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Capacity Analysis and Facility Requirements

INTRODUCTION. The capacity of an airfield is primarily a function of the major aircraft operating surfaces that compose the facility and the configuration of those surfaces (runways and taxiways). However, it is also related to, and considered in conjunction with, wind coverage, airspace utilization, and the availability and type of navigational aids. Capacity refers to the number of aircraft operations that a facility can accommodate on either an hourly or yearly basis. It does not refer to the size or weight of aircraft. Facility requirements are analyzed to determine those facilities needed to meet the forecast demand and aircraft fleet provided they are consistent with the established role and goals of the airport. Evaluation procedures will focus on the airport's appropriate Airport Reference Code (ARC)/ dimensional criteria, runway length, pavement strength, instrument approach capability, and layout of aircraft storage facilities.

Knowledge of the types of aircraft currently using, and those aircraft expected to use, the Nut Tree Airport provides information concerning the appropriate Airport Reference Code (ARC) designation for the facility. FAA Advisory Circular 150/5300-13, *Airport Design*, provides guidelines for this ARC determination, which is based on the "Design Aircraft" that is judged the most critical aircraft using, or projected to use, the airport. The ARC relates aircraft operational and physical characteristics to design criteria that are applied to various airport components. Under this methodology, safety margins are provided in the physical design of airport facilities.

There are two components in determining the ARC for an airport, an operational component and a physical component. The first component, depicted by a capital letter, is the Aircraft Approach Category and relates to aircraft approach speed (operational component). The second component, depicted by a Roman numeral, is the Airplane Design Group (ADG) and relates to airplane wingspan (physical component).

Currently, a large number of single engine training aircraft utilize the Airport on a regular basis; however, this traffic is supplemented by a fair number of multi-engine, turbo-prop, and jet aircraft that are operated for both business and recreational purposes.

Runway 2/20

All aircraft, including both fixed wing and helicopters, operating at Nut Tree Airport utilize Runway 2/20 for landings and takeoffs. The Airport's current Airport Layout Plan identifies the Beech Super King Air B200 as the "Critical Aircraft" for this runway, which specifies an ARC of B-II. The King Air B200 is a medium size twin-engine general aviation turbo-prop aircraft that has an approach speed of 103 knots and a wingspan of 54.5 feet. According to current operational estimates, approximately 2,420 turbo-prop operations were conducted at the Airport in 2009, in addition to approximately 3,420 business jet operations. It is assumed that the majority of existing and forecast jet aircraft operations at the Nut Tree Airport are conducted by FAA approach category B aircraft (aircraft with approach speeds of 91 knots or more but less than 121 knots).

FAA guidance defines a "substantial use threshold" on federally funded projects for critical design airplanes (i.e., the design aircraft) to have at least 500 or more annual itinerant operations at the Airport. According to instrument approach data acquired from the FAA's Aircraft Situational Display to Industry (ASDI) system, only an average of 15 aircraft operations were conducted at the Nut Tree Airport by aircraft with approach speeds of more than 121 knots over the last four years. However, the reliability of the ASDI system is low due to the National Business Aviation Association (NBAA) program that allows member aircraft operators to block tail numbers from the system. However, based on airport management estimates, there are a very small number of jet operations by aircraft in approach category C (more than 121 knots approach speed) and unless an operator of an approach category C aircraft decides to base at the Nut Tree Airport, Approach Category B is likely appropriate for the foreseeable future. Approach category B also include a large number of small and medium size business jets. An example of business jet operations in aircraft approach category B is the Dassault Aviation, Falcon 50B and Falcon 900, both of which are permanently based at the Nut Tree Airport.

Airfield Capacity Methodology

This section addresses the evaluation method used to determine the capability of the airside facilities to accommodate aviation operational demand. Evaluation of this capability is expressed in terms of potential excesses and deficiencies in capacity. The methodology utilized for the measurement of airfield capacity in this study is described in FAA Advisory Circular 150/5060-5, *Airport Capacity and Delay*. From this methodology, airfield capacity is defined in the following terms:

- **Hourly Capacity of Runways:** The maximum number of aircraft that can be accommodated under conditions of continuous demand during a one-hour period.
- **Annual Service Volume (ASV):** A reasonable estimate of an airport's annual capacity (i.e., the level of annual aircraft operations that will result in an average annual aircraft delay of approximately one to four minutes).

The capacity of an airport's airside facilities is a function of several factors. These include the layout of the airfield, local environmental conditions, specific characteristics of local aviation demand, and air traffic control requirements. The relationship of these factors and their cumulative impact on airfield capacity are examined in the following paragraphs.

Airfield Layout

The layout or "design" of the airfield refers to the arrangement and interaction of the airfield components, which include the runway system, taxiways, and ramp entrances. As previously described, Nut Tree Airport operates around a single runway (i.e., Runway 2/20). This runway is served by a full-length parallel taxiway system (i.e., Taxiway "A") with five connector taxiways. There are also aircraft run-up areas or holding bays located near the end of each runway.

All of the Airport's existing hangar facilities are located on the southeast side of the runway adjacent to the primary aircraft parking apron. These facilities include various T-hangars, and individual clear span hangars located adjacent to a taxilane that extends from the north side of the aircraft parking apron. There are also a number of larger executive/corporate hangars located adjacent to taxilanes that extend from the south side of the aircraft parking apron.

Environmental Conditions

Climatological conditions specific to the location of an airport not only influence the layout of the airfield, but also impact the utilization of the runway system. Variations in the weather, resulting in limited cloud ceilings and reduced visibility typically lower airfield capacity, while changes in wind direction and velocity typically dictate runway usage and influence runway capacity. Meteorological data from the Nut Tree Airport Automated Surface Observing System (ASOS) was ordered from the National Climatic Data Center for use in this Airport Master Plan.

Wind Coverage. Surface wind conditions (i.e., direction and speed) generally determine the desired alignment and configuration of the runway system. Runways, which are not oriented to take advantage of prevailing winds, will restrict the capacity of the Airport. Wind conditions affect all airplanes in varying degrees; however, the ability to land and takeoff in crosswind conditions varies according to pilot proficiency and aircraft type. Generally, the smaller the aircraft, the more it is affected by the crosswind component.

As mentioned previously, wind data for Nut Tree Airport was available for analysis from 2001 through 2009. There were approximately 62,056 observations available for analysis. The allowable crosswind component is dependent upon the Airport Reference Code (ARC) for the type of aircraft that utilize the Airport on a regular basis. According to the existing Airport Layout Plan, the current Airport Reference Code (ARC) for Runway 2/20 is ARC B-II and based on data presented in the previous chapter, ARC B-II is still considered the appropriate ARC for Nut Tree Airport. The ARC system is discussed in more detail later in this chapter on page D.12. For ARC B-II classifications, the standards specify that the 10.5-knot and 13-knot crosswind components be utilized for analysis. Therefore, the 10.5-knot and 13-knot crosswind components have been analyzed for Nut Tree Airport. The following illustration, entitled *NUT TREE AIPPORT ALL WEATHER WIND ROSE: 13- & 10.5-KNOT CROSSWIND COMPONENTS*, illustrates a comparative analysis of the all weather wind coverage provided at the Airport.

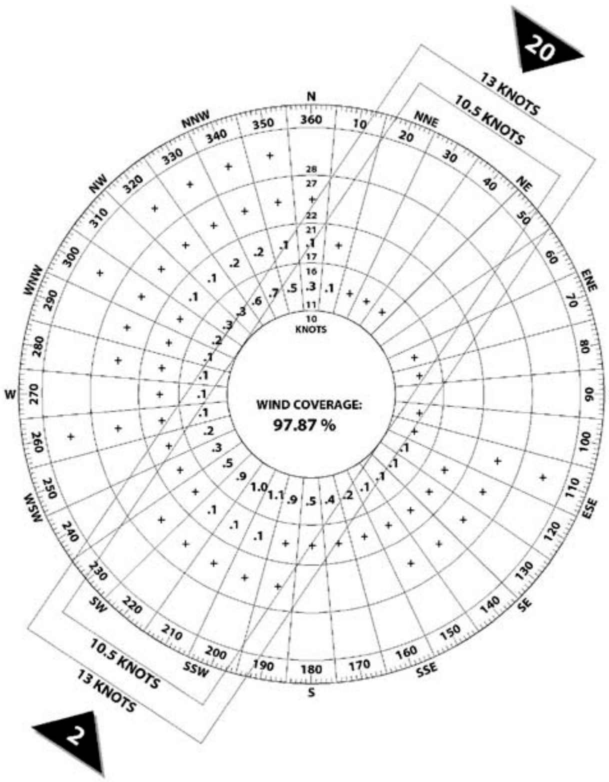
The desirable wind coverage for an airport's runway system is 95 percent. This means that the runway orientation and configuration should be developed so that the maximum crosswind component is not exceeded more than 5 percent of the time annually. The following table, entitled *NUT TREE AIRPORT ALL WEATHER WIND COVERAGE SUMMARY*, quantifies the wind coverage offered by the airport's existing runway system, including the coverage for each runway end. Based on the comparative all weather wind analysis for the Airport, utilizing the FAA Airport Design Software supplied with AC 150/5300-13, the existing single runway configuration provides adequate wind coverage (i.e., in excess of 95 percent) for both the 10.5- and the 13-knot crosswind components. Therefore, no additional runways are required from a *wind coverage* standpoint.

