This manual is applicable to World Traffic version 2.1.0 and greater and will be updated as needed.

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Credits:

Austin Meyer – for X-Plane and permission to use modified version of X-Plane aircraft with World Traffic.
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1 Introduction

World Traffic is an application designed to fill the skies and taxiways of your favourite airports with lots of planes. You can even land and sea traffic. Flight paths are defined through flight plans which are simple to create by specifying the aircraft in the flight, some flight parameters, and the steerpoints that the aircraft will follow. Arrivals and departures are controlled by World Traffic based on wind and aircraft type info so that aircraft will land and takeoff from suitable runways.

1.1 Feature List

Subsequent sections in the manual will describe how to use these various features:

General Features

- Sample flight plans and ground routes are provided for KSEA and LOWI. These illustrate almost all of the functionality of the application and may be used as examples for your own flights.
- Several default aircraft are provided with many more to come. Users may create their own aircraft as well. Aircraft have a flight model which takes into account aircraft fuel load so that aircraft flying a long distance will require more fuel and will require more runway to takeoff. The engine model's thrust is dependant on altitude. Aircraft are affected by weather so turn up the crosswinds and turbulence and watch the planes react.
- STAR/SID data by Navigraph is included for the World's airports so that aircraft may follow these departures and approaches.
- World-Traffic Radar plugin is included to get a bird's eye view of the traffic coming and going from the selected airport.
- Flight plans can be grouped into zones to enable/disable flights for a specific region or to enable/disable flights for a specific vintage of aircraft. You can organize the flight plan folders however you wish and enable or disable whatever regions you are interested in.
- Directional, multi-track aircraft engine sounds with doppler shift.
- Optional control of X-Plane multi-player aircraft so that TCAS is functional for World-Traffic controlled aircraft.
- ATC system to allow you to interact with the World Traffic application so that it is aware of your position and can vector you and and assign you arrival/departure runways. Your aircraft will be commanded to follow taxi info to the active runways and will be vectored along SID/STAR routes.
- Track camera lets you follow any of the World Traffic controlled aircraft, boats, and vehicles.
- Flight information window allows you to quickly find active flights, flight information about that flight, and to view that flight with the track camera.

Flight Plans

- Random Flight Plan Generator to create hundreds of flight plans for your favourite airports.

- User-defined flight plans to specify the flight path of an aircraft or a formation of aircraft.
- Flight plans can be for air (including helicopters), ground, or sea traffic.
- Selectable departure types for normal takeoffs or vertical departures if the aircraft thrust:weight ratio is sufficient and the first flight plan waypoint is high enough to warrant a vertical departure.
- Selectable arrival types for straight-in approaches, overhead breaks, or low approaches.
- Settable start times specified in zulu time or instant start meaning the flight will start as soon as X-Plane starts.
- Various formation configurations.
- Formation joinups after takeoff.
- Settable altitudes for each steerpoint in the flight plan where altitude can be in feet above sea level or feet above ground level for terrain following flights.
- Flight plans can be defined for specific aircraft tail numbers so that a specific aircraft can be defined to follow a multi-leg route.

Ground Routes

- User-defined ground routes to specify specific parking locations for aircraft.
- Ground routes can be specific to a general type of aircraft, a type of aircraft, or a specific tail number so you can have planes park in the parking spots you want.
- Runway intersections are defined in ground routes to specify hold lines and to determine when planes are on or crossing runways.

Flight Model

- Simple flight model using aerodynamics and ballistics equations from the NASA web site to provide a flight models accurate enough so that you can follow the World-Traffic controlled aircraft. You can define drag coefficient, cross-sectional area, and thrust to tune aircraft performance.
- Wind and turbulence affect aircraft so that they will bounce around in turbulence and crab into the wind in flight.
- Afterburner thrust is settable so afterburner-equipped aircraft can accelerate quickly when required, perform vertical departures, and fly supersonic.
- Larger aircraft have slower roll rates and pitch rates compared to smaller aircraft.
- Angle of Attack (AOA) increases as speed decreases and flap deployment will decrease AOA. Cruise AOA and landing/takeoff AOA can be specified for each aircraft to give reasonable AOA through the aircraft's speed range.

Aircraft Object Animation

- Custom datarefs are provided to provide your aircraft with full animation of control surfaces,

landing gear, canopy, nozzle, engine blades/prop, thrust reverser, lights etc.

- All types of aircraft lighting is supported and the lights will function correctly depending on the phase of flight and aircraft type. Landing lights will go on and taxi lights will go off when the aircraft taxis onto a runway for takeoff. The strobe lights will turn off when the plane arrives and turns off the runway. Cabin lights will stay and aircraft doors will stay open for a few minutes after an airliner parks until the passengers are all off the plane. Most other lighting turns off when the aircraft engines are shut down.

Application Control of Aircraft

Besides the normal flight model control of aircraft between steerpoints, the application will also perform the following functions.

- Planes are vectored on final approach to maintain sufficient spacing between other incoming aircraft.
- Simultaneous runway operations are functional.
- Collision avoidance for taxiing aircraft.
- Non-military aircraft try and maintain a speed of less than 250 knots below 10,000 feet.
- Planes will hold for approaching aircraft that are landing, taking off, or taxiing towards other planes.
- Planes will overshoot the runway if there is another plane on it.
- Planes will overshoot the runway if they can't slow down enough or descend low enough to land.
- Planes will go into holding patterns if all adequate runways are in use or if the cross wind exceeds aircraft limits.

1.2 Planned Features

See the Classic Jet Simulations web site (www.classicjetsims.com) for a list of planned features.

1.3 Quick Start Guide

To get the application running as quickly as possible follow these procedures:

Below is a quick start guide:

0. First define the menu keys you need to open the World Traffic menus (see section 2 below on setup).
1. Go the World Traffic Regions menu and enable the three included regions so that they are green. (Use the arrow keys to move the cursor up or down and click enter to enable the region)
2. Select the Resynch option in the World Traffic menu or use the key you defined in section 2 to re-start all the flight plans. This will activate the demo flight plans at KSEA.

To Create your own traffic:

1. X-Plane aircraft do not work as AI aircraft for World Traffic since there is a limit of 20 of these. You need to download AI planes specifically created for World Traffic which are either modified X-Plane aircraft, AI conversions from FSX, or custom models. Download extra add-on aircraft, route files and ground routes you're interested in here: http://forums.x-plane.org/index.php?app=downloads&showcat=156
2. Go to your favourite airport
3. Open the Random Flight Plan Generator (see section 4.5 in the manual for info)
4. Add a new airport definition file for your favourite airport. Make sure to fill out all fields including connecting airports and operators and then generate the flight plans.
5. Do a Resync to load in the new region folder created above (apt_name_RANDOM)
6. Enable the region folder and do another Resynch to activate all the flight plans and traffic.
7. After this you'll need to create ground routes for your airports or download them from the link above. Creating ground routes is a bit involved. Without ground routes planes will start on the departure runways and disappear after landing. The manual describes this in detail as well as other aspects to the sim. If you are interested in creating ground routes for your airport, there is a new ground route recorder app here:

   http://forums.x-plane.org/index.php?app=downloads&showfile=21206

   There is also another ground route builder, AGRE, in development here:

   http://forums.x-plane.org/index.php?showtopic=84846

   There is the in-sim editor as well:

   http://forums.x-plane.org/index.php?showtopic=74679

2 Installation

2.1 Installation

Open the WorldTraffic zip file and extract the folders into the following locations:

- Move the ClassicJetSimUtils folder in the zip file into the main X-Plane folder
- Move the WorldTraffic folder in the zip file into the X-Plane/Resources/Plugins folder.
- Move the WorldTrafficRTG folder in the zip file into the X-Plane/Resources/Plugins folder.
- Move the WorldTrafficRadar folder in the zip file into the X-Plane/Resources/Plugins folder.
- Move the Classic Jet Simulations folder in the zip file into the X-Plane/Aircraft folder.
- Optionally, put the apt.dat file in the zip file into the X-Plane/Custom Scenery/KSEA Demo Area/Earth nav data folder. This simply moves the control tower view up above the tower so you can see the planes taking off and landing in the KSEA demo area. The World Traffic aircraft are not visible otherwise through the glass in the KSEA tower.

