Final Environmental Assessment for the Southern California Metroplex Project

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1 Introduction

The National Environmental Policy Act of 1969 (NEPA) [42 United States Code (U.S.C.) § 4321 *et seq.*], requires federal agencies to disclose to decision makers and the interested public a clear, accurate description of the potential environmental impacts that could arise from proposed federal actions. Through NEPA, Congress has directed federal agencies to consider environmental factors in their planning and decision-making processes and to encourage public involvement in decisions that affect the quality of the human environment. As part of the NEPA process, federal agencies are required to consider the environmental effects of the Proposed Action, reasonable alternatives to the Proposed Action, and a No Action Alternative (i.e., analyzing the potential environmental effects of not undertaking the Proposed Action). The Federal Aviation Administration (FAA) has established a process to ensure compliance with the provisions of NEPA through FAA Order 1050.1E, Change 1, *Environmental Impacts: Policies and Procedures* (FAA Order 1050.1E). The Proposed Action, the subject of this Environmental Assessment (EA), is called the Southern California Metroplex or "SoCal Metroplex" Project.[1] The procedures designed for the SoCal Metroplex Project would be used by arriving and departing aircraft operating under Instrument Flight Rules at the study area airports ("the Study Airports").

This EA, prepared in accordance with FAA Order 1050.1E, documents the potential effects to the environment that may result from the optimization of Air Traffic Control (ATC) procedures at the Study Airports. These airports were selected based on whether they would be directly served by a proposed procedure and if so, whether they served the required number of annual Instrument Flight Rules filed operations under FAA Order 1050.1E. The Study Airports are:

- Bermuda Dunes Airport (UDD)
- Bob Hope Airport (BUR)
- Brown Field Municipal Airport (SDM)
- Camarillo Airport (CMA)
- Gillespie Field Airport (SEE)
- Jacqueline Cochran Regional Airport (TRM)
- John Wayne – Orange County Airport (SNA)
- Long Beach Airport (Daugherty Field) (LGB)
- Los Angeles International Airport (LAX)
- McClellan-Palomar Airport (CRQ)
- Miramar Marine Corps Air Station (NKX)
- Montgomery Field Airport (MYF)
- North Island Naval Air Station (Halsey Field)(NZY)
- Ontario International Airport (ONT)
- Oxnard Airport (OXR)
- Palm Springs International Airport (PSP)
- Point Mugu Naval Air Station (NTD)
- San Diego International Airport (SAN)

[1] The Metroplex initiative was formerly referred to as the Optimization of Airspace and Procedures in the Metroplex (OAPM) initiative. A Metroplex is a geographic area covering several airports, serving major metropolitan areas and a diversity of aviation stakeholders.

- Santa Barbara Municipal Airport (SBA)
- Santa Monica Municipal Airport (SMO)
- Van Nuys Airport (VNY)

This EA includes the following chapters and appendices:

- **Chapter 1: Introduction.** Chapter 1 provides basic background information on the air traffic system, the Next Generation Air Transportation System (NextGen) program, Performance-Based Navigation (PBN), the FAA's Metroplex initiative, and information on the Southern California Metroplex and the Study Airports.
- **Chapter 2: Purpose and Need.** Chapter 2 discusses the need (i.e., problem) and purpose (i.e., solution) for airspace and procedure optimization in the Southern California Metroplex area, and identifies the Proposed Action.
- **Chapter 3: Alternatives.** Chapter 3 discusses the Proposed Action and the No Action Alternative analyzed as part of the environmental review process.
- **Chapter 4: Affected Environment.** Chapter 4 discusses existing environmental conditions within the Southern California Metroplex area.
- **Chapter 5: Environmental Consequences.** Chapter 5 discusses the potential environmental impacts associated with the Proposed Action and the No Action Alternative.
- **Appendix A: Agency and Public Coordination and List of Receiving Parties. Appendix A** documents agency and public coordination associated with the EA process and lists the local agencies and parties identified to receive copies of the Draft and Final EA documents.
- **Appendix B: List of Preparers. Appendix B** lists the names and qualifications of the principal persons contributing information to this EA.
- **Appendix C: References. Appendix C** provides references to documents used to prepare the EA document.
- **Appendix D: List of Acronyms and Glossary. Appendix D** lists acronyms and provides a glossary of terms used in the EA.
- **Appendix E: Basics of Noise. Appendix E** presents information on aircraft noise as well as the general methodology used to analyze noise associated with aviation projects.
- **Appendix F: Responses to Comments on the Draft EA**. **Appendix F** presents comments from the public on the Draft EA received during the public comment period and responses to the comments prepared by the FAA.

1.1 Project Background

On January 16, 2009, the FAA asked RTCA[2] to create a joint government-industry task force to make recommendations for implementation of Next Generation Air Transportation System (NextGen) operational improvements for the nation's air transportation system. In

[2] RTCA, Inc. Executive Summary, *NextGen Mid-Term Implementation Task Force Report*, September 9, 2009.

response, RTCA assembled the NextGen Mid-Term Implementation Task Force (Task Force 5), which included more than 300 representatives from commercial airlines, general aviation, the military, aerospace manufacturers, and airport stakeholders.[3] Section 1.2.5 discusses the NextGen Program in more detail.[4]

On September 9, 2009, RTCA issued the NextGen Mid-Term Implementation Task Force Report, which provided the Task Force 5 recommendations. One of these recommendations directed the FAA to undertake planning for implementing Performance-Based Navigation (PBN)[5] procedures on a metroplex basis, including Area Navigation (RNAV) and Required Navigation Performance (RNP), which are discussed further in Sections 1.2.5.1 and 1.2.5.2. Based on this recommendation, the FAA began the Metroplex initiative.

The purpose of the Metroplex initiative is to optimize air traffic procedures and airspace on a regional scale. This is accomplished by developing procedures that take advantage of technological advances in navigation, such as RNAV, while ensuring that aircraft not equipped to use RNAV continue to have access to the National Airspace System (NAS). This approach addresses airspace congestion and other factors that reduce efficiency in busy metroplex areas and accounts for key operating airports and airspace in the Metroplex. The SoCal Metroplex Study Airports are further discussed in Section 1.4. The Metroplex initiative also addresses connectivity with other metroplex areas. The overall intent is to use limited airspace as efficiently as possible for congested metroplex areas.[6]

1.2 Air Traffic Control and the National Airspace System

The following sections provide basic background information on air traffic control and the NAS. This information includes a description of the NAS, the role of Air Traffic Control (ATC), the methods air traffic controllers use to provide services within the Air Traffic Control system, and the different phases of aircraft flight within the NAS. Following this discussion, information is provided on the FAA's NextGen program and the Metroplex initiative.

1.2.1 National Airspace System

Under the Federal Aviation Act of 1958 (49 USC § 40101 *et seq*.), the FAA is delegated control over use of the nation's navigable airspace and regulation of domestic civil and military aircraft operations in the interest of maintaining safety and efficiency. To help fulfill this mandate, the FAA established the NAS. Within the NAS, the FAA provides air traffic services for aircraft takeoffs, landings, and the flow of aircraft between airports through a system of infrastructure (e.g., air traffic control facilities), people (e.g., air traffic controllers,

[3] RTCA, Inc. is a private, not-for-profit corporation that develops consensus-based recommendations regarding communications, navigation, surveillance (CNS), and air traffic management (ATM) system issues. RTCA functions as a federal advisory committee and includes roughly 400 government, industry, and academic organizations from the United States and around the world. Members represent all facets of the aviation community, including government organizations, airlines, airspace users, airport associations, labor unions, and aviation service and equipment suppliers. More information is available at http://www.rtca.org.

[4] RTCA Inc., Executive Summary, *NextGen Mid-Term Implementation Task Force Report*, September 9, 2009.

[5] Additional information on Performance-Based Navigation (PBN) is provided on the FAA Fact Sheet, "NextGen Goal: Performance-Based Navigation," April 24, 2009 [http://www.faa.gov/news/fact_sheets/news_story.cfm?newsId=8768 (accessed April 11, 2012)].

[6] U.S. Department of Transportation, Federal Aviation Administration, *FAA Response to Recommendations of the RTCA NextGen Mid-Term Implementation Task Force*, January 2010, p. 14.

maintenance, and support personnel), and technology (e.g., radar, communications equipment, ground-based navigational aids [NAVAIDs],[7] etc.) The NAS is governed by various FAA rules and regulations.

The NAS comprises one of the most complex aviation networks in the world. The FAA continuously reviews the design of all NAS resources to ensure they are effectively and efficiently managed. The FAA Air Traffic Organization (ATO) is the primary organization responsible for managing airspace and flight procedures in the NAS. When changes are proposed to the NAS, the FAA works to ensure that the changes maintain or enhance system safety and improve efficiency. One way to accomplish this mission is to employ emerging technologies to increase system flexibility and predictability.[8]

1.2.2 Air Traffic Control within the National Airspace System

The combination of infrastructure, people, and technology used to monitor and guide (or direct) aircraft within the NAS is referred to collectively as ATC. One of ATC's responsibilities is to maintain safety and expedite the flow of traffic in the NAS by applying defined minimum distances or altitude between aircraft (referred to as "separation"). This is accomplished through required communications between air traffic controllers and pilots and the use of navigational technologies.

Aircraft operate under two distinct categories of flight rules: Visual Flight Rules (VFR) and Instrument Flight Rules (IFR).[9] Under VFR, pilots are responsible to "see and avoid" other aircraft and obstacles such as terrain to maintain safe separation. Under IFR, aircraft operators are required to file flight plans and use navigational instruments to operate within the NAS. Helicopters and general aviation aircraft typically operate under VFR conditions. The majority of commercial air traffic operates under IFR.

Depending on whether aircraft are operating under IFR or VFR, air traffic controllers apply various techniques to maintain separation between aircraft,[10] including the following:

- **Vertical or "Altitude" Separation:** separation between aircraft operating at different altitudes,
- **Longitudinal or "In-Trail" Separation:** separation between two aircraft operating along the same flight route, referring to the distance between a lead and a following aircraft; and
- **Lateral or "Side-by-Side" Separation:** separation between aircraft (left or right side) operating along two separate but nearby flight routes.

Exhibit 1-1 depicts the three dimensions around an aircraft used to determine separation.