Table D1
NUT TREE AIRPORT ALL WEATHER WIND COVERAGE SUMMARY

Runway Designation	13-Knot Crosswind Component w/ 5-Knot Tailwind	10.5-Knot Crosswind Component w/ 5-Knot Tailwind
Runway 2/20	97.87%	96.13%
Runway 2	66.86%	66.50%
Runway 20	92.15%	91.20%

Source: National Oceanic and Atmospheric Administration, National Climatic Data Center, Station #72482. Vacaville, California.
Notes: Wind analysis tabulation provided by BARNARD DUNKELBERG & COMPANY utilizing the FAA Airport Design Software supplied with AC 150/5300-13.

Figure D1
NUT TREE AIRPORT ALL WEATHER WIND ROSE: 13-, & 10.5-KNOT CROSSWIND COMPONENTS



Source: National Oceanic and Atmospheric Administration, National Climatic Data Center. Station #72482 - Vacaville, California. Period of Record – August 2001-December 2009. Total Observations: 62,056.

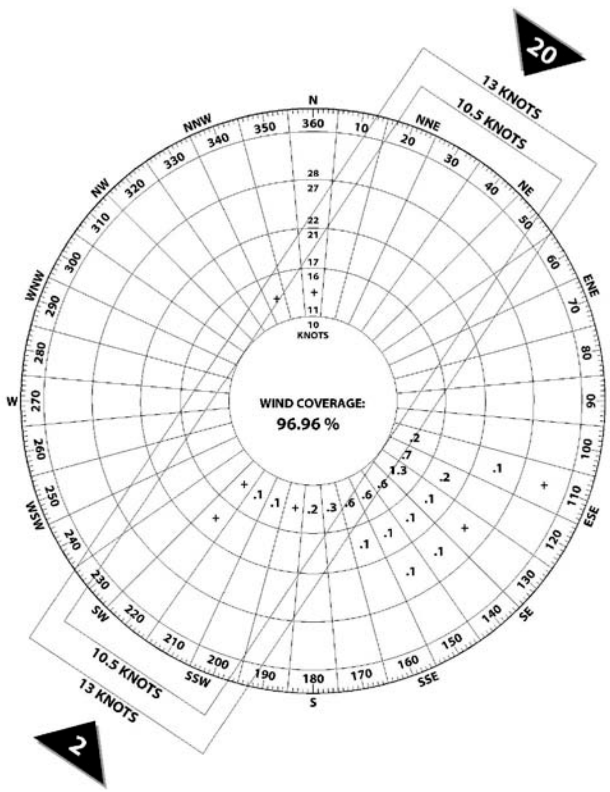
The Airport is currently served two straight-in RNAV (GPS) approaches to Runway 20 and one circling VOR/DME approach. In an effort to evaluate the effectiveness of these approaches, and analyze the potential benefits of implementing lower approach visibility minimums, an Instrument Flight Rules (IFR) wind rose has been constructed. The following table and illustration quantify the wind coverage offered by each runway end in consideration of the lowest potential approach minimums (ceiling equal to or greater than 200 feet and/or visibility equal to or greater than 1/2 statute mile).

Table D2
NUT TREE AIRPORT IFR WEATHER WIND COVERAGE SUMMARY

Runway Designation	13-Knot Crosswind Component w/ 5-Knot Tailwind	10.5-Knot Crosswind Component w/ 5-Knot Tailwind
Runway 2/20	96.96%	95.21%
Runway 2	90.50%	89.37%
Runway 20	94.42%	92.70%

Source: National Oceanic and Atmospheric Administration, National Climatic Data Center, Station #72482. Vacaville, California.
Notes: Wind analysis tabulation provided by BARNARD DUNKELBERG & COMPANY utilizing the FAA Airport Design Software supplied with AC 150/5300-13.

Figure D2
NUT TREE AIRPORT IFR WEATHER WIND ROSE: 13-, & 10.5-KNOT CROSSWIND COMPONENTS



Source: National Oceanic and Atmospheric Administration, National Climatic Data Center. Station #72482 - Vacaville, California. Period of Record – August 2001-December 2009. Total Observations: 2,476.

Characteristics of Demand

Certain site-specific characteristics related to aviation use and aircraft fleet makeup impact the capacity of the airfield. These characteristics include runway use, aircraft mix, percent arrivals, touch-and-go operations, and exit taxiways.

Aircraft Mix. The capacity of a runway is dependent on the type and size of the aircraft that utilize the facility. Aircraft are categorized into four classes: Classes A and B consist of small single engine and twin-engine aircraft (both prop and jet), weighing 12,500 pounds or less, which are representative of the general aviation fleet. Class C and D aircraft are larger jet and propeller aircraft typical of those utilized by some of the larger corporations, the airline industry, and the military. Aircraft mix is defined as the relative percentage of operations conducted by each of these four classes of aircraft. In consideration of the forecasts presented in the previous chapter, an aircraft mix table has been generated. Nut Tree Airport has no operations by Class D aircraft (over 300,000 pounds), nor are any expected to occur in the future. Because no records are kept with regard to classification of aircraft by weight at Nut Tree Airport, it has been assumed that the number of Class C aircraft operations at the Airport is a very small percentage of total operations. Some aircraft meeting the Class C weight designation known to use the Airport include the Dassault Falcon 50, the Dassault Falcon 900 and some of the larger Cessna Citation business jet aircraft. The following table, entitled *AIRCRAFT CLASS MIX FORECAST, 2009-2030*, presents the projected operational mix for the selected forecasts.

Table D3
AIRCRAFT CLASS MIX FORECAST, 2009-2030

	VFR Conditions			IFR Conditions		
Year	**Class A & B**	**Class C**	**Class D**	**Class A & B**	**Class C**	**Class D**
2009[1]	99.5%	0.5%	---	88.0%	12.0%	---
2015	99.4%	0.6%	---	87.0%	13.0%	---
2020	99.3%	0.7%	---	86.0%	14.0%	---
2025	99.2%	0.8%	---	85.0%	15.0%	---
2030	99.1%	0.9%	---	84.0%	16.0%	---

Class A - Small Single Engine, < 12,500 pounds
Class B - Small Twin-Engine, < 12,500 pounds
Class C - 12,500 - 300,000 pounds
Class D - > 300,000 pounds
[1] Existing percentage breakdown was estimated by *BARNARD DUNKELBERG & COMPANY.*

Percent Arrivals. Runway capacity is also significantly influenced by the percentage of all operations that are arrivals. Because aircraft on final approach are typically given absolute priority over departures, higher percentages of arrivals during peak periods of operations will reduce the Annual Service Volume (ASV). The operations mix occurring on the runway at Nut Tree Airport reflects a general balance of arrivals to departures; therefore, it will be assumed in the capacity calculations that arrivals equal departures during the peak period.

Touch-and-Go Operations. A touch-and-go operation refers to an aircraft maneuver in which the aircraft performs a normal landing touchdown followed by an immediate takeoff, without stopping or taxiing clear of the runway. These operations are normally associated with training activity and are included in local operations figures when reported by an airport traffic control tower. According to airport management, local operations are estimated to represent approximately 39 percent of the total annual operations being conducted at the Airport, and flight training represents a majority of this activity. It is anticipated that the existing level of flight training will continue through the planning period. However, the Airport will likely accommodate an increasing percentage of business-related itinerant general aviation operations in the future; thus, the overall percentage of touch-and-go operations is projected to decrease slightly as a percentage of the total through the planning period.

Runway Use. The use configuration of the runway system is defined by the number, location, and orientation of the active runway(s) and relates to the distribution and frequency of aircraft operations to those facilities. Both the prevailing winds in the region and the existing runway facility at Nut Tree Airport combine to dictate the utilization of the existing runway system. According to airport management observations, which are generally supported by the all weather wind coverage data, Runway 20 is utilized 90 percent of the time annually. As identified previously, the wind coverage also typically favors Runway 20 during IFR conditions, which is supported by the airport's existing instrument approach procedure.

Exit Taxiways. The capacity of a runway system is greatly influenced by the ability of an aircraft to exit the runway as quickly and safely as possible. Therefore, the quantity and design of the exit taxiways can directly influence aircraft runway occupancy time and the capacity of the runway system.

Due to the location of the existing exit taxiways serving the runway system at Nut Tree Airport, the number of available exit taxiways for use in the capacity calculation is adequate. Based upon the mix index of aircraft operating at the Airport under VFR conditions, the capacity analysis, as described in the FAA Advisory Circular 150/5060-5, *Airport Capacity and Delay*, gives credit to only those runway exit taxiways located between 2,000 and 4,000 feet from the landing threshold. Therefore, landings to both Runway 2 and Runway 20 each received an exit rating of two. A taxiway exit rating of four is the maximum rating that can be received, and no credit given for an exit within 750 feet of another exit. Based upon the location of the existing exit taxiways, only one additional exit taxiway could be added to the midfield area in consideration of the specified design criteria. However, given the airport's existing and projected operational levels, the location of future taxiway improvements (if any) will be evaluated in conjunction with the formulation of airside development alternatives.