Your folder structure must look as follows in order for the application to function properly:

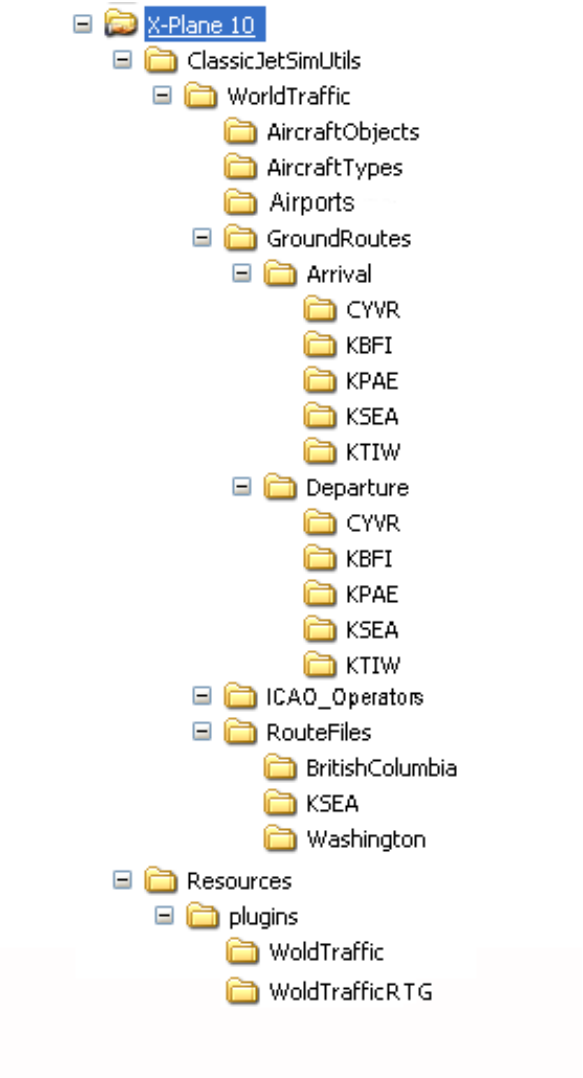


Illustration 1: World Traffic Folder Structure

Note: If you are using X-Plane 9.7, delete or rename AIplane.acf in the X-Plane/Aircraft/Classic Jet Simulations/World Traffic folder. Then rename AIplaneXP9.acf to AIplane.acf.

2.2 Activation

After you install the WorldTraffic application, it will run in evaluation mode which only allows the plugin to run 15 flight plans. After you purchase it, you will be e-mailed a key file called WorldTrafficKey.txt. The file goes into your X-Plane/Resourse/Plugins/WorldTraffic folder.

2.3 Support

If you have any questions about the plugin or need help, please contact me by e-mail at greg@classicjetsims.com ... You may also check out the support forum at X-Plane.org located here: http://forums.x-plane.org/index.php?showforum=176

3 Setup

3.1 Sound Setup

Sounds should work automatically on the Mac and on the PC if you are using Windows 7 or greater. If you are not hearing sounds, the first step should be to make sure your engine volume is turned up in the Preferences window in the plugin. See section 6.2.3 Preferences for how to do that.

If you are using earlier versions of Windows, you may need to install the OpenAL sound driver. That can be found here: http://connect.creativelabs.com/openal/Downloads/Forms/AllItems.aspx

Download and run the oalinst.exe file from that site.

Note: As always, before installing new software, make sure to create a restore point on your PC first. I've installed this successfully on my WindowsXP machines in the past but I lost my sound when I tried it on Windows 7, which I didn't need to do.

3.2 Key and Mouse Setup

The plugin will start running when X-Plane starts up but you'll need to configure a few keys so you can use the functionality. These are the functions currently available and the keys that I use to call the function. You can use keys of your own choice of course.

- Key_Command_Menu – **CTRL-W** suggested
- Resynch – **CTRL-R** suggested
- Previous_Menu – this is optional if you don't like the default **Backspace** key
- ATC_Radar – **SHFT-R** suggsested
- ATC_Menu – **CTRL-A** suggested
- ATC_Prev_Command – **SHFT-A** suggested
- Track_Camera – **F9** suggested
- Track Camera Back – Goes to previous aircraft – **SHIFT F9** suggested
- Track_Camera_Toggle_Flight_Info – **CTRL-F9** suggested
- Track_Camera_Move_In – **V** (you may use the mouse wheel as well for this)
- Track_Camera_Move_Out – **C** (you may use the mouse wheel as well for this)
- Track_Camera_Zoom_In – **X** suggested
- Track_Camera_Zoom_Out – **Z** suggested
- Track Camera Move In/Out – mouse wheel
- Track Camera View Lock – left mouse click

With X-Plane running, select the **Settings – Joystick & Equipment** menu. From that menu, click the

Keys tab on top. Click the **Add New Key Assignment** box in the bottom-middle of this window to setup the first WorldTraffic key as shown below:

