Los Angeles World Airports

LAX North Airfield
Proposed Runway Configuration

Safety Risk Assessment

WCG, Inc. - LAX Version 1.0

May 2007

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Executive Summary

In 2006 the Federal Aviation Administration implemented a Safety Management System (SMS) and Safety Risk Management (SRM) process for the busiest and most complex commercial use airport traffic control facilities in the National Airspace System (NAS).

The FAA SMS/SRM is designed to identify operational hazards, analyze the risks associated with these hazards and establish mitigating strategies to ensure the safe and expeditious management of air traffic. It is a structured, table-top analysis of airport operations or airspace procedures.

The five step process follows a clear and definitive methodology to:

- Describe the airport system
- Identify existing hazards
- Analyze risks and causal factors
- Assess risk severity and frequency
- Develop a range of options to mitigate risks to an acceptable level of safety

The Los Angeles World Airports Executive Director chartered a Safety Risk Management Panel to follow this process and to specifically develop and prioritize airport improvements that will increase the level of airfield safety at LAX. The North Airfield Complex at LAX was the focus of the Panel's evaluation at LAX.

The Safety Risk Management Panel consisted of the Washington Consulting Group, Inc., personnel from the Federal Aviation Administration LAX Airport Traffic Control Tower and LAX Airside Field Operations. The Los Angeles World Airports senior staff served as a resource for information.

The current configuration of the LAX North Airfield Complex was completed in the 1970's when it was designed to efficiently accommodate FAA Design Group III and IV aircraft, such as the Boeing 727-737, DC-9 and DC-10 (See Appendix 3) which were the dominating fleet until the late 1990's. Today's fleet mix at LAX has a quickly growing number of Design Group V and VI aircraft (Boeing 747-767-787, A340-380, C5A) that generate significant air traffic complexities not originally considered into the North Airfield design.

The North Airfield Complex consists of Runway 24L/06R and 24R/06L. Runway 24L/06R is 10,285 feet long and Runway 24R/06L is 8,925 feet long. Both runways are 150 feet wide. These runways accommodate the fleet mix of aircraft using LAX, however, with procedures that have several restrictions and prohibited taxi areas when simultaneous similar type aircraft operations are

occurring. These restrictions are reflected in the current LAX Jeppesen Airport Chart (See Appendix 5).

The Safety Risk Assessment was conducted on these procedures and other operational scenarios based on aircraft landing and departing, taxiing to and from the North Airfield and arriving aircraft taxiing off Runway 24R/06L using the current configuration of high speed exit taxiways and crossing the adjacent parallel runway.

The assessment further addressed the projected increase of aircraft diversity of very large to very small aircraft (fleet mix) in the National Airspace System (NAS) and the impact of this changing fleet mix on the North Airfield Complex. The analysis also assessed the use of “Taxiway Echo” which parallels runway 24L/06R.

Figure 1
The Washington Consulting Group, Inc. used the FAA Safety Management System (SMS) and Safety Risk Management (SRM) five step process to conduct this analysis.

Source: FAA SMS Manual

The hazards and risks associated with the current LAX North Airfield configuration has been identified in this document. While these hazards have been mitigated to an acceptable level of risk based on present day usage, this study found that significant improvements can be made to the safety level of the operation by modernizing the North Airfield design to meet the standards for the existing and future aircraft fleet.

Examples of the mitigation include numerous control factors which are utilized within the National Airspace System (NAS). The controls include the following:

- Aircraft separation standards established by the Air traffic Control handbook, FAA Order 7110.65;

- Aircraft operating techniques/responsibilities in the Federal Aviation Regulations (FAR's) and in the Airmen's Information Manual (AIM);

- Mandatory communications protocols such as “hear-back-read back” phraseology between controllers and pilots;

- Airport markings, lighting and signage that meet and exceed FAA Standards;

- Aircrew and Air Traffic Control (ATC) certification;

- Initial and recurrent training of system user’s including airport operators, pilots and controllers;

- System awareness by user’s of existing airfield hazards;

- Technology applications including : Airport Movement Advisory Safety System (AMASS) and Traffic Conflict Avoidance System (TCAS); and

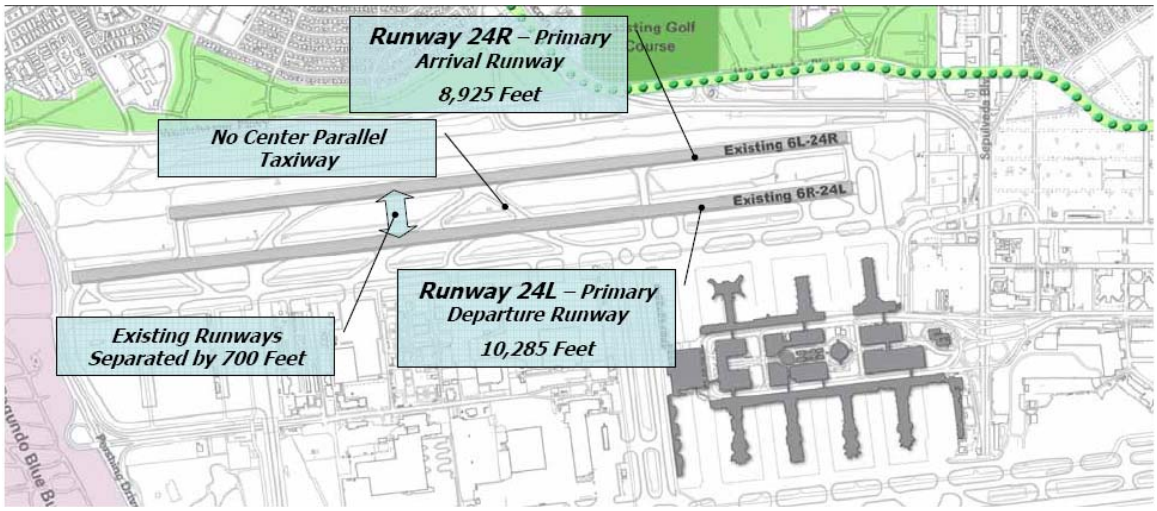
- Airfield system design including runways, taxiways, lighting, marking, signage and technology applications.

The continuing number of runway incidents, along with the projected increase of operations with new large aircraft (NLA), such as the A380, resulted in the analysis to focus on the airfield system design and a new runway configuration to ensure operations in the North Airfield Complex safely maintains an acceptable level of risk and maintains the integrity of the National Airspace System (NAS).

The proposed North Airfield configuration is designed to improve accessibility for large aircraft at LAX and maintain existing system efficiency. Most importantly, this design mitigates the potential for runway incursions, thereby enhancing the safety of passengers and aircraft at LAX.

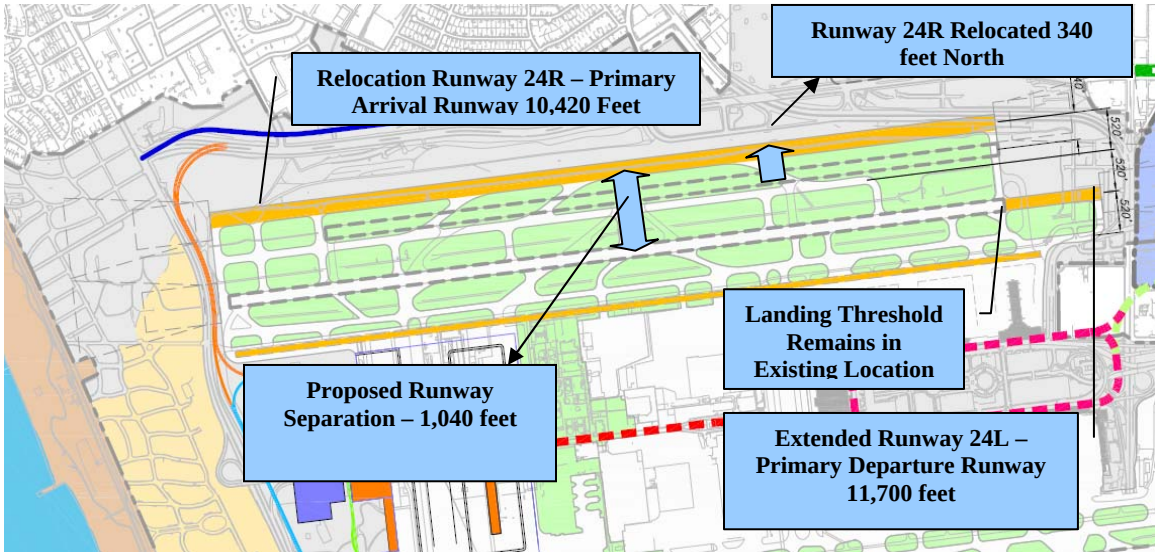
This Safety Risk Assessment specifically compared the current airfield configuration risks with the proposed configuration. Significant safety-related issues were mitigated to a lower level of risk with the new runway configuration.

Figure 2
Current Configuration of North Airfield Complex



Source: Los Angeles World Airports, 2007

Figure 3
Proposed Configuration of the North Airfield Complex



Source: Los Angeles World Airports, 2007

Using the FAA SRM process, the Safety Risk Management Panel (SRMP) developed a Preliminary Hazard List (PHL). The panel reviewed each hazard, followed the FAA SRM process to categorize similar risks and developed the Preliminary Hazard Analysis (PHA).

The PHA then identified the causes, system states, possible effects, severity, existing controls, likelihood, and current risks of the present runway configuration. The same process was conducted with the proposed configuration which resulted in the significant reduction and, in some cases, elimination of risks through an improved mitigation of the identified hazards.

The panel assessed each of the risks identified in this Safety Risk Assessment. Once this assessment was completed and the hazards mitigated using control factors as noted above, a safety assessment risk matrix was charted to compare the current North Airfield Complex with the proposed configuration.

The panel identified ten (10) hazards associated with aircraft operating on the existing LAX North Airfield (See Figure 4). The assessment/treatment of these with the implementation of the proposed North Airfield configuration resulted in the significant reduction or elimination of risks. These airfield improvements directly relate to the removal of the midfield high speed turnoffs to the immediate and adjacent parallel runway, increased distance between the parallel runways and operational opportunity for large/heavy aircraft to fully clear a runway after landing and the change to procedures for aircraft taxiing on Taxiway Echo.

By implementing the recommended North Airfield design changes, these hazards and the associated risks are greatly reduced for runway incursions, near mid-air collisions, surface collisions, and increased pilot/controller workload.

Figure 4

The analysis developed a Preliminary Hazard List (PHL)

Hazard Number	Hazard Description	Possible Effect
LAX 001	**Aircraft landing Runway 24R, crossing Runway 24L without ATC clearance at taxiway Yankee or Zulu with a NON-HEAVY aircraft departing**	**Reduction of separation by a high severity operational error that could lead to an aircraft collision, large reduction in safety margin, serious or fatal injury, physical distress and excessive workload**

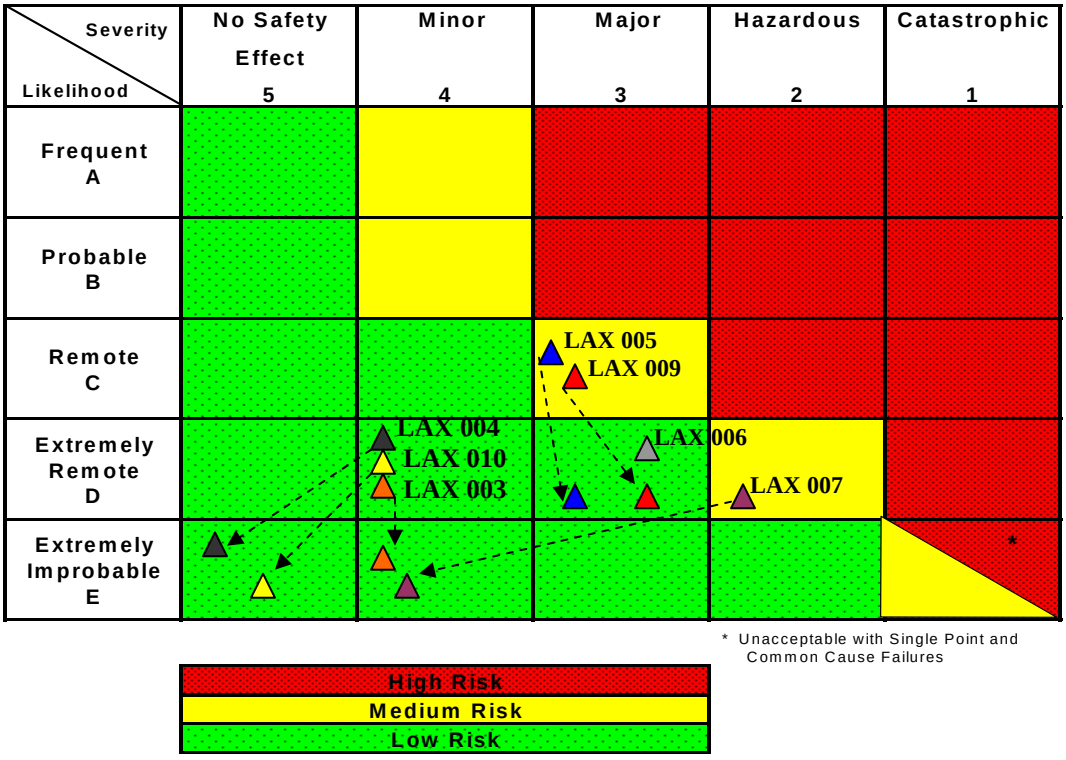
Hazard Number	Hazard Description	Possible Effect
LAX 002	Aircraft landing Runway 24R, crossing Runway 24L without ATC clearance at taxiway Yankee or Zulu with a HEAVY aircraft departing	Reduction of separation by a high severity operational error that could lead to an aircraft collision, large reduction in safety margin, serious or fatal injury, physical distress and excessive workload
LAX 003	Aircraft landing Runway 24R, crossing Runway 24L without an ATC clearance at taxiway Alpha-Alpha or Bravo-Bravo with a HEAVY aircraft departing Runway 24L	Significant increase in ATC and Flight Crew workload; reduction in safety margin and physical discomfort of passengers
LAX 004	Aircraft landing Runway 24R, crossing Runway 24L without an ATC clearance at taxiway Alpha-Alpha or Bravo-Bravo with a NON-HEAVY aircraft departing Runway 24L	Slight reduction in ATC capability, slight increase in Flight Crew workload, reduction in safety margin and physical discomfort of passengers
LAX 005	Runway's 24L and 24R in use for arrivals and departures Runway 24L arrival with a Runway 24L departure resulting in an over flight hazard	Reduction of separation by a moderate severity operational error, significant increase in Flight Crew workload, significant reduction in safety margin, physical distress to passengers or possible injury
LAX 006	Runway's 24L and 24R in use for arrivals and departures Runway 24R arrival with a runway 24R departure resulting in an over flight hazard	Reduction of separation by a moderate severity operational error, significant increase in Flight Crew workload, significant reduction in safety margin, physical distress to passengers or possible injury