Airfield Capacity Analysis

As previously described, the determination of capacity for Nut Tree Airport uses the methodology described in the FAA Advisory Circular 150/5060-5, *Airport Capacity and Delay*, along with the Airport Design Computer Program that accompanies AC 150/5300-13. Unfortunately, the FAA's methodology for calculating capacity incorporates numerous assumptions, some of which do not apply to Nut Tree Airport. The assumptions that are incorporated into the FAA's capacity calculations are: arrivals equal departures; the percent of touch-and-go operations is between 0-50 percent of total operations; there is a full-length parallel taxiway with ample exits and no taxiway crossing problems; there are no airspace limitations; the Airport has at least one runway equipped with an ILS and the necessary air traffic control facilities to carry out operations in a radar environment; IFR weather conditions occur roughly 5 percent of the time; and, approximately 80 percent of the time, the Airport is operated with the runway use configuration that produces the greatest hourly capacity. Since Nut Tree Airport does not have an ILS or an ATCT, the capacity calculations using the FAA methodology would be overstated, and the capacity would be less than that stated in the Advisory Circular in consideration of existing conditions.

Applying information generated from the preceding analyses, capacity and demand are formulated in terms of the following results:

- **Hourly Capacity of Runways (VFR and IFR)**
- **Annual Service Volume (ASV)**

The FAA's methodology to estimate hourly capacity and ASV for long-range planning purposes is presented in FAA Advisory Circular 150/5060-5. Based on a single runway use configuration with a specified mix index ranging from 0- 20, the maximum possible VFR and IFR hourly capacities at Nut Tree Airport would be at 98 and 59 operations, respectively, with a projected ASV of less than 230,000 operations per year. However, because Nut Tree Airport does not conform to several of the assumptions listed above (i.e., the Airport does not have an ATCT or precision instrument approach), this means that the existing operational capacity at Nut Tree Airport would be less than the figures presented above. General planning principles suggest that airport operators should begin to consider future capacity enhancements when an airport reaches 60 percent of its ASV. For Nut Tree Airport, this planning threshold would not be reached until traffic volumes approach 138,000 operations (60 percent of 230,000 ASV). Since existing traffic levels are estimated at 101,500 operations and forecast traffic levels by the end of the planning period are just over 127,000 operations, it is not anticipated that operational capacity will be an issue at the Airport within the 20-year planning period of this study. Furthermore, given the existing development constraints on, and in the vicinity of, the Airport, it is unlikely that additional runways could ever be constructed to accommodate significant gains in operational capacity demands.

Capacity Summary

This section has analyzed the capacity of existing facilities at Nut Tree Airport. Both adequate airfield and ground access facilities are critical components in the ability of the Airport as a whole to efficiently serve the public. Capacity deficiencies that cause delays associated within one area will often be reflected in the ability or inability of the entire facility to function properly.

The following Facility Requirements section will delineate the various facilities required to properly accommodate future demand. That information, in addition to the capacity analysis, will provide the basis for formulating the alternative development scenarios for Nut Tree Airport, ensuring that the new Recommended Development Plan can adequately accommodate the long-term aviation development requirements of the region.

Facility Requirements

This section presents the analysis of requirements for airside and landside facilities necessary to meet aviation demand at Nut Tree Airport. For those components determined to be deficient, the type and size of facilities required to meet future demand is identified. Airside facilities examined include the runways, taxiways, runway protection zones, thresholds, and navigational aids. For the purposes of this analysis, landside facilities include such facilities as hangars, aircraft apron areas and airport support facilities.

This analysis uses the growth scenario set forth in the forecast of demand for establishing future development needs at the Airport. This is not intended to dismiss the possibility that, due to the unique circumstances in the region, either accelerated growth or consistently higher or lower levels of activity may occur. Aviation activity levels should be monitored for consistency with the forecasts. In the event of changes, the schedule of development should be adjusted to correspond to the demand for facilities rather than be set to predetermined dates of development. By doing this, over-building or under-building can be avoided.

Airside Requirements

In efforts to identify future demand at Nut Tree Airport for those facilities required to adequately serve future needs, it is necessary to translate the forecast aviation activity into specific types and quantities. This section addresses the actual physical facilities and/or improvements to existing facilities needed to safely and efficiently accommodate the projected demand that will be placed on the Airport. This section consists of two separate analyses: those requirements dealing with *airside* facilities and those dealing with *landside* facilities.

Airport Reference Code (ARC)/Design Aircraft Analysis

The types of aircraft presently utilizing an airport and those projected to utilize the facility in the future are important considerations for planning airport facilities. An airport should be designed in accordance with the Airport Reference Code (ARC) standards that are described in AC 150/5300-13, *Airport Design.* The ARC is a coding system used to relate and compare airport design criteria to the operational and physical characteristics of the aircraft intended to operate at the Airport.

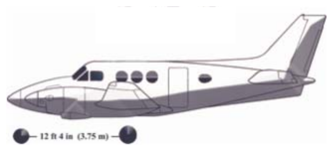
The ARC has two components that relate to the Airport's "Design Aircraft" (often referred to as the critical aircraft). The first component, depicted by a letter (i.e., A, B, C, D, or E), is the aircraft approach category, and relates to aircraft approach speed based upon operational characteristics. The second component, depicted by a Roman numeral (i.e., I, II, III, IV, or V), is the aircraft design group and relates to aircraft wingspan (physical characteristic).

Generally speaking, aircraft approach speed applies to runways and runway-related facilities, while aircraft wingspan is primarily related to separation criteria associated with taxiways and taxilanes. Examples of aircraft by ARC are illustrated in the following figure entitled *REPRESENTATIVE AIRCRAFT BY AIRPORT REFERENCE CODE (ARC) DESIGNATION.*

The 2007 Airport Layout Plan identified the Beech Super King Air 200 (ARC B-II) as the existing "Design Aircraft" for the Airport, and identified the Citation V (ARC B-II) as the future "Design Aircraft."

Runway 2/20 is currently designed to accommodate ARC B-II aircraft. As presented in the *Forecasts of Aviation Activity* chapter, multi-engine turboprop and business jet operations are anticipated to steadily increase throughout the 20-year planning period. However, the majority of these operations are expected to be conducted by ARC B-I and B-II aircraft and therefore, B-II is considered the appropriate ARC through the planning period.

ARC A-I
Single-Engine Aircraft - 2 to 6 seats
Beech Bonanza
Beech Baron B55
Cessna-150



ARC B-I
Twin-Piston Aircraft - 4 to 10 seats
Beech King Air B100
Piper 31-310 Navajo
Beech Baron 58

ARC B-I
Very Light Jet/Small Cabin 4-6 seats
Eclipse 500
Citation Mustang
Adam Aircraft A700

ARC B-II
Twin-Turboprop Aircraft - 6 to 10 seats
Includes most commercial turboprop aircraft.
Beech Super King Air B200
Cessna 441 Conquest
Grumman Gulfstream I

ARC B-II
Business Jet/Small Cabin - 6 to 12 seats
Dassault Falcon 900
Dassault Falcon 50
Cessna Citation II/III/VII

Source: Aircraft Ground Service Guide, 2002 and Aircraft Manufacturer.
Note: Representative Aircraft not to scale.

FIGURE D3 Representative Aircraft By Airport Reference Code (ARC) Designation

Airfield Dimensional Criteria

FAA Advisory Circular 150/5300-13, *Airport Design*, recommends standard widths, minimum clearances, and other dimensional criteria for runways, taxiways, safety areas, aprons, and other physical airport features based on the previously determined "Design Aircraft" and it's associated ARC (Beech Super King Air 200 and B-II). However, it is important to note that the "Design Aircraft" is to be used for ARC determination only and is not intended to be used dictate runway length requirements. This is explained in more detail in the following section entitled Runways.

The following table entitled *ARC B-II DIMENSIONAL STANDARDS FOR RUNWAY 2/20 (In Feet)*, compare existing conditions against the dimensional design requirements that would apply to Nut Tree Airport Airport depending on the Airport Reference Code and the existing and potential future approach visibility minimums.

As can be noted in the following table and delineated in the following illustration, Runway 2/20 at Nut Tree Airport is, for the most part, in compliance with FAA specified ARC B-II design standards. However, there are a couple of exceptions in considerations of FAA specified ARC B-II, greater than ¾ mile visibility minimums, dimensional criteria. These non-standard conditions include runway object free area width, runway object free area length beyond runway end, and taxiway object free area width. Various alternatives will be evaluated in the following *Alternatives Analysis* chapter of this Airport Master Plan to determine the preferred solutions to meet all FAA design standards.

