
Los Angeles International Airport North Airfield Safety Study

FFC LAX Simulation Data and Academic Panel Demand Files

Compiled by the Academic Panel and Betty Silva (NASA Ames)



April 19, 2010

Files Delivered to LAWA as part of the LAX FFC Simulation Study (North Airfield Safety Study)

The NASA FFC simulations collected a large variety of data. In order to run all FFC simulations, the Academic Panel generated significant amount of data that was processed by NASA Ames. The hard drive delivered to LAWA is organized in several folders as shown in Figure 1. Five folders contain both NASA and Academic Panel generated data files. If there are any questions about these files please direct them to:

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Name	Date Modified	Date Created
LAX FFC Simulation Deliverables.doc	Today, 1:31 PM	Today, 1:31 PM
▶ NASA FFC Outputs	Apr 19, 2010 9:36 PM	Aug 19, 2009 12:49 AM
▶ AP Panel Support Files	Apr 19, 2010 9:33 PM	Apr 13, 2010 9:43 PM
▶ FFC Demand Scenarios by AP Panel	Apr 13, 2010 9:56 PM	Apr 13, 2010 9:12 PM
▶ CVS Sim Outputs	Jan 5, 2010 12:32 AM	Aug 19, 2009 12:49 AM
▶ Surveys and Interviews	Sep 29, 2009 2:33 PM	Sep 10, 2009 12:18 PM

Figure 1. Organization of the Files in the LAWA Hard Drive.

Figure 2 illustrates the organization of the NASA FFC Outputs folder. This folder contains all FFC audio files for each simulation run (54 runs total). FFC audio files are posted in WAV format. Audio log files contain summary communication data between pilots and controllers for each simulation run. These files contain numeric and text data sets. The ATG

history Files Folder contains detailed information on aircraft positions for each simulation run. These are organized by date.

Name	Date Modified	Date Created
LAX FFC Simulation Deliverables.doc	Today, 1:33 PM	Today, 1:31 PM
▼ NASA FFC Outputs	Apr 19, 2010 9:36 PM	Aug 19, 2009 12:49 AM
▶ FFC Audio Files	Apr 19, 2010 9:27 PM	Apr 16, 2010 3:20 PM
▶ Audio Log files	Sep 30, 2009 12:53 PM	Sep 1, 2009 8:12 PM
▶ ATG_History_Files	Sep 26, 2009 9:23 PM	----
▶ Statistics	Sep 18, 2009 5:19 PM	Sep 1, 2009 8:17 PM
▶ AP Panel Support Files	Apr 19, 2010 9:33 PM	Apr 13, 2010 9:43 PM
▶ FFC Demand Scenarios by AP Panel	Apr 13, 2010 9:56 PM	Apr 13, 2010 9:12 PM
▶ CVS Sim Outputs	Jan 5, 2010 12:32 AM	Aug 19, 2009 12:49 AM
▶ Surveys and Interviews	Sep 29, 2009 2:33 PM	Sep 10, 2009 12:18 PM

Figure 2. NASA FFC Output Folder Contents.

Figure 3 illustrates the organization of the AP Panel Support Files folder. This folder contains spreadsheets with the aircraft mix and LAWA 2020 demand files used by the AP Panel to derive hourly demands in every FFC simulation run. The PDF file called Aircraft_mix_rationale.pdf contains the design rationale to estimate the future aircraft mix at LAX. The file Runway_Status_Lights.pdf contains the AP Panel suggested locations of runway status lights in the airfield and used in the FFC simulations.