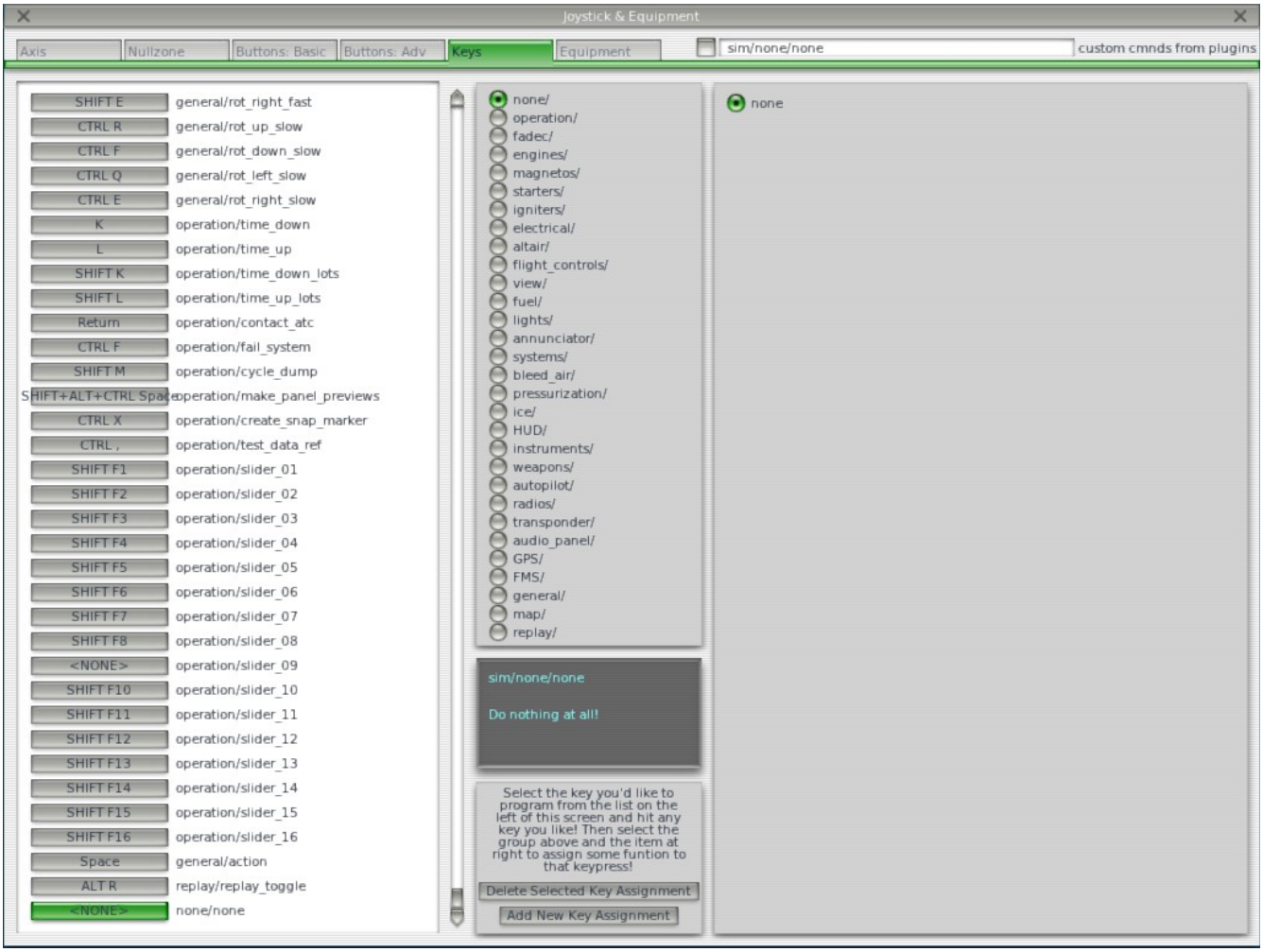


Illustration 2: Key Setup Window

Now, click on the new button labelled <NONE> on the bottom-left of the window if it is not already highlighted in green. Press the key that you want to associate with the WorldTraffic function you are currently configuring. The <NONE> text will get replaced by the key that you press.

A function selection box is now available in the top-right of this window with a default selection of "sim/none/none". Click on the box to the left of that text. A new window will appear as shown below:

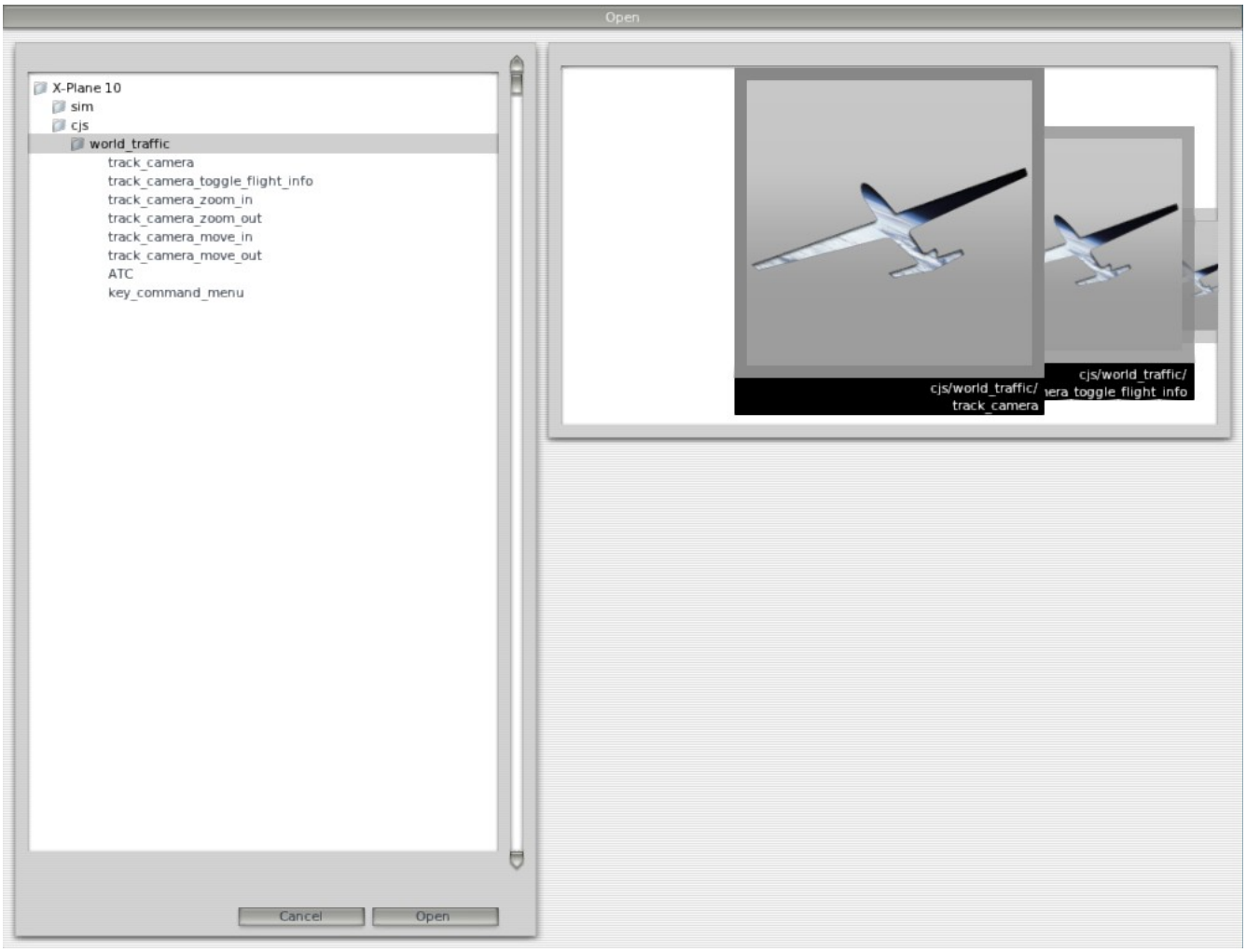


Illustration 3: World Traffic Custom Key Setup

Click on the **cjs** folder and then the **world traffic** folder to expand the options. You will see a list of key functions available from the WorldTraffic application. Click the function that you want to assign to your new key and click the **Open** button to complete the assignment. Repeat this procedure for each of the key functions.

4 How Does it All Work

This section describes how a flight works from end to end. The subsequent sections in chapter 5 describe the file formats in detail that are referenced in this section.

4.1 Initialization

When X-Plane is started and World Traffic is initialized, it looks through all of the active route files in the enabled regions and determines which flights are in progress and which flights have ended based on the start times of the flights as defined in the flight plans, the speeds, and the route distance. For flights that are in progress, it will determine about where the flight should be and place the aircraft in flight at the calculated position, speed, and altitude. If it is determined that a flight is on approach, it will place the aircraft somewhere in the middle of a STAR approach if defined for that airport and if the aircraft has a FMS. If it is determined that a flight has landed, it will find a suitable unused ground route for the aircraft and place the aircraft on the ground route's parking spot.

The Flight Plans can all be found in the X-Plane/ClassicJetSimUtils/WorldTraffic/RouteFiles folders with the region name being identical to one of the sub-folders here. See Appendix A1 – Flight Plan File Format for a description of the flight plan file format and section 5.1 Region for a description on regions.

4.2 Determining the Active Runways

Before any flights are started, the active runway/s for the departing airport are determined. If there is an Airport Operations file (see section 5.7 Airport Operations), that will be used along with the wind and time of day to determine what runways are active for arrival and departure. If no Airport Operations file is defined, the active runway is determined solely using wind direction. If the wind is calm, the active runway/s will be the first ones defined in the X-Plane or custom scenery apt.dat files.

Airport Operations files are all found in the XPlane/ClassicJetSimUtils/WorldTraffic/AirportOperations folder with the name of the file being the name of the airport.

4.3 Starting a Flight

World Traffic looks through all loaded flight plans and checks to see if it is time to start them. The start time is defined in the flight plan and can be specified as a specific time and can have a specific day or a set of days, or the flight can be set to start immediately if the start time for the flight plan is set to -1.