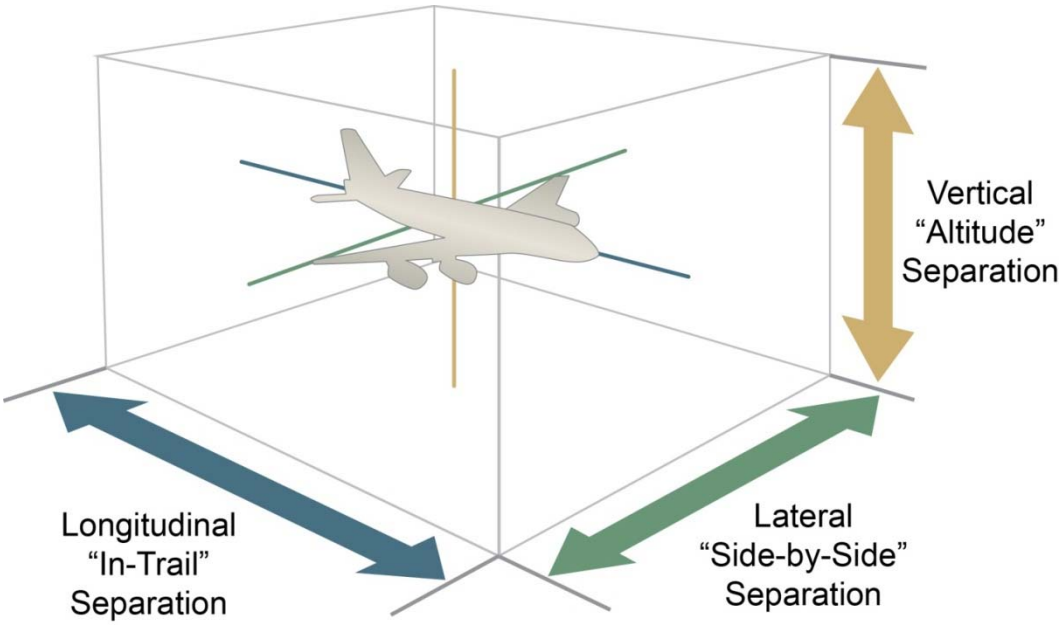
[7] NAVAIDs are facilities that transmit signals that define key points or routes.

[8] U.S. Department of Transportation, Federal Aviation Administration, Order JO 7400.2K, , *Procedures for Handling Airspace Matters*, Section 32-3-5(b) "National Airspace Redesign," February 19, 2014.

[9] 14 Code of Federal Regulations (C.F.R.), Part 91.

[10] Defined in FAA Order JO 7110.65W, *Air Traffic Control*.

Exhibit 1-1 Three Dimensions Around an Aircraft



Source: ATAC Corporation, December 2012.
Prepared by: ATAC Corporation, October 2013.

Air traffic controllers use radar to monitor aircraft and provide services that ensure separation. Published instrument procedures provide predictable, efficient routes that move aircraft through the NAS in a safe and orderly manner. These procedures reduce verbal communication between air traffic controllers and pilots. Published instrument procedures are described as "conventional" procedures when they use ground-based NAVAIDs.

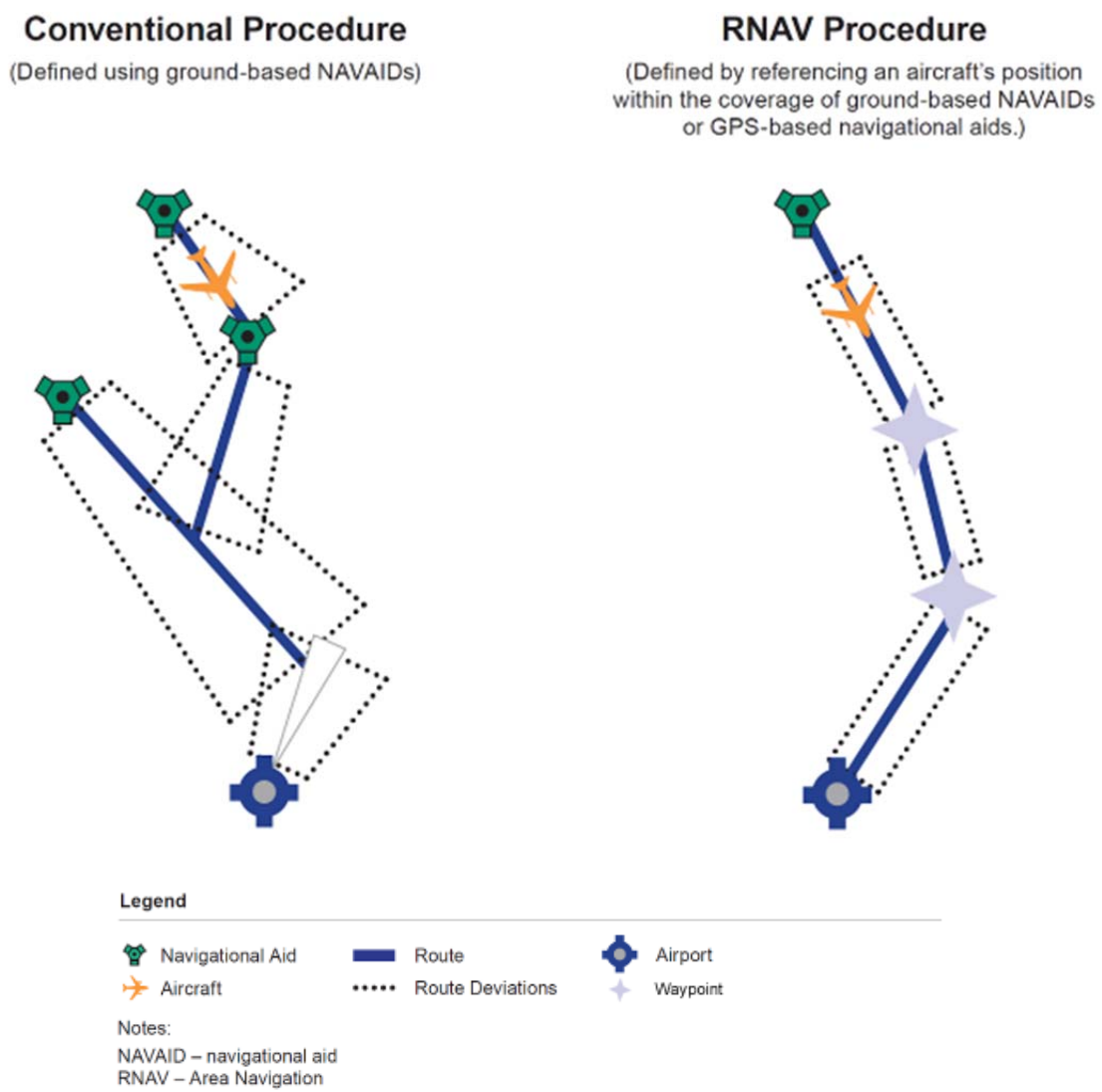
In its effort to modernize the NAS, the FAA is developing instrument procedures that use advanced technologies. A primary technology in this effort is RNAV. RNAV uses technology, including Global Positioning System (GPS), to allow an RNAV-equipped aircraft to fly a more efficient route. This route is based on instrument guidance that references an aircraft's position relative to ground-based NAVAIDs or satellites. **Exhibit 1-2** compares a conventional procedure and an RNAV procedure.

ATC uses a variety of methods and coordination techniques to maintain safety within the NAS, including:

- **Vectors:** Directional headings issued to aircraft to provide navigational guidance and to maintain separation between aircraft and/or obstacles,
- **Speed Control:** Instructions issued to aircraft to reduce or increase aircraft speed to maintain separation between aircraft,
- **Reroute:** Controllers may change an aircraft's route for a variety of reasons, such as avoidance of inclement weather, to maintain separation between aircraft, and/or to protect airspace,
- **Point-out:** Notification issued by one controller when an aircraft might pass through or affects another controller's airspace and radio communications will not be transferred,

- **Holding Pattern/Ground Hold:** Controllers assign aircraft to a holding pattern in the air or hold aircraft on the ground before departure to maintain separation between aircraft and to manage arrival/departure volume; and/or
- **Altitude Assignment/Level-off:** Controllers assign altitudes to maintain separation between aircraft and/or to protect airspace. This may result in aircraft "leveling off" during ascent or descent.
- As an aircraft moves from origin to destination, ATC personnel function as a team and transfer control of the aircraft from one controller to the next and from one ATC facility to the next.

Exhibit 1-2 Comparison of Routes Following Conventional versus RNAV Procedures



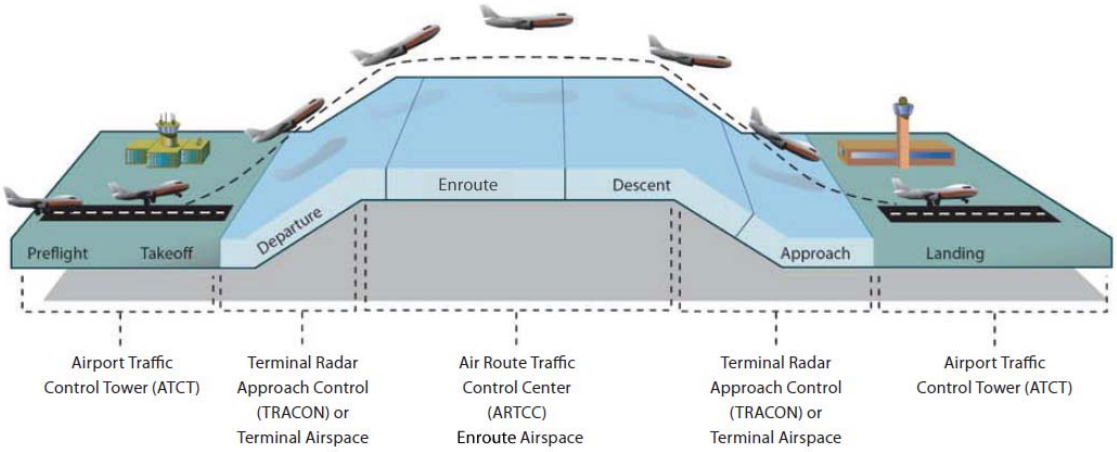
Source: U.S. Department of Transportation, Federal Aviation Administration, "Performance-Based Navigation (PBN)" brochure, 2009.
Prepared by: ATAC Corporation, March 2014.

1.2.3 Aircraft Flow within the National Airspace System

An aircraft traveling from airport to airport typically operates through six phases of flight (plus a "preflight" phase). **Exhibit 1-3** depicts the typical phases of flight for a commercial aircraft. These phases include:

- **Preflight (Flight Planning):** The preflight route planning and flight checks performed in preparation for takeoff,
- **Push Back/Taxi/Takeoff:** The aircraft's transition across the airfield from push-back at the gate, taxiing to an assigned runway, and takeoff from the runway,
- **Departure:** The aircraft's in-flight transition from takeoff to the enroute phase of flight, during which it climbs to the assigned cruising altitude,
- **Enroute:** Generally, the level segment of flight (i.e., cruising altitude) between the departure and destination airports,
- **Descent:** The aircraft's in-flight transition from an assigned cruising altitude to the point at which the pilot initiates the approach to a runway at the destination airport,
- **Approach:** The segment of flight during which an aircraft follows a standard procedure that guides the aircraft to the landing runway, and
- **Landing:** Touch-down of the aircraft at the destination airport and taxiing from the runway to the gate or parking position.