Table D4
ARC B-II DIMENSIONAL STANDARDS FOR RUNWAY 2/20 (In Feet)

Item	Existing Dimension	ARC B-II with ≥ ¾ Mile Visibility Minimums [1]	ARC B-II with < ¾ Mile Visibility Minimums
Runway Width	75	75	100
Runway Centerline to Parallel Taxiway Centerline (Taxiway "A")	240	240	300
Runway Centerline to Aircraft Parking Area	355	250	400
Runway Centerline to Holdline	200	200	250
Runway Safety Area Width	150	150	300
Runway Safety Area Length Beyond Runway End			
Runway 2	300	300	600
Runway 20	300	300	600
Runway Safety Area Length Prior to Landing Threshold			
Runway 2	300	300	600
Runway 20	300	300	600
Runway Object Free Area Width	500	500	800
Runway Object Free Area Length Beyond RW End			
Runway 2	**135** [2]	300	600
Runway 20	300	300	600
Runway Obstacle Free Zone Width	400	400	400
Runway Obstacle Free Zone Length Beyond Runway End	200	200	200
Taxiway Width	40	35	35
Taxiway Centerline to Parallel Taxilane Centerline	145	97	97
Taxiway Safety Area Width	79	79	79
Taxiway Object Free Area Width	**110.5** [3]	131	131
Threshold Siting Surface Criteria			
Runway 2 [4]	---	Obstructions[6]	Obstructions[6]
Runway 20 [5]	---	Criteria Met	Criteria Met

Source: AC 150/5300-13, Federal Aviation Administration. Existing dimensions delineated in **bold** text reflect potential non-standard criteria. [1] Existing runway approach visibility minimums. [2] OFA off the end of the approach end of Runway 2 is penetrated by canal. [3] Taxiway OFA is penetrated by a light pole and the perimeter fence near the approach end to Runway 20. [4] Applies existing runway type 4 criteria for Appendix 2, AC 150/5300-13 Change 9. [5] Applies existing runway type 6 criteria for Appendix 2, AC 150/5300-13 Change 9. [6] Obstructions include two trees, scheduled to either be removed or topped and the fence that runs along Putah South Canal, scheduled to be obstruction lighted.

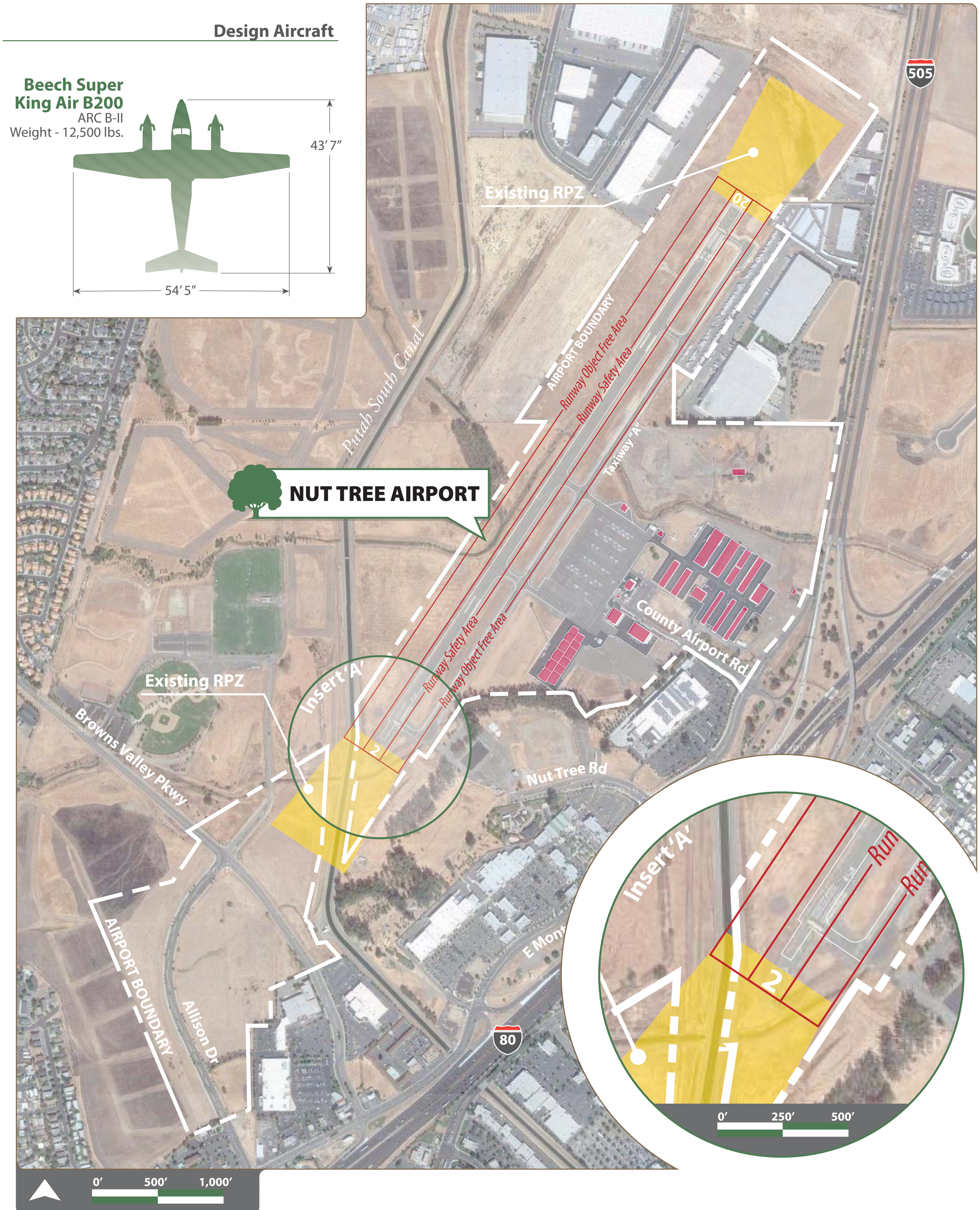


FIGURE D4 ARC B-II Dimensional Criteria
(Not Lower Than 3/4 Mile Visibility Minimums)

Objects Affecting Navigable Airspace. The criteria contained in Federal Aviation Regulations (FAR) Part 77, *Objects Affecting Navigable Airspace*, apply to existing and proposed manmade objects and/or objects of natural growth and terrain (i.e., obstructions). These guidelines define the critical areas in the vicinity of airports that should be kept free of obstructions. Secondary areas may contain obstructions if they are determined to be non-hazardous by an aeronautical study and/or if they are marked and lighted as specified in the aeronautical study determination. Airfield navigational aids, as well as lighting and visual aids, by nature of their location, may constitute obstructions. However, these objects do not violate FAR Part 77 requirements, as they are essential to the operation of the Airport.

Existing obstructions to the FAR Part 77 primary surface at Nut Tree Airport include high terrain to the west of the Airport and various poles, trees, bushes, transmission towers, ball field lights, and other light poles. Proposed Disposition of many of these obstruction is listed on the Airspace Plan from the 2007 ALP Update and include trimming/removal of some bushes and trees and the lighting and marking of other obstructions. It should also be noted that all existing objects will be evaluated in consideration of the ultimate planned approaches and associated FAR Part 77 surfaces during this Airport Master Plan process.

Runways

In consideration of the forecasts of future aviation activity, the adequacy of the runway system must be analyzed from several perspectives. These include runway orientation and airfield capacity, which were analyzed in the previous sections, as well as runway length, pavement strength, and runway visibility, which will be evaluated in the following sections. The analysis of these various aspects pertaining to the runway system will provide a basis for recommendations of future improvements.

Runway Orientation. Nut Tree Airport currently operates with a single runway system, Runway 2/20, which provides a generally north/south orientation. As presented in a previous section, according to both comparative wind roses, the existing runway configuration provides excellent wind coverage (i.e., in excess of 96 percent for the 10.5-knot crosswind component and 97 percent for the 13-knot crosswind component) according to the Airport's ASOS data. Therefore, no additional runways need to be evaluated from a *wind coverage* standpoint.

Airfield Capacity. The evaluation of airfield capacity, as presented in previous sections, indicates that the Airport will not exceed the capacity of the existing runway/taxiway system before the end of the planning period.

Runway Length. The determination of runway length recommendations for Nut Tree Airport is based on several factors. These factors include:

- **Airport elevation;**

- **Mean maximum daily temperature of the hottest month;**
- **Runway gradient;**
- **Family grouping of critical aircraft for runway length purposes; and,**
- **Stage length of the longest nonstop trip destination.**

The runway length operational requirements for aircraft are greatly affected by elevation, temperature, and runway gradient. The calculations for runway length requirements at Nut Tree Airport are based on an elevation of 116 feet AMSL, 95.0 degrees Fahrenheit NMT (mean normal maximum temperature of the hottest month), and a maximum difference in runway elevation at the centerline of approximately three feet.

Generally, for design purposes, runway length recommendations at general aviation airports are premised upon a combination of the most demanding aircraft or family grouping of aircraft within the general aviation fleet that are operating, or are projected to operate, at the airport in the future. For Nut Tree Airport, this fleet is dominated by small aircraft weighing 12,500 pounds maximum takeoff weight (MTOW) or less, with a few larger aircraft (i.e., some of the business jets that are based at the Airport) weighing more than 12,500 pounds but less than 60,000 pounds MTOW. As can be seen in the following table, entitled *RUNWAY 2/20 TAKEOFF LENGTH RECOMMENDATIONS* there are four runway lengths shown for small aircraft (i.e., less than ten passenger seats) type runways. This table is derived from the computer-based FAA Airport Design Software supplied in conjunction with FAA AC 150/5300-13, *Airport Design*. Each of these provides the required length to accommodate a certain type of aircraft that will utilize the runway. The lengths range from 2,590 to 4,370 feet in length.