Five minutes before a flight is to start, the flight will be put into a pre-flight mode. It will try and find a departure ground route to put the aircraft on. First an estimate is made of the aircraft's required takeoff distance which is based on the aircraft's weight which is determined by how much fuel the plane needs to get to its destination and the airport elevation. Runways of suitable length will only be considered.

Next, it will first and find a departure ground route that has an aircraft of the same type parked on it which would have been done during initialization (see section 4.1 Initialization above) or when a plane can landed and taxied to its parking spot. If found, the parked aircraft will be used for the flight. If it can't find the same type of aircraft, it will look for a departure ground route with any parked aircraft on it, using the one with the oldest parking time. If found the parked aircraft is deleted and replaced with the aircraft defined in the flight plan. Ground routes are prioritized based on length. A shorter taxiway route will be selected if unless there are significantly more aircraft taxiing to that runway (5) than to a runway further away in which case it will then select the further taxi route.

Departure ground routes are all found in the XPlane/ClassicJetSimUtils/WorldTraffic/GroundRoutes/Departure folder with one folder existing for each airport. See Appendix A2 – Ground Route File Format for a description of the Ground Route file format.

4.4 Taking Off

Each runway is defined a departure queue. Aircraft are only allowed onto the active runway to takeoff when they are first in the queue and there are no aircraft about to land. Traffic separation is enforced on takeoff for wake turbulence using these spacing rules:

- Super Heavies – 2 minutes
- Heavies -1.5 minutes
- Large Jets/Props – 1 minute
- Medium Jets/Props – 45 seconds
- Light Jets/Fighters – 30 seconds
- Light Props 15 seconds

When the aircraft starts to takeoff, it tries to find a valid SID (for aircraft with a FMS) or a custom departure (for aircraft without a FMS). The aircraft will be assumed to have a FMS if not a light prop. This can be overridden in the aircraft definition file.

If multiple SIDs are available, it will select one that exits at a point closest to its destination. If no custom departures are found with planes with no FMS they will follow a SID if it is suitable for the aircraft type. If not found the aircraft will simply climb on the runway heading for a few miles before proceeding en-route.

SIDs are provided with the included Navigraph data and are found in the Xplane/ClassicJetSimUtils/NavigraphData folder with the file being named after the airport. The user may also define custom departures for airports in the same file using the special section for Custom Departures. These are useful for flights in mountainous areas where a complex departure route may be required to provide terrain avoidance.

4.5 Enroute Flight

Once an aircraft has completed the takeoff phase and has followed the SID or custom departure or automatic departure route, it will then head for the first waypoint defined in the flight plan and will fly that route to completion in most cases.

The Flight Plans can all be found in the X-Plane/ClassicJetSimUtils/WorldTraffic/RouteFiles folders with the region name being identical to one of the sub-folders here. See Appendix A1 – Flight Plan File Format for a description of the flight plan file format and section 5.1 Region on regions.

4.6 Arrivals

If an aircraft has a FMS, it will start looking for a STAR when getting close (50Nm to 120Nm) of its destination. The aircraft will be assumed to have a FMS if not a light prop. This can be overridden in the aircraft definition file. For aircraft without a FMS, it will start looking for a Custom Arrival when getting close to its destination. If more than one STAR exists, it will select a STAR entry point closest

to its current position. STARs may be entered mid-way through as well. If a suitable STAR is found, it will be loaded. If the the preference "Ground Routes Required for Arrival Runways" is set to ON, aircraft will only use arrival runways with ground routes if they exist. If no ground routes exist, then any runway of suitable length can be used.

For any out and back flight where the departure and arrival airports are the same, a STAR or Custom Arrival will only be searched for on the last leg of the route. If no STAR or Custom Arrival is defined for the airport, an automatic arrival is calculated for the aircraft which simply points the aircraft to a suitable arrival runway with the final approach point being between 1 to 7 Nm from the runway depending on aircraft size.

During the arrival phase of flight, World Traffic tries to provide separation between arriving aircraft. Each aircraft's arrival time onto a runway is continuously calculated. If an aircraft's arrival time is less than 90 seconds behind another aircraft's arrival time, it will be requested to slow down. It will also consider distances between arriving aircraft for aircraft not heading for the same runway. Again if it determines that if an aircraft in front is less than 90 seconds in front, the aircraft will be asked to slow down. Finally, an aircraft may asked to continue on its current heading where the STAR waypoint is of type VECTORS if the aircraft's arrival time is too close to the aircraft in front of it.

STARs are provided with the included Navigraph data and are found in the Xplane/ClassicJetSimUtils/NavigraphData folder with the file being named after the airport. The user may also define custom arrivals for airports in the same file using the special section for Custom Arrivals. These are useful for flights in mountainous areas where a complex arrival route may be required to provide terrain avoidance.

4.6 Landing

Once an aircraft has landed, it will try and find an Arrival Ground Route for the aircraft. If no ground route file is found, the aircraft will disappear once coming to a stop on the runway.

Arrival ground routes are all found in the XPlane/ClassicJetSimUtils/WorldTraffic/GroundRoutes/Arrival folder with one folder existing for each airport. See Appendix A2 – Ground Route File Format for a description of the Ground Route file format.

5 World Traffic Files and Folders

5.1 Region

Note that the file containing the enabled/disabled status of the regions is called WorldTrafficRegions.prf and is written to the X-Plane/Output/preferences folder. Deleting this file will disable all regions which may be necessary if you are trying to load too many regions and are having memory problems running the 32 bit version of X-Plane.

A region is a folder under the X-Plane/ClassicJetSimUtils/WorldTraffic/RouteFiles folder. It is where all of the flight plans are stored. The purpose of having separate region folders is to help organize your flight plans. A region can be an airport, a state or province, or a country, whatever size that gives you a manageable number of flight plans. It may also be used if you want to create set of flight plans for planes of different eras. For example you could have one region with flight plans for modern aircraft and another region with flight plans for historic aircraft and the disable the region not in use.

Having the option to enable and disable regions will also optimize the operation of the application. It will improve the start time and reduce memory usage. There is no point in having a region enabled for an area in Australia if you are flying in the U.S. and don't plan on flying there.

One important thing to note is that you may put identical flight plans in more that one region folder. For example, you may have a flight plan defined for a flight from KLAX to KSEA. If you have region folders for KSEA and KLAX, you can put this flight plan in both of those folders. Only one copy of the flight plan will get loaded. The purpose of this is that if you are flying from KSEA to the eastern U.S., you can disable the KLAX region. The flight plan from KSEA to KLAX will still get run since it's in the KSEA region folder but all other flight plans in the KLAX folder will not get run. Again this saves loading time and memory usage. This is the recommended method of using the application especially when you have lots of flight plans defined.

5.2 Flight Plan

Note: The airport runway definitions are taken from the main X-Plane airport database (apt.dat). No custom scenery airport definitions are used at this time so that functionality is consistent among users. If the runway and taxiway definitions in the main X-Plane airport database are not accurate, then it is suggested that Robin be provided with the more accurate info for the master X-Plane database.

A flight plan is a file defining the path of an aircraft, vehicle or boat. It specifies the aircraft in the flight, the formation type if more than 1 aircraft is in the flight, the start time, whether a vertical deparuture is required, and other flight-related parameters. The flight plan files go in any of the region folders under the XPlane/ClassicJetSimUtils/WorldTraffic/RouteFiles folder. See Appendix A1 – Flight Plan File Format for the Flight Plan file format.

5.3 Ground Route File

Note: The airport taxiway definitions are taken from the main X-Plane airport database (apt.dat). No custom scenery airport definitions are used so that functionality is consistent among users. If the runway and taxiway definitions in the main X-Plane airport database are not accurate, then it is suggested that Robin be provided with the more accurate info for the master X-Plane database.

A ground route file is similar to a flight plan but specifies the path that aircraft follow on the ground. A special case are ground route files for helicopters which are not actually ground routes, but approach

paths that the helicopter takes from its last waypoint defined in the flight plan to its landing spot. No ground files are created for vehicles or boats. Flight plans are used in that case.