Exhibit 1-3 Typical Phases of a Commercial Aircraft Flight



Source: U.S. Department of Transportation, Federal Aviation Administration, Houston Area Air Traffic System (HAATS), Airspace Redesign, Final Environmental Assessment, Figure 1.1.1-1, March 2008.
Prepared by: ATAC Corporation, March 2014.

1.2.4 Air Traffic Control Facilities

The NAS is organized into three-dimensional areas of navigable airspace that are defined by a floor, a ceiling, and a lateral boundary. Each is controlled by different types of ATC facilities including:

- **Airport Traffic Control Tower:** Controllers at an Airport Traffic Control Tower (ATCT) located at an airport provide air traffic services for phases of flight associated with aircraft takeoff and landing. The ATCT typically controls airspace extending from the airport out to a distance of several miles.
- **Terminal Radar Approach Control:** Controllers at a Terminal Radar Approach Control (TRACON) provide air traffic service to aircraft as they transition between an airport and the enroute phase of flight, and from the enroute phase of flight to an airport. This includes the departure, climb, descent, and approach phases of flights. The TRACON airspace is broken down into sectors. As an aircraft moves between sectors, responsibility for it transfers from controller to controller. Controllers maintain separation between aircraft that operate within their sectors. The terminal airspace in the Southern California Metroplex area is referred to as Southern California TRACON or "SCT" and is shown on **Exhibit 1-4**.
- **Air Route Traffic Control Centers:** Controllers at Air Route Traffic Control Centers (ARTCCs or "Centers") provide air traffic services during the enroute phase of flight. Similar to TRACON airspace, the Center airspace is broken down into sectors. As shown on **Exhibit 1-4**, the Southern California Metroplex is comprised of airspace delegated to the Los Angeles ARTCC (ZLA) and SCT.

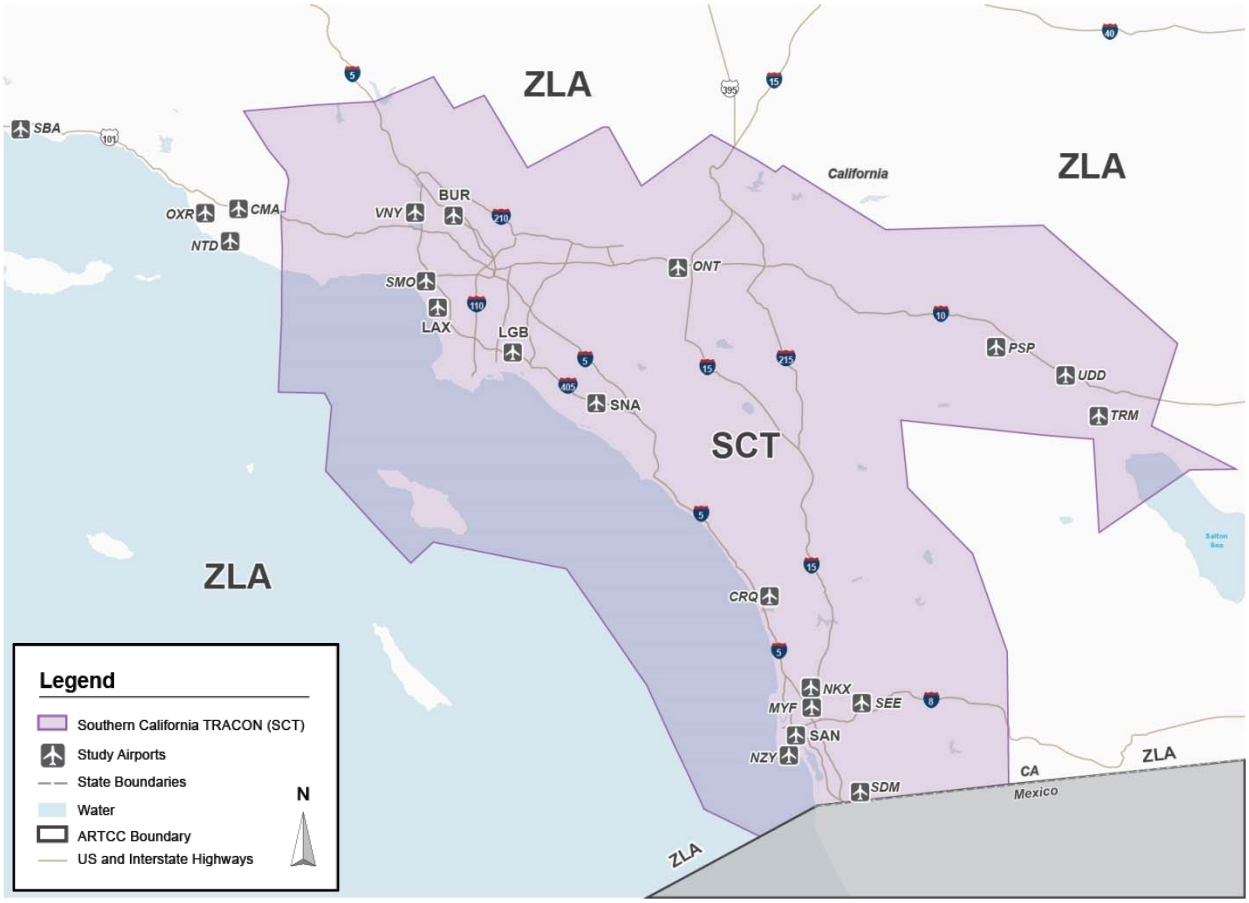
The following sections discuss how air traffic controllers at these ATC facilities control the phases of flight for aircraft operating under IFR.

1.2.4.1 Departure Flow

As an aircraft operating under IFR, also known as an "IFR aircraft", departs a runway and follows its assigned heading, it moves from the ATCT airspace, through the terminal airspace, and into enroute airspace where it proceeds on a specific route to its destination airport.

Within the terminal airspace, TRACON controllers provide services to aircraft departing from the ATCT airspace to transfer control points referred to as "exit points." An exit point represents an area along the boundary between terminal airspace and enroute airspace. Exit points are generally established near commonly used routes to efficiently transfer aircraft between terminal and enroute airspace. When aircraft pass through the exit point, control transfers from TRACON to ARTCC controllers as the aircraft joins a specific route.

Exhibit 1-4 Airspace in the Southern California Metroplex Area



Notes:

ZLA – Los Angeles Center	*SCT – Southern California TRACON*	*UDD - Bermuda Dunes Airport*	*BUR - Bob Hope Airport*
SDM - Brown Field Municipal Airport	*CMA - Camarillo Airport*	*SEE - Gillespie Field Airport*	*TRM - Jacqueline Cochran Regional Airport*
SNA - John Wayne – Orange County Airport	*LGB - Long Beach Airport (Daugherty Field)*	*LAX - Los Angeles International Airport*	*CRQ - McClellan-Palomar Airport*
NKX - Miramar Marine Corps Air Station	*MYF - Montgomery Field Airport*	*NZY - North Island Naval Air Station (Halsey Field)*	*ONT - Ontario International Airport*
OXR - Oxnard Airport	*PSP - Palm Springs International Airport*	*NTD - Naval Air Station Point Mugu*	*SAN - San Diego International Airport*
SBA - Santa Barbara Municipal Airport	*SMO - Santa Monica Municipal Airport*	*VNY - Van Nuys Airport*	

Sources: U.S. Department of Transportation, Federal Aviation Administration, National Flight Data Center, National Airspace System Resources, Airport, and Runway databases, accessed February 2015 (airspace boundaries); National Atlas of the United States of America (U.S. County and State Boundaries, Water Bodies); Bureau of Transportation Statistics, National Transportation Atlas Database (U.S. and Interstate Highways).

Prepared by: ATAC Corporation, May 2015.

Standard Instrument Departures

Departing IFR aircraft use a procedure called a Standard Instrument Departure (SID). A SID provides pilots with defined lateral and vertical guidance to facilitate safe and predictable navigation from an airport through the terminal airspace to a specific route in the enroute airspace. A “conventional” SID follows a route defined by ground-based NAVAIDs, may be

based on vectoring, or both. Because of the increased precision inherent in RNAV technology, an RNAV SID defines a more predictable route through the airspace than a conventional SID. Some RNAV SIDs may be designed to include paths called "runway transitions" that serve particular runways at airports. Transitions are a series of fixes leading to/from a common route. They serve as the entry and exit points into terminal and enroute airspace. A SID may have several runway transitions serving one or more runways at one or more airports. From the runway transition, aircraft may follow a common path before being directed along one or several diverging routes referred to as "enroute transitions." Enroute transitions may terminate at exit fixes or continue into enroute airspace where aircraft join a specific route.

1.2.4.2 Arrival Flow

An aircraft begins the descent phase of flight within the enroute airspace. During descent, the aircraft transitions into the terminal airspace through an "entry point," bound for the destination airport. The entry point represents a point along the boundary between terminal airspace and enroute airspace where control of the aircraft transfers from ARTCC to TRACON controllers.

Standard Terminal Arrival Routes

Aircraft that arrive in the terminal airspace normally follow an instrument procedure called a Standard Terminal Arrival Route (STAR). Aircraft leaving enroute airspace and entering terminal airspace may follow an enroute transition from an entry fix to the STAR's common route in the terminal airspace. From the common route segment, aircraft may follow a runway transition before making an approach to the airport.

1.2.4.3 Required Aircraft Separation

As controllers manage the flow of aircraft into, out of, and within the NAS, they maintain some of the following separation distances between aircraft[11]:

- **Altitude Separation (vertical):** When operating below 41,000 feet above mean sea level (MSL), two aircraft must be at least 1,000 feet above/below each other until or unless lateral separation is ensured.
- **In-Trail Separation (longitudinal):** Within a radar-controlled area, the minimum distance between two aircraft on the same route (i.e., in-trail) can be between 2.5 to 10 nautical miles (NM)[12], depending on factors such as aircraft class, weight, and type of airspace.
- **Side-by-Side Separation (lateral):** Similar to in-trail separation, the minimum side-by-side separation between aircraft must be at least three NM in terminal airspace and five NM in enroute airspace.
- **Visual Separation:** Aircraft may be separated by visual means when other approved separation is assured before and after the application of visual separation.

[11] For a detailed explanation of separation standards, see FAA Order 7110.65W.

[12] A nautical miles is equivalent to 1.15 statute miles

1.2.5 Next Generation Air Transportation System

The NextGen program is the FAA's long-term plan to modernize the NAS from a ground-based system of air traffic control to a GPS-based system of air traffic management that allows for the development of PBN procedures.[13] The Metroplex initiative is a key step in the overall process of transitioning to the NextGen system. Achieving the NextGen system requires implementing RNAV and RNP PBN procedures and aircraft "auto-pilot" and Flight Management System (FMS) capabilities.[14] RNAV and RNP capabilities are now readily available, and PBN can serve as the primary means aircraft use to navigate along a route. More than 90 percent of U.S. scheduled air carriers are equipped for some level of RNAV. The following sections describe PBN procedures in greater detail.

