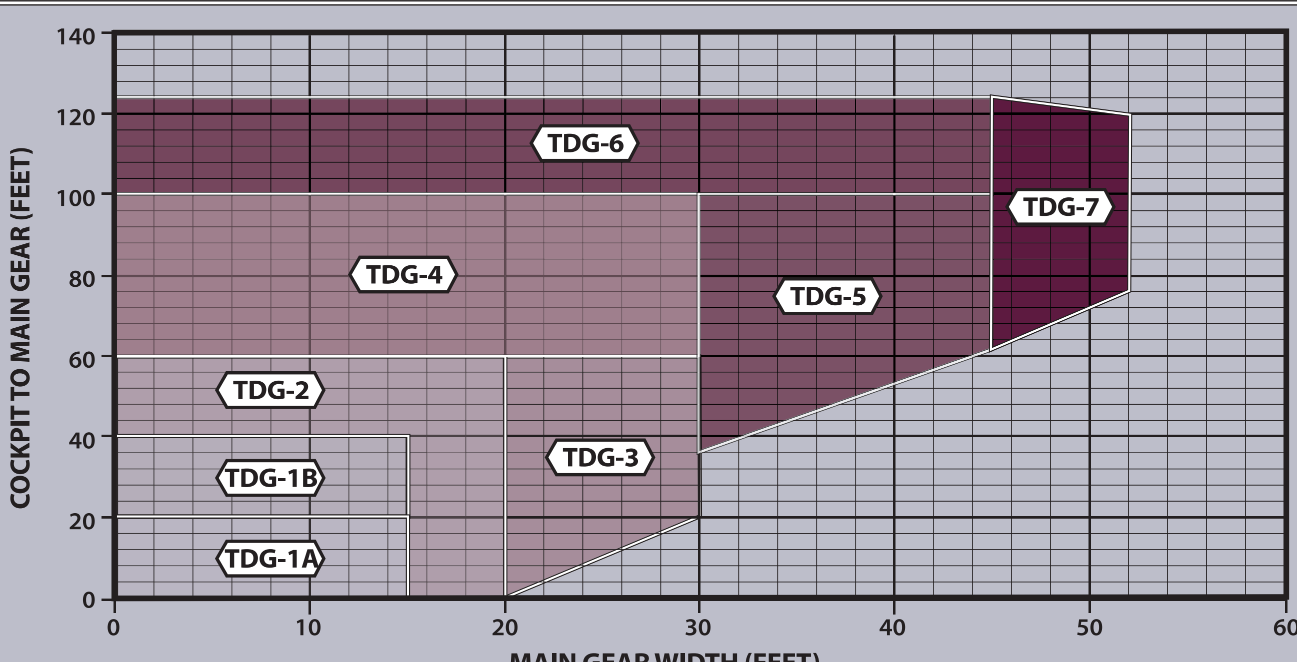
AIRCRAFT APPROACH CATEGORY (AAC)	
Category	**Approach Speed**
A	less than 91 knots
B	91 knots or more but less than 121 knots
C	121 knots or more but less than 141 knots
D	141 knots or more but less than 166 knots
E	166 knots or more

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

Exhibit 2F
AIRCRAFT CLASSIFICATION PARAMETERS

A-I

Aircraft	TDG
Beech Baron 55	1A
Beech Bonanza	**1A**
Cessna 150, 172	1A
Eclipse 500	1A
Piper Archer, Seneca	1A

B-I

Aircraft	TDG
Beech Baron 58	**1A**
Beech King Air 90	1A
Cessna 421	1A
Cessna Citation CJ1 (525)	1A
Cessna Citation 1(500)	2
Embraer Phenom 100	1B

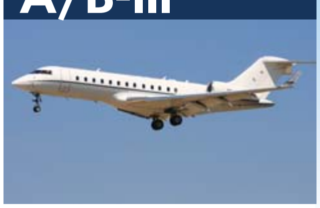
A/B-II *12,500 lbs. or less*

Aircraft	TDG
Beech Super King Air 200	**2**
Cessna 441 Conquest	1A
Cessna Citation CJ2 (525A)	2
Pilatus PC-12	1A