Name	Date Modified	Date Created
LAX FFC Simulation Deliverables.doc	Today, 1:35 PM	Today, 1:31 PM
▶ NASA FFC Outputs	Apr 19, 2010 9:36 PM	Aug 19, 2009 12:49 AM
▼ AP Panel Support Files	Apr 19, 2010 9:33 PM	Apr 13, 2010 9:43 PM
▶ Runway_Status_Lights_forFFC	Apr 13, 2010 10:18 PM	Apr 13, 2010 10:18 PM
▶ Aircraft_mix_rationale	Apr 13, 2010 10:08 PM	Apr 13, 2010 10:08 PM
▶ demand_lawa_2020.xls	Apr 13, 2010 9:45 PM	Jan 14, 2010 6:36 PM
▶ demand_lawa_2007.xls	Apr 13, 2010 9:45 PM	Jan 14, 2010 6:36 PM
▶ AircraftFleetMixLAWA2020.xlsx	Feb 14, 2010 12:31 AM	Oct 17, 2008 4:16 PM
▶ aircraft.xlsx	Oct 15, 2008 10:00 PM	Oct 15, 2008 10:00 PM
▶ airlines.xlsx	Oct 15, 2008 9:52 PM	Oct 15, 2008 9:52 PM
▶ FFC Demand Scenarios by AP Panel	Apr 13, 2010 9:56 PM	Apr 13, 2010 9:12 PM
▶ CVS Sim Outputs	Jan 5, 2010 12:32 AM	Aug 19, 2009 12:49 AM
▶ Surveys and Interviews	Sep 29, 2009 2:33 PM	Sep 10, 2009 12:18 PM

Figure 3. AP Panel Support Files Folder Contents.

Name	Date Modified	Date Created
LAX FFC Simulation Deliverables.doc	Today, 1:37 PM	Today, 1:31 PM
▶ NASA FFC Outputs	Apr 19, 2010 9:36 PM	Aug 19, 2009 12:49 AM
▶ AP Panel Support Files	Apr 19, 2010 9:33 PM	Apr 13, 2010 9:43 PM
▼ FFC Demand Scenarios by AP Panel	Apr 13, 2010 9:56 PM	Apr 13, 2010 9:12 PM
LAX_FFC_Demand Sets_ExcelExplanation	Apr 13, 2010 9:55 PM	Apr 13, 2010 9:55 PM
▶ VMC Scenarios	Apr 13, 2010 9:22 PM	Jul 31, 2009 6:33 PM
▶ Night Scenarios	Aug 1, 2009 12:12 AM	Aug 1, 2009 12:12 AM
▶ IMC Scenarios	Jul 31, 2009 6:33 PM	Jul 31, 2009 6:33 PM
▶ CVS Sim Outputs	Jan 5, 2010 12:32 AM	Aug 19, 2009 12:49 AM
▶ Surveys and Interviews	Sep 29, 2009 2:33 PM	Sep 10, 2009 12:18 PM

Figure 4. FFC Demand Scenarios by AP Panel Folder Contents.