1.2.5.1 RNAV

Exhibit 1-5 compares conventional and RNAV routes. RNAV uses technology, including GPS, to allow an RNAV-equipped aircraft to fly a more efficient route. This route is based on instrument guidance that references an aircraft's position relative to satellites. RNAV enables aircraft traveling through terminal and enroute airspace to follow more accurate and better-defined routes. This results in more predictable routes and altitudes that can be pre-planned by the pilot and air traffic control. Predictable routes improve the ability to ensure vertical, longitudinal, and lateral separation among aircraft.

Routes based on ground-based NAVAIDs rely on the aircraft equipment directly communicating with the NAVAID radio signal and are often limited by issues such as line-of-sight and signal reception accuracy. NAVAIDs such as VHF Omnidirectional Ranges (VORs) are affected by variable terrain and other obstructions that can limit their signal accuracy. Consequently, a route that is dependent upon ground-based NAVAIDS requires at least six NM of clearance on either side of its main path to ensure accurate signal reception. As demonstrated by the dashed lines on **Exhibit 1-5**, this clearance requirement increases the farther an aircraft is from the VOR. In comparison, RNAV signal accuracy requires only two NM of clearance on either side of a route's main path.

RNAV routes can mirror conventional routes or, by using satellite technology, provide paths within the airspace that were not previously possible with ground-based NAVAIDs.

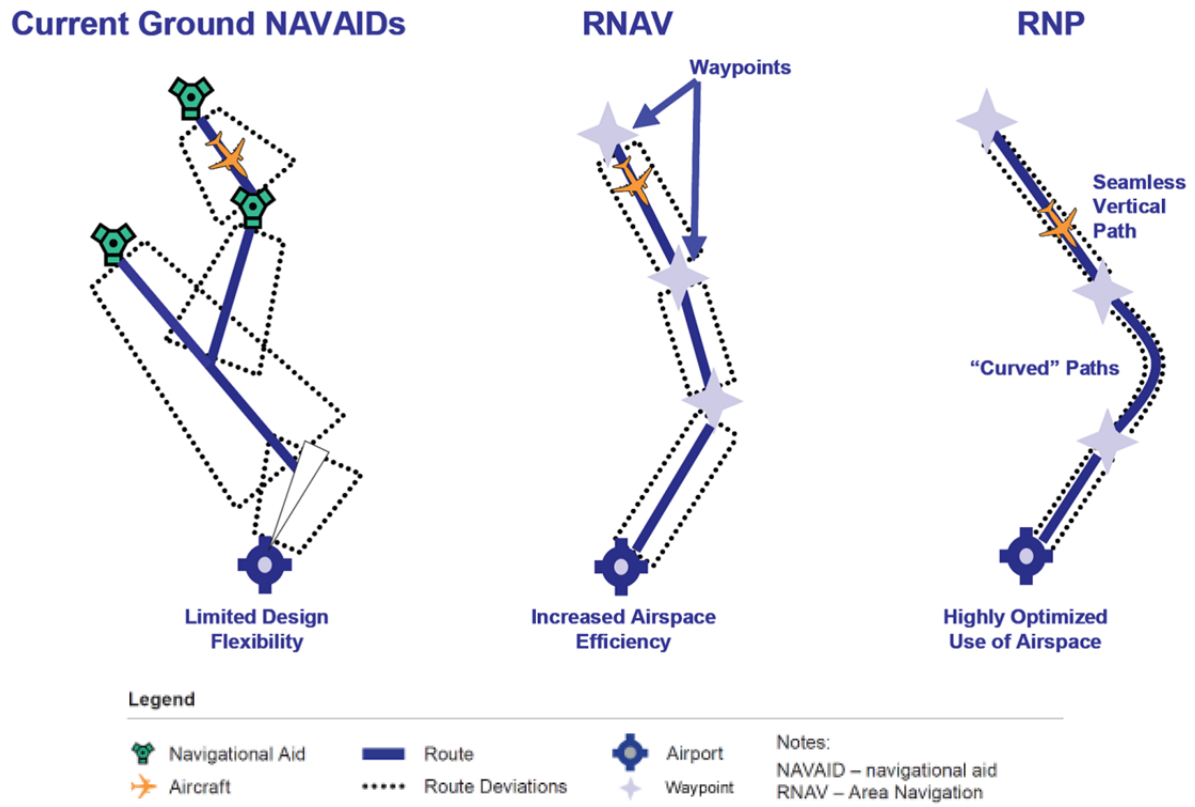
1.2.5.2 RNP

RNP is an RNAV procedure with signal accuracy that is increased through the use of onboard performance monitoring and alerting systems. An RNP is an RNAV procedure that requires greater accuracy of on-board performance monitoring and alerting equipment, as well as special pilot training. A defining characteristic of an RNP operation is the ability for an RNP-capable aircraft navigation system to monitor the accuracy of its navigation (based on the number of GPS satellite signals available to pinpoint the aircraft location) and inform the crew if the required data becomes unavailable.

[13] U.S. Department of Transportation, Federal Aviation Administration, Fact Sheet, "NextGen Goal: Performance-Based Navigation," April 24, 2009 [http://www.faa.gov/news/fact_sheets/news_story.cfm?newsId=8768 (accessed April 11, 2012)].

[14] A Flight Management System (FMS) is an onboard computer that uses inputs from various sensors (e.g., GPS and inertial navigation systems) to determine the geographic position of an aircraft and help guide it along its flight path.

Exhibit 1-5 Navigational Comparison – Conventional/RNAV/RNP



Source: U.S. Department of Transportation, Federal Aviation Administration, "Performance-Based (PBN) Brochure," October 2009.
Prepared by: ATAC Corporation, March 2013.

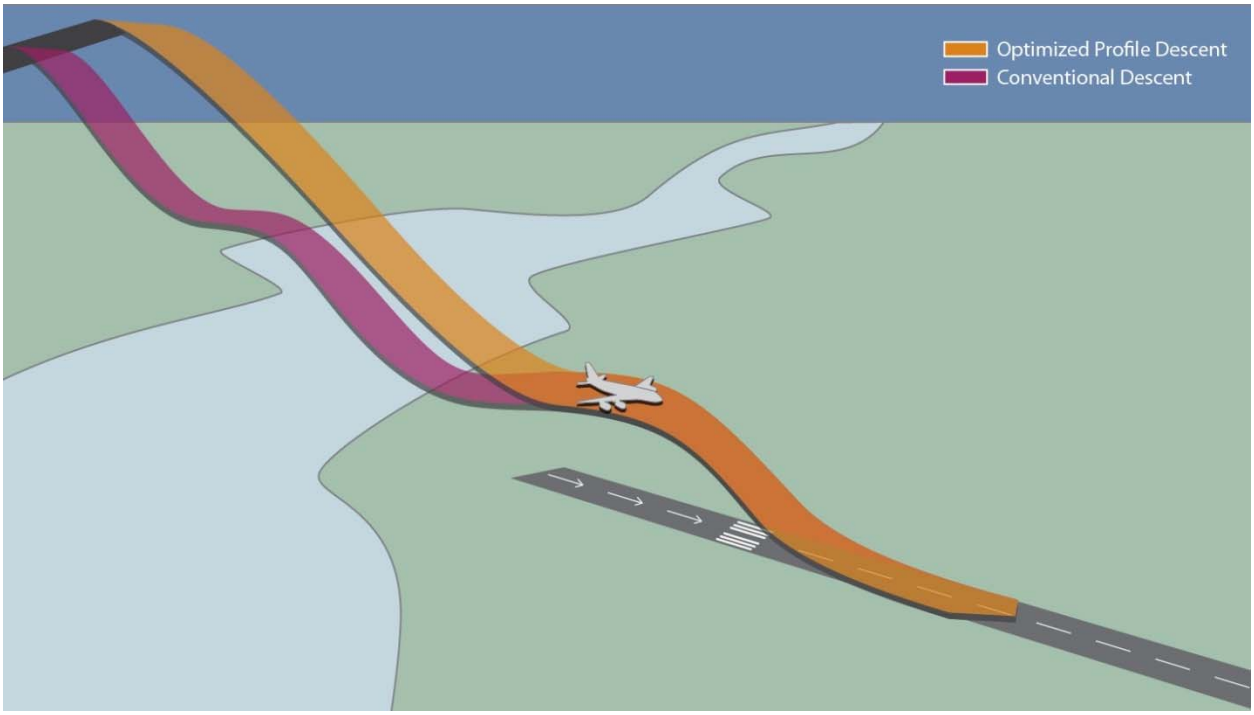
Exhibit 1-5 compares conventional, RNAV, and RNP procedures. It shows how an RNP-capable aircraft navigation system provides a more accurate location (down to less than a mile from the intended path) and will follow a highly predictable path. The enhanced accuracy and predictability make it possible to implement procedures within controlled airspace that are not always possible under the current air traffic system.Optimal Profile Descent

An Optimal Profile Descent (OPD) is a flight procedure that allows an aircraft using FMS to fly continuously from the top of descent to landing with minimal level-off segments. **Exhibit 1-6** illustrates an OPD procedure compared to a conventional descent. Aircraft that fly OPDs can maintain higher altitudes and lower thrust for longer periods. As level-off segments are minimized, OPDs reduce the need for communications between controllers and pilots.

1.2.5.3 Optimal Profile Climb

An Optimal Profile Climb (OPC) is similar to OPD, but related to departures. An OPC is a flight procedure that allows an aircraft using FMS to fly continuously from the runway to top of climb with minimal level-off segments. Aircraft that fly OPCs can get to higher altitudes sooner with minimal changes in thrust. As level-off segments are minimized, OPCs reduce the need for communications between controllers and pilots.

Exhibit 1-6 Optimized Profile Descent Compared to a Conventional Descent



Source: ATAC Corporation, December 2012.
Prepared by: ATAC Corporation, October 2013.

1.2.6 The Metroplex Initiative

As part of the Metroplex initiative, the FAA is designing and implementing RNAV procedures that take advantage of the technology available in a majority of commercial service aircraft. The Metroplex initiative specifically addresses congestion, airports in close geographical proximity, and other limiting factors that reduce efficiency in busy metroplex airspace. Efficiency is improved by implementing more RNAV-based standard instrument procedures and connecting the routes defined by the standard instrument procedures to high- and low-altitude RNAV routes. Efficiency is further improved by using RNAV to optimize the use of the limited airspace in congested metroplex environments.

1.3 The Southern California Metroplex

The following sections describe the airspace structure and existing standard instrument procedures of the Southern California Metroplex that would be affected by the SoCal Metroplex Project.