Hazard Number	Hazard Description	Possible Effect
LAX 007	Runway's 24L and 24R in use for arrivals and departures Runway 24R arrival holding at taxiway AA or BB with a Runway 24R trailing arrival and Runway 24L departure Resulting in the preceding aircraft remaining in the Obstacle Free Zone (OFZ)	Reduction of separation by a high severity operational error that could lead to an aircraft collision, large reduction in safety margin, serious or fatal injury, physical distress and excessive workload
LAX 008	Runway 24L in use for arrivals and departures Taxiway Echo in use with a Design Group V or VI aircraft Resulting in taxiing aircraft tail impeding on the Runway 24L Object Free Zone (OFZ)	Reduction of separation by a moderate severity operational error, significant increase in Flight Crew workload, significant reduction in safety margin, physical distress to passengers or possible injury
LAX 009	Runway 24L/06R and Runway 24R/06L in use with increase of complexity associated with new fleet mix of Design Group V/VI Aircraft	Reduction of separation by a moderate severity operational error, significant increase in Flight Crew workload, significant reduction in safety margin, physical distress to passengers or possible injury
LAX 010	Runway 24R in use and Aircraft Rescue and Firefighting (ARFF) equipment operating with-in the runway safety area northeast of the runway Resulting in ARFF equipment inadvertently in the OFZ	Slight increase of ATC complexity No effect on flight Crew Inconvenience

Source: LAX-WCG, Inc. Safety Risk Management Panel, 2007

Figure 5

The Washington Consulting Group, Inc. used the severity and likelihood chart below to represent the matrix of the residual and significant improvements from the proposed design of the North Airfield Complex vs. the hazards associated with the current complex design. This is further defined in Section 6, 7 and 8 of this document



Summary of residual hazards and risks from current airfield configuration to proposed airfield configuration

Notes:

- **LAX 001 Eliminated as a hazard from a medium risk in the current configuration**
- **LAX 002 Eliminated as a hazard from a medium risk in the current configuration**
- **LAX 003 Remained a low risk**
- **LAX 004 Reduced to no safety effect from a minor low risk**
- **LAX 005 Reduced to a low risk from a medium risk in the current configuration**
- **LAX 006 Remained a low risk**
- **LAX 007 Reduced to a low risk from a medium risk in the current configuration**
- **LAX 008 Eliminated as a hazard from a medium risk in the current configuration**
- **LAX 009 Reduced to a low risk from a medium risk in the current configuration**
- **LAX 010 Reduced to no safety effect from a minor low risk**

Source: Washington Consulting Group, Inc.

With the existing control factors applied to mitigate risks, the Panel maintained a focus on the system design as the principle solution to improve safety and maintain efficiency of the North Airfield Complex.

The Panel addressed a worst-case scenario that discussed historical data and current mitigation efforts. While the likelihood of a credible event that may occur with a catastrophic outcome remains low, increasing airport activities and aircraft fleet complexities increase the likelihood of a catastrophic aircraft collision.

"Hear-back – read-back" incidents or aircraft crossing an active runway without a clearance from ATC are still occurring. The most recent occurrence was on the North Airfield Complex on February 24, 2007.

The outcome of a communication error provided the opportunity for the WCG Inc., SMS/SRM expert, to address a worst-case scenario. Using the SMS/SRM process WCG determined the possibility as listed below:

Describe the System

The LAX North Airfield Complex (Runway 24R and Runway 24L) in use for aircraft arrivals and departures. Personnel involved include FAA Certified Professional Controllers, Commercial Air Carrier Aircrews, Executive Corporate Aircrews, General Aviation Pilots, Military Aircrews, airport operators and LAX airside personnel. Machines include aircraft, ground service equipment, air traffic resources, emergency responding apparatus and possible construction equipment. The system is managed by FAA Orders, LAWA SOP's, individual airline operating procedures and airport operator procedures. The environment is the North Airfield Complex and associated runways and taxiways.

Identify the Hazard

Aircraft arriving on Runway 24R and exiting the runway at Taxiway Yankee or Zulu and crossing Runway 24L without a clearance or misunderstanding hold instructions to avoid crossing in front of a departing or arriving aircraft on Runway 24L.

Departure aircraft on Runway 24L has accelerated to a high velocity but has not reached rotation speed leaving few alternatives such as veering left or right to avoid a collision, attempting to abort takeoff and stop or before a collision attempt an early rotation and risk stalling the airplane to avoid a collision. Arrival aircraft is in the process of a go-around (over-flight).

Analyze the Hazard

Arriving or departing aircrew must respond (see and avoid) or air traffic instructions must be timely to provide mitigation and avoid a collision.

The immediate availability of the high-speed exit, coupled with close proximity of the adjacent parallel runway provides little latitude for aircrews or air traffic controllers to mitigate miscommunication. At the same time, the proximity of the crossing taxiway location relative to the acceleration of the departing aircraft, or go around (over-flight) creates the credible scenario for an aircraft collision on the airfield. Severity level is catastrophic.

Assess the Risk

Worst credible outcome: miscommunication between arriving/departing aircraft and ATC; air traffic instructions not timely due to late or non-existent AMASS alert; distractions or frequency congestion.

The collateral effects are possible loss of control, departing aircraft experiencing a stall, colliding with other ground traffic or extreme damage to brakes and aircraft structure. The likelihood assessment is considered extremely remote based on current control factors; however, the qualitative description is that the event is unlikely to occur, but possible in an item's life cycle.

Treating the Risk

Given the multitude of air traffic control factors and the remaining hazard, the only remaining mitigation tool is to change the design of the system (North Airfield Complex). The addition of a center parallel taxiway system and additional separation of the runways; coupled with new 90 degree connecting taxiways for crossing the active runway will enhance safety, provide aircrews time to acclimate to the surface environment and allow new large aircraft to clear the runway Obstacle Free Zones (OFZ's).

Source: LAWA.Org

This credible worst case scenario occurrence was derived from subject matter experts using qualitative discussions; as such, the Panel concludes that increasing activity, complexities of the current system state and diversity of air traffic certainly have an impact on increasing the possibilities of a catastrophic event.

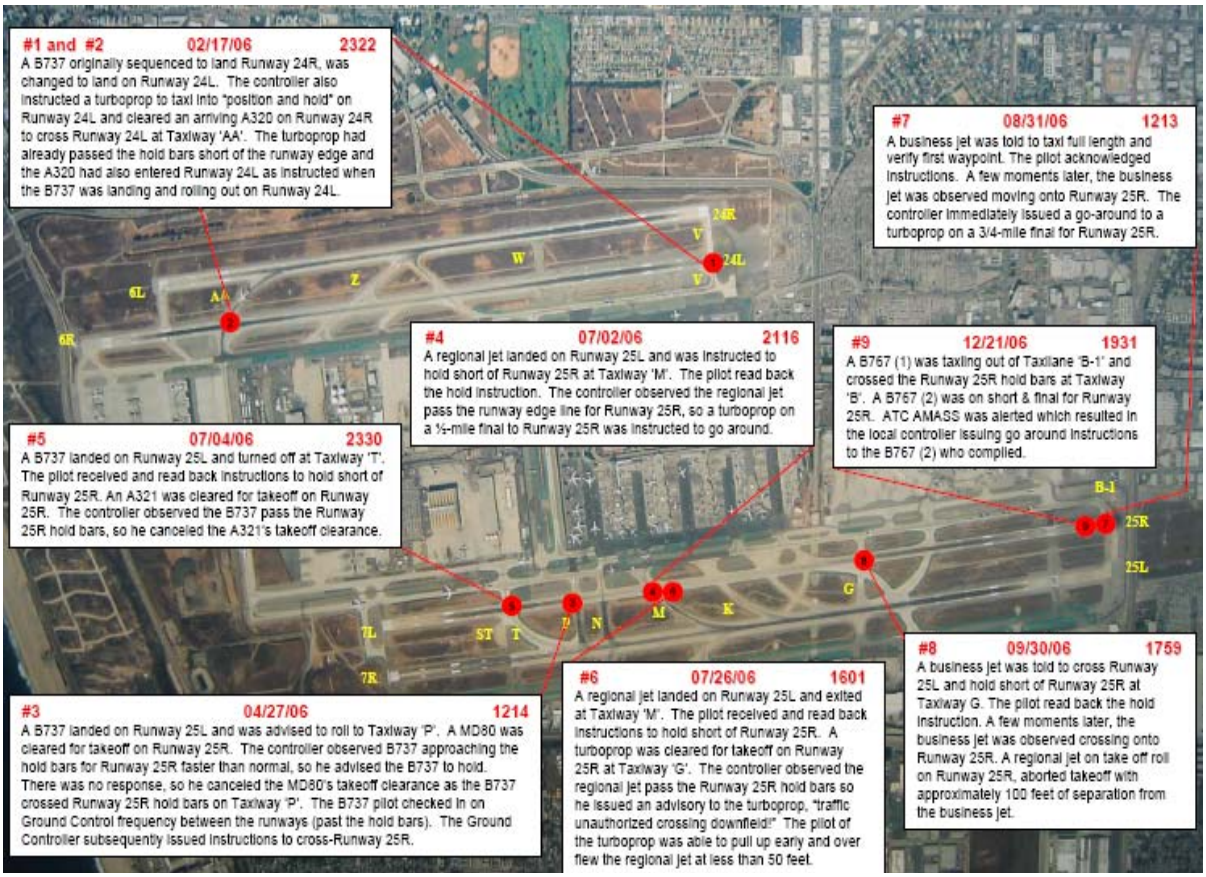
In addition to addressing a credible, worst-case scenario based upon the continuance of runway incidents, the Panel further recognized that airfield "standardization" is a principle concern in the National Airspace System (NAS). The LAX South Airfield Complex is completing a reconfiguration that will provide a center parallel taxiway between Runway 25L and Runway 25R. The South Airfield will also have a new network of high-speed exit taxiways from Runway 25L leading to the new center parallel taxiway followed by 90-degree exit taxiways for crossing Runway 25R.

This design will have an influencing impact on mitigating a significant history of runway incursion incidents.

The proposed design of the North Airfield Complex also includes a center taxiway between Rwy24L and Rwy24R. In addition to mitigation of potential incidents, the center taxiway provides a significant level of efficiency as it relates to Design Group V and VI aircraft.

The SRM panel concluded that the implementation of the proposed runway configuration results in improving the LAX safety by eliminating three significant hazards and reducing six other hazards to lower risks. LAX 006 remained in the major severity, extremely remote category.

LAX Runway Incidents 2006



Source: LAWA.Org

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Appendix 9 – FAA Advisory Circular AC 150 5200 137 SMS for NAS Airports

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Introduction

In 2006, the Federal Aviation Administration developed a Safety Management System (SMS) and Safety Risk Management (SRM) process as a result of requirements to the member states of the International Civil Aviation Organization (ICAO). The FAA SMS/SRM process meets those requirements and provides a methodology to identify, assess and treat potential and immediate hazards within the aviation industry. As an extension of the FAA's initial efforts to introduce SMS to its internal lines-of business, the FAA has recently introduced a SMS process for major airports in the National Airspace System (NAS).

The Los Angeles World Airports (LAWA) anticipated this action and has conducted a safety risk assessment for the Los Angeles International Airport (LAX) North Airfield Complex. The assessment was specifically focused on the hazards associated with the current runway/taxiway configuration and to test the efficacy of the proposed airfield configuration. The LAX North Airfield improvements are designed to improve accessibility for large aircraft arriving to their terminal, reduce delays by a more efficient taxiway layout that will reduce airline operating costs, and mitigate the potential for runway incursions; thereby enhancing the safety of passengers and aircraft at LAX.

In conducting the safety assessment described in this document, the Safety Risk Management (SRM) process has been applied as defined by the Federal Aviation Administration (FAA) Safety Management System (SMS) Manual. The current assessment, along with the identified risks, risk analysis, and treatment of risks are contained in this Safety Risk Assessment.

The current configuration of the North Airfield Complex is the result of numerous evolutions beginning with the construction of Runway 24L/06R in the 1960's and Runway 24R in the 1970's.

Air traffic practices during this period provided what appeared to be a simple process, or system, of using the outboard runway (Runway 24R) primarily for arrivals and the in-board runway (Runway 24L) primarily for departures. Lower air traffic density and a fleet mix of smaller aircraft at the time allowed the high speed taxiways to serve as a timely way to safely and efficiently cross an active inboard runway and proceed to the taxiway and terminal environment ahead of the next departing aircraft.