B-II *over 12,500 lbs.*

Aircraft	TDG
Beech Super King Air 350	2
Cessna Citation CJ3(525B), Bravo (550), V (560)	2
Cessna Citation CJ4 (525C)	**1B**
Cessna Citation Latitude/Longitude	1B
Embraer Phenom 300	1B
Falcon 10, 20, 50	1B
Falcon 900, 2000	2
Hawker 800, 800XP, 850XP, 4000	1B
Pilatus PC-24	1B

A/B-III



Aircraft	TDG
Bombardier Dash 8	3
Bombardier Global 5000, 6000, 7000, 8000	**2**
Falcon 6X, 7X, 8X	2

C/D-I

Aircraft	TDG
Lear 25, 31, 45, 55, **60**	**1B**
Learjet 35, 36 (D-I)	1B

C/D-II

Aircraft	TDG
Challenger 600/604/800/850	1B
Cessna Citation VII, X+	1B
CRJ-700	2
Embraer Legacy 450/500	1B
ERJ-135, 140, 145	2
Gulfstream IV, 350, 450 (D-II)	2
Gulfstream G200/G280	1B
Lear 70, 75	1B

C/D-III *less than 150,000 lbs.*

Aircraft	TDG
Boeing 737-700, BBJ	3
CRJ-900, 1000	2
ERJ-170, 175, 190, 195	3
Gulfstream V	2
Gulfstream G500, 550, 600, **650 (D-III)**	**2**

C/D-III *over 150,000 lbs.*

Aircraft	TDG
Airbus A319-100, 200	3
Boeing 737 -800, 900, BBJ2 (D-III)	**3**
MD-83, 88 (D-III)	4

C/D-IV

Aircraft	TDG
Airbus A300-100, 200, 600	5
Boeing 757-200	4
Boeing 767-300, **400**	**5**
MD-11	6

D-V

Aircraft	TDG
Airbus A330-200, 300	5
Airbus A340-500, 600	6
Boeing 747-100 - 400	5
Boeing 777-300	6
Boeing 787-8, 9	**5**

Note: Aircraft pictured is identified in bold type.

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 characteristics). 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 characteristics). 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 (TOFA), taxilane object free area, 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 TDG is classified by an alphanumeric system: 1A, 1B, 2, 3, 4, 5, 6, and 7. 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 taxiway safety area (TSA), taxiway/taxilane object free area (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.

The back side of **Exhibit 2F** summarizes the classification of the most common aircraft in operation today. Generally, recreational and business piston and turboprop aircraft will fall in AAC A and B, and ADG I and II. Business jets typically fall in AAC B and C, while the larger commercial aircraft will fall in AAC C and D.

AIRPORT AND RUNWAY CLASSIFICATIONS

Airport and runway 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.

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 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 available instrument approach 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 reads "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: AAC and ADG. A runway may have more than one DPRC depending on the parallel taxiway separation distance.

***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 at an airport. The current Airport Layout Plan (ALP) for CHD identifies the ARC as B-II.

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.

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 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, or 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 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.

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 DESIGN AIRCRAFT

There are three elements for classifying the airport design aircraft. The three elements are the AAC, ADG, and the TDG. The AAC and ADG are examined first, followed by the TDG.

The FAA's Traffic Flow Management System Count (TFMSC) database captures an operation when a pilot files a flight plan 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, limited radar coverage, and VFR operations, TFMSC data does not account for all aircraft activity at an airport by a given aircraft type. However, the TFMSC does provide an accurate reflection of IFR activity. Operators of high-performance aircraft, such as turboprops and jets, tend to file flight plans at a high rate. **Exhibit 2G** presents the TFMSC operational mix at the airport for turboprops and jets since 2009. According to this data, operations at CHD within AAC B and ADG II have exceeded the 500 operations threshold each year since 2009. Operations within AAC C at CHD have grown in the past couple years; however, they are still well below the 500 annual operations threshold.