1.3.1 Southern California Metroplex Airspace

Exhibit 1-4 depicts the airspace structure in the Southern California Metroplex. The Southern California Metroplex consists of airspace delegated to SCT and ZLA. ZLA provides Air Traffic Services for 179,416 square miles of enroute airspace covering the southwestern United States. The airspace overlies parts of California, Nevada, Utah, and Arizona. It abuts Oakland Center (ZOA), oceanic airspace to the west, Oakland Center domestic airspace and Salt Lake Center (ZLC) airspace to the north, Denver Center (ZDV) and Albuquerque Center (ZAB) airspace to the east, and Mexican airspace to the south.

ZLA is responsible for all private and commercial aircraft landing, departing, and traversing inside its lateral boundaries when they are operating under IFR conditions and offers select services to aircraft, such as helicopters and general aviation aircraft, operating under VFR conditions. ZLA provides air traffic control service to United States and foreign military aircraft operating both IFR and VFR in ZLA airspace. ZLA controllers provide air traffic services in the airspace above and adjacent to the SCT airspace.

SCT controllers provide air traffic services for terminal airspace from the surface to as high as 17,000 feet MSL, covering 10,000 square miles of airspace over the Southern California Metroplex area[15]. The lateral boundary of the SCT airspace is irregularly shaped, with the northernmost point approximately nine miles north-northwest of City of Fillmore. The eastern boundary is over the Salton Sea and envelopes the airspace over Palm Springs International Airport. The southern boundary is on the border between the United States and Mexico. The western boundary is over the Pacific Ocean and includes Santa Catalina Island.

SCT is generally the final radar facility responsible for separating and sequencing aircraft that are landing at and departing from airports in its airspace. This includes the initial sequencing of LAX and SAN departures as well as providing safe and expeditious flows of traffic into and out of another 44 airports, 26 of which have control towers. SCT provides air traffic control services to IFR-filed aircraft and, when requested or required, VFR aircraft. As with ZLA, SCT also offers these services to military aircraft that are operating in its airspace.

1.3.2 Southern California Metroplex Airspace Constraints

The following provide a general overview of the constraints related to controlling aircraft within the Southern California Metroplex area airspace.

1.3.2.1 Mountainous Terrain

The topography of Southern California includes the Transverse Mountain Ranges, including the Santa Susanna, Santa Monica, and San Gabriel Mountains, and the Peninsular Mountain Ranges, including the Santa Ana and Temescal Mountains. The Transverse Mountain Ranges run from east to west and, the Peninsular Mountain Ranges are a group of mountains that run along the Pacific Coast through Southern California. As a result, the Southern California Metroplex area is within designated mountainous terrain. Mountainous terrain poses significant challenges due to disturbed airflow, causing potentially high downdrafts and turbulence. These areas are typically categorized as precipitous terrain[16]. Procedures with identified precipitous terrain require a higher than standard minimum altitude over the terrain. Due to the proximity of precipitous terrain and required higher standard minimum altitudes, location and altitude of flight procedures are limited within the Southern California Metroplex area.

1.3.2.2 Class Bravo Airspace

Class Bravo (or Class B) airspace is regulatory airspace, generally located around major airports, such as LAX and SAN. The rules for flying inside of Class Bravo airspace are more

[15] The Southern California area contains several local approach control facilities along with airport traffic control towers located at numerous airports. The responsibilities for airspace in these facilities are generally more localized to individual airports. Additionally several military facilities exist who provide air traffic control into and out of their airfields.

[16] Terrain characterized by steep or abrupt slopes

restrictive than for other types of terminal airspace. These rules make for a safer and more orderly flow of traffic within Class Bravo airspace. Class Bravo airspace design has a direct impact on the flow of traffic within the Southern California Metroplex area.

Due to Class Bravo airspace design, ZLA delivers arrival flow traffic to SCT via eight arrival flows with aircraft sequenced at least five miles in trail. The eight arrival paths represent 50 percent of daily traffic and between 64 percent and 68 percent of arrivals during peak evening hours.

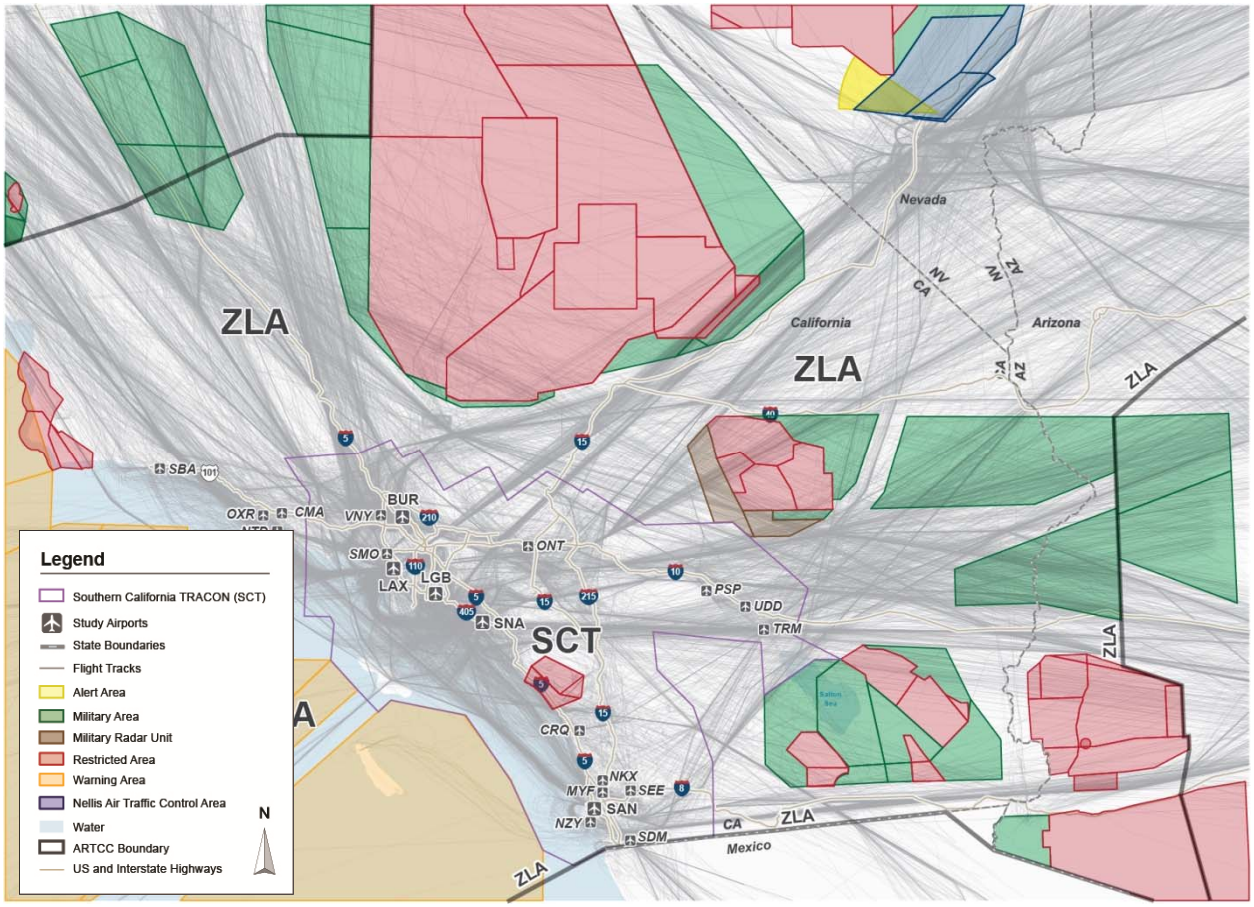
1.3.2.3 Southern California Metroplex Special Use Airspace

Exhibit 1-7 depicts the boundaries of Special Use Airspace (SUA) in the Southern California Metroplex. SUA is airspace with defined vertical and lateral boundaries containing certain hazardous activities such as military flight training and air-to-ground military exercises that must be confined. SUA defined dimensions are identified by an area on the surface of the earth within which certain air traffic activities must be confined or where certain restrictions are imposed on aircraft operations that are not a part of those activities, or both.[17] SUA is an important component of the NAS that allows for the safe use of the airspace by military and non-military air traffic. In addition to aviation activity, SUA can accommodate ground, sea-based, and combined arms training and testing. These areas either limit aircraft activity allowed within the airspace or restrict other aircraft from entering during specific days and/or times. Three types of SUA are found within the Southern California Metroplex:

- **Alert Areas:** Alert areas are depicted on an aeronautical chart to inform pilots of areas that may contain a high volume of pilot training activities or an unusual type of aerial activity, neither of which is hazardous to aircraft. Alert Areas are depicted on aeronautical charts for the information of non-participating pilots.
- **Restricted Area:** Restricted areas contain airspace within which aircraft, while not wholly prohibited, are subject to restrictions when the area is being used. The area denotes the existence of unusual, often invisible hazards to aircraft such as artillery firing, aerial gunnery, or guided missiles. Entering a restricted area without authorization may be extremely hazardous to the aircraft and its occupants. When the area is not being used, control of the airspace is released to the FAA, and ATC can use the area for normal operations.
- **Warning Area:** Warning areas are airspace of defined dimensions, extending from three NM outward from the coast of the U.S., in which activity may occur that is hazardous to non-participating aircraft. The purpose of warning areas is to warn pilots of potential danger. A warning area may be located over domestic and/or international waters.

[17] FAA Order JO7400.8X, *Special Use Airspace*.

Exhibit 1-7 Special Use Airspace



Notes:

ZLA – Los Angeles Center	*SCT – Southern California TRACON*	*UDD - Bermuda Dunes Airport*	*BUR - Bob Hope Airport*
SDM - Brown Field Municipal Airport	*CMA - Camarillo Airport*	*SEE - Gillespie Field Airport*	*TRM - Jacqueline Cochran Regional Airport*
SNA - John Wayne – Orange County Airport	*LGB - Long Beach Airport (Daugherty Field)*	*LAX - Los Angeles International Airport*	*CRQ - McClellan-Palomar Airport*
NKX - Miramar Marine Corps Air Station	*MYF - Montgomery Field Airport*	*NZY - North Island Naval Air Station (Halsey Field)*	*ONT - Ontario International Airport*
OXR - Oxnard Airport	*PSP - Palm Springs International Airport*	*NTD - Naval Air Station Point Mugu*	*SAN - San Diego International Airport*
SBA - Santa Barbara Municipal Airport	*SMO - Santa Monica Municipal Airport*	*VNY - Van Nuys Airport*	

Sources: U.S. Department of Transportation, Federal Aviation Administration, National Flight Data Center, National Airspace System Resources, Airport, and Runway databases, accessed June 2016 (airspace boundaries); National Atlas of the United States of America (U.S. County and State Boundaries, Water Bodies); Bureau of Transportation Statistics, National Transportation Atlas Database (U.S. and Interstate Highways).

Prepared by: ATAC Corporation, June 2016.