During this period, the separation of the runways and the operating size of the aircraft did not impede the runway Obstacle Free Zones (OFZ). As a result, The North Airfield Complex successfully provided a system for Design Group III and IV Aircraft for over 30 years.

Also during this period, the North Field Complex experienced two serious accidents and a series of incidents, which are identified as systems errors or

operational errors by FAA standards. Those errors and accidents provided quantifiable data for the Safety Risk Management Panel to analyze hazard locations within the Complex.

It is expected that the North Airfield Complex will experience a significant increase in the proportion of large, heavy aircraft as system user's balance costs in operating from the North Airfield Complex versus the South Airfield Complex, particularly with Design Group V and VI aircraft.

The expanding and complex fleet mix using both the National Airspace System (NAS) generally and LAX specifically will generate a burden on the current airfield configuration and increase the likelihood of additional system errors, increase delays and manifest higher operating costs for the consumer, resulting in a negative impact on the overall safety and efficiency of LAX.

The SRM Panel reviewed significant incident data from both the South and North Airfield Complexes relative to runway incursions while focusing on the North Airfield current complexities. As a result, the Panel views the proposed North Airfield configuration as a design and physical solution to greatly reduce the risk of runway incursions.

A runway incursion, as defined by the Federal Aviation Administration (FAA), is any occurrence in the airport runway environment involving an aircraft, vehicle, person, or object on the ground that creates a collision hazard or results in a loss of required separation with an aircraft taking off, intending to takeoff, landing, or intending to land.

In June 2006, the FAA Air Traffic Organization, Terminal Business (ATO-T) aggressively initiated a program to address system errors at the most prominent field facilities within the NAS. While the majority of the system errors were in the Terminal Radar Approach Facilities (TRACONS), such as New York, Chicago, Southern and Northern California (SCT & NCT), including Dallas Fort-Worth (DFW) and Atlanta (ATL); Los Angeles Airport Traffic Control Tower (LAX), along with Chicago ATCT (ORD) and several others, were identified as "airports of interest"

Continuing into 2007, this program requires the facility manger and key staff to brief the ATO-T Vice-President every 120 days on methodologies to mitigate system errors or incidents.

Further, and of historical significance, the FAA in 2002 published a study entitled, "FAA Runway Safety Report: Runway Incursion Trends at Towered Airports in the United States – CY 1998 – CY 2001." This report identified a total of 1,460 runway incursions out of 268 million airport operations in the U.S. that resulted in three collisions and four fatalities over the four years studied. LAX experienced

38 total runway incursions during the period of the FAA study and had an average rate occurrence of 1.24 incursions per 100,000 operations.

Within the first quarter of Calendar Year (CY) 2007, the North Airfield has already experienced an operational error similar to the hazard identified in LAX 004 of the Preliminary Hazard List (PHL).

Figure 6
Runway Incidents for 1st Quarter CY-2007

Source: LAWA.Org

The FAA also classifies runway incursions by their relative severity. The highest severity is given to an incursion in which extreme action is needed to avoid a collision or if a collision occurs. Five of the 38 runway incursions at LAX during the period of the FAA study were in this category, however, none of the five resulted in a collision.

While over 80 percent of these incursions took place on the South Field Complex, it is of historical significance to review the system design during this period which is similar to the North Airfield current configuration. These incidents were at such an alarming rate that the South Field Complex is completing a major reconfiguration and adding a parallel taxiway between Runway 25L/07R and Runway 25R/07L which is expected to mitigate future incidents.

The principle goal of the FAA is to raise awareness of runway incursions, identify solutions, and implement strategies to reduce their severity and frequency as well as the risk of a runway collision. Airport surface radar technology and airport infrastructure implementation at key airports, similar to LAX, are some of the strategies identified by the FAA to help solve the problem.

LAWA has already implemented improvements to airfield lighting, taxiway marking, runway signage, and has sponsored on-going seminars on airfield familiarization with airport users. However, more improvement is needed. Taxiway system configuration is one of the key infrastructure methods to solving the problem.

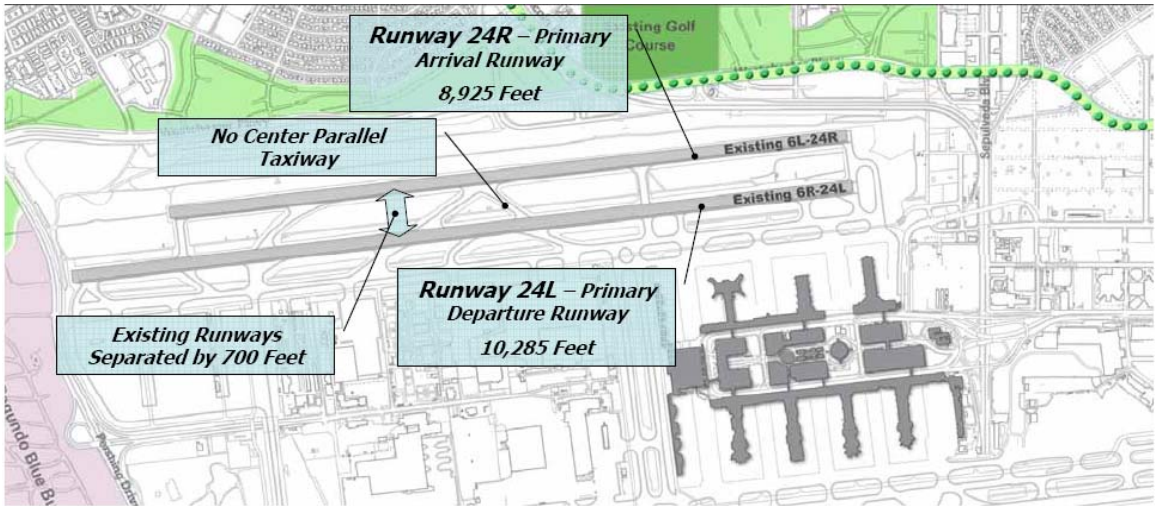
LAWA, in cooperation with NASA Ames Research Center, conducted a study titled “Los Angeles International Airport Runway Incursion Studies, Phase III – Center Taxiway Simulation” (published on July 31, 2003), comparing the cost and benefits of a center parallel taxiway and an “end-around” taxiway on the South Airfield Complex. LAWA sponsored and participated in this operational analysis and “human-in-the-loop” testing that included FAA Air Traffic Controllers from LAX Tower.

The study concluded that the end-around taxiway greatly increased taxi time and delays for arriving aircraft and thereby increased the operational costs of this option and did not produce any increased safety margin. ***Air traffic controllers also found the center parallel taxiway to be an operationally efficient solution to the primary cause of the most severe types of runway incursions experienced at LAX.***

Section 1 – Current System (Baseline)

The LAX North Airfield Complex has two parallel operational runways. These runways are oriented in an east-west direction. Runway 24L/06R is 10,285 feet long. Its elevation on the east end is 111 feet above sea level and the elevation on the west end is 108 feet above sea level. Runway 24R/06L is 8,925 feet long. Its elevation is 117 feet above sea level on the east end and 112 feet on the west end. Both runways are 150 feet wide.

Both runways are lighted and equipped with navigational aids, which allows aircraft arrivals and departures under both visual and instrument landing conditions. Parallel-dependent ILS approaches are conducted to Runways 24L/24R and 06L/06R.



Source: LAWA.Org

There currently exist several restrictions and prohibited operations with the North Airfield Complex. These include significant restrictions with taxiways which negatively impact the use of Runway 24L for arrivals and departures. Another impacting restriction relates to Runway 24R arrivals and is associated with aircraft that cannot exit past the runway Obstacle Free Zone (OFZ) after arrival.

Similar to air traffic practices established in the early design of the 1970's, the current air traffic practices use Runway 24R as the primary arrival runway and Runway 24L is the primary departure runway.

As a result, exiting arrivals of Group V aircraft generates complexities which are listed in the PHL and PHA of this study.

The existing runways are separated by 700 feet. There is no center parallel taxiway and high speed exits go directly into the adjacent runway.

Section 2 – Proposed System - North Airfield Configuration

The proposed North Airfield Configuration provides several significant changes associated with safety and efficiency. It is primarily designed to improve accessibility for large aircraft, reduce delays and mitigate the potential for runway incursions; thereby, enhancing the safety of passengers, LAWA employees and aircrews at LAX.

This proposal has the LAWA Airport Planning staff extending significant efforts to ensure long range operations identify, mitigate and fully address potential hazard areas while also maintaining efficiency, cost savings and overall effective operations.

The proposed system has Runway 24R/06L relocated 340 feet north and extended an additional 1,495 feet to the west for a total length of 10,420 feet. It is expected to remain as a primary arrival runway. Runway 24L/06R is extended 135 feet west and 1,280 feet east for a total length of 11,700 feet. It is expected to remain as the primary departure runway.

The proposed configuration provides 1,040 feet separation between the parallel runways. It provides a significant change that removes the high speed exits directly into the adjacent runway.

A center parallel taxiway generates an additional opportunity for aircrews to exit the runway expeditiously while maintaining integrity of runway safety zones. It further reduces the possibilities of untimely "hear back – read back" errors that have produced quantifiable incidents.

In addition to the safety implications, the center taxiway mitigates air traffic control complexities and provides alternatives to move aircraft east or west without generating delays and accommodates Design Group V and VI aircraft.

The new parallel center taxiway would be 10,420 feet long and 100 feet wide. It would be planned as a full-length Modified Group VI parallel taxiway located 520 feet north of Runway 24L/06R and 520 feet south of Runway 24R/06L.

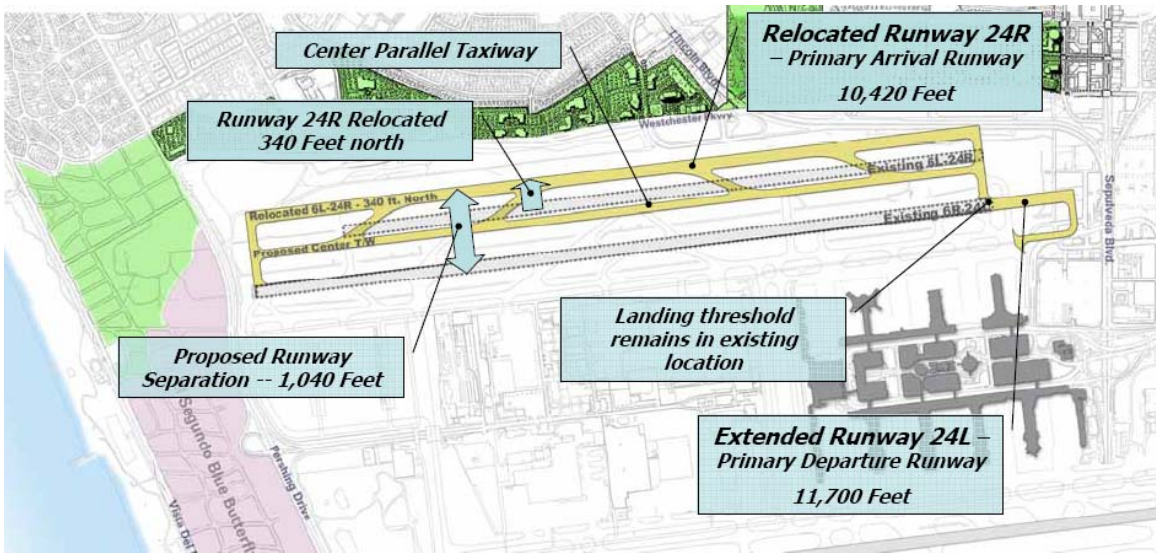
FAA Design Group VI taxiway separation standards call for 600 feet between a runway centerline and taxiway centerline intended to serve aircraft with Design Group VI tail heights, lengths and wing-span. Significant analysis was provided in the Draft LAX Master Plan, Chapter VI, Section 3.2.6.3, Justification for the Modified Group VI Standards to Accommodate the New Large Aircraft (NLA) at LAX, documenting the feasibility of using 520 feet separation at LAX and meet the same safety standards set by FAA for airfield safety. FAA has approved the use of these modified Group VI standards in their approval of the LAX Airport Layout Plan.

The new North Airfield center parallel taxiway, combined with the configuration of the exit taxiways, is instrumental in the physical solution to runway incursions. Exiting high-speed or acute angled exits off of Runway 24R/06L diverge from the runway centerline to the south and are aligned to cross Runway 24L/06R, directing arriving aircraft to Taxiway E.

The new exit taxiways associated with Runway 24R/06L would similarly diverge at acute angles from the runway centerline toward the south until they intersect with the new center parallel taxiway centerline.

Arriving aircraft would then proceed west or east (depending on the direction from which they arrived) for a short distance before coming to a perpendicular connecting taxiway that crosses Runway 24L/06R. This required turn, associated with this taxiway layout, provides time for pilots to fully acclimate to the airport surface environment, to comply with air traffic control taxi instructions and to clearly see runway hold bars prior to crossing the inboard runway.

All of these safety benefits are achieved without degrading the arrival and departure capacity of the north airfield runways.



Source: LAWA.org

Section 3 – Safety Risk Management Planning and Impacted Organizations

The Los Angeles World Airports staff, in coordination with the Washington Consulting Group, Inc., identified the stakeholders to support and participate with this safety assessment.

The key stakeholders were identified as the Safety Risk Management Panel (SRMP) responsible for conducting a safety risk assessment of the current LAX North Airfield Complex and the proposed North Airfield Configuration. The SRM Panel met on February 26 through February 28, 2007. The SRM Panel also met on March 8, 2007, March 21, 2007 and March 27 – 28, 2007.

During these meetings, the SRM Panel discussed hazards, risks, mitigation strategies, and other related issues.