Ground route files specify the path that an aircraft takes from the runway it lands on to its parking spot. It also specifies the path that an aircraft takes from its parking spot to one or more of the active runways for takeoff. Ground route files can be specific to a general aircraft type (eg. Heavy airliner or fighter), to a specific aircraft type (eg. 747), or to a specific aircraft tail number (eg. N-032JR). This allows as much customization as required to have any plane taxi and park to exactly where you want it. For large airports with lots of runways, there will have to be a lot of ground route files defined to cover all of the possible combinations of arrival/departure runways and parking spots for various aircraft types and tail numbers. Hopefully, users will start making these available for users to share.

The ground route files are created for specific airports. They go in any of the airport folders under the Xplane/ClassicJetSimUtils/WorldTraffic/GroundRoutes/Arrival and Xplane/ClassicJetSimUtils/WorldTraffic/GroundRoutes/Deparutes folders. See Appendix A2 – Ground Route File Format for the Ground Route File format.

5.4 Aircraft Types

X-Plane aircraft do not work as AI aircraft for World Traffic since there is a limit of 20 of these. You need to create your own or download AI planes specifically created for World Traffic which are either modified X-Plane aircraft, AI conversions from FSX, or custom models.

The performance and dimensions of an aircraft are defined an Aircraft Type file. This file is also associated with an X-Plane object file that the World Traffic application draws in the X-Plane world. World Traffic has a simple flight model based on aerodynamics and ballistics equations available from the NASA web site. It is therefore possible to define an aircraft so that it flies well enough to give reasonable accelerations and climb speeds so that you can fly around with it. The flight model is simple enough though that you should be able to run at least 30 aircraft at once in a 40 Nm radius of the user with only a 3% drop in frame rates. Outside of the user area you can have a lot more aircraft active since their position is only updated once a second.

If you want to create your own aircraft for World Traffic, you will have to e-mail me for a key which is entered in the aircraft definition file. I have paid Aircraft3D to make several payware aircraft packages so I need to cover these costs first. The World Traffic application is sold initially at a reduced priced since these aircraft were not yet ready at the time of release. If users wish to make payware or freeware aircraft for World Traffic, this is not a problem if the aircraft are not on our list. Our list of aircraft in development is here:

http://www.classicjetsims.com/WorldTraffic/addons.html

Contact us first though before you spend time making an aircraft to make sure your plane is not our list.

When creating a new aircraft when you don't have a key, call the aircraft TEST.obj and the aircraft definition file TEST.txt. The key is not required for the aircraft when it is named that.

The aircraft type files can be found in the Xplane/ClassicJetSimUtils/WorldTraffic/AircraftTypes folder. See Appendix A3 – Aircraft File Format for the Aircraft Type file format.

5.5 Aircraft Objects

The aircraft object file must have the same name as the aircraft type file except with a .obj extension rather than a .txt extension. The aircraft object file is the X-Plane object file that World Traffic uses to

draw in the X-Plane skies. Any of the features supported by the X-Plane object format such as LOD, lighting, shadow-hiding etc are functional with the World Traffic application. The object files must be modified to use the datarefs provided by World Traffic and the object must be positioned in a specific way to work with the plugin but modifications are not too difficult.

The aircraft object files can be found in the Xplane/ClassicJetSimUtils/WorldTraffic/AircraftObjects folder. See Appendix A3 – Aircraft File Format for the Aircraft Object information.

5.6 Airport Definition

The airport definition file is not required but is used in the creation of random flight plans. See chapter 4.5 for more information.

5.7 Airport Operations

Airport Operations files go in the Xplane/ClassicJetSimUtils/WorldTraffic/AirportOperations folder. The Airport Operations file is not required but allows customization of airport procedures. Based on wind conditions and time of day, a specific set of runways can be designated for takeoff and/or landing. Runways can be configured to support specific aircraft types and aircraft navigation systems (eg ILS, RNAV, etc). Approach angles to runways may also be defined for airports that have approach angles different than the standard 3 degree approach. One example is London City Center airport which has an approach angle of 5.5 degrees with the final approach point 3.4 Nm from the runway.

Using the Airport Operations file for EGLC, this section will explain how the Airport Operations file is configured. You can look at the included airport operations file for KORD if you want to see something more complex.

5.7.1 OPERATIONS

This section defines the various modes of operation based on wind speed/direction and time of day. Associated with the the mode of operation will be a set of runways that will be in use which is defined in another section.

```
INDEX    Low Wind Speed    High Wind Speed    Low Wind Dir    High Wind Dir    Time    Time      Comments (not parsed)
-------------------------------------------------------------------------------------------------------------------------
START_OPERATIONS
0        0                  5                  0              360          00:00   24:00     East Ops A
1        5                  1000             183              3          00:00   24:00     East Ops B
2        5                  1000               3            183          00:00   24:00     West Ops
END_OPERATIONS
```

The “INDEX” field must be unique starting from zero. In this example, operation “0” (East Ops A) is in effect when the wind is from 0 to 5 knots in any direction during all times of the day. Operation “1” (East Ops B) is in effect when the wind is above 5 knots on a heading of 183 degrees to 3 degrees with the wind direction moving clockwise. Operation “2” (West Ops) is in effect when the wind is above 5 knots on a heading of 3 degrees to 183 degrees.

5.7.2 RUNWAY_OPS

This section specifies which runways are in use for takeoff and arrival for each unique operation defined above.

```
Ops                          1   2          Start  End
Index   Active Runway       Arr Dep         Time   Time    Comments (not parsed)
-------------------------------------------------------------------------------------------
START_RUNWAY_OPS
```

```
0       28                      1           00:00  24:00   East Ops A
0       28                      2           00:00  24:00
1       28                      1           00:00  24:00   East Ops B
1       28                      2           00:00  24:00
2       10                      1           00:00  24:00   West Ops
2       10                      2           00:00  24:00
END_RUNWAY_OPS
```

The “Ops Index” field corresponds to the “INDEX” field in the OPERATIONS section above. For Operation “0” and Operation “1”, runway 28 is configured as the runway for both arrival and departure during all times of the day. For Operation “2”, runway 10 is configured as the runway for both runway and departure during all times of the day.

5.7.3 RUNWAYS

```
        Supported AC Types   Supported Approaches  Final Approach  Final Approach
Runway  0 1 2 3 4 5 6 7 8 9     1 2 3 4 5 6 7 8         Angle         Distance Nm
-------------------------------------------------------------------------------
START_RUNWAYS
10     1 0 0 1 1 1 1 1 1 0      1 1 1 1 1 1 1 1         5.5             3.4
28     1 0 0 1 1 1 1 1 1 0      1 1 1 1 1 1 1 1         5.5             3.4
END_RUNWAYS
```

Valid aircraft types are:

- 0 - FIGHTER - F-18, F-16, F-15, F-14, SU-27, Mig-29, F-22, F-35
- 1 - SUPER_HEAVY_JET - A-380, C-5, 747, AN-225
- 2 - HEAVY_JET - A-340, A-330, 777, 767, 787, C-141, L-1011, DC-10
- 3 - LARGE_JET - A-320, 737, 757,
- 4 - LARGE_PROP - A-400, Hercules
- 5 - MEDIUM_JET - Regional Jets
- 6 - MEDIUM_PROP - Regional Prop planes
- 7 - LIGHT_JET - lear jet, Gulfstream, Global Express
- 8 - LIGHT_PROP - GA prop planes
- 9 - HELICOPTER

Aircraft Navigation Systems:

- 0 - Visual - DH 3000', vis - 3Nm (all runways support visual approaches)
- 1 - Non Precision (VOR,NDB,TACAN, etc) – DH = 200-500', RVR = 0.5-1.25 Nm
- 2 - ILS/DME – DH = 200', RVR = 0.5 - 1 Nm
- 3 - RNAV (GPS or RNP) - DH = 200', RVR - 2400'-4000'
- 4 - ILS CAT I - DH = 200', RVR - 1200-2400', Vis - 1600' or 1200' in Canada
- 5 - ILS CAT II - DH = 100', RVR - 1200', Vis - N/A (same for CYVR)
- 6 - ILS CAT IIIa - DH = 0', RVR - 600' (same for CYVR)
- 7 - ILS CAT IIIb - DH = 0', RVR – 150'
- 8 - ILS CAT IIIc - DH = 0', RVR = 0' - not currently used anywhere

Final Approach Angle and Final Approach Distance fields should normally be left blank so that the default values are used. You can set these for airports where the final approach requires a steeper descent angles in case there is terrain blocking the runway for example. The valid values for Final approach angle are between 2 and 12 degrees. The valid values for final approach distance are between 1 and 5 nautical miles.