Name	Date Modified	Date Created
LAX FFC Simulation Deliverables.doc	Today, 1:38 PM	Today, 1:31 PM
▶ NASA FFC Outputs	Apr 19, 2010 9:36 PM	Aug 19, 2009 12:49 AM
▶ AP Panel Support Files	Apr 19, 2010 9:33 PM	Apr 13, 2010 9:43 PM
▶ FFC Demand Scenarios by AP Panel	Apr 13, 2010 9:56 PM	Apr 13, 2010 9:12 PM
▼ CVS Sim Outputs	Jan 5, 2010 12:32 AM	Aug 19, 2009 12:49 AM
LAX-NASS B747 LogPart 1.pdf	Sep 8, 2009 1:40 PM	Sep 3, 2009 6:18 PM
LAX-NASS B747 LogPart2.pdf	Sep 8, 2009 11:32 AM	Sep 8, 2009 11:31 AM
▶ 09012009	Sep 2, 2009 4:03 PM	Sep 2, 2009 4:01 PM
▶ 08312009	Sep 2, 2009 4:01 PM	Sep 2, 2009 4:00 PM
▶ 08282009	Aug 28, 2009 7:15 PM	Aug 28, 2009 7:13 PM
▶ 08272009	Aug 27, 2009 6:58 PM	Aug 27, 2009 6:57 PM
▶ 08262009	Aug 26, 2009 8:19 PM	Aug 26, 2009 8:17 PM
▶ 08252009	Aug 25, 2009 6:50 PM	Aug 25, 2009 6:48 PM
▶ 08052009	Aug 23, 2009 6:24 PM	Aug 19, 2009 3:08 PM
▶ 08042009	Aug 23, 2009 6:22 PM	Aug 19, 2009 3:05 PM
▶ 08202009	Aug 20, 2009 8:03 PM	Aug 20, 2009 8:01 PM
▶ 08192009	Aug 19, 2009 8:07 PM	Aug 19, 2009 8:05 PM
▶ 08182009	Aug 19, 2009 3:23 PM	Aug 19, 2009 3:21 PM
▶ 08172009	Aug 19, 2009 3:21 PM	Aug 19, 2009 3:19 PM
▶ 08142009	Aug 19, 2009 3:19 PM	Aug 19, 2009 3:17 PM
▶ 08132009	Aug 19, 2009 3:17 PM	Aug 19, 2009 3:16 PM
▶ 08112009	Aug 19, 2009 3:16 PM	Aug 19, 2009 3:14 PM
▶ 08102009	Aug 19, 2009 3:14 PM	Aug 19, 2009 3:13 PM
▶ 08072009	Aug 19, 2009 3:13 PM	Aug 19, 2009 3:11 PM
▶ 08062009	Aug 19, 2009 3:11 PM	Aug 19, 2009 3:09 PM
▶ Surveys and Interviews	Sep 29, 2009 2:33 PM	Sep 10, 2009 12:18 PM

Figure 5. CVS Sim Outputs Folder Contents.

Name	Date Modified	Date Created
LAX FFC Simulation Deliverables.doc	Today, 1:39 PM	Today, 1:31 PM
▶ NASA FFC Outputs	Apr 19, 2010 9:36 PM	Aug 19, 2009 12:49 AM
▶ AP Panel Support Files	Apr 19, 2010 9:33 PM	Apr 13, 2010 9:43 PM
▶ FFC Demand Scenarios by AP Panel	Apr 13, 2010 9:56 PM	Apr 13, 2010 9:12 PM
▶ CVS Sim Outputs	Jan 5, 2010 12:32 AM	Aug 19, 2009 12:49 AM
▼ Surveys and Interviews	Sep 29, 2009 2:33 PM	Sep 10, 2009 12:18 PM
▼ Pilots	Sep 29, 2009 3:58 PM	Sep 10, 2009 12:18 PM
▶ Scanned Surveys	Sep 29, 2009 3:58 PM	Sep 11, 2009 12:41 PM
▶ Pilots MP3	Sep 28, 2009 1:37 PM	Sep 10, 2009 1:57 PM
Pilot Surveys.xls	Sep 10, 2009 6:44 PM	Sep 10, 2009 6:44 PM
▶ Pilots WAV	Sep 10, 2009 2:49 PM	Sep 10, 2009 2:49 PM
▶ Controllers	Sep 29, 2009 2:33 PM	Sep 10, 2009 12:18 PM

Figure 6. Surveys and Interviews Folder Contents.

Explanation of NASA FFC Outputs

This section is a description of the NASA Ames FFC simulation outputs. This section was prepared by Betty Silva (NASA Ames Research Center).

There were three systems that collected scenario data during the simulation: 1) MaxSim, 2) Airspace Traffic Generator (ATG) and 3) B747 Flight Simulator. MaxSim is the system which drove the out-the-window views. The ATG generated the scenario was sent to MaxSim and the pilot stations.