SRM Panel Members	**Organization**	**Role**
Walt Smith	WCG, Inc.	SMS/SRM Expertise
Raymond Jack	LAWA-Airside Operations	Field Level Expertise
Kurt Rammelsberg	FAA-LAX ATCT	ATC Procedures
Michael Doucette	LAWA-Airport Planning	Source of Information
Nick Johnson	Johnson Aviation	Source of Information
Jacob Brothers	LAWA – Staff	Technical Assistant

Organizations impacted by this Safety Risk Assessment range from the LAX ATCT facility through the customers of the NAS (aircraft operators) that use LAX, and the airport operator (LAWA).

LAWA, together with the FAA, is responsible for the safe conduct of air traffic operations at LAX. The FAA Southern California TRACON (SCT) will also adjust procedures as the new runway configuration is commissioned to meet residual risk mitigation.

There were no high risk determinations as a result of this analysis (this would be a case where an identified hazard and its associated risk has no mitigating controls short of an immediate operational change). Medium risk hazards were clearly mitigated to a lower risk based on prudent control factors and the new design of the proposed configuration, which is intended to enhance safety, accommodate an increase of Design Group V and VI aircraft and reduce operational costs for LAX operators.

Section 4 – Assumptions

Projected domestic and international demands for the Los Angeles International Airport indicate a significant use of Group V and VI aircraft.

Current planning scenarios, including the modernization and expansion of the Bradley International Terminal, will generate a defining increase of international passenger usage at LAX.

The current air carriers at LAX have purchased large numbers of Group V and IV aircraft.

Regional aviation planners are addressing safety concerns with runway incursions, reduce air quality impacts from existing North Airfield taxiways and gate locations; balance long-haul departing aircraft operations between the North and South Complex and improve runway and taxiway spacing to ease large aircraft movement and safety.

The proposed North Airfield Runway configuration specifically facilitates these concerns.

While current air traffic procedures provides a safe use of the parallel runways in the North Airfield with Group IV aircraft, it has inherent design flaws that generate air traffic complexities with modern large aircraft (Groups V and VI) usage that will also impact efficiency.

Historical and quantifiable data on both the South Airfield and North Airfield Complexes shows that the continuing use of the high-speed exit taxiways by aircraft immediately proceeding into the adjacent runway is a continuing hazard for the passengers and air crews operating on the North Airfield Complex.

Air traffic operations will continue to generate complexities as increased activities with Design Group V and VI aircraft use the North Airfield Complex.

For air traffic efficiency, the airport will maintain the existing arrival and the departure rate while making taxiway improvements and removing taxiway obstructions to reduce delays and maintain a safe and expeditious traffic flow.

Section 5 – System Description (Phase 1)
Fleet Mix - Using the 5M Model to describe the system

LAX has a FAA terminal air traffic control (ATC) facility that provides 24-hour traffic advisories, spacing, sequencing, and separation services to visual flight rules (VFR) and instrument flight rules (IFR) aircraft operating within the class B airspace designated for the airport. The air traffic controllers at LAX, using a combination of terminal surveillance radar and visual observation, direct air traffic so it flows smoothly and efficiently. The controllers give aircrews instructions to operate on the airport movement area, air traffic clearances, and advice based on their own observations and information received from the automated weather system, radar systems, pilots, and other sources.

The FAA controllers provide separation services between landing and departing aircraft, transfer control of aircraft on instrument flights when the aircraft leave their airspace, and receive control of aircraft on instrument flights coming into their airspace from controllers at adjacent facilities.

The LAX Class B airspace consists of specified airspace within which all aircraft operators are subject to the minimum pilot qualification requirements, operating rules, and aircraft equipment requirements of 14 Code of Federal Regulations (CFR) Part 91. Within Class B airspace, no person may operate an aircraft unless (1) the aircraft has an operable two-way radio capable of communications with ATC on appropriate frequencies and (2) the aircraft is equipped with the applicable operating transponder and automatic altitude reporting equipment.

Operations within Class B airspace can be conducted in instrument meteorological conditions (IMC) or visual meteorological conditions (VMC) under instrument flight rules (IFR) or visual flight rules (VFR).

5.1 – Fleet Mix at Los Angeles International Airport

The Los Angeles International Airport is primarily known as an “air carrier” airport. All of the major U.S. domestic air carriers and numerous U.S. international air carriers are the primary users of the airport. An extensive and significant number of non-U.S. international air carriers also use LAX.

The United States Air Force also operates at LAX, mostly using the C-5A, C-17 and the C-130 aircraft.

The aircraft mix consists of the very largest to the very smallest aircraft types on an hourly and daily basis, every day of the year, 24 hours each day. This fleet includes all of the Boeing commercial aircraft types, including the projected use of the 787 series and the largest daily concentration of Boeing 747s of any US airport. The Airbus 380 is planned for daily commercial service starting in 2008

from LAX. At the same time, nearly one third of the daily operations at LAX are made by small commuter aircraft with 30 to 50 seats.

5.2 – The 5M Model that describes the system, operation or procedure

Systems will always have sub-components of a larger system. This section presents a system description using the 5M Model to ensure a complete and accurate description of the system and all of the elements:

Mission

The mission is the safe and expeditious flow of air traffic at the Los Angeles International Airport and the efficient utilization of the new runway configuration to maintain airfield capacity, enhance safety control factors, including design, reduce air quality impacts and decrease operators' costs.

(hu)Man

The panel decided that the human element consisted of all the ATC personnel at the LAX Airport Traffic Control Tower, the pilot community that includes commercial air carriers, general aviation and the military; and the airfield employees and operators.

Machine

The machine element is bounded by all the necessary equipment needed to safely perform commercial aircraft operations at Los Angeles International Airport This includes aircraft, routine ground service vehicles, emergency responding apparatus, field maintenance and construction equipment.

Management

The management element is bounded by FAA Order 7110.65, ATC Procedures, LAX ATCT, operator's procedures and LAWA airside standard operating procedures (SOP).

Media/Environment

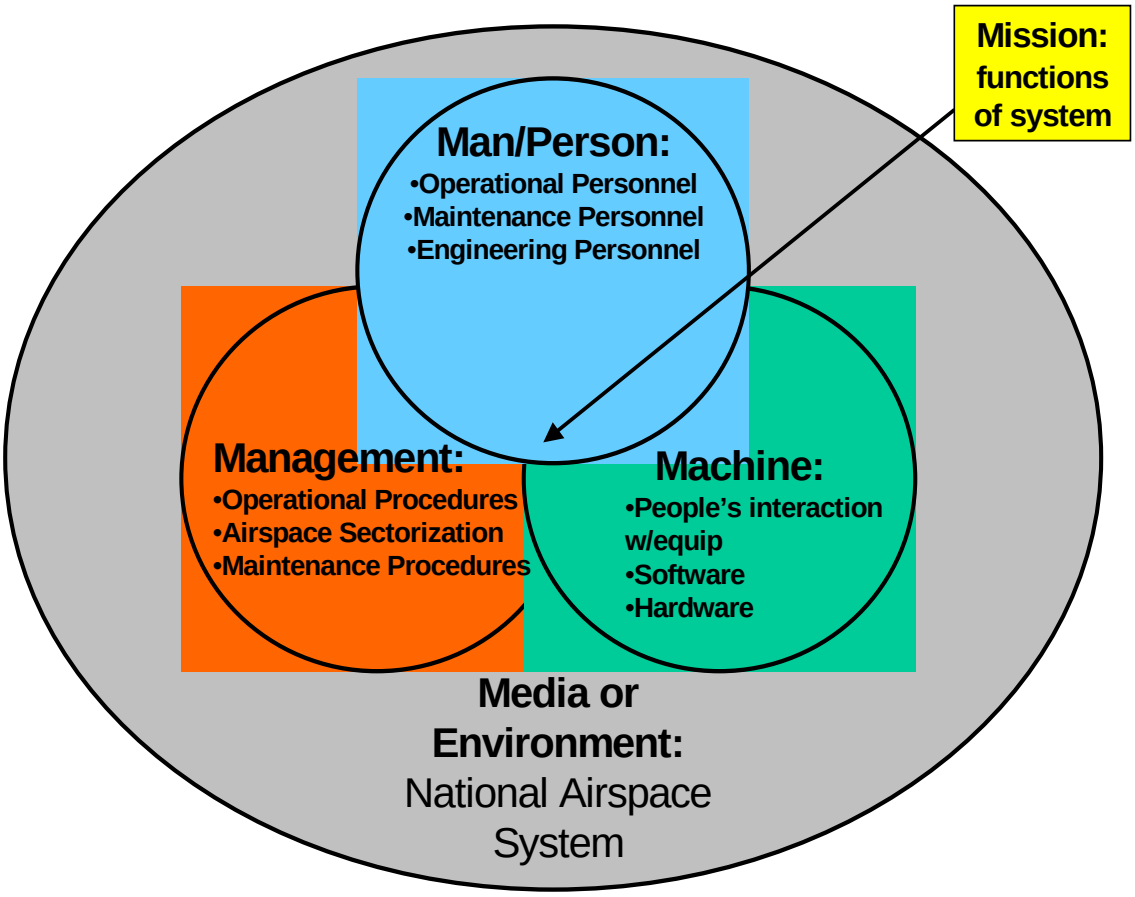
The media/environment refers to the NAS element that will be affected. The SRM Panel bounded the media/environment to LAX Airport Traffic Control Tower, pilots using LAX, companies operating at LAX and the airport operator.

5.2 – Resources

The data sources relied upon for this assessment included:

- FAA Order 7110.65
- FAA Safety Management System Manual, version 1.1
- Historical data from LAWA and FAA

Figure 7
The SMS/SRM 5M Model



Source: FAA SMS manual

Safety Risk Management Panels must describe the system which includes the scope of the problem or change. The system and operation must be described and modeled in sufficient detail for the safety assessment to proceed to the next stage, which is identifying the hazards.

Useful descriptions of the system exhibit two essential characteristics:

- Correctness: The description accurately reflects the system with an absence of ambiguity or error in its attributes.

- Completeness: No attributes have been omitted and are essential and appropriate to the level of detail in the change.

System description should include as it is configured today, as well as planned future configurations.

Section 6 – Identified Potential Hazards (Phase 2)
Describe Each Risk

The Safety Risk Management Panel (SRMP) identified six medium risk hazards and four low risk hazards associated with the current North Airfield Complex.

6.1 – Description of Hazards

The following is a detailed description of the identified hazards reviewed during this assessment.

Runway 24R arrival crossing Runway 24L with or with-out a clearance with arrival and departure aircraft using Runway 24L where:

- **LAX 001** – Aircraft crossing at taxiway ZULU or YANKEE (Non-heavy aircraft) resulting in a high severity operational error;

- **LAX 002** – Aircraft crossing at taxiway ZULU or YANKEE (Heavy aircraft) resulting in a high severity operational error;

- **LAX 003** – Aircraft crossing at taxiway Alpha-Alpha or Bravo-Bravo (Heavy aircraft) resulting in a significant increase in ATC workload;

- **LAX 004** – Aircraft crossing at taxiway Alpha-Alpha or Bravo-Bravo (Non-heavy aircraft) resulting in a slight reduction in safety margins;

Runway 24L and Runway 24R in use for arrivals and departures where:

- **LAX 005** – Runway 24L Departure with a Runway 24L Arrival (Over-flight) resulting in a moderate severity operational error;

- **LAX 006** – Runway 24R Departure with a Runway 24R Arrival (Over-flight) resulting in a moderate severity operational error;

- **LAX 007** – Runway 24R Arrival with a preceding Runway 24R arrival at taxiway Alpha-Alpha and Bravo-Bravo resulting in a high severity operational error;

Runway 24L arrival or departure where:

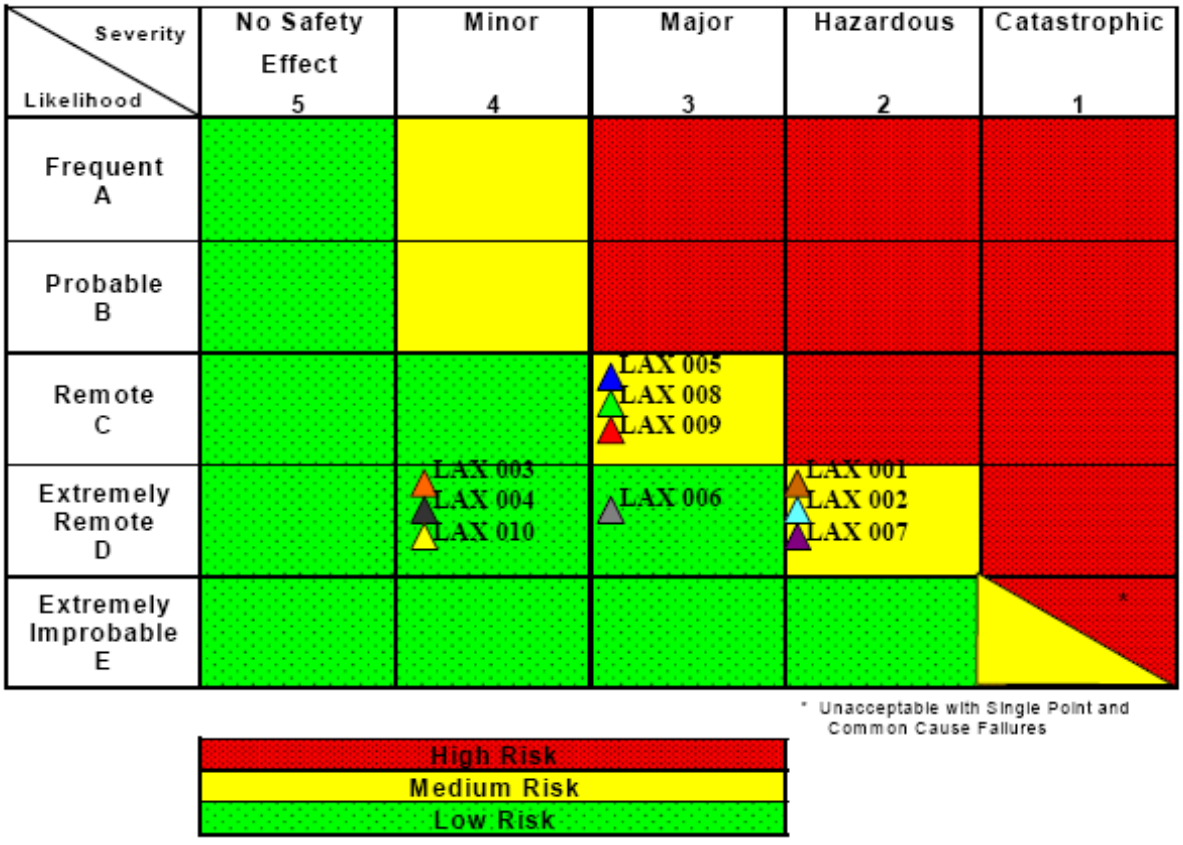
- **LAX 008** – Design Group V or VI aircraft simultaneously using Taxiway Echo at the east end resulting in a moderate severity operational error;

Runway 24L and Runway 24R in use where:

- **LAX 009** – Increased activity and complexity of Design Group V and VI operating on the North Airfield Complex resulting in moderate severity operational error;

- **LAX 010** – Aircraft Rescue and Firefighting (ARFF) equipment operating within the runway safety area at northeast end of runway 24R resulting in an increase of ATC workload and a distracter to aircrews.