5.8 SIDs, STARs, Custom Approaches, and Custom Departures

These files while not required can be used to route planes on specific SID/STAR approaches or other custom routes that may be required for flights into mountainous areas where the automatically-calculated approaches and departures are not adequate. Data specific to World Traffic can be purchased from the Navigraph web site here:

https://www.navigraph.com/

A SID is a Standard Instrument Departure. All departing aircraft with a FMS will follow a SID if available.

A STAR is a Standard Terminal Arrival Route. All arriving aircraft with a FMS will follow a STAR if available.

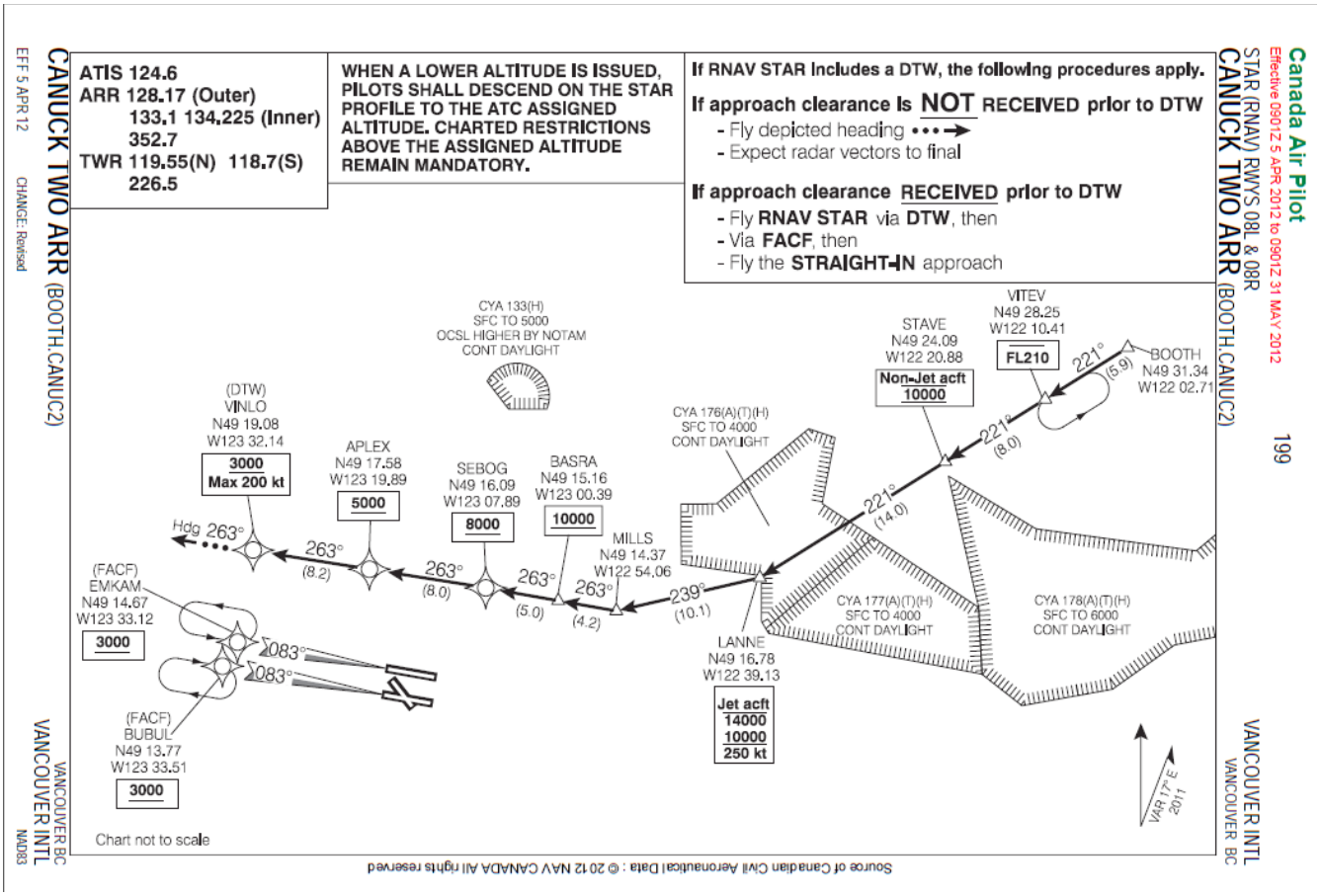
The aircraft will be assumed to have a FMS if not a light prop. This can be overridden in the aircraft definition file.

The SID/STAR data is provided in xml format with the included Navigraph data and is found in the Xplane/ClassicJetSimUtils/NavigraphData folder with the file being named after the airport. Do not add custom approaches or departures to the Navigraph data as these files are maintained by Navigraph so can be overwritten at any time. You may change the specific attributes though to set enable or disable a route or set the time of operation. **Navigraph data may not be shared or distributed amoug users.**

Custom Arrivals and Departures are used by aircraft without a FMS or by aircraft with a FMS if no SIDs or STARs are defined. The custom approach/departure data is found in the Xplane/ClassicJetSimUtils/CustomAirportRoutingData folder. The user may edit these files to define custom approaches and departures. For examples of Custom Arrivals and Custom Departures, look at the included LOWI.xml file. Any custom data can be shared among users as long as the files don't contain any routing data provided by Navigraph.

The Navigraph files specify a single route using latitude and longitude coordinates, speed limitations, and altitude limitations. Published SID/STAR diagrams often show a path to all runways. The Navigraph data breaks the SID/STAR into separate routes for each runway in these cases. Here is an example of a STAR for Vancouver (CYVR) for the Canuck Arrival Procedure for runways 8R and 8L. You can see a bigger image online here:

http://www.classicjetsims.com/images/CanuckArr.png



You can view the raw xml file for CYVR by opening the file XPlane/ClassicJetSimUtils/NavigraphData/CYVR.xml. If you double-click on it, it will probably open in your web browser. You can also open it in a text editor. To see if most easily, open it using an online xml editor/viewer, such as this one: http://xmlgrid.net/