1. MaxSim Event Data (raw)
2. MaxSim Trajectory and Airport Surface data (processed from the MaxSim Event Data)
3. ATG History Data (raw)
4. B747 Flight Simulator Data (e.g. altitude, speed, latitude, longitude)
5. Processed communication data (e.g. number of passages, duration of each passage)

The qualitative data collected are as follow:

- a) Controller background information
- b) Controller post-run questionnaires
- c) Controller post-participation questionnaires
- d) Pilot background information
- e) Pilot post-landing questionnaires
- f) Pilot post-hour questionnaires
- g) Pilot end of day questionnaires
- h) Spreadsheets containing tabulated controller and pilot survey responses
- i) Pilot and controller hand-written interview notes and digital recorded interviews in wav format.

LAX FFC Simulation Deliverables

This section contains a short description of the deliverables for the LAX-NASS project that are generated in the post-processing of the data recorded by the Maxsim software. Some of the data described here is redundant with data recorded by the Airspace Target Generator (ATG) and its associated subsystems. This document only describes the files generated from the Maxsim-recorded data.

All of the files described here result from processing the Maxsim "data recording" data. This data is all published as part of the High Level Architecture (HLA) messaging system and was recorded by the MAK Logger running during the simulations as part of the Maxsim software.

The processing is accomplished in two steps:

1. Read the HLA file, extract aircraft trajectory data, and generate a ground event file by comparing the time-history trajectory data for each aircraft with the set of ground points used by ATG to control aircraft on the ground. This ground-event file is an emulation of the "data collection" file normally generated by Maxsim for its own aircraft. Also, generate a set of files based on the HLA data.
2. Process the ground event file, compute various statistics from the ground events, and produce various reports from the data about number of operations, taxiing times, hold times, runway crossing times, and runway occupancy times.

Seventeen files are produced for each run by this processing: 8 in phase 1 and 9 in phase 2. Each file, except one, is a plain text file and is either a data file without formatting or a report file with some minimal text-based formatting. One file is an Excel spreadsheet document containing a summary of that run, with rows of data for each flight.

The files have names based on the run descriptor entered by the FFC Test Engineer at the time of the run. The naming convention used for runs during the LAX-NASS simulations is 'laxA_XY_Z_runNB', where

A Airport database (A = 3, b, d, m, n) XYGroup VI operations (X = 2, 4, 6; Y = B, S)

Z Meteorological conditions (Z = V, I, N)

NB Run number (N = 1,54; B = ",a,b,etc. for repeated runs)

For example, the first run was done with the LAXB airport database, with 2 Group VI aircraft using both sides of the airport and under VMC conditions, so the run identifier used was 'laxb_2b_v_run1'. Run 2 was the LAXB database with 6 group VI aircraft on both sides and IMC conditions, and the run was restarted because of a technical problem, so the run identifier was 'laxb_6b_i_run2a'.

In the descriptions below, 'laxx' will represent the full run identifier.

Those repeated runs that were 15 min or more in duration are included, while runs less than that are not.

Phase 1 Files

Eight files are generated from the HLA data in the first processing phase:

1. `laxx.act` A time history of the number of aircraft active in the simulation. Format is: 'time number', with time in seconds and number of active aircraft. A line is written every time an aircraft is activated or terminated.

2. `laxx.csv` File of ground events. The format is: Time, callsign, location, status, UTC

Time is in hh:mm:ss from start of simulation. Location is name of ground point (see `laxx.rts` file, described below) or a runway designator. Status is one of (HOLD,IN,OUT,PUSHBACK,THRESHOLD,TOUCHDOWN, ON,OFF,START,STOP). UTC is wall-clock time, but is always zero for this project.

3. `laxx.dat` Comma-separated file giving summary for each flight in run. The format is: Callsign, Category, A/C Type, Takeoff, Liftoff, Threshold, Touchdown, Missed approach

Where:

Category is 'A' for arrivals, 'D' for departures Takeoff, Liftoff, Threshold, Touchdown are times in seconds Missed approach is time in sec. of missed approach, if any.