Figure 8
Identified Potential Hazards
Risk Matrix of Current Configuration



Source: LAX-WCG, Inc. Safety Risk Management Panel

Section 7 – Risk Analysis & Risk Assessment (Phase 3 & 4)

The Safety Risk Management Panel (SRMP) methodology for risk analysis is based on the approach outlined in the FAA Safety Management System and the five step process detailed in the SMS Manual: Describe the System, Identify the Hazards, Analyze the Hazards, Assess the Risk, and Treat the Risk.

Figure 9
Safety Risk Management
Five Step Process

Source: FAA SMS Manual

Describing and Bounding the System

The Panel identified the system as the current North Airfield Configuration and the Proposed North Airfield Configuration. The 5M Model indicates a multitude of participants with this system as outlined in Section 5 of this document.

Hazard Analysis

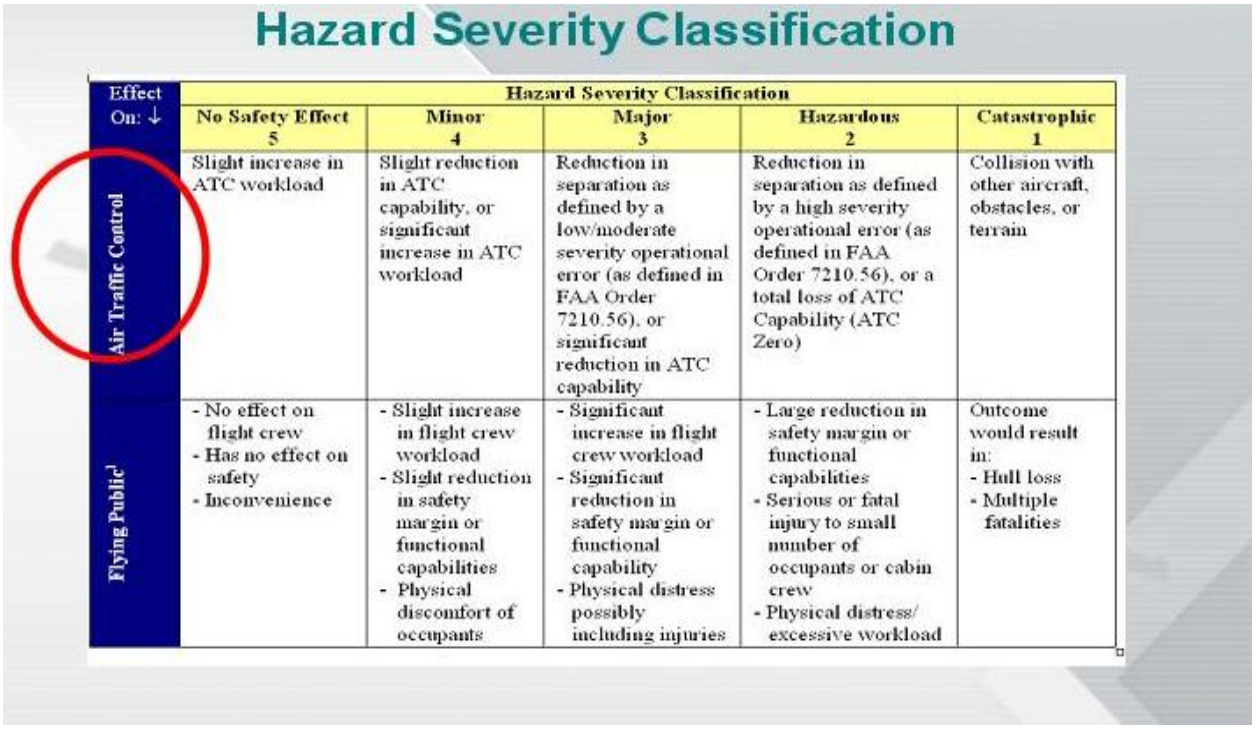
The Panel held a discussion on each of the identified hazards. The purpose of these discussions were to examine the cause of the hazard, validate the severity of consequence for each of the hazards, and assign a qualitative likelihood of

occurrence based on the operational expertise of the WCG, Inc., the LAX FAA air traffic control personnel and the airport airside staff. Quantitative data from similar configurations, such as the LAX South Airfield configuration prior to the new construction, was instrumental in determining severity and likelihood.

Risk Determination

Risk is the composite of predicted "severity and likelihood" of the potential effect of a hazard in the worst credible system state. Risk is determined by two factors: severity of consequence and likelihood of occurrence. Risk is not determined simply by the likelihood that the hazard will occur, but the worst credible outcome will occur. The risk matrix from section 4.41 of the FAA SMS Manual, Appendix A, was used to identify and document the risk levels.

Figure 10
Hazard Severity Classification



Source: FAA SMS Manual

Severity is determined by the worst credible outcome. Credible outcome is dependent on the system state (weather, evening hours, etc).

The NAS and the Los Angeles International Airport incorporate numerous controlling factors within the system that significantly impact positive reduction of severity. These include control instructions, crew procedures, separation standards, surface radar, etc. Severity is determined independent of likelihood.

Figure 11
Likelihood of Occurrence Chart

The Safety Risk Management Panel determined likelihood on a qualitative basis from the FAA Safety Management System chart below

	NAS Systems			Flight Procedures	ATC Operational	
	Quantitative	Qualitative				
		Individual Item/System	ATC Service/ NAS Level System		Per Facility	NAS-wide
Frequent	Probability of occurrence per operation/ operational hour is equal to or greater than $1x10^{-3}$	Expected to occur about once every 3 months for an item	Continuously experienced in the system	Probability of occurrence per operation/ operational hour is equal to or greater than $1x10^{-5}$	Expected to occur more than once per week	Expected to occur more than every 1-2 days
Probable	Probability of occurrence per operation/ operational hour is less than $1x10^{-3}$, but equal to or greater than $1x10^{-5}$	Expected to occur about once per year for an item	Expected to occur frequently in the system		Expected to occur about once every month	Expected to occur about several times per month
Remote	Probability of occurrence per operation/ operational hour is less than or equal to $1x10^{-5}$ but equal to or greater than $1x10^{-7}$	Expected to occur several times in life cycle of an item	Expected to occur numerous times in system life cycle	Probability of occurrence per operation/ operational hour is less than or equal to $1x10^{-5}$ but equal to or greater than $1x10^{-7}$	Expected to occur about once every year	Expected to occur about once every few months
Extremely Remote	Probability of occurrence per operation/ operational hour is less than or equal to $1x10^{-7}$ but equal to or greater than $1x10^{-9}$	Unlikely to occur, but possible in an item's life cycle	Expected to occur several times in the system life cycle	Probability of occurrence per operation/ operational hour is less than or equal to $1x10^{-7}$ but equal to or greater than $1x10^{-9}$	Expected to occur about once every 10-100 years	Expected to occur about once every 3 years
Extremely Improbable	Probability of occurrence per operation/ operational hour is less than $1x10^{-9}$	So unlikely that it can be assumed that it will not occur in an item's life cycle	Unlikely to occur, but possible in system life cycle	Probability of occurrence per operation/ operational hour is less than $1x10^{-9}$	Expected to occur less than once every 100 years	Expected to occur less than once every 30 years

Source: FAA SMS Manual

Likelihood notes:

- The FAA SMS likelihood chart assumes operation 24x7 (365 days) or approximately 8760 hrs/year for a single item/system
- The chart assumes NAS-Wide occurrence is an order of magnitude greater than an individual item/system.
- The chart assumes the hazard is 3 times likely to occur in the NAS than in a single facility.

The Preliminary Hazard Analysis (PHA)

The PHA, listed below, was developed by the SRMP, and used to identify the hazards and analyze the risks. Each step is outlined below.

Figure 12
Preliminary Hazard Analysis (PHA)
Describing the System – Identifying the Hazard – Analyzing the Risk

(1) Hazard #	(2) Hazard Description	(3) Causes	(4) System State	(5) Possible Effect	(6) Severity & Rationale
LAX 001	Aircraft departing or arriving 24L with aircraft inadvertently crossing at taxiway Yankee or Zulu	Communication Error Equipment Malfunction Runway Hazard	Simultaneous use of Rwy24L & Rwy 24R Non-Heavy Aircraft	Near collision Hazardous with high severity operational error	2D Medium Risk Hazardous Severity Based on subject matter expertise
LAX 002	Same scenario as LAX 001	As Above	Simultaneous use of Rwy24L & Rwy 24R Heavy Aircraft	As Above	2D Medium Risk Hazardous Severity Based on subject matter expertise
LAX 003	Aircraft departing or arriving 24L with aircraft inadvertently crossing at taxiway Alpha-Alpha or Bravo-Bravo	As Above	Simultaneous use of Rwy24L & Rwy 24R Heavy Aircraft	Reduction of ATC capabilities and increase of controller aircrew workload	4D Low Risk Minor Severity Based on subject matter expertise
LAX 004	Same scenario as LAX 003	As Above	Simultaneous use of Rwy24L & Rwy 24R Non-Heavy Aircraft	Same as LAX 003 above	4D Low Risk Minor Severity Based on subject matter expertise
LAX 005	Runway 24L & Runway 24R used for arrivals and departures at same time	As Above	Runway 24L arrival with a Runway 24L departure (Over flight)	Near collision Major with moderate severity operational	3C Medium Risk Major Severity

(1) Hazard #	(2) Hazard Description	(3) Causes	(4) System State	(5) Possible Effect	(6) Severity & Rationale
				error	
LAX 006	Same scenario as LAX 005	Communication Error Equipment Malfunction Runway Hazard	Runway 24R arrival with a Runway 24R departure (Over flight)	Reduction of ATC capabilities and increase of controller aircrew workload	3D Low Risk Major Severity Based on subject matter expertise
LAX 007	Same scenario as LAX 005	As Above	Runway 24R arrival with a preceding arrival – Taxiway Alpha-Alpha or Bravo-Bravo	Near collision Hazardous with high severity operational error	2D Medium Risk Hazardous Severity
LAX 008	Runway 24L and Taxiway Echo in use	As Above	Design Group V or VI aircraft using Taxiway Echo	Near collision Major with moderate severity operational error	3C Medium Risk Major Severity
LAX 009	Increase complexity of fleet mix on North Airfield	As Above	Design Group V or VI aircraft using areas with restrictions and complex coordination	Near collision Major with moderate severity operational error	3C Medium Risk Major Severity
LAX 010	ARFF equipment using northeast end of LAX	Communication Error Equipment Malfunction	Runway 24R in use	Reduction of ATC capabilities and increase of controller aircrew workload	4D Low Risk Major Severity Based on subject matter expertise

Source: LAX-WCG, Inc. SRM Panel

Section 8 – Treatment of Risks/Mitigation of Hazards (Phase 5)
Risk Treatment

For each hazard, the Panel identified existing safety requirements and recommended safety mitigation strategy (s) that will lessen the risk or control the hazards using the safety order of precedence from Table 4.4 of the FAA SMS Manual. After the hazards were defined and possible effects were identified, means to control the hazards were developed.

Los Angeles International Airport has detailed (quantitative) information available for operations on the North Airfield and South Airfield operations that includes the historical data associated with incidents, accidents and systems errors as defined by the FAA.

However, as a result of analyzing the proposed North Airfield configuration, the Panel decided to base the analysis on qualitative data obtained from subject matter experts. The quantitative data was used to assist in framing the issues and mitigation strategies. This methodology was consistently applied across of the hazards.

After applying the mitigations strategies associated with the proposed runway configuration, Hazard LAX 001, LAX 002 and LAX 008 were mitigated from a medium risk to complete elimination as a hazard.

LAX 005, LAX 007 and LAX 009 were mitigated from medium to low risks. LAX 003, LAX 004, LAX 006 and LAX 010 remained at a low risk.