There are also four different lengths given for large aircraft (i.e., aircraft weighing between 12,500-60,000 pounds). The runway length recommendations for large aircraft range between 4,750 to 9,060 feet for Nut Tree Airport. Currently, this family of aircraft is restricted at times from operating at the Airport at the longer stage lengths or with maximum fuel loads, due to the existing runway length of only 4,700 feet. The runway length recommendations shown in the following table are dependent on meeting the operational requirements of a certain percentage of the fleet at a certain percentage of the useful load, (e.g., 75 percent of the fleet at 60 percent useful load). The useful load of an aircraft is defined as the difference between the maximum allowable structural gross weight and the operating weight empty. In other words, it is the load that can be carried by the aircraft composed of passengers, fuel, and cargo. Generally speaking, the following family grouping of business jet aircraft comprise 75 percent of the large aircraft fleet weighing less than 60,000 pounds: Learjets, Sabreliners, Citations, Falcons, Hawkers, and the Westwind.

Table D5
RUNWAY 2/20 TAKEOFF LENGTH RECOMMENDATIONS

	Runway Takeoff Length (Feet)	
	Dry Pavement	**Wet Pavement**
Existing Condition		
Runway 02/20	4,700	4,700
Small Aircraft with less than 10 seats [1]		
75% of Small Aircraft	2,590	2,590
95% of Small Aircraft	3,160	3,160
100% of Small Aircraft	3,750	3,750
Small Aircraft with more than 10 seats	4,370	4,370
Large Aircraft less than 60,000 pounds		
75% of fleet/60% useful load	4,750	5,430
100% of fleet/60% useful load	5,680	5,680
75% of fleet/90% useful load	7,140	7,140
100% of fleet/90% useful load	9,060	9,060

Notes: Runway lengths based on 116 feet AMSL, 95.0˚F NMT, and maximum difference in runway end elevation of three feet. [1] The majority of aircraft operating at the Airport are contained within the Small Aircraft Category (i.e., $\leq$12,500 lbs.).

An important factor to note when considering the generalized large aircraft runway takeoff length requirements presented in the previous table is that the actual length necessary for a runway is a function of elevation, temperature, and aircraft stage length. As temperatures change on a daily basis, the runway length requirements change accordingly. The cooler the temperature, the shorter the runway necessary; therefore, for example, if an airport is designed to accommodate 75 percent of the fleet at 90 percent useful load, this does not mean that, at certain times a larger aircraft cannot use the airport or that aircraft cannot use it with heavier loadings than that represented by 90 percent of the maximum useful load. Following an examination of the various runway lengths provided in the previous table, it should be noted that Runway 2/20, with an existing length of 4,700 feet, could accommodate the entire small aircraft fleet and very close to 75 percent of the large aircraft fleet at 60 percent useful load (under dry pavement conditions).

As mentioned previously, pilots operating from Nut Tree Airport can adjust the operating weight of their aircraft based upon the specific payload requirements of their flight and the runway length available for takeoff. In addition, the specific performance capabilities of general aviation aircraft are documented through the aircraft certification process and defined by Federal Aviation Regulations (FAR) Part 23. Therefore, both takeoff and landing procedures conducted at Nut Tree Airport must comply with these regulations to ensure the safety of these operations.

In 2005, FAA published AC 150/5325-4B entitled Runway Length Requirements for Airport Design. This AC provides standards and guidelines recommended by FAA strictly for use in the design of civil airports and includes airplane performance data curves and tables for use in airport planning and runway length analysis. Experience has shown that these performance data curves and tables produce recommended runway lengths very similar to the output produced by the Airport Design Program and included in the previous table.

AC 150/5325-4B uses a five-step procedure to determine recommended runway lengths for airport planning purposes. The information derived from this five-step procedure is for airport design only and is not to be used for flight operations. The five steps are paraphrased below with a paragraph following that discusses how the step was followed for this particular runway length analysis for Nut Tree Airport.

Step #1. Identify the list of critical design airplanes that will make regular use of the proposed runway for an established planning period of at least five years. For Federally funded projects, the definition of the term "substantial use" quantifies the term "regular use" (i.e. 500 annual operations).

> This list of critical design airplanes for the Nut Tree Airport includes a number of business jet aircraft that are regular users of the Airport. This list includes a Dassault Falcon 50, a Dassault Falcon 900, a Cessna Citation 501 and a Beechcraft Premier 1. The combined number of annual operations by these aircraft at Nut Tree Airport exceed the FAA's substantial use threshold of 500 operations and are projected to continue to do so over the next five years.

(2) Step #2. Identify the airplanes that will require the longest runway lengths at maximum certificated takeoff weight (MTOW). This will be used to determine the method for establishing the recommended runway length. When the MTOW of listed airplanes is 60,000 pounds (27,200 kg) or less, the recommended runway length is determined according to a family grouping of airplanes having similar performance characteristics and operating weights. When the MTOW of listed airplanes is over 60,000 pounds (27,200 kg), the recommended runway length is determined according to individual airplanes.

> Again, as stated previously, the airplanes that will require the longest runway lengths at MTOW include the list of business jet aircraft that are regular users of Nut Tree Airport with MTOWs of more than 12,500 pounds but less than 60,000 pounds.

(3) Step #3. Use table 1-1 (Appendix B) and the airplanes identified in step #2 to determine the method that will be used for establishing the recommended runway length. Table 1-1 categorizes potential design airplanes according to their MTOWs. MTOW is used because of the significant role played by airplane operating weights in determining runway lengths. The

first column in Table 1-1 separates the various airplanes into one of three weight categories. The second column identifies the applicable airport design approach (by airplane family group or by individual airplanes) as noted previously in step #2. The third column directs the airport designer to the appropriate chapter for design guidelines and whether to use the referenced tables contained in the AC or to obtain airplane manufacturers' airport planning manuals (APM) for each individual airplane under evaluation.

The airplanes that require the longest runway length at Nut Tree Airport are in the *Over 12,500 pounds but less than 60,000 pounds* category and as such, Chapter 3 is the appropriate location of design guidelines. Chapter 3 directs the airport designer to Tables 3-1 and 3-2 (Appendix B). Table 3-1 provides the list of those airplanes that comprise the "75 percent of the fleet" category and therefore can be accommodated by the runway lengths resulting from Figure 3-1. All four of the previously mentioned business jets known to be regular users of Nut Tree Airport are included in Table 3-1, meaning that the design curves in Figure 3-1 (Appendix B) are appropriate for use in runway length determinations for Nut Tree Airport. Figure 3-1 Appendix B includes two design curves, one for 75 percent of the fleet at 60 percent useful load, and one for 75 percent of the fleet at 90 percent useful load. Using the mean daily maximum temperature of the hottest month and the airport elevation for Nut Tree Airport, the first curve produces a recommended runway length of approximately 4,950 feet while the second curve produces a recommended runway length of approximately 7,100 feet.

Furthermore, paragraph 306 of Chapter 3 states that *General aviation (GA) airports have witnessed an increase use of their primary runway by scheduled airline service and privately owned business jets. Over the years business jets have proved themselves to be a tremendous asset to corporations by satisfying their executive needs for flexibility in scheduling, speed, and privacy. In response to these types of needs, GA airports that receive regular usage by large airplanes over 12,500 pounds (5,670 kg) MTOW, in addition to business jets, should provide a runway length comparable to non-GA airports. That is, the extension of an existing runway can be justified at an existing GA airport that has a need to accommodate heavier airplanes on a frequent basis.*

(4) Step #4. Select the recommended runway length from among the various runway lengths generated by step #3 per the process identified in chapters 2, 3, or 4, as applicable.

Paragraph 302 of Chapter 3 instructs the airport designer to then select either the "60 percent useful load" curves or the "90 percent useful load" curves on the basis of the haul length and service needs of the critical design airplanes. According to information provided by the operator of the Dassault Falcon 50 and Falcon 900 aircraft (Appendix A), the operator is often forced to stop in Oakland or Sacramento for fuel for long haul trips departing Nut Tree Airport in the summer months. Therefore, the 90 percent useful load curve was selected in an effort to allow the aircraft operators to maximize fueling and load capabilities.

(5) Step #5. Apply any necessary adjustment to the obtained runway length, when instructed by the applicable chapter of this AC, to the runway length generated by step #4 to obtain a final recommended runway length. For instance, an adjustment to the length may be necessary for runways with non-zero effective gradients. Chapter 5 provides the rationale for these length adjustments.

The recommended runway length from Figure 3-1 must be adjusted at the rate of 10 feet for each foot of elevation difference between the high and low points of the runway centerline. Given that the elevation difference at Nut Tree Airport is only three feet, the adjustment is 30 additional feet, or a recommended runway length of 7,130 feet.

A third method for determining runway length recommendations for airport design involves analyzing FAA published takeoff lengths for specific aircraft types. In this case, the specific aircraft types being the two most critical business jet aircraft based at the Nut Tree Airport, the Dassault Falcon 50, the Dassault Falcon 900. FAA landing field length data at sea level for each of these aircraft was obtained from the Aviation Week & Space Technology Aerospace Source Book and then adjusted based on the elevation (116 feet MSL), mean maximum temperature of the hottest month (95.0 degrees Fahrenheit) and gradient difference (3 feet). The runway length recommendations for each specific aircraft are listed in the following table entitled *GENERAL RUNWAY LENGTH RECOMMENDATIONS FOR "CRITICAL" AIRCRAFT TYPES*.