Airport Design Aircraft Summary

The current aircraft approach category is "B." The current airplane design group is "II." The most active B-II airplane at CHD is the Beechcraft King Air 200/300/350, which are TDG 2 aircraft. **Therefore, the current airport design aircraft is classified as B-II-2. The future airport design aircraft is planned to remain as B-II-2 represented by small to mid-sized business jet aircraft such as the Cessna Citation Jet CJ4 or Citation X.** As a general aviation reliever, CHD's operations portfolio is anticipated to remain within the AAC A/B and ADG I/II categories. Operations for AAC C/D and ADG III are not anticipated to exceed 500 annual operations in the future.

RUNWAY DESIGN CODE

The RDC relates to specific FAA design standards that should be met in relation to a runway. The RDC takes into consideration the AAC, ADG, and the RVR. In most cases, the critical design aircraft will also be the RDC for the primary runway.

Current RDC

Runway 4R-22L, as the primary runway, should be designed to accommodate the overall airport design aircraft, which has been identified as B-II-2. The primary runway is 4,870 feet long, 75 feet wide, and has non-precision instrument approaches with visibility minimums as low as one mile on the Runway 4R end. Based on the current activity, the applicable RDC is **B-II-5000**.

Runway 4L-22R, as the secondary runway, has been previously planned to accommodate primarily small aircraft that weigh less than 12,500 pounds. As such, the applicable RDC for the secondary runway is **B-II-VIS (small aircraft exclusive)**.

Future RDC

Since the future critical design aircraft for CHD remains within the B-II category, the future RDC for Runway 4R-22L is planned to remain as **B-II-5000**. The future RDC for Runway 4L-22R is also planned to remain as RDC B-II-VIS (small aircraft exclusive).

APPROACH AND DEPARTURE REFERENCE CODES

The approach and departure reference codes (APRC and DPRC) describe the current operational capabilities of each runway and the adjacent parallel taxiways, where no special operating procedures are necessary. Essentially, the APRC and DPRC describe the current conditions at an airport in runway classification terms when considering the parallel taxiway.

The parallel taxiway for Runway 4R-22L is located 400 feet from the runway (centerline to centerline). Runway 4R has non-precision instrument approaches with one-mile visibility minimums. The APRC for Runway 4R-22L is D/IV/5000 and D/V/5000 and its DPRC is D/IV and D/V.

Runway 4L-22R is separated from its parallel taxiway by 240 feet and has no published instrument approaches. Therefore, its APRC is B/II/VIS and its DPRC is B/II.

CRITICAL AIRCRAFT SUMMARY

Table 2R summarizes the airport and runway classification currently and in the future. The critical aircraft is now defined by those aircraft in ARC B-II and is expected to remain in this category.