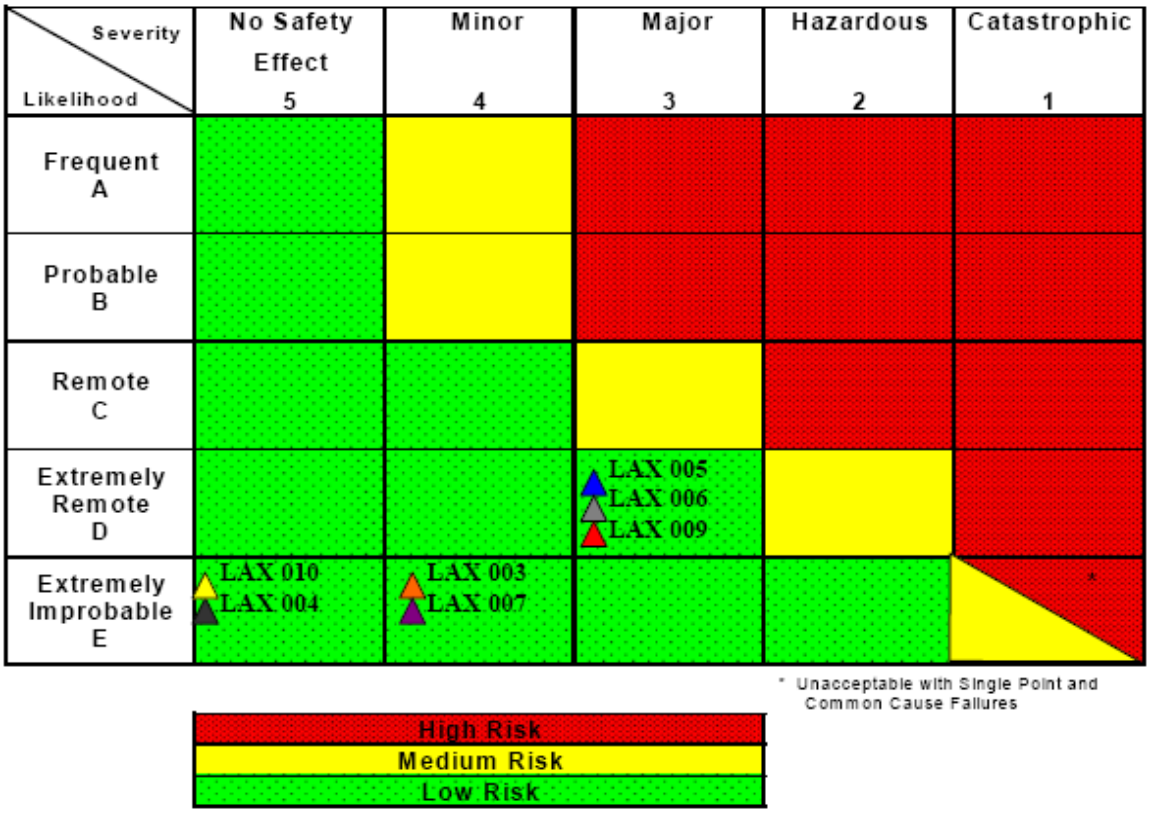
The ten identified hazards; their severity, likelihood and risk were discussed in the previous section. Six hazards, LAX 001, LAX 002, LAX 005, LAX 007, LAX 008 and LAX 009 were judged to be the most serious hazards that could lead to high severity operational errors. These six hazards are considered to be at medium risk with the current configuration of the North Airfield Complex.

The remaining four hazards have a lesser risk that would result with increased ATC and aircrew workload.

The proposed North Airfield configuration resulted in hazards LAX 001, LAX 002 and LAX 008 to be eliminated. LAX 005 and LAX 009 were reduced to a low risk and significantly, LAX 007 shifted from a medium risk with hazardous severity to a low risk with minor severity.

Figure 13

Safety Risk Matrix with Proposed Configuration



Note: LAX 001 - 002 and LAX 008 were eliminated as a hazard with the proposed configuration

Source: LAX-WCG, Inc. SRM Panel

The chart below incorporates the identified hazards into definable groups of interdependent operations; thereby providing a clear analysis of the overall mitigating strategy as a result of implementing the proposed North Airfield Runway configuration.

Figure14

Risk Mitigation Strategies

Hazard #'s	Risk	Mitigation
LAX 001 LAX 002 LAX 003 LAX 004	**Runway 24R crossing Runway 24L with or without a clearance at taxiways Yankee – Zulu – Alpha-Alpha or Bravo-Bravo**	**- New center taxiway between Runway 24L/06R and Runway 24R/06L eliminates the complexity of aircraft immediately proceeding through the**

Hazard #'s	Risk	Mitigation
		adjacent or flanking runway
LAX 005 **LAX 006** **LAX 007**	**Runway 24L/06R and Runway 24R/06L in use for arrivals and departures resulting in possible over flights from aircraft on short final or aircraft exiting with out clearing the runway safety area**	**- Proposed configuration results in a displaced threshold for Runway 24L that mitigates over flights** **- New center taxiway between Runway 24L/06R and Runway 24R/06L provides for aircraft exit without delay and additional distance from the runway safety area to clear the runways**
LAX 008 **LAX 009** **LAX 010**	**Increased use of Design Group V and VI aircraft**	**- Proposed configuration is designed to provide an efficient system for arrivals and departures to include aircraft operating in the movement area**

Source: LAX-WCG, Inc. SRM Panel

The panel recognizes that numerous control factors are utilized within the National Airspace System (NAS). The controls clearly mitigate known and projected hazards and risks. ***One of the most compelling control factors is the system design.***

The Safety Risk Management Panel made note of the following mitigations:

- Separation standards established by FAA Order 7110.65
- Operating techniques/responsibilities in the Airmen's Information Manual
- Mandatory communications and "hear-back-read back phraseology
- Airport (ICAO) markings – lighting – signage
- Aircrew and ATC certification
- Training of system user's including airport operators
- System awareness by user's
- Technology

- System design

Figure 15
Preliminary Hazard List (PHA)
Assess and Treat the Risk

Hazard	(7) Current Controls	(8) Likelihood	(9) Likelihood Rationale	(10) Current Risk	(11) Recommended Safety Requirements	(12) Residual Risk
LAX 001	AMASS, ASDE, 7110.65, Visual Aids, Training Runway Guide Lights	Extremely Remote	Unlikely to occur, but possible in an item's life cycle	2D Medium Risk Hazardous Severity	New center taxiway between Runway 24L/06R and 24R/06L eliminates the Complexity of aircraft immediately proceeding through the adjacent flanking runway	Eliminated
LAX 002	As Above	Extremely Remote	Unlikely to occur, but possible in an item's life cycle	2D Medium Risk Hazardous Severity	As Above	Eliminated
LAX 003	As Above	Extremely Remote	Unlikely to occur, but possible in an item's life cycle	4D Low Risk Minor Severity	As Above	4E Low Risk Minor severity
LAX 004	As Above	Extremely Remote	Unlikely to occur, but possible in an item's life cycle	4D Low Risk Minor Severity	As Above	5E Low Risk No safety effect
LAX 005	As Above	Remote	Expected to occur several times in life cycle of an item	3C Medium Risk Major Severity	As Above	3D Low Risk Medium Severity
LAX 006	As Above	Extremely Remote	Unlikely to occur, but	3D Low	As Above	3D Low Risk

Hazard	(7) Current Controls	(8) Likelihood	(9) Likelihood Rationale	(10) Current Risk	(11) Recommended Safety Requirements	(12) Residual Risk
			possible in an item's life cycle	Risk Major Severity		Medium Severity
LAX 007	As Above	Extremely Remote	Unlikely to occur, but possible in an item's life cycle	2D Medium Risk Hazardous Severity	As Above	4E Low Risk Minor Severity
LAX 008	As Above	Remote	Expected to occur several times in life cycle of an item	3C Medium Risk Major Severity	As Above	Eliminated
LAX 009	As Above	Remote	Expected to occur several times in life cycle of an item	3C Medium Risk Major Severity	As Above	3D Low Risk Major Severity
LAX 010	As Above	Extremely Remote	Unlikely to occur, but possible in an item's life cycle	4D Low Risk Minor Severity	As Above	5E No safety effect

Source: LAX-WCG, Inc. SRM Panel

Section 9 – Tracking and Monitoring Hazards

The Safety Risk Management Panel identified the following hazards as medium risks while developing the Preliminary Hazard List (PHL). While these hazards were mitigated to a low risk with the Preliminary Hazard Analysis (PHA), they are recommended to be monitored:

- LAX 001 Inadvertent Runway Crossing
- LAX 002 Inadvertent Runway Crossing
- LAX 005 Over-flight due to go-around
- LAX 007 Holding in the OFZ on Rwy24R
- LAX 008 A/C on Taxiway Echo-Rwy24L arrival
- LAX 009 Excess coordination Group V & IV

The hazard tracking should include continuous monitoring of operational errors (OE's), operational deviations (OD's), surface incidents and Quality Assurance Reviews (QAR's) related to the North Airfield Complex.

Aircrew safety reports are another venue to obtain relative data.

This information will serve as quantitative data for the current system (baseline) and provide further information associated with a design change to improve safety and enhance efficiency.

Section 10: Report Summary

The Safety Risk Assessment of the current North Airfield Complex identified several medium category hazards. The existing safety controls, such as the FAA separation standards and the Standard Operating Procedures (SOP's) within the scope of the airport user's and operators, resulted in mitigating these to an acceptable level of risk.

However, the efficiency of the North Airfield Complex is not at an acceptable level. This was clearly evident during the arrival and departure of the A380 on March 20, 2007. The aircraft required special procedures through-out its arrival, departure and taxi in the movement area.

The Safety Risk Management Panel (SRMP) reviewed quantifiable and historical data associated with both the North and South Airfield Complex. The previous configuration in the South Airfield Complex revealed numerous hazards. ***The Panel recognizes that these hazards relate to a high rate of system user's and runway crossings from airport tenants; however, the data also provides insight into the configuration complexities associated with an aircraft inadvertently proceeding into a flanking or parallel runway***.

Not surprisingly, extensive investigation of these unusual high incidents indicate a significant number of "hear-back - read-back" incidents, misunderstandings and latent practices where acceptable procedures lead to increasing risks.

The most recent runway incursion in the North Airfield Complex indicates that historical trends established in the previous South Airfield configuration are becoming more apparent and relate to the system design.

The Panel conducted a credible worst case scenario based upon current trends with communication errors, particularly at high risk locations in the present configuration. This scenario has a catastrophic outcome if the system state (poor visibility due to weather or evening operations), loss of technical tools and other control resources (such as untimely control instructions, frequency congestion or aircrew inability to respond) occur simultaneously.

The analysis of a credible worst case scenario occurrence was derived from subject matter experts using qualitative discussions; as such, the Panel feels increasing activity, complexities of the current system state and diversity of air traffic certainly have an impact on increasing the possibilities of a catastrophic event.

It is the recommendation of the Safety Risk Management Panel that the North Airfield Complex proposed configuration be adopted.

Appendix 1: Preliminary Hazard Analysis (PHA)

(1) Hazard #	(2) Hazard Description	(3) Causes	(4) System State	(5) Possible Effect	(6) Severity & Rationale	(7) Current Controls	(8) Likelihood	(9) Likelihood Rationale	(10) Current Risk	(11) Recommended Safety Requirements	(12) Residual Risk
LAX 001	Aircraft departing or arriving 24L with aircraft inadvertently crossing at taxiway Yankee or Zulu	Communication Error Equipment Malfunction Runway Hazard	Simultaneous use of Rwy24L & Rwy 24R Non-Heavy Aircraft	Near collision Hazardous with high severity operational error	2D Medium Risk Hazardous Severity Based on subject matter expertise	AMASS, ASDE, 7110.65, Visual Aids, Training Runway Guide Lights	Extremely Remote	Unlikely to occur, but possible in an item's life cycle	2D Medium Risk Hazardous Severity	New center taxiway between Runway 24L/06R and 24R/06L eliminates the Complexity of aircraft immediately proceeding through the adjacent flanking runway	Eliminated
LAX 002	Same scenario as LAX 001	As Above	Simultaneous use of Rwy24L & Rwy 24R Heavy Aircraft	As Above	2D Medium Risk Hazardous Severity Based on subject matter expertise	As Above	Extremely Remote	Unlikely to occur, but possible in an item's life cycle	2D Medium Risk Hazardous Severity	As Above	Eliminated
LAX 003	Aircraft departing or arriving 24L with aircraft inadvertently crossing at taxiway Alpha-Alpha or Bravo-Bravo	As Above	Simultaneous use of Rwy24L & Rwy 24R Heavy Aircraft	Reduction of ATC capabilities and increase of controller aircrew workload	4D Low Risk Minor Severity Based on subject matter expertise	As Above	Extremely Remote	Unlikely to occur, but possible in an item's life cycle	4D Low Risk Minor Severity	As Above	4E Low Risk Minor severity
LAX 004	Same scenario as LAX 003	As Above	Simultaneous use of Rwy24L & Rwy 24R Non-Heavy Aircraft	Same as LAX 003 above	4D Low Risk Minor Severity Based on subject matter expertise	As Above	Extremely Remote	Unlikely to occur, but possible in an item's life cycle	4D Low Risk Minor Severity	As Above	5E Low Risk No safety effect
LAX 005	Runway 24L & Runway 24R used for arrivals and departures at same time	As Above	Runway 24L arrival with a Runway 24L departure (Over flight)	Near collision Major with moderate severity operational error	3C Medium Risk Major Severity	As Above	Remote	Expected to occur several times in life cycle of an item	3C Medium Risk Major Severity	As Above	3D Low Risk Medium Severity
LAX 006	Same scenario as LAX 005	Communication Error Equipment Malfunction Runway Hazard	Runway 24R arrival with a Runway 24R departure (Over flight)	Reduction of ATC capabilities and increase of controller aircrew workload	3D Low Risk Major Severity Based on subject matter expertise	As Above	Extremely Remote	Unlikely to occur, but possible in an item's life cycle	3D Low Risk Major Severity	As Above	3D Low Risk Medium Severity
LAX 007	Same scenario as LAX 005	As Above	Runway 24R arrival with a preceding arrival – Taxiway Alpha-Alpha or Bravo-Bravo	Near collision Hazardous with high severity operational error	2D Medium Risk Hazardous Severity	As Above	Extremely Remote	Unlikely to occur, but possible in an item's life cycle	2D Medium Risk Hazardous Severity	As Above	4E Low Risk Minor Severity
LAX 008	Runway 24L and Taxiway Echo in use	As Above	Design Group V or VI aircraft using Taxiway Echo	Near collision Major with moderate severity operational error	3C Medium Risk Major Severity	As Above	Remote	Expected to occur several times in life cycle of an item	3C Medium Risk Major Severity	As Above	Eliminated
LAX 009	Increase complexity of fleet mix on North Airfield	As Above	Design Group V or VI aircraft using areas with restrictions and complex coordination	Near collision Major with moderate severity operational error	3C Medium Risk Major Severity	As Above	Remote	Expected to occur several times in life cycle of an item	3C Medium Risk Major Severity	As Above	3D Low Risk Major Severity
LAX 010	ARFF equipment using northeast end of LAX	Communication Error Equipment Malfunction	Runway 24R in use	Reduction of ATC capabilities and increase of controller aircrew workload	4D Low Risk Major Severity Based on subject matter expertise	As Above	Extremely Remote	Unlikely to occur, but possible in an item's life cycle	4D Low Risk Minor Severity	As Above	5E No safety effect