ZLA has 93,196 square miles of special use airspace (SUA), representing 52 percent of its total coverage area. ZLA is required to ensure that civilian and military aircraft (not under the authority of the United States Armed Forces)[18] are routed within the remaining 86,220

[18] Aircraft under the direct control of the military air traffic control facilities are confined to Special Use Areas (SUAs) or departure and arrival patterns near military airfields. These SUAs are specific areas of airspace that are used by military aircraft and are

square miles of airspace. In addition to the SUA inside of ZLA, there are also smaller blocks of airspace inside of SCT that are designated for military use. For example, Military Radar Units (MRUs) are fixed or mobile ground-based units under the jurisdiction of the military that may provide services in accordance with letters of agreement with the appropriate ATC facility.

Due to the limited commercial airspace outside of SUAs, there can be choke points for arrivals and departures into and out of the Southern California area when SUA such as Restricted Areas are in effect. This is caused by the funneling of traffic into corridors that avoid SUAs.

When developing procedures that transect Restricted Areas, it may be necessary to design a number of procedures to account for some of the limitations imposed on usage inherent with this type of SUA. Accordingly, it is generally safer, simpler, and more effective to design procedures that avoid SUA altogether.

1.3.3 STARs and SIDs Serving Study Airports

As of December 2011, 96 published STARs and SIDs serve the Study Airports within the Southern California Metroplex. Of these, 73 are conventional procedures. Eight RNAV STARs and 15 RNAV SIDs serve the Study Airports.

1.4 Southern California Metroplex Major Study Airports

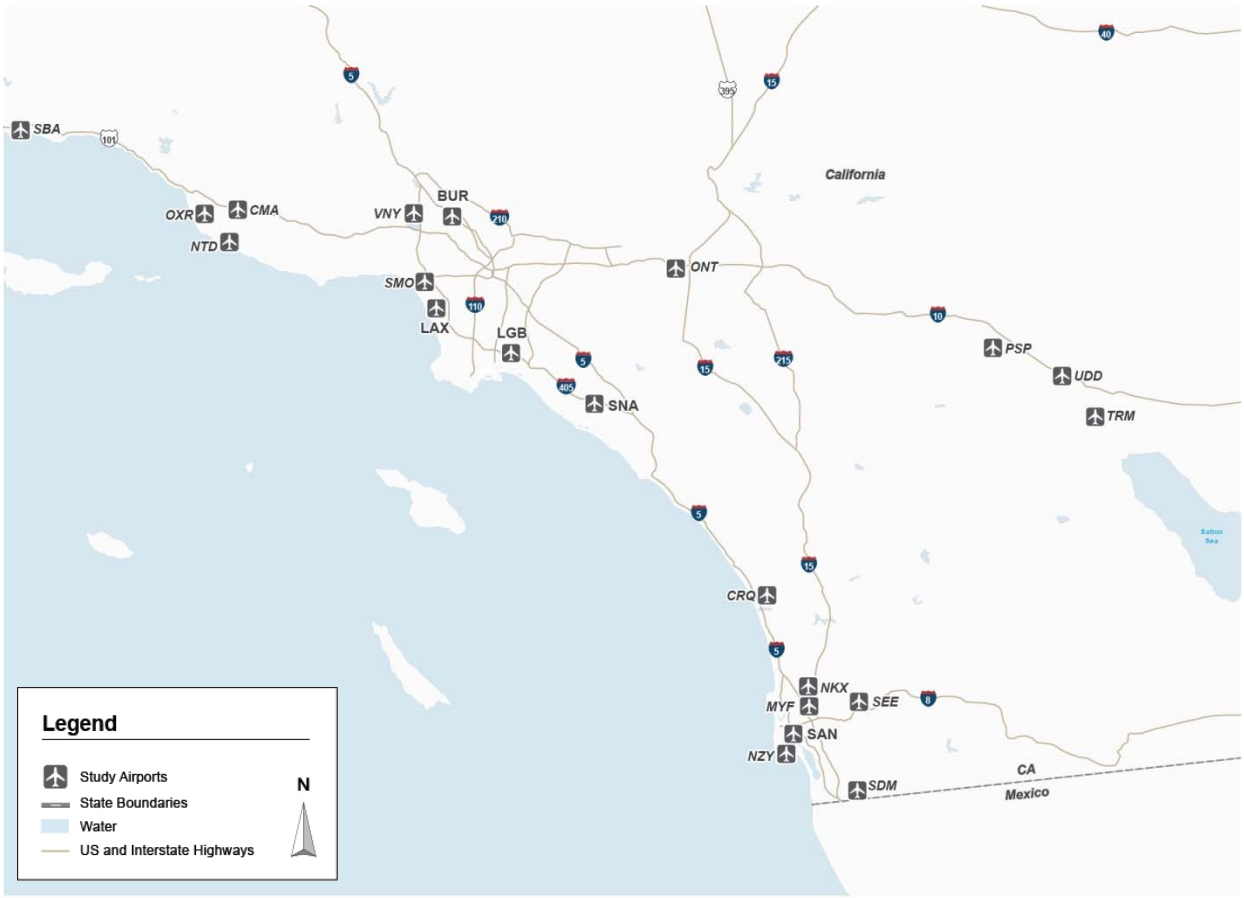
Exhibit 1-8 shows the locations of the 21 SoCal Metroplex Project Study Airports. The Study Airports were selected based on specific FAA criteria: each airport must have a minimum of 700 annual IFR-filed jet operations or 90,000 or more annual propeller aircraft operations. Airports that did not meet these thresholds were not included as Study Airports because the Proposed Action would result in little or no change to their operations. In addition, airports where the majority of traffic operates under VFR were also excluded from selection as Study Airports because they are not expected to be affected by the Proposed Action. VFR aircraft operating outside controlled airspace are not required to be in contact with ATC. Because these aircraft operate at the discretion of the pilot on a “see and be seen” basis and are not required to file flight plans, FAA generally has very limited information for these operations.

Of the 21 airports included in the SoCal Metroplex Project, the Study Team identified the following as the Major Study Airports:

Bob Hope Airport (Burbank) (BUR) is located approximately 15 NM north of LAX. BUR is classified as a medium-hub commercial service airport in the National Plan of Integrated Airport Systems (NPIAS). BUR has two runways, described in **Table 1-1**. As of December 2013, BUR IFR arrivals may be assigned one of two RNAV STARs or one of two conventional STARs. Departing IFR aircraft may be assigned one of two conventional SIDs.

provided air traffic control services by either ATC or the military. The United States Military branches are specifically charged with management of that airspace when active.

Exhibit 1-8 Study Airport Locations



Notes:

UDD - Bermuda Dunes Airport	*BUR - Bob Hope Airport*	*SDM - Brown Field Municipal Airport*	*CMA - Camarillo Airport*
SEE - Gillespie Field Airport	*TRM - Jacqueline Cochran Regional Airport*	*SNA - John Wayne – Orange County Airport*	*LGB - Long Beach Airport (Daugherty Field)*
LAX - Los Angeles International Airport	*CRQ - McClellan-Palomar Airport*	*NKX - Miramar Marine Corps Air Station*	*MYF - Montgomery Field Airport*
NZY - North Island Naval Air Station (Halsey Field)	*ONT - Ontario International Airport*	*OXR - Oxnard Airport*	*PSP - Palm Springs International Airport*
NTD - Naval Air Station Point Mugu	*SAN - San Diego International Airport*	*SBA - Santa Barbara Municipal Airport*	*SMO - Santa Monica Municipal Airport*
VNY - Van Nuys Airport			

Sources: U.S. Department of Transportation, Federal Aviation Administration, National Flight Data Center, National Airspace System Resources, Airport, and Runway databases, accessed February 2015 (airspace boundaries); National Atlas of the United States of America (U.S. County and State Boundaries, Water Bodies); Bureau of Transportation Statistics, National Transportation Atlas Database (U.S. and Interstate Highways).

Prepared by: ATAC Corporation, March 2015.

John Wayne-Orange County Airport (SNA) is located approximately 32 NM southeast of LAX. SNA is classified as a medium-hub commercial service airport under the NPIAS. SNA has two runways, described in **Table 1-1**. As of December 2013, SNA IFR arrivals may be assigned one RNAV STAR or one of two conventional STARs. Departing IFR aircraft may be assigned one of two RNAV SIDs or one of five conventional SIDs.

Los Angeles International Airport (LAX) is located in southwestern Los Angeles and is approximately 16 miles from downtown Los Angeles. It is bordered to the west by the

Pacific Ocean. LAX is classified as a large-hub commercial service airport under the NPIAS. LAX has four runways, described in **Table 1-1**. As of December 2013, LAX IFR arrivals may be assigned one of three RNAV STARs or one of 14 conventional STARs. Departing IFR aircraft may be assigned one of eight RNAV SIDs or one of 12 conventional SIDs.

Long Beach Airport (Daugherty Field) (LGB) is located approximately 15 NM southeast of LAX and accommodates a mix of commercial, corporate, and general aviation activity. LGB is classified as a small-hub commercial service airport in the NPIAS. The airport has five runways, described in **Table 1-1**. As of December 2013, LGB IFR arrivals may be assigned one RNAV STAR or one of two conventional STARs depending upon where they enter the terminal airspace. Departing IFR aircraft may be assigned one RNAV SID or one conventional SID.

Ontario International Airport (ONT) is located approximately 41 NM east of LAX. ONT is classified as a medium-hub commercial service airport under the NPIAS. The airport has two runways, described in **Table 1-1**. As of December 2013, arriving IFR aircraft may be assigned to one of two conventional STARs, depending on where they enter the terminal airspace. Departing IFR aircraft may be assigned one of four conventional SIDs.

San Diego International Airport (SAN) is located approximately 95 NM southeast of LAX. SAN is classified as a large-hub commercial service airport under the NPIAS. SAN has one runway, described in **Table 1-1**. As of December 2013, arriving IFR aircraft may be assigned to one of two RNAV STARs or one of three conventional STARs, depending on where they enter the terminal airspace. Departing IFR aircraft may be assigned one RNAV SID or one of three conventional SIDs.

Table 1-1 Southern California Metroplex EA Major Study Airports

Airport Name	Airport Code	Location	Runways[1/]
Major Airports			
Bob Hope Airport (Burbank)	BUR	Burbank, CA	8,15, 26, 33
John Wayne-Orange County Airport	SNA	Santa Ana, CA	1L, 19R, 1R, 19L
Los Angeles International Airport	LAX	Los Angeles, CA	7L, 25R, 7R, 25L, 6R, 24L, 6L, 24R
Long Beach Airport (Daugherty Field	LGB	Long Beach, CA	12, 30, 7L, 25R, 7R, 25L, 16R, 34L, 16L, 34R
Ontario International Airport	ONT	Ontario, CA	8L, 26R, 8R, 26L
San Diego International Airport	SAN	San Diego, CA	9, 27

Notes:
1/ A runway can be used in both directions, but are named in each direction separately. Runway number is based on the magnetic direction of the runway (e.g., Runway 09 points to the east direction). The two numbers on either side always differ by 180 degrees. If there is more than one runway pointing in the same direction, each runway number includes an 'L', 'C' or 'R' at the end. This is based on which side a runway is next to another one in the same direction.