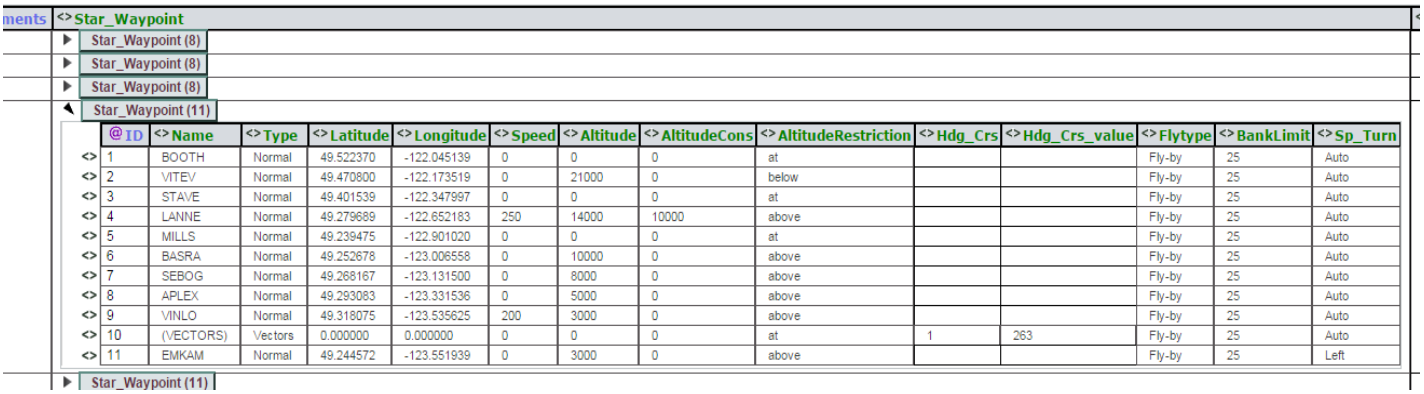
In xmlgrid, select the file to open and click the submit button to open the file. Clicking on any of the black triangles will expand the node to see more data. To look at the Canuck approach, click on the triangles to open the ProceduresDB / Airport / Star path which should give you a list of all STARs. There are columns next to the STAR name that provide the following information:

- Runways – the runways that the STAR should be applied to. This can be a comma-delimited list, or can be set to All for all runways.
- JetsOnly – the data from Navigraph has this field defaulted to false. It can be edited by the user if it is determined that the approach should only be used by jets.
- PropsOnly – the data from Navigraph has this field defaulted to false. It can be edited by the user if it is determined that the approach should only be used by propeller aircraft.

- Enabled – this can be set by the user to disable an approach
- StartTime/EndTime – these values can be set by the user to make an approach only available during certain hours.
- Comments – not used by the application at this time.

Now click on the triangle next to the CANUC3.08L "Star_Waypoint" section to see all of the waypoints for this approach. You'll see a form like the one below, and again here is a larger image if that is too small to see:

http://www.classicjetsims.com/images/CanuckArrNavigraph.png



ments <> Star_Waypoint

Star_Waypoint (8)

Star_Waypoint (8)

Star_Waypoint (8)

Star_Waypoint (11)

@ ID	<> Name	<> Type	<> Latitude	<> Longitude	<> Speed	<> Altitude	<> AltitudeCons	<> AltitudeRestriction	<> Hdg_Crs	<> Hdg_Crs_value	<> Flytype	<> BankLimit	<> Sp_Turn
<> 1	BOOTH	Normal	49.522370	-122.045139	0	0	0	at			Fly-by	25	Auto
<> 2	VITEV	Normal	49.470800	-122.173519	0	21000	0	below			Fly-by	25	Auto
<> 3	STAVE	Normal	49.401539	-122.347997	0	0	0	at			Fly-by	25	Auto
<> 4	LANNE	Normal	49.279689	-122.652183	250	14000	10000	above			Fly-by	25	Auto
<> 5	MILLS	Normal	49.239475	-122.901020	0	0	0	at			Fly-by	25	Auto
<> 6	BASRA	Normal	49.252678	-123.006558	0	10000	0	above			Fly-by	25	Auto
<> 7	SEBOG	Normal	49.268167	-123.131500	0	8000	0	above			Fly-by	25	Auto
<> 8	APLEX	Normal	49.293083	-123.331536	0	5000	0	above			Fly-by	25	Auto
<> 9	VINLO	Normal	49.318075	-123.535625	200	3000	0	above			Fly-by	25	Auto
<> 10	(VECTORS)	Vectors	0.000000	0.000000	0	0	0	at	1	263	Fly-by	25	Auto
<> 11	EMKAM	Normal	49.244572	-123.551939	0	3000	0	above			Fly-by	25	Left

Star_Waypoint (11)

You'll see that the Name field corresponds to the waypoint name on the chart. The lat/lon coordinates are provided.

Altitudes are left blank in the file unless there is a restriction to follow. On the chart you'll see that at VITEV, there is an altitude listed of 21,000 feet (FL210). There is a line above it which means that you must be below this altitude. If the line were below that altitude, you'd have to be above it. If there was a line above and below that altitude, you'd have to be at that exact altitude. In this case, we have to be below that altitude so the "AltitudeRestriction" field in the file is set to "below".

Speeds are also left blank unless there is a restriction to follow. On the chart you'll see that at LANINE, there is a speed listed as 250 knots. You must be at this speed or slowed during the approach. You must also be at an altitude between 10,000 and 14,000 feet.

The second last waypoint is just shown as VECTORS with the Type field set as "Vectors". This indicates that ATC will send you out on the specified heading which in this case is 263 degrees until you are able to turn to the last waypoint EMKAM.

World Traffic will parse this file and have the aircraft arrive following this route and following the altitude and speed restrictions. For the VECTORS waypoint, the plane continues on its heading until the arrival ETA on the runway fits into a slot with other arriving aircraft allowing 90 seconds of separation at a minimum.

In the above example aside from the Vectors waypoint, all other waypoints are of type Normal in which case the aircraft flies directly to that waypoint. There are other types as well as described below:

Waypoint Types:

- Normal – fly to the specified waypoint
- Vectors – fly on the specified heading until traffic separation requirements are met to proceed to

the next waypoint and to continue the approach.

- Intc – fly on the specified heading until intercepting the specified radial from a give location
- ConstHdgtoAlt – fly on the specified heading until reaching the specified altitude
- VorRadialIntc – same as Intc
- DmeIntc – fly on the specified heading until reaching the specified distance from the specified location.

6 World Traffic Operation

This section describes how to use the menu structure and what the various functions do.

6.1 General Operation

Once you call up the ATC or Key Command menu using the keys you defined in section 3 Setup, you can use the up and down arrow keys to scroll up and down in the menus. Clicking the **Enter** key will select the menu option next to the cursor. The **Backspace** key takes you back one level in the menu. If you are at the top level in the menu, pressing the **Backspace** key will close the menu. If the Backspace key does not work for you or you wish to use another key, you can define that from the custom key setup menu. See section 3.2 Key and Mouse Setup for information on how to do that.

6.2 Key Command Menu

This menu displays information on all flights defined, it lets you enable and disable flight regions, it allows you set application preferences, and it allows you to re-synchronize all of the flights if you have changed the time or if you wish to restart the instant flights. Pressing the key function that you defined in section 3 Setup brings up the Key Command menu which gets displayed in the top-right corner of the X-Plane window as shown below:

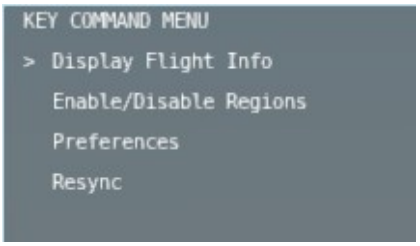


Illustration 4: Key Command Main Menu

One thing to note is that bringing up this menu will close the ATC menu and bringing up the ATC menu will close the Key Command menu. It is not possible to have both menus function at the same time since it's not possible to determine what menu the user's key presses are destined for.