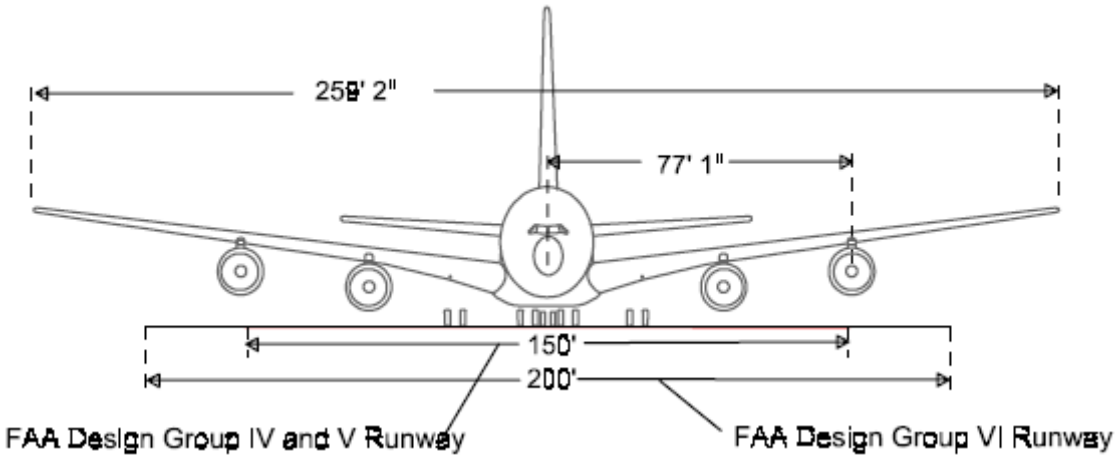
Appendix 2: Safety Management System – Safety Risk Management
SMS-SRM

DEFINITIONS

SAFETY	Freedom from unacceptable risk. Safety can be equated to some measurable goal (e.g., an accident rate less than an acceptable specified value)
ACCIDENT	An unplanned event that results in a harmful outcome; e.g., death, injury, occupational illness, or major damage to or loss of property
INCIDENT	An occurrence other than an accident that affects or could affect the safety of operations
RISK	The composite of predicted severity and likelihood of the potential effect of a hazard
ASSESSMENT	An estimation of the size and scope of risk or quality of system or procedure.
HAZARD	Any real or potential condition that can cause injury, illness, or death to people; damage to, or loss of, a system, equipment, or property; and/or damage to the environment. A hazard is a condition that is a prerequisite to an accident or incident
CAUSE	An event that leads to a hazard or hazardous condition
SOURCE (of a hazard)	Any potential origin of system failure, including equipment, operating environment, human factors, human machine interface, procedures and external services
SYSTEM	An integrated set of constituent pieces that are combined in an operational or support environment to accomplish a defined objective. These pieces include people, operational environment, usage, equipment, information, procedures, facilities, services, and other support services
ERROR TOLERANT SYSTEM	Total elimination of risk is an unachievable goal. Even in organizations with the best training programs and a strong safety culture, human operators will occasionally make errors. It is important that systems be designed and implemented in such a way that, to the maximum extent possible, errors and equipment failures do not result in an accident or incident
COMMON CAUSE FAILURE	A failure that occurs when a single fault results in the corresponding failure of multiple system components or functions

EFFECT	A description of the potential outcome of the hazard if it occurs in the defined system state
SYSTEM STATE	The system state refers to a variety of hazardous system conditions, including but not limited to location, system mode, velocity, operating rules in effect, type of operation, energy (power sourcing, electromagnetic environmental effects, etc.), operational environment and ambient environment. System state can be described in: *Operational and Procedure Terms* – Visual Flight Rules (VFR) vs. Instrument Flight Rules (IFR), Land and Hold Short Operations, etc. *Conditional Terms* – Instrument Meteorological Conditions (IMC) vs. Visual Meteorological Conditions (VMC), peak operating hours, etc. *Physical Terms* – Electromagnetic Environment Effects, precipitation, primary power source, back-up power source, etc. In addition, for any given hazard, not all system states have equal risk
WORST CREDIBLE OUTCOME	Assessment of hazards should make adequate allowance for worst-case conditions. However, it is also important that hazards included in the final analysis be *credible* hazards. *Worst* – Most unfavorable conditions expected (e.g., extremely high levels of traffic, extreme weather disruption) *Credible* – Implies that it is reasonable to expect the assumed combination of extreme conditions will occur within the operational lifetime of the system
DESIGN DIVERSITY	Independent generation of different implementations of the same logic function

Appendix 3: Description of Design Group Aircraft



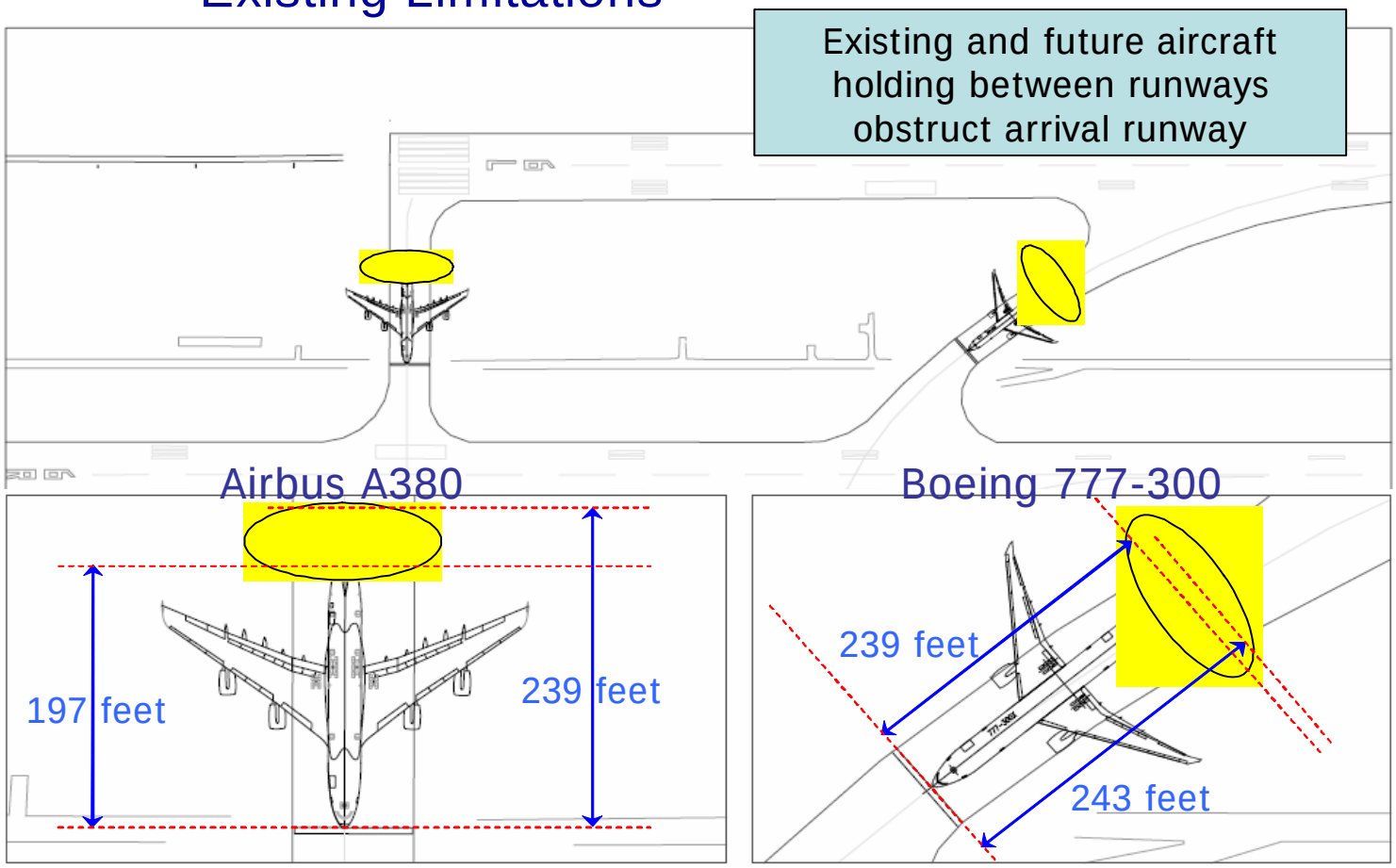
Airport Reference Code (ARC) Determination

Aircraft Approach Category	Aircraft Approach Speed (stall speed x 1.3 in knots)
A	0 to 90
B	91 to 120
C	121 to 140
D	141 to 165
E	166 or more
Airplane Design Group	Aircraft Wingspan in Feet (Meters)
I	0 up to but not including 49 (15)
II	49 (15) up to but not including 79 (24)
III	79 (24) up to but not including 118 (36)
IV	118 (36) up to but not including 171 (52)
V	171 (52) up to but not including 214 (65)
VI	214 (65) up to 262 (80)

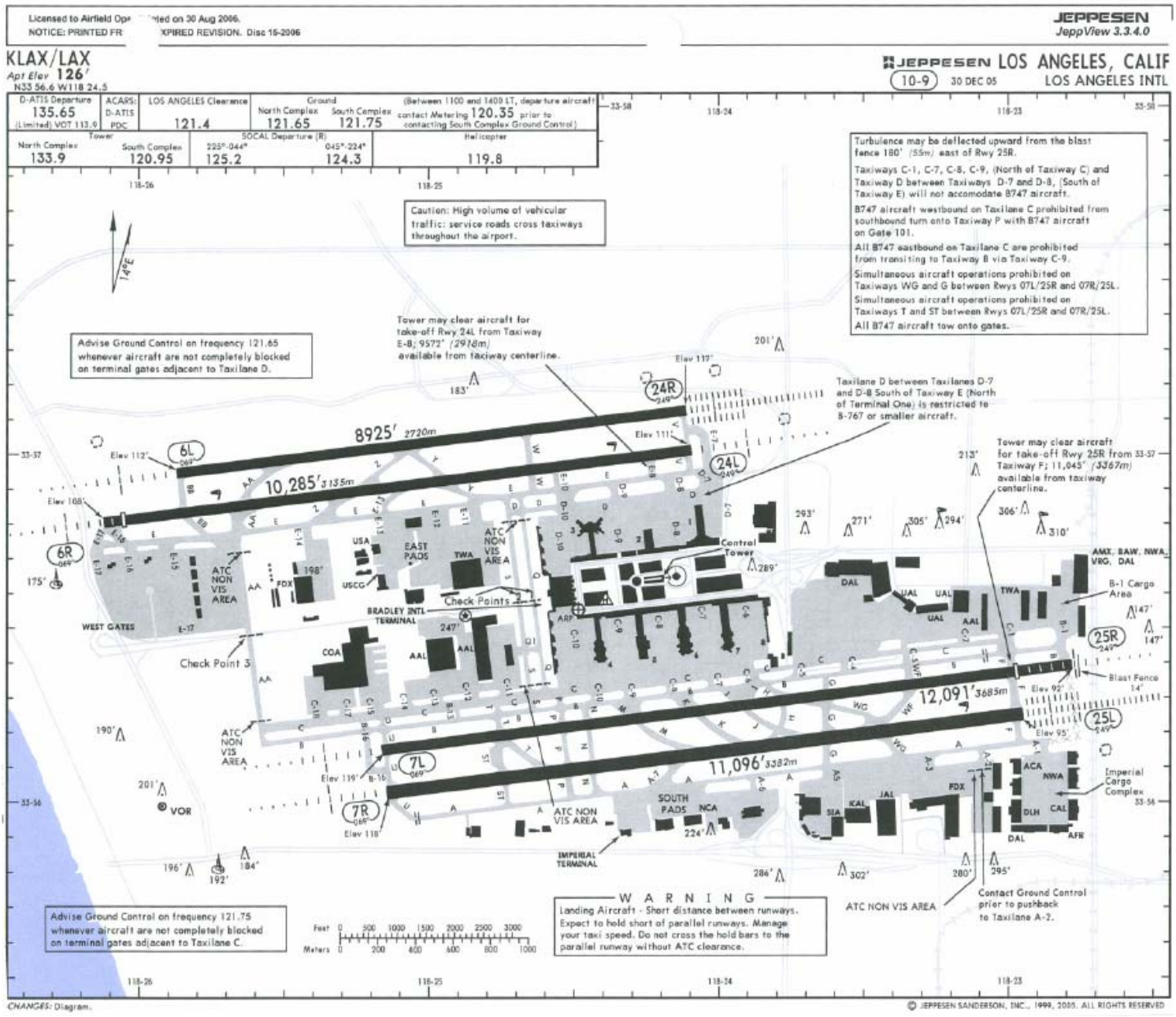
Appendix 4: North Airfield Limitations for Design Group V and VI