Table D6
GENERAL RUNWAY LENGTH RECOMMENDATIONS FOR "CRITICAL" AIRCRAFT TYPES

	FAA Takeoff Field Length (ft.) At Sea Level	FAA Takeoff Field Length (ft.) [(1)] Adjusted
Airplanes greater than 12,500 lbs. and less than 60,000 pounds.		
Dassault Falcon 50EX	4,890	5,857
Dassault Falcon 900DX	4,890	5,857

Source: Aviation Week & Space Technology, Aerospace Source Book 2009.
Notes: Runway lengths based on takeoff distance over a 50 ft. obstacle. [(1)] Adjusted runway lengths consider airport elevation, temperature and runway gradient (116 feet AMSL, 95.0˚F NMT, and maximum difference in runway end elevation of three feet).

From this analysis and based on the airport's existing and projected operational activity, it appears that operators of larger general aviation aircraft would benefit from a longer runway at Nut Tree Airport. The question then becomes, do the physical constraints present at the

Airport allow for a longer runway and if so, how much longer? This question and the existing runway deficiency will be evaluated in the following *Alternatives Analysis and Development Concepts* chapter and will be examined in conjunction with the previously identified dimensional criteria deficiencies to identify potential alternative airfield development recommendations.

Runway Pavement Strength. As identified in the *Inventory of Existing Conditions* chapter of this document, Runway 2/20 is rated in good condition, with an existing gross weight bearing capacity of 30,000 pounds single wheel main gear configuration. The existing gross weight bearing capacity of the runway also suggests that the Nut Tree Airport was likely designed for the family grouping of aircraft weighing between 12,500 and 60,000 pounds as described in the previous section. Based on the projected operational fleet mix, the runway will not likely require a strengthening project within the planning period of this study. In addition, all existing airfield pavement should be tested periodically to properly ascertain existing pavement strengths.

Runway Line-of-Sight. According to existing runway line-of-sight standards, any two points located five feet above the runway centerline must be mutually visible for the entire length of the runway. If the runway has a full-length parallel taxiway, the visibility requirement is reduced to a distance of one-half the runway length. Nut Tree Airport does have a full length parallel taxiway and does comply with the runway line-of-sight standards for the entire length of the runway.

Taxiways

Taxiways are constructed primarily to enable the movement of aircraft between the various functional areas on the airport and the runway system. Some taxiways are necessary simply to provide access between aircraft parking aprons and runways; whereas, other taxiways become necessary to provide more efficient and safer use of the airfield.

The parallel taxiway at Nut Tree Airport currently meets separation standards centerline to centerline with Runway 2/20; however, a section of the taxiway near the approach end of Runway 20 does not meet taxiway object free area standards due to the presence of a light pole and the airport perimeter fence in this area. Options for correcting this non-standard condition will be considered in the *Alternatives Analysis sand Development Concepts* chapter.

Additional taxiway improvements to be analyzed include the potential future extension of access taxiways and/or taxilanes to serve additional hangar development and expansion areas on the Airport. In the *Alternatives Analysis and Development Concepts* chapter, the existing access taxiway system will be evaluated with respect to existing and future departure ends of the runway, and every effort will be made to physically separate the airport roadways from taxiways to prohibit unauthorized vehicles from accessing the Airport's aircraft movement areas, and to assist in the safety and security monitoring of the Airport.

Instrumentation and Lighting

Electronic landing aids, including instrument approach capabilities and associated equipment, airport lighting, and weather/airspace services, were detailed in the *Inventory of Existing Conditions* chapter of this document. The Airport is equipped with two existing RNAV (GPS) instrument approaches to Runway 20, which offer visibility minimums ranging from 1-¾ to 1-mile, depending upon the category of aircraft.

At present, GPS approaches (LPV, LNAV/VNAV and LNAV) are anticipated to be the FAA's standard approach technology. With GPS, the cost of establishing new or improved instrument approaches at many airports can be significantly reduced due to the lack of required ground instrumentation. Because of the expected continued use of sophisticated general aviation and corporate aircraft at Nut Tree Airport, the ability to implement improved instrument approaches should be considered, including an identification of the potential impacts on the airport's design (i.e., the configuration of the safety and object clearing standards surrounding the runway system and FAR Part 77 airspace criteria).

Visual Landing Aids (Lights). Presently, the runway at Nut Tree Airport is equipped with Medium Intensity Runway Lights (MIRLs), Precision Approach Path Indicators (PAPIs) located on the left side of each runway end and Runway End Identifier Light (REILs). Based upon the previous discussion regarding the potential for improved instrument approach capabilities and visibility minimums, it is recommended that the existing MIRLs, PAPIs and REILs should be retained at the Airport. Also, consideration should be given to the installation of an Approach Lighting System (ALS) to improve the approach capabilities and visibility minimums to Runway 20.

Runway Protection Zones (RPZs). The function of the RPZ is to enhance the protection of people and property on the ground off the end of runways. This is achieved through airport control of the property within the RPZ area. This control can be exercised through either fee simple ownership or the purchase of an RPZ easement. The RPZ is trapezoidal in shape and centered about the extended runway centerline. Its inner boundary begins 200 feet beyond the end of the area usable for takeoff or landing. The dimensions of the RPZ are functions of the type of aircraft that regularly operate at the airport, in conjunction with the specified visibility minimums of the approach (if applicable).

The RPZs, as shown on the existing airport layout plan, are based on dimensional standards for ARC B-II. Any potential runway extension and/or improved instrument approach minimums may necessitate additional RPZ easement or property acquisition at both runway ends with the required acreage being dependent upon the ultimate location of the runway thresholds. The following table entitled *RUNWAY PROTECTION ZONE DIMENSIONS*, lists existing RPZ dimensional requirements, along with the requirements for improved approach capabilities and/or more demanding approach category aircraft.

Table D7
RUNWAY PROTECTION ZONE DIMENSIONS

Item	Width at Runway End (feet)	Width at Outer End (feet)	Length (feet)
Existing RPZ Dimensions:			
Runway 2	500	700	1,000
Runway 20	500	700	1,000
Required RPZ Dimensions for Various Visibility Minimums:			
Visual and not lower than One mile (Statute), Small Aircraft Exclusively	250	450	1,000
Not lower than One Mile (Statute), Approach Categories A & B[1]	500	700	1,000
Not lower than One Mile (Statute), Approach Categories C & D	1,010	1,010	1,700
Not lower than ¾-Mile (Statute), All Aircraft	1,000	1,510	1,700
Lower than ¾-Mile (Statute), All Aircraft	1,000	1,750	2,500

Source: FAA Advisory Circular 150/5300-13, *Airport Design.*

Future Lighting. As mentioned previously, Runway 2/20 is equipped with Medium Intensity Runway Lights (MIRLs). These lights should be maintained in conjunction with the existing/proposed instrument approach procedures. In addition, Medium Intensity Taxiway Lights (MITLs), which are presently in place on Taxiway "A", should be maintained.

Glide path indicator lights are a system of lights that provide visual vertical approach slope guidance to aircraft during an approach to the runway. Precision Approach Path Indicators (PAPIs) or Visual Approach Slope Indicators (VASIs) are designed for day and nighttime use during VFR (i.e., good weather) conditions. The existing PAPIs are recommended to be retained at each runway end. Runway End Identifier Lights (REILs) are a system of lights that provides an approaching aircraft a rapid and positive identification of the approach end of the runway. The existing REILs at both runway ends are recommended to be retained. The need for a future Approach Lighting System (ALS) would be contingent on the installation of a lower visibility minimum approach into the Airport.

Landside Requirements

Landside facilities are those facilities that support the airside facilities, but are not actually a part of the normal aircraft operating surfaces. These consist of such facilities as terminal buildings, hangars, aprons, access roads and support facilities. Following a detailed analysis of these facilities, current deficiencies can be noted in terms of accommodating both existing and future aviation needs at the Airport.

General Aviation Requirements

The aircraft based at Nut Tree Airport are stored in one of four areas: T-hangars, clear span hangars, large corporate hangars, or apron tiedowns. Currently, there are 201 aircraft based at the Airport. Over half of these aircraft are stored in approximately 107 hangar units, in 25 separate buildings. Over the course of the 20-year planning period, the number of based aircraft is forecast to increase to 267, indicating that an increase in storage facilities to accommodate approximately 66 new aircraft will be required. It is assumed that future storage spaces will reflect an increase in the percentage of based aircraft stored in hangars.

Tiedown Storage Requirements/Based Aircraft. Aircraft tiedowns are provided for those aircraft that do not require hangar storage, do not desire to pay the cost for hangar storage or are on the Airport's hangar wait list. Space calculations for these areas are typically based on 300 square yards of apron for each aircraft tiedown. This amount of space allows for aircraft parking and circulation between the rows of parked aircraft. Based upon existing aircraft storage practices and demand for new hangar facilities, it is projected that a significant number of new aircraft, as well as existing based aircraft that are currently stored on the apron, would prefer to have enclosed hangar storage. As a result, it is projected that the based aircraft apron requirements will increase at a much slower rate than itinerant aircraft apron requirements throughout the planning period as additional hangar storage facilities are constructed at the Airport.

Tiedown Storage Requirements/Itinerant Aircraft. In addition to the needs of the based aircraft tiedown areas addressed in the preceding section, transient aircraft also require apron parking areas at Nut Tree Airport. This storage is provided in the form of transient aircraft tiedown space. In calculating the area requirements for these tiedowns, an area of 400 square yards per aircraft has been used. As previously described, it is projected that demand for based aircraft apron space will increase over the planning period. This means that all demand for additional transient aircraft apron space will have to be met with newly constructed aircraft parking apron. Consequently, the development plan for the Airport will designate adequate areas for future apron development to satisfy the additional demand.