ARC	Aircraft Model	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
A-I	Cirrus Vision Jet	0	0	0	0	0	0	0	0	4	8
	Eclipse 400/500	4	6	8	22	8	10	18	10	16	8
	Epic Dynasty	0	0	0	0	4	2	2	2	0	0
	Kodiak Quest	2	10	42	24	18	0	0	4	2	2
	Lancair 4	6	0	0	0	0	0	0	0	0	0
	Lancair Evolution/Legacy	6	26	18	20	38	10	4	6	4	36
	Piper Malibu/Meridian	26	28	44	72	90	96	82	136	76	66
	Socata TBM 7/850/900	106	72	76	32	28	26	30	40	126	250
	TOTAL	150	142	188	170	186	144	136	198	228	370
A-II	Cessna Caravan	2	2	4	6	4	4	10	12	14	16
	De Havilland Twin Otter	0	0	0	2	0	2	0	0	0	8
	Pilatus PC-12	36	32	40	66	80	110	50	38	100	114
	TOTAL	38	34	44	74	84	116	60	50	114	138
B-I	Beechjet 400	16	14	18	18	10	14	6	6	0	6
	Cessna 425 Corsair	48	30	24	26	20	46	68	40	34	66
	Citation CJ1	180	218	176	70	70	70	78	124	90	82
	Citation I/SP	2	12	6	22	6	6	10	10	22	8
	Citation M2	0	0	0	0	0	0	0	2	0	2
	Citation Mustang	8	4	14	86	84	82	48	18	16	4
	Falcon 10	4	0	0	0	0	0	0	2	2	2
	Honda Jet	0	0	0	0	0	0	50	28	6	14
	King Air 90/100	124	144	62	46	42	56	76	88	88	96
	Mitsubishi MU-2	22	16	12	2	4	2	0	4	6	2
	Phenom 100	4	22	4	6	18	22	16	8	6	8
	Piaggio Avanti	4	10	4	0	0	0	2	2	2	0
	Piper Cheyenne	14	12	4	0	6	4	10	0	4	2
	Premier 1	0	6	0	2	2	0	4	4	4	0
	TOTAL	426	488	324	278	262	302	368	336	280	292
B-II	Aero Commander 690	32	14	6	16	84	124	90	116	116	88
	Beech 1900	2	2	0	0	0	4	0	0	0	0
	Cessna Conquest	40	54	36	14	22	38	36	20	16	30
	Challenger 300	0	0	2	4	0	2	8	12	16	26
	Citation CJ2/CJ3/CJ4	74	66	142	166	172	160	166	174	218	188
	Citation II/SP/Latitude	4	8	22	8	24	20	36	24	32	46
	Citation Longitude	0	0	0	0	0	0	0	0	0	4
	Citation V/Sovereign	34	72	114	148	136	152	54	92	102	94
	Citation X	0	16	6	14	8	12	10	0	6	8
	Citation XLS	74	36	64	32	30	62	132	82	70	46
	Dornier 328	0	0	0	0	2	0	0	0	4	0
	Falcon 20/50	2	2	0	0	4	2	2	6	2	2
	Falcon 2000	2	0	2	0	0	0	0	0	4	0
	Falcon 900	14	2	0	8	2	0	0	2	0	0
	King Air 200/300/350	212	260	180	146	212	230	226	264	348	340
	King Air F90	2	0	2	0	0	0	0	0	0	0
	Phenom 300	0	6	4	2	10	26	36	70	62	50
	Swearingen Merlin	0	0	0	2	2	4	0	0	2	0
	TOTAL	492	538	580	560	708	836	796	862	998	922

ARC	Aircraft Model	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
B-III	Bombardier Global Express	0	0	0	0	0	0	0	0	2	0
	Grumman E-2 Hawkeye	0	0	0	0	0	0	0	0	2	0
	TOTAL	0	0	0	0	0	0	0	0	4	0
C-I	BAe HS 125 Series	2	0	0	0	0	0	0	0	0	0
	Learjet 20 Series	4	0	0	4	0	8	14	18	4	0
	Learjet 31	10	0	0	2	0	0	0	2	2	4
	Learjet 40 Series	6	22	16	2	0	6	2	98	152	250
	Learjet 60 Series	2	0	2	2	2	0	2	4	4	0
	Westwind II	0	0	0	0	0	2	0	0	2	0
	TOTAL	24	22	18	10	2	16	18	122	164	254
C-II	Challenger 600/604	0	0	0	0	2	2	2	2	2	2
	Citation III/VI	0	2	2	4	2	0	2	2	0	0
	Embraer ERJ-135/140/145	0	0	0	2	0	0	0	0	0	0
	Gulfstream 100/150	8	6	2	6	4	4	8	2	6	4
	Gulfstream 280	0	0	0	0	0	0	0	2	0	0
	Hawker 800 (Formerly Bae-125-800)	4	2	10	4	6	4	6	4	4	2
	Learjet 70 Series	0	0	0	0	0	0	0	0	0	2
	TOTAL	2	10	14	16	14	10	18	12	12	10
D-I	Learjet 35/36	4	0	0	0	4	0	6	0	0	0
	TOTAL	4	0	0	0	4	0	6	0	0	0
D-II	Gulfstream 200	2	0	0	0	0	2	0	0	0	0
	Gulfstream 450	0	0	2	0	0	0	6	2	4	0
	TOTAL	2	0	2	0	0	2	6	2	4	0