North Airfield

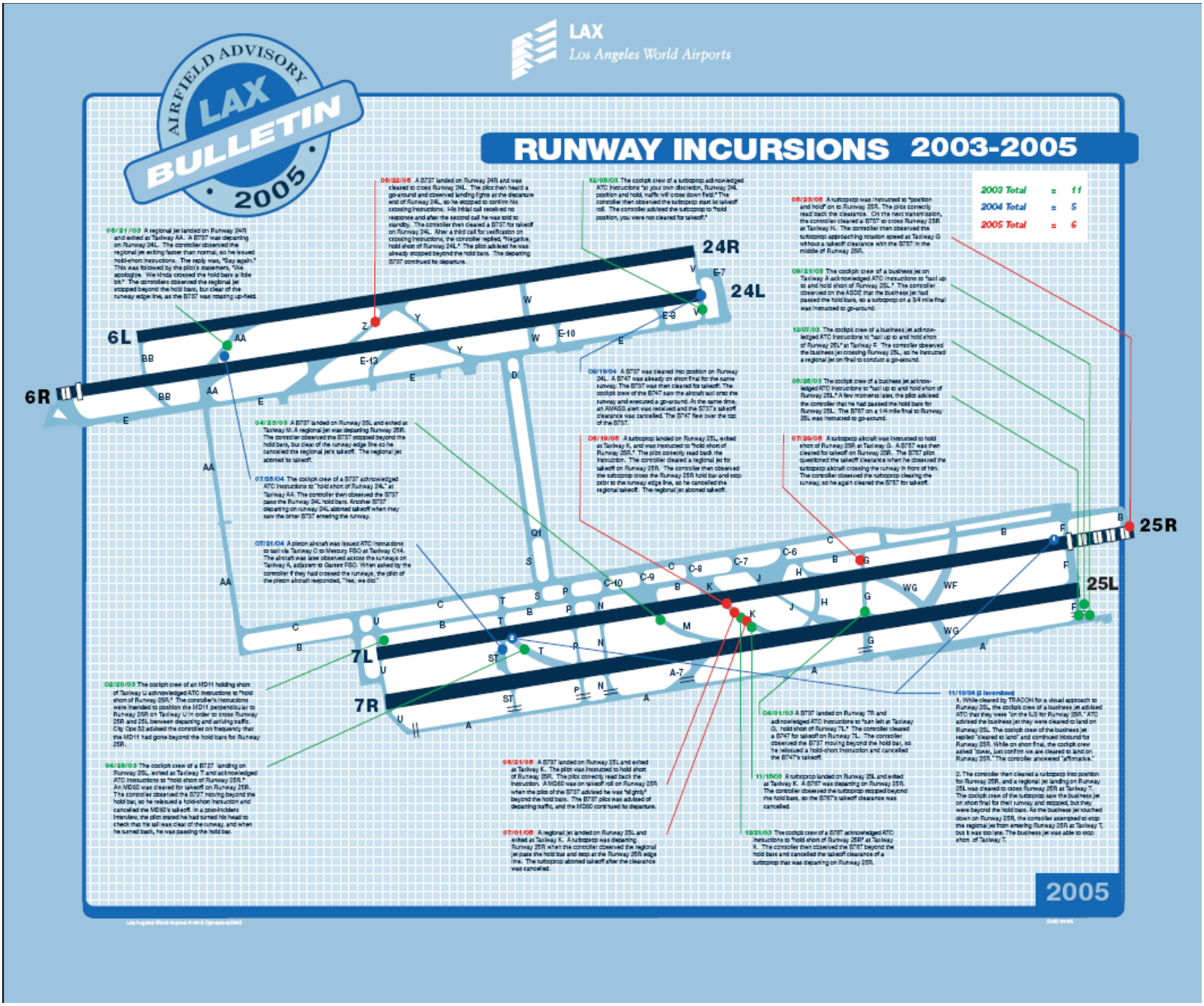
Existing Limitations



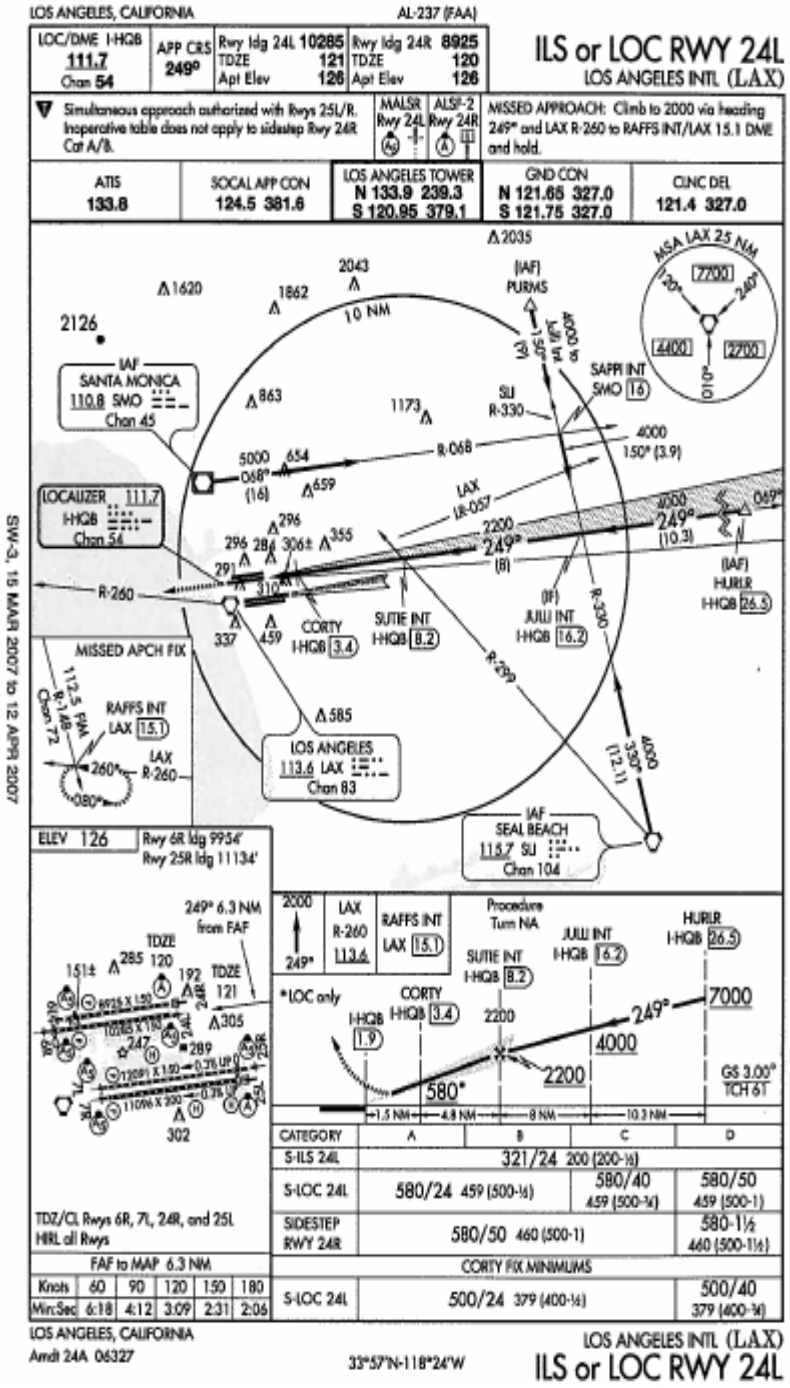
Appendix 5: Jeppesen Airport Diagram Listing Restrictions



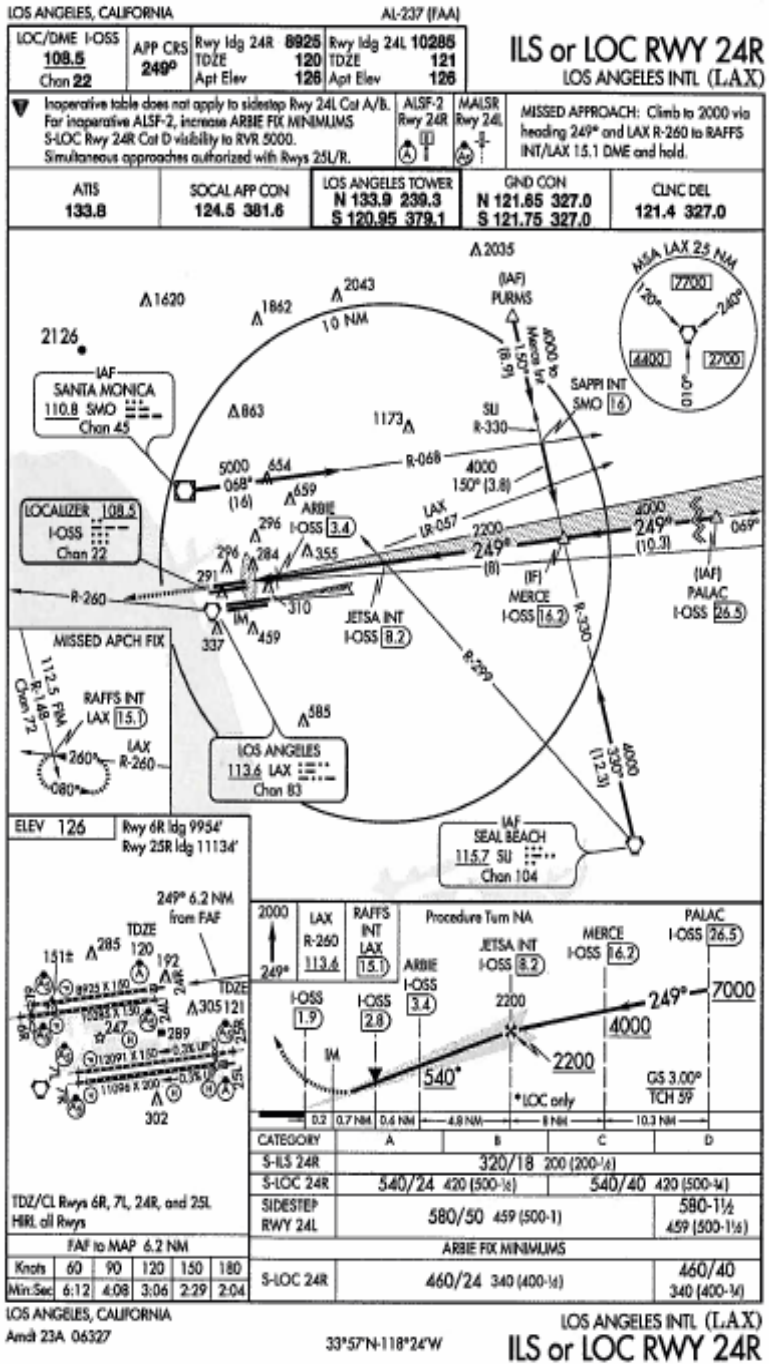
Appendix 6: LAWA Historical Data of System Errors and Incidents (03-2005)



Appendix 7: Jeppesen ILS Approach Charts Runway 24L and 24R



SW-3, 15 MAR 2007 to 12 APR 2007



SW-3, 15 MAR 2007 to 12 APR 2007

SW-3, 15 MAR 2007 to 12 APR 2007

Appendix 8: LAX Class B Airspace

Appendix 9: FAA Advisory Circular AC 150-5200-37 SMS for NAS Airports

U.S. Department of Transportation

Federal Aviation Administration

Advisory Circular

Subject: INTRODUCTION TO SAFETY MANAGEMENT SYSTEMS (SMS) FOR AIRPORT OPERATORS

Date: February 28, 2007 **Initiated by:** AAS-300

AC No: AC 150/5200-37 **Change:**

1. PURPOSE. This Advisory Circular (AC) introduces the concept of a safety management system (SMS) for airport operators.

BACKGROUND. The application of a systematic, proactive, and well-defined safety program (as is inherent in a SMS) allows an organization producing a product or service to strike a realistic and efficient balance between safety and production. The forecast growth in air transportation will require new measures and a greater effort from all aviation producers—including airport operators—in order to achieve a continuing improvement in the level of aviation safety. The use of SMS at airports can contribute to this effort by increasing the likelihood that airport operators will detect and correct safety problems before those problems result in an aircraft accident or incident. In November 2005, the International Civil Aviation Organization (ICAO) amended Annex 14, Volume I (Airport Design and Operations) to require member States to have certificated international airports establish an SMS. The FAA supports harmonization of international standards, and has worked to make U.S. aviation safety regulations consistent with ICAO standards and recommended practices. The agency intends to implement the use of SMS at U.S. airports to meet the intent of the ICAO standard in a way that complements existing airport safety regulations in 14 CFR Part 139.

The following actions are being taken in conjunction with the implementation of SMS at commercial airports in the United States:

Rulemaking. The FAA has opened a rulemaking project to consider a formal requirement for SMS at certificated airports. In the United States, about 570 airports are certificated under 14 CFR Part 139, *Certification of Airports*. The agency anticipates issuing a notice of proposed rulemaking (NPRM) for public comment in 2008. A decision on a final rule will not be made until the agency has considered all of the public and industry comments received on the NPRM. We will also take into account the experience of airports that have already implemented an SMS. In any decision to issue a final rule to have airport operators implement SMS, the FAA would:

- Consider the benefits and costs of the rule and tailor the rule to impose the minimum burden and costs necessary for effective implementation
- Consider whether the requirement should apply to all certificated airports or only to airports above a certain activity level