The following table shows the type of facilities and the number of units or square feet needed for that facility in order to meet the forecast demand for each development phase. It is expected that the majority of the owners of aircraft that will be newly based at the Airport will desire some type of indoor storage facility. The actual type of hangar storage facility to accommodate based aircraft has been identified as T-hangars, clear span hangars, and larger corporate and/or FBO-type hangars; although, the actual number, size, and location of the larger hangar types will depend on user needs and financial feasibility. In addition, access and perimeter roadway locations and auto parking requirements are not included in this tabulation because the amount of land necessary for these facilities will be a function of the location of other facilities, as well as the most effective routing of access roadways. The following table, entitled *GENERAL AVIATION FACILITY REQUIREMENTS, 2009-2030*, depicts the area required for general aviation landside facilities during all stages of development. This will assist in the development of detailed facility staging discussed in later chapters of this document.

Table D8
GENERAL AVIATION FACILITY REQUIREMENTS, 2009-2030

	Total Number Required (In yd^2)				
Facility	**2009** [(1)]	**2015**	**2020**	**2025**	**2030**
Itinerant/GA Apron	--- [(2)]	36,925	39,602	42,462	45,520
Based A/C GA Apron	--- [(2)]	31,800	32,700	33,900	34,500
Total Apron (yd^2) [(1)]	52,500	68,725	72,302	76,362	80,020
Hangar Space					
T-hangars/Clear Span (no./yd^2)	94/49,611	113/59,011	118/61,622	124/64,756	132/68,933
Exec./Corp. (no./yd^2)	12/11,667	14/13,611	17/16,528	18/17,500	20/19,444
Total	**113,778**	**141,347**	**150,452**	**158,618**	**168,397**

Source: BD&Co. Projections based on FAA AC 150/5300-13. [(1)] Actual. [(2)] The existing aircraft parking apron is not specifically designated as parking for either based or itinerant aircraft.

Support Facilities Requirements

In addition to the aviation and airport access facilities described above, there are several airport support facilities that have quantifiable requirements and that are vital to the efficient and safe operation of the Airport. The support facilities at Nut Tree Airport that require further evaluation include the fuel storage facility, the adjacent access roadway system, and airport infrastructure development.

Fuel Storage Facility. According to fuel sale estimates provided by Nut Tree Airport personnel, there has been an average of 211,665 gallons of AvGas and Jet A fuel sold per year at Nut Tree Airport over the past four years. Based on 2004 total operation counts, this equates to just over two gallons of fuel sold per aircraft operation. Typically, as operations increase, fuel storage requirements can be expected to increase proportionately. By applying the ratios of AvGas gallons sold and Jet A gallons sold per operation over the 20-year planning period, an estimate of future fuel storage needs can be calculated. Jet aircraft, which use Jet A fuel, typically take on considerably more fuel than aircraft using AvGas and, as such, it is assumed that the ratio of gallons per operation is much higher. As can be seen in the following table, entitled *FUEL STORAGE REQUIREMENTS, 2009-2030*, it appears that the capacity of both types of fuel may need to be increased. Therefore, adequate expansion area will be reserved in the vicinity of the existing fuel farm to accommodate additional fuel storage tanks.

Table D9
FUEL STORAGE REQUIREMENTS, 2009-2030

	2009 [1]	2015	2020	2025	2030
Annual Operations	*101,500*	*108,286*	*114,290*	*120,631*	*127,329*
Annual Operations (AvGas)	94,395	97,457	106,290	112,127	118,416
Average AvGas Fuel Ratio (Gal.)	0.8	0.8	0.8	0.8	0.8
Total Annual AvGas Storage Required (Gal.)	75,516	77,966	85,032	89,749	94,933
Storage Capacity (Gal.)	10,500	10,500	10,500	10,500	10,500
Minimum Delivery Frequency (Deliveries per Year)	7.2	7.4	8.1	8.5	9.0
Annual Operations (Jet A)	7,105	7,580	8,000	8,444	8,913
Average Jet A Fuel Ratio (Gal.)	21	21	21	21	21
Total Annual Jet A Fuel Storage Required (Gal.)	149,205	159,180	168,006	177,328	187,174
Storage Capacity (Gal.)	13,000	13,000	13,000	13,000	13,000
Minimum Delivery Frequency (Deliveries per Year)	11.5	12.2	12.9	13.6	14.4

[1] Base year estimates.

Access Roadway Development. Due to the close proximity of the terminal area to Monte Vista Avenue and I-505, roadway access to the Airport is very good. The Airport is currently accessed via County Airport Road via Monte Vista Avenue which runs parallel to I-505 near Nut Tree Airport. However, should apron and hangars development areas separate from the main terminal area be considered, additional access roadway development may be required. The Airport terminal area can also be accessed from the new Nut Tree commercial development via a recently constructed pedestrian walkway and bridge over Pine Tree Creek.

Potential Land Acquisition and Westside Development. In 2008, Solano County prepared an Environmental Assessment (EA) for the fee simple acquisition of 141 acres of land in the vicinity of Nut Tree Airport. The 141 acres consisted of various parcels of land in three separate areas around the Airport. The first of these three areas being a 16 acre area adjacent to Monte Vista Avenue and the existing hangars that has since been acquired. The other two acquisition areas that have not yet been acquired include a 32 acre area off the approach end of Runway 20, also adjacent to Monte Vista Avenue, and a 93 acre undeveloped area located adjacent to the western boundary of airport property.

The purpose and need for the acquisition of each of these areas was primarily to provide protection of the approach to Runway 20 and to provide a buffer between aviation uses and adjacent development. The acquisition of the area under the approach to Runway 20 will also allow for the potential extension or shift of the runway and potential improvement to the instrument approach capabilities of Runway 20. The acquisition of the area located west of the Airport will also permit the expansion of airport facilities to accommodate potential growth in both based and transient aircraft as identified in the previous chapter of the *Airport Master Plan*. Options for expansion of aviation and/or aviation-related facilities in order to accommodate this forecast growth will be examined in the following chapter.

Summary

The need for facilities, which has been identified in this chapter, can now be utilized to formulate the overall future Development Plan for Nut Tree Airport. The formulation of this plan will begin by establishing goals for future airport development and an analysis of development alternatives, whereby demand for future airport facilities can be accommodated. These alternatives will be presented in the following chapter, entitled *Alternatives Analysis and Development Concepts*. The following list is a summary of the major airport improvement considerations that are indicated in the *Facility Requirements* section.

- **Correct non-standard Runway Object Free Area (OFA) penetration by the airport perimeter fence and the Putah South Canal berm**
- **Correct non-standard Taxiway Object Free Area (OFA) near the approach end of Runway 20**
- **Programming for the ultimate runway system (runway length, width and strength)**
- **Programming for instrument approach improvements**
- **Programming for land acquisition to support a potential runway shift, a potential runway extension and/or potential instrument approach improvements**
- **Additional aircraft parking apron for based and transient aircraft**
- **Additional hangar area in accordance with based aircraft demand**
- **Programming for land acquisition to support aviation and/or aviation related development**
- **Additional access roadways for future aircraft parking and hangar development areas**

It is important to note that the recommendations in this *Airport Master Plan* are provided to best understand what facility improvements might be needed at the Nut Tree Airport, and where those facilities might best be placed. In other words, the *Airport Master Plan* provides recommendations on how various parcels of the Airport might best be developed in consideration of potential demand and community/environmental influences. One of the basic assumptions of this *Airport Master Plan* is that if a future improvement is identified on the recommended development plan; it will only be built if there is actual demand, if the project is financially feasible, and if environmental impacts are insignificant or can be appropriately mitigated.

Appendix A - Runway Length Support Letters

Copart **Corporate Headquarters** ***Auto Auctions***

June 23, 2010

Mr. Andrew Swanson, Airport Manager
Nut Tree Airport
Solano County, General Services Dept.
301 County Airport Road Suite 205
Vacaville, CA 95688

RE: Airport Master Plan Support

Dear Mr. Swanson:

As an aircraft operator at the Nut Tree Airport, we would like to offer the following information in support of the upcoming Airport Master Plan. Copart Inc. is located in Fairfield, CA and currently bases two corporate jet aircraft at the Nut Tree Airport, a Dassault Falcon 50 and Dassault Falcon 900. We estimate that each aircraft operates at least one flight per week departing from and returning to the Nut Tree Airport. In other words, our two aircraft account for at least 200 annual aircraft operations at the airport.

In particular, we are very interested in the runway length analysis to be conducted during this planning process. During the winter months, we are able to operate with full passenger and fuel loads to most potential destinations; however, our operations are very much constrained during warmer months by the 4,700 feet of available runway length at the Nut Tree Airport. Even with the exceptional performance of Dassault aircraft, we are often forced to depart with reduced passenger and/or fuel loads during these conditions, or stop at Oakland or Sacramento to top the tanks for long-haul trips. An optimal runway length that would allow our aircraft to operate efficiently and fulfill the company missions that were envisioned for these aircraft when they were purchased by Copart would be approximately 5,500 feet. This runway length would allow us to operate our aircraft non-stop to the East Coast without the requirement of additional fuel stops.