Source: Department of Transportation, Federal Aviation Administration. digital-Airport/Facility Directory. January 1, 2013 (http://aeronav.faa.gov/index.asp?xml=aeronav/applications/d_afd; accessed February 13, 2013).
Prepared by: ATAC Corporation, October 2013.

As shown in **Table 1-2**, in 2011, approximately 76 percent of all IFR traffic within the Southern California Metroplex area operated at the major Study Airports.

Table 1-2 Distribution of 2011 IFR Traffic under FAA Control Among Study Airports in SCT

Airport	IFR Operations	Percent of Total Operations
Bob Hope Airport (Burbank)	79,332	60.5%
John Wayne-Orange County Airport	129,341	49.8%
Los Angeles International Airport	611,478	99.4%
Long Beach Airport (Daugherty Field)	56,211	20.4%
Ontario International Airport	71,259	85.8%
San Diego International Airport	185,650	98.8%
Total IFR Operations	**1,133,271**	**73.0%**
Total SCT IFR Operations	**1,497,617**	**76.0%**

Source: Department of Transportation, Federal Aviation Administration. Operations Network: Tower Counts for BUR, SNA, LAX, LGB, ONT, SAN (https://aspm.faa.gov/opsnet/sys/Tower.asp; accessed January 30, 2014.)
Prepared by: ATAC Corporation, January 2014.

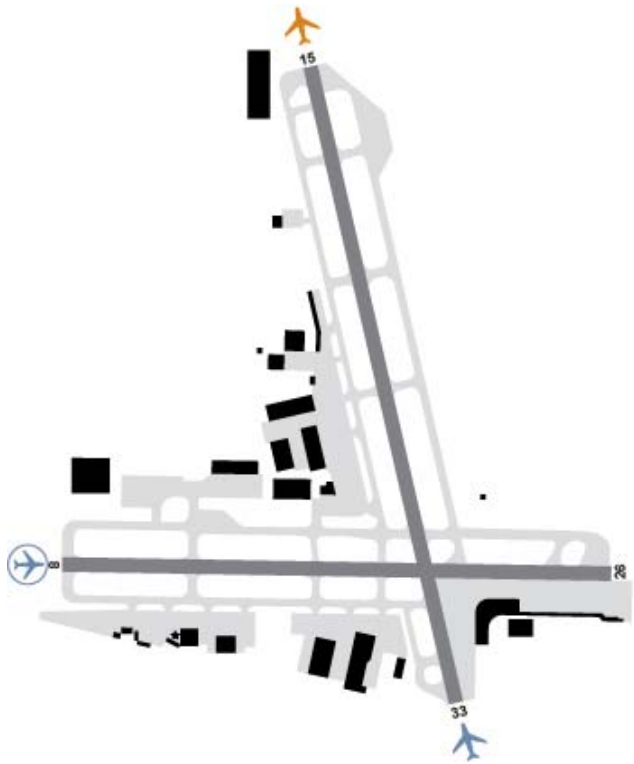
1.4.1 Major Study Airports Runway Operating Configurations

The major Study Airports often operate under several different runway operating configurations depending on factors such as weather, prevailing wind, and air traffic conditions. As a result, it is possible for the runway ends used for arrivals and departures to change several times throughout a day. Controllers at these airports use different runway operating configurations.

Exhibits 1-9 through **1-14** illustrate the primary runway operating configurations at BUR, SNA, LAX, LGB, ONT, and SAN, respectively. These configurations are based on the FAA's Aviation System Performance Metrics for December 1, 2012 through November 30, 2013.

Exhibit 1-9 BUR Runway Operating Configurations

Runways 08/15
Operating Configuration –
Arrivals 96.3% Departures 96.5%



Runways 33/26
Operating Configuration –
Arrivals 3.1% Departures 3.0%

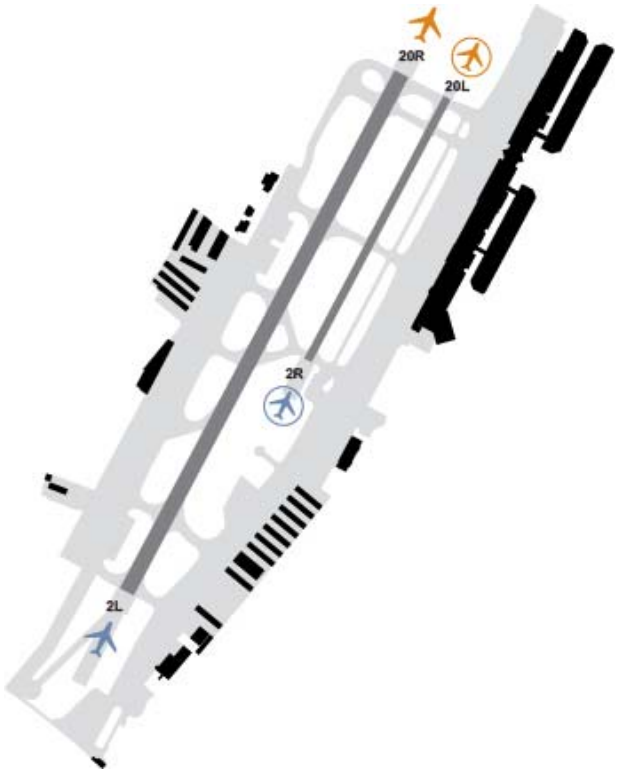
Runways 08/33
Operating Configuration –
Arrivals 0.6% Departures 0.5%

Notes: Noise abatement procedures (west flow) represent 0.1% of operations.

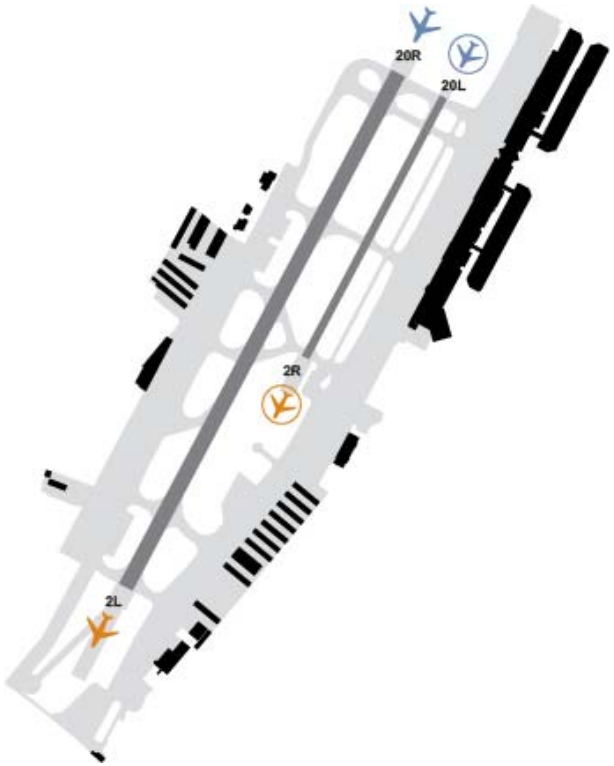
Source: U.S. Department of Transportation, Federal Aviation Administration, Airport Diagrams [http://www.faa.gov/airports/runway_safety/diagrams/ (accessed December 2014)]; FAA ASPM for December 1, 2012 through November 30, 2013 (retrieved December 2014).

Prepared By: ATAC Corporation, February 2015.

Exhibit 1-10 SNA Runway Operating Configurations



SNA: South Flow
Operating Configuration –
Arrivals 3.0% Departures 3.2%

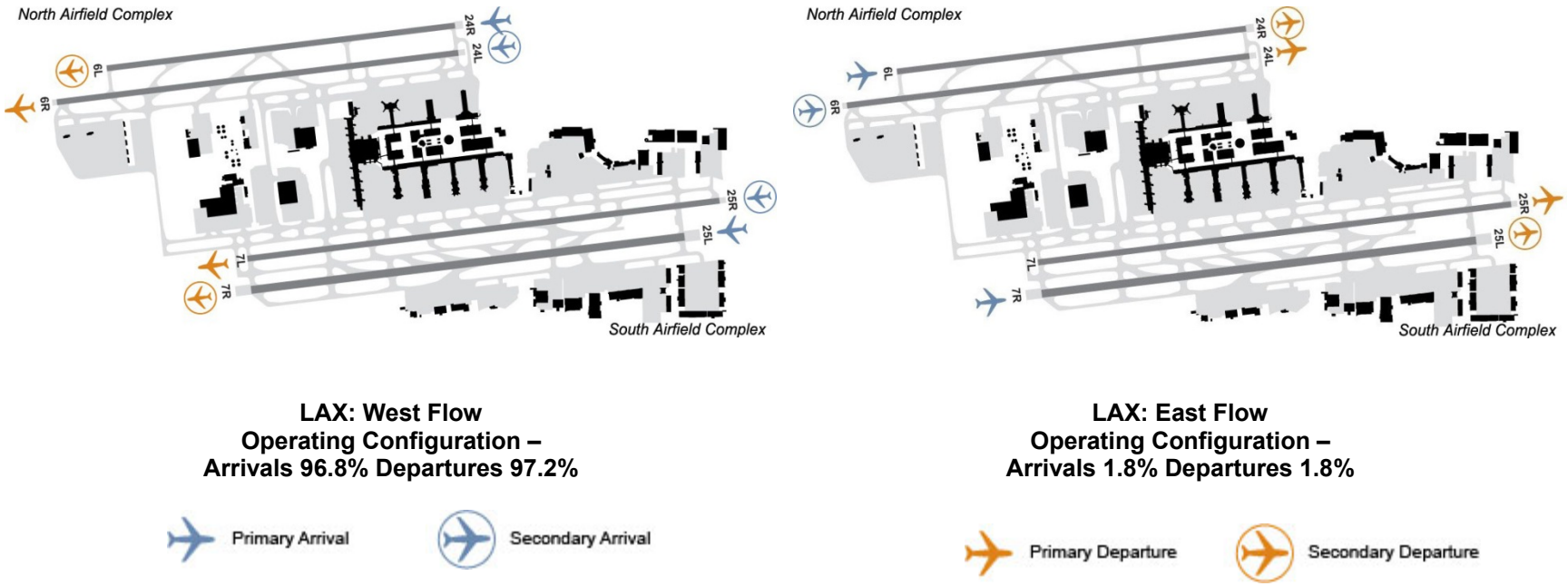


SNA: North Flow
Operating Configuration –
Arrivals 97.0% Departures 96.8%

Primary Arrival Secondary Arrival Primary Departure Secondary Departure

Source: U.S. Department of Transportation, Federal Aviation Administration, Airport Diagrams [http://www.faa.gov/airports/runway_safety/diagrams/ (accessed December 2014)]; FAA ASPM for December 1, 2012 through November 30, 2013 (retrieved December 2014).
Prepared By: ATAC Corporation, February 2015.