4. `laxx.rpt` Report of missed approaches. Each possible go-around will be described, giving the callsign, runway, time in sec., position in X,Y m., altitude in ft., and heading in deg.

5. `laxx.rwml` Report of Runway Status Light (RWSL) activity. The format is: Time, Object, Airport, Runway, Taxiway, Type, Status, Name where:

Time - Time in sec. from start of simulation Object

HLA object number of RWSL light set Airport

LAX3, LAXB, LAXD, LAXM, LAXN Runway

Runway designator Taxiway Name of closest taxiway Type

Either REL or THL Status

Light intensity from 0 to 5 Name

Name of RWSL light set

6. lxxx.sum Standard output of summary program that processes the HLA data. Contains paths of input and output files. Also includes a summary table of all flights in the simulation, giving HLA object number, HLA object tag, callsign, aircraft type, visual representation file, flag, and number of update packets recorded in file. This is followed by a summary of arrivals, giving landing runway and times for threshold crossing, touchdown, and missed approach. A summary table for departures gives runway and times for takeoff, liftoff, and threshold crossing.

7. lxxx.trk Aircraft trajectory file. This file includes the position of flights as recorded by the MAK Logger. The format is: Object #, Callsign, Time (sec.), State, X (nm.), Y (nm.), Altitude (ft.), Heading (deg.), Speed (fps), Vertical Speed (fps), Pitch (rad), Yaw (rad), Roll (rad) Lines are given in the order received. The X,Y values are displacements from the airport reference point.

8. lxxx.rts Ground points file giving the name and location of the ground points used to generate the ground events from aircraft trajectories. The information in this file was derived from the routes file that ATG uses to control aircraft on the ground. The format is: Name, X (m.), Y (m.), Index, Type, Description.

Where:

X,Y Displacement from airport reference point in m.

Index Index in original routes file (not all points in routes file are used)

Type Type of point: 0 = ordinary, 1 = gate, 2 = runway, 4 = runway exit,

Phase 2 Files

Nine additional files are generated from the HLA data in the second processing phase:

9. lxxx_arr.csv Summary of arrival flights as a comma-separated text file. The format is: Callsign, A/C Type, Runway, Touchdown, Runway Exit, Runway Occupancy, Spot, Spot Time, Gate, Gate Time, Taxi Duration, # Holds, Hold Point 1, Hold 1 Time, Hold 1 Duration, etc.

Spots were not used at LAX, and hold points and times were not calculated.

10. laxx_arr.txt Ground events generated for arrival flights, grouped by individual flights in order of activation. Warnings generated for each flight are also included.

11. laxx_dep.csv Summary of departure flights as a comma-separated text file. The format is: Callsign, A/C Type, Runway, Gate, Pushback, Spot, Spot In Time, Spot Out Time, Spot Duration, Runway Hold, Takeoff, Ltoff, Runway Occupancy, Taxi Duration, # Holds, etc.

12. laxx_dep.txt Ground events generated for each departure flight, grouped by individual flights in order of activation. Warnings generated for each flight are also included.

13. laxx_unk.txt Ground events generated for each flight, for which a determination of arrival or departure cannot be made.

14. laxx_err.txt Errors or anomalies encountered in processing ground events.

15. laxx_stats.log Standard output of the stats.pl program, which calculates statistics from ground events file.

16. laxx_rpt.txt Report file giving summary and detailed statistics calculated from ground events. Report sections include the following:

Overall program summary
Arrival Statistics
Departure Statistics
Arrivals Taxi-in Statistics
Departures Taxi-out Statistics
Runway Crossings By Runway
Runway Statistics For Five Minute Intervals
Operation Counts Per Time Interval
Taxi and Runway Occupancy Durations
Runway Takeoff Occupancy Times
Runway Landing Occupancy Times

17. laxx.xls Spreadsheet giving summary statistics for each flight in simulation. Arrivals and departures are placed in separate worksheets.