If you have any questions about this letter of support, please feel free to contact me. I look forward to participating in this planning process for the Nut Tree Airport.

Sincerely yours,

Rick Shafer, Chief Pilot
Copart Inc.

cc: Barnard Dunkelberg & Company

Appendix B – Runway Length Analysis Tables

Table 1-1. Airplane Weight Categorization for Runway Length Requirements

Airplane Weight Category Maximum Certificated Takeoff Weight (MTOW)			Design Approach	Location of Design Guidelines
12,500 pounds (5,670 kg) or less	Approach Speeds less than 30 knots		Family grouping of small airplanes	Chapter 2; Paragraph 203
	Approach Speeds of at least 30 knots but less than 50 knots		Family grouping of small airplanes	Chapter 2; Paragraph 204
	Approach Speeds of 50 knots or more	With Less than 10 Passengers	Family grouping of small airplanes	Chapter 2; Paragraph 205 Figure 2-1
		With 10 or more Passengers	Family grouping of small airplanes	Chapter 2; Paragraph 205 Figure 2-2
Over 12,500 pounds (5,670 kg) but less than 60,000 pounds (27,200 kg)			Family grouping of large airplanes	Chapter 3; Figures 3-1 or 3-2 [1] and Tables 3-1 or 3-2
60,000 pounds (27,200 kg) or more or Regional Jets [2]			Individual large airplane	Chapter 4; Airplane Manufacturer Websites (Appendix 1)

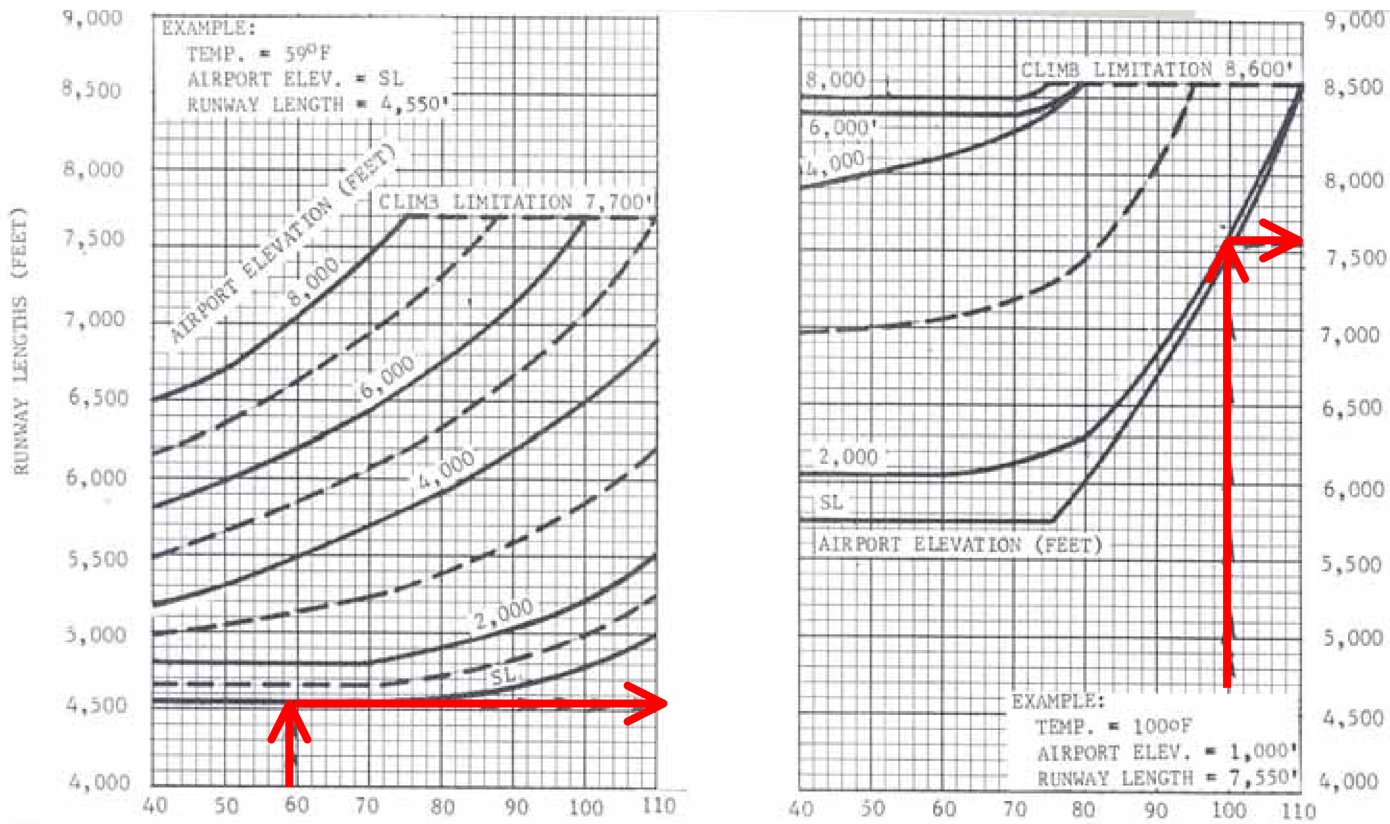
Note [1]: When the design airplane's APM shows a longer runway length than what is shown in figure 3-2, use the airplane manufacturer's APM. However, users of an APM are to adhere to the design guidelines found in Chapter 4.

Note [2]: All regional jets regardless of their MTOW are assigned to the 60,000 pounds (27,200 kg) or more weight category.

103. PRIMARY RUNWAYS. The majority of airports provide a single primary runway. Airport authorities, in certain cases, require two or more primary runways as a means of achieving specific airport operational objectives. The most common operational objectives are to (1) better manage the existing traffic volume that exceed the capacity capabilities of the existing primary runway, (2) accommodate forecasted growth that will exceed the current capacity capabilities of the existing primary runway, and (3) mitigate noise impacts associated with the existing primary runway. Additional primary runways for capacity justification are parallel to and equal in length to the existing primary runway, unless they are intended for smaller airplanes. Refer to AC 150/5060-5, *Airport Capacity and Delay,* for additional discussion on runway usage for capacity gains. Another common practice is to assign individual primary runways to different airplane classes, such as, separating general aviation from non-general aviation customers, as a means to increase the airport's efficiency. The design objective for the main primary runway is to provide a runway length for all airplanes that will regularly use it without causing operational weight restrictions. For Federally funded projects, the criterion for substantial use applies (see paragraph 102a(8).) The design objective for additional primary runways is shown in table 1-2. The table takes into account the separation of airplane classes into distinct airplane groups to achieve greater airport utilization. Procedurally, follow the guidelines found in subparagraph 102(b) for determining recommended runway lengths for primary runways, and, for additional primary runways, apply table 1-2.

104. CROSSWIND RUNWAYS. The design objective to orient primary runways to capture 95 percent of the crosswind component perpendicular to the runway centerline for any airplane forecast to use the airport is not always achievable. In cases where this cannot be done, a crosswind runway is recommended to achieve the design standard provided in AC 150/5300-13, *Airport Design,* for allowable crosswind components according to airplane design groups. Even when the 95-percentage crosswind coverage standard is achieved for the design airplane or airplane design group, cases arise where certain airplanes with lower crosswind capabilities are unable to utilize the primary runway. For airplanes with lesser crosswind capabilities, a crosswind runway may be built, provided there is regular usage. For Federally funded projects, the criterion for substantial use applies to the airplane used as the design airplane needing the crosswind runway (see paragraph 102a(8).) The design objective for the length of crosswind runways is shown in table 1-3. Procedurally, follow the guidelines found in subparagraph 102(b) for determining recommended runway lengths for crosswind runways, and, for additional crosswind runways, apply table 1-3.

Figure 3-1. 75 Percent of Fleet at 60 or 90 Percent Useful Load



Mean Daily Maximum Temperature of Hottest Month of the Year in Degrees Fahrenheit

75 percent of feet at 60 percent useful load **75 percent of feet at 90 percent useful load**

Table 3-1. Airplanes that Make Up 75 Percent of the Fleet

Manufacturer	Model
Aerospatiale	Sn-601 Corvette
Bae	125-700
Beech Jet	400A
Beech Jet	Premier I
Beech Jet	2000 Starship
Bombardier	Challenger 300
Cessna	500 Citation/501Citation Sp
Cessna	Citation I/II/III
Cessna	525A Citation II (CJ-2)
Cessna	550 Citation Bravo
Cessna	550 Citation II
Cessna	551 Citation II/Special
Cessna	552 Citation
Cessna	560 Citation Encore
Cessna	560/560 XL Citation Excel
Cessna	560 Citation V Ultra
Cessna	650 Citation VII
Cessna	680 Citation Sovereign

Manufacturer	Model
Dassault	Falcon 10
Dassault	Falcon 20
Dassault	Falcon 50/50 EX
Dassault	Falcon 900/900B
Israel Aircraft Industries (IAI)	Jet Commander 1121
IAI	Westwind 1123/1124
Learjet	20 Series
Learjet	31/31A/31A ER
Learjet	35/35A/36/36A
Learjet	40/45
Mitsubishi	Mu-300 Diamond
Raytheon	390 Premier
Raytheon Hawker	400/400 XP
Raytheon Hawker	600
Sabreliner	40/60
Sabreliner	75A
Sabreliner	80
Sabreliner	T-39