Exhibit 1-11 LAX Runway Operating Configurations

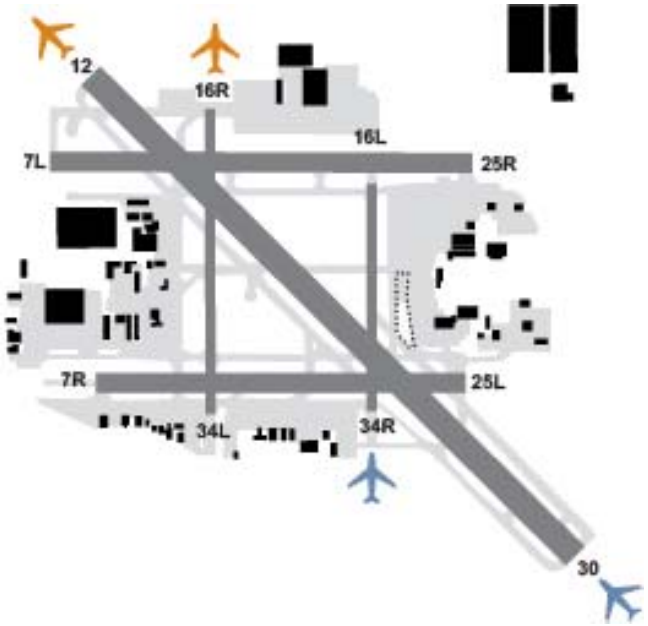


Notes: Late night operations arrive and depart from over the ocean (Arrivals to Runways 6R, 7L – 1.4%; Departures from Runways 24L, 25R – 1.0%).

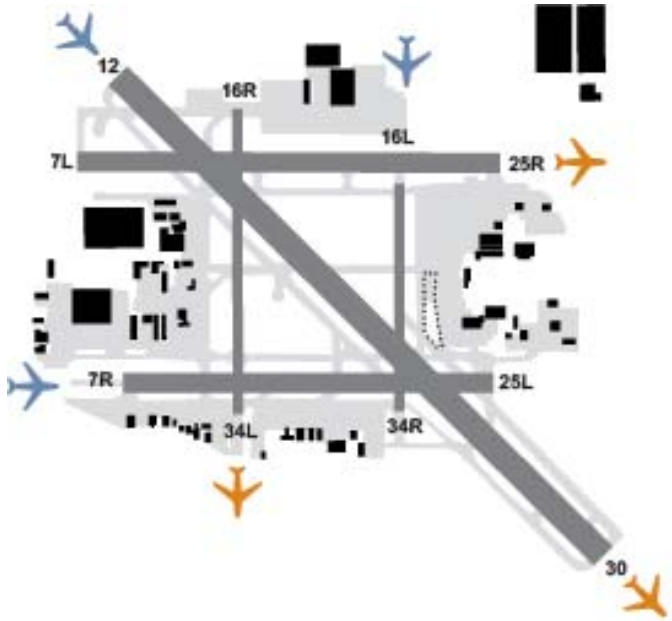
Source: U.S. Department of Transportation, Federal Aviation Administration, Airport Diagrams [http://www.faa.gov/airports/runway_safety/diagrams/ (accessed December 2014)]; FAA ASPM for December 1, 2012 through November 30, 2013 (retrieved December 2014).

Prepared By: ATAC Corporation, May 2015.

Exhibit 1-12 LGB Runway Operating Configurations



LGB: North Flow Operating Configuration – Arrivals 96.5% Departures 95.8



LGB: South Flow Operating Configuration – Arrivals 3.5% Departures 3.3%

Primary Arrival

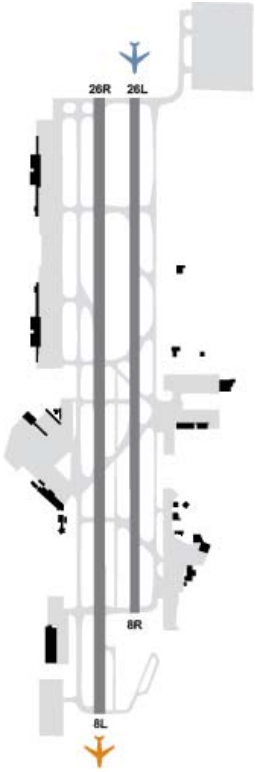
Primary Departure

Notes: Late night operations depart over the ocean (Departures from Runways 12/ 30 – 0.1%).

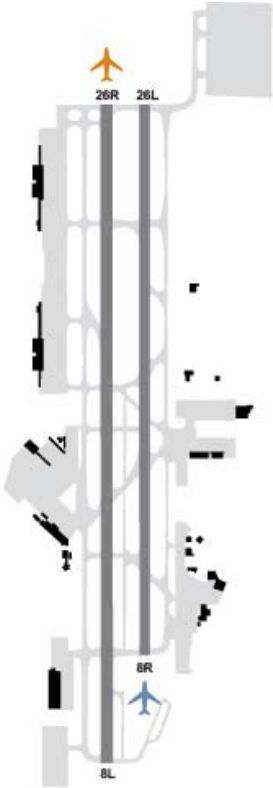
Source: U.S. Department of Transportation, Federal Aviation Administration, Airport Diagrams [http://www.faa.gov/airports/runway_safety/diagrams/ (accessed December 2014)]; FAA ASPM for December 1, 2012 through November 30, 2013 (retrieved December 2014).

Prepared By: ATAC Corporation, February 2015.

Exhibit 1-13 ONT Runway Operating Configurations



ONT: West Flow
Operating Configuration –
Arrivals 95.7% Departures 95.8%



ONT: East Flow
Operating Configuration –
Arrivals 4.2% Departures 4.0%

Primary Arrival

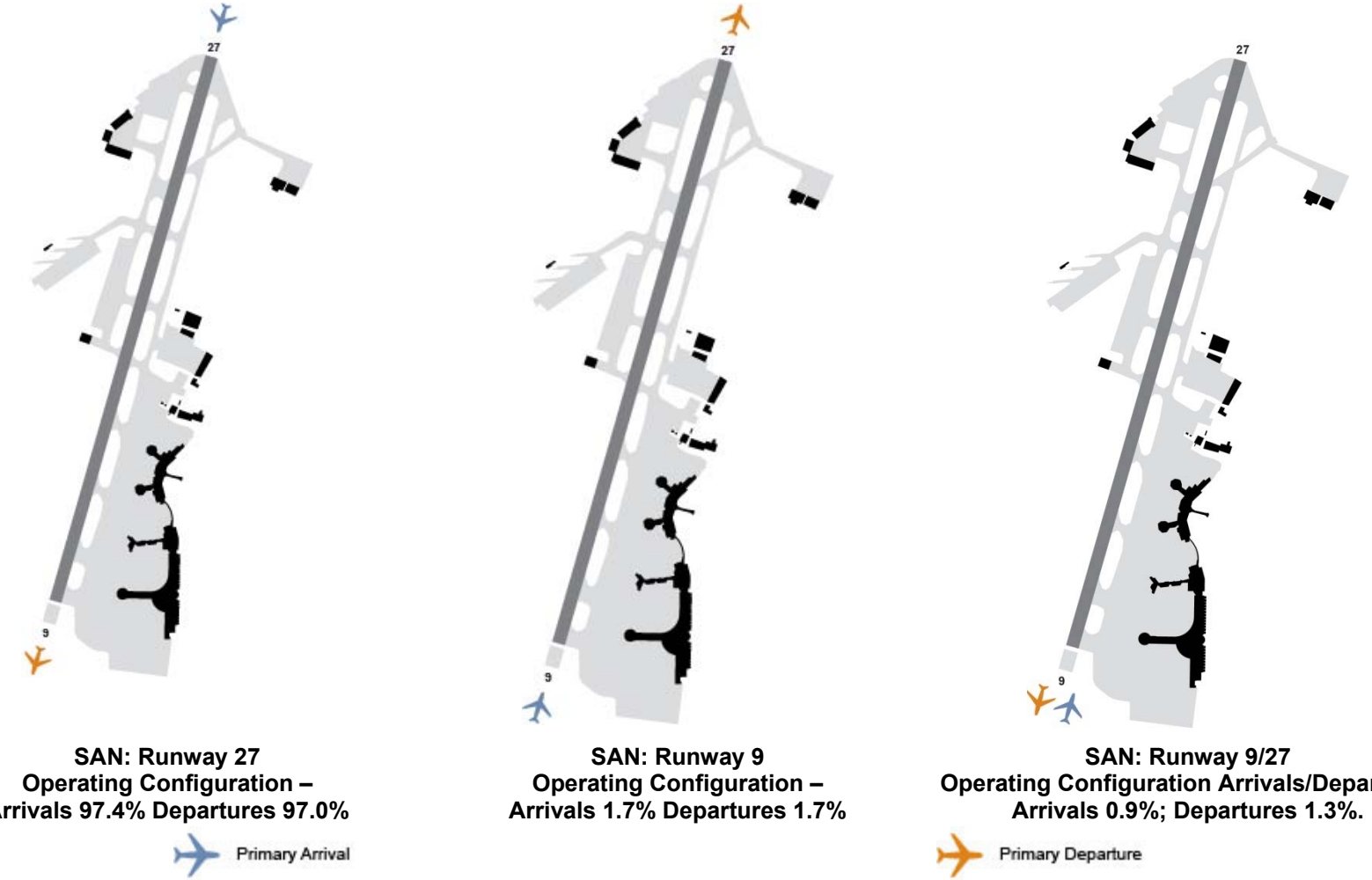
Primary Departure

Notes: Late night operations – Arrivals Runways 26L, 26R – 0.1%; Departures Runways 8L, 8R – 0.1%.

Source: U.S. Department of Transportation, Federal Aviation Administration, Airport Diagrams [http://www.faa.gov/airports/runway_safety/diagrams/ (accessed December 2014)]; FAA ASPM for December 1, 2012 through November 30, 2013 (retrieved December 2014).

Prepared By: ATAC Corporation, February 2015.

Exhibit 1-14 SAN Runway Operating Configurations



SAN: Runway 27 Operating Configuration – Arrivals 97.4% Departures 97.0%

SAN: Runway 9 Operating Configuration – Arrivals 1.7% Departures 1.7%

SAN: Runway 9/27 Operating Configuration Arrivals/Departures Arrivals 0.9%; Departures 1.3%.

Source: U.S. Department of Transportation, Federal Aviation Administration, Airport Diagrams [http://www.faa.gov/airports/runway_safety/diagrams/ (accessed December 2014)]; FAA ASPM for December 1, 2012 through November 30, 2013 (retrieved December 2014).
Prepared By: ATAC Corporation, May 2015.