ARC CODE SUMMARY

ARC CODE	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
A-I	150	142	188	170	186	144	136	198	228	370
A-II	38	34	44	74	84	116	60	50	114	138
B-I	426	488	324	278	262	302	368	336	280	292
B-II	492	538	580	560	708	836	796	862	998	922
B-III	0	0	0	0	0	0	0	0	4	0
C-I	24	22	18	10	2	16	18	122	164	254
C-II	12	10	14	16	14	10	18	12	12	10
D-I	4	0	0	0	4	0	6	0	0	0
D-II	2	0	2	0	0	2	6	2	4	0
TOTAL	1,148	1,234	1,170	1,108	1,260	1,426	1,408	1,582	1,804	1,986

APPROACH CATEGORY SUMMARY

AC	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
A	188	176	232	244	270	260	196	248	342	508
B	918	1,026	904	838	970	1,138	1,164	1,198	1,282	1,214
C	36	32	32	26	16	26	36	134	176	264
D	6	0	2	0	4	2	12	2	4	0
TOTAL	1,148	1,234	1,170	1,108	1,260	1,426	1,408	1,582	1,804	1,986

AIRPLANE DESIGN GROUP SUMMARY

DG	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
I	604	652	530	458	454	462	528	656	672	916
II	544	582	640	650	806	964	880	926	1,128	1,070
III	0	0	0	0	0	0	0	0	4	0
TOTAL	1,148	1,234	1,170	1,108	1,260	1,426	1,408	1,582	1,804	1,986

Note: ARC- Airport Reference Code *Source: Traffic Flow Management System Counts*

Exhibit 2G
HISTORICAL TURBOPROP AND JET OPERATIONS

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TABLE 2R
Airport and Runway Classifications
Chandler Municipal Airport

	Runway 4R-22L (existing/ultimate)	Runway 4L-22R (existing/ultimate)
Airport Reference Code (ARC)	B-II	B-II (small airplane)
Airport Design Aircraft	B-II-2	B-II-2 (small airplane)
Critical Aircraft (Typ.)	Beechcraft King Air 200/300/350 (existing) Cessna Citation Jet CJ4/Citation X (ultimate)	Beechcraft King Air C/F90
Runway Design Code (RDC)	B-II-5000	B-II-VIS (small airplane)
Approach Reference Code (APRC)	D/IV/5000 and D/V/5000	B/II/VIS
Departure Reference Code (DPRC)	D/IV and D/V	B/II

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

SUMMARY

This chapter has outlined the various activity levels that might reasonably be anticipated over the planning period, as well as the critical design aircraft for the airport. Based aircraft are forecast to grow from 441 currently to 640 by 2040. Operations are forecast to grow from 220,662 in 2019 to 274,675 by 2040. The projected growth is driven by FAA's positive outlook for general activity nationwide, as well as positive outlooks for socioeconomic growth (population, employment, and income/GRP) in the Phoenix metropolitan area.

The critical design aircraft for the airport was determined by examining the FAA TFMSC database of flight plans. The current critical design aircraft is described as B-II-2 and is best represented by a Beechcraft King Air 200/300/350, a twin-engine turboprop typically utilized for business operations or air charters. The future design aircraft is projected to remain in the same category represented by small to mid-sized business jets such as the Cessna Citation Jet CJ4 or Citation X.

As noted previously, the forecasts of aviation demand were developed in 2019 prior to the Covid-19 pandemic and the associated economic downturn. Commercial aviation throughout the country has experienced a significant downturn; however certain segments of general aviation, specifically charters, air taxi, and fractionals have appeared to maintain pre-pandemic levels and in many cases, were showing increases as people sought alternatives to flying commercial. Prior to implementation of suggested projects identified later in this report, the forecast element may need to be re-validated. Based upon the types of aircraft using CHD throughout its history, the proposed existing and ultimate design aircraft are considered reasonable and valid for planning purposes.

The next step in the planning process is to assess the capabilities of the existing facilities to determine what upgrades may be necessary to meet future demands. The range of forecasts developed here will be taken forward in the next chapter as planning horizon activity levels that will serve as milestones or activity benchmarks in evaluating facility requirements.