6.2.1 Display Flight Info

Press the **Enter** key with the cursor on the top line to go to the Flight Information window. A window now appears as shown below:

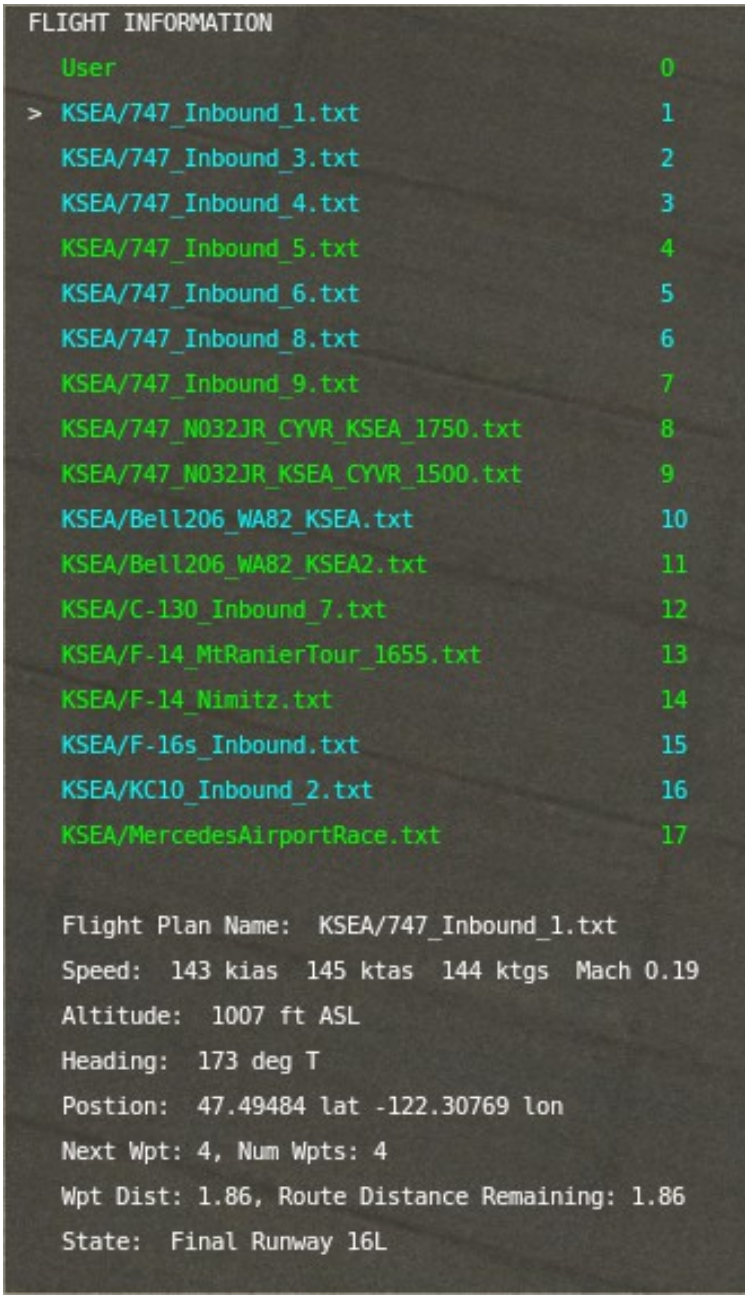


Illustration 5: Flight Information Display

This window shows a list of all enabled flight plans defined along with the Flight Plan Identifier number which may be used to correlate the flight plans in this window with the specific Flight Plan Identifier shown for the aircraft when using the Track Camera . The first flight is always the “user” flight. This is information about the plane the user is currently flying in X-Plane. Other flight plans are shown in green, blue, and red. Plans shown in blue indicate that the plane/s in the flight are

currently moving. Plans shown in green indicate that the plane/s in the flight are currently parked. Plans shown in red indicate that the flight plan defined is invalid or incomplete. Use the up and down arrows to scroll though the list. At the bottom of the display in white, is information on the currently selected flight plan. Information includes the following:

- Flight Plan Name – Name of the file including the sub-folder name which can be found in the ClassicJetSimUtils/WorldTraffic/RouteFiles folder.
- Speed – Speed of the aircraft in indicated airspeed, true airspeed, ground speed, and Mach.
- Altitude – Altitude of the aircraft in feet above sea level
- Heading – Heading of the aircraft in degrees true.
- Position – Position of the aircraft in latitude/longitude decimal coordinates.
- Waypoint Info – The last waypoint in the waypoint list that the plane has passed. The waypoint list will either be the flight plan, the ground route file, or intermediate waypoint lists the plane is given for approach waypoints, takeoff waypoints, holding pattern waypoints, or overshoot pattern waypoints.
- Waypoint Distance – The distance in Nm to the next waypoint.

Pressing the Enter key on a flight information window will cause the track camera to display that aircraft if the aircraft is in a valid state and in range of the user (10 to 80 Nm depending on what the user has the track camera display range set to).

6.2.2 Enable/Disable Regions

Selecting this menu option shows the regions currently enabled and disabled. See section 5.1 Region for a description of what regions are. You must use the Resync option to activate changes made in this menu. Disabling a region will result in all flight plans in that region folder not being loaded the next time that the plugin starts. Below is an example of the window:

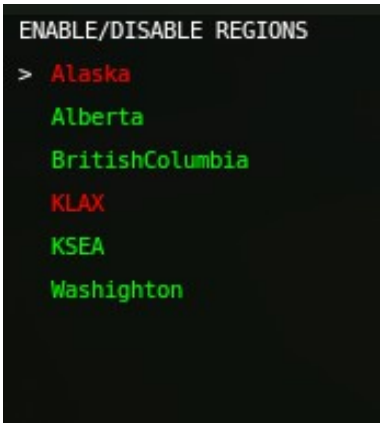


Illustration 6:
Enable/Disable Regions

Regions shown in red are disabled. Ones shown in green are enabled. Pressing the Enter key will toggle the state between enabled and disabled.

6.2.3 Preferences

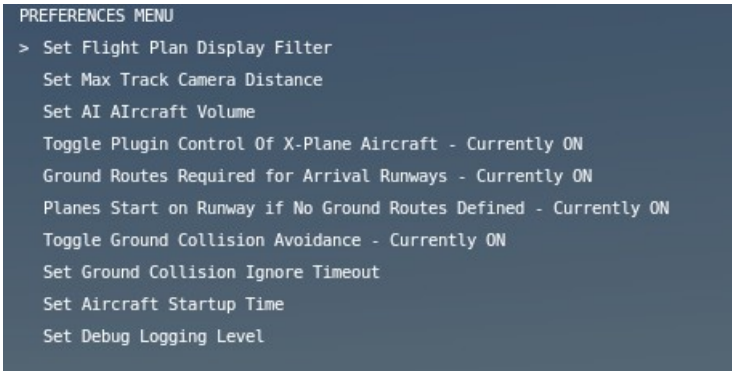


Illustration 7: Preferences Menu

The Preferences menu allows the user to set various preferences used by the application. The Preferences menu is shown below:

Flight Plan Display Filter

This option allows the user to change the filtering option for aircraft displayed in the Flight Information window. The available options are

- Display All Loaded Flight Plans – All flight plans are displayed including ones for planes not yet loaded or for parked aircraft as well as for aircraft in flight.
- Show Flight Plans for Active Aircraft – Flight plans are displayed only for aircraft moving in the air or on the ground.
- Show Flight Plans for Active Aircraft Nearby – Flight plans are displayed only for aircraft moving in the air or on the ground that are near by. Planes considered to be near by are planes within the maximum draw distances as set in the next preferences described below.

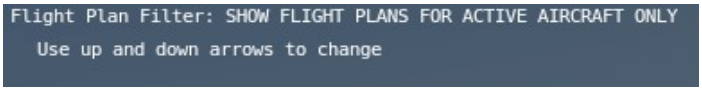


Illustration 8 - Flight Plan Filter

Max Track Camera Distance

The track camera distance can be set in this sub menu.

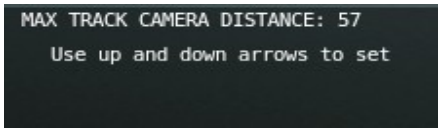


Illustration 9: Max Track Camera Draw Distance

Use the up and down arrow keys to change the maximum draw distance. This distance specifies the maximum distance away from the user's aircraft that World Traffic will draw aircraft. The value can be between 10 and 80 Nm. Aircraft outside this range are not drawn but their position is still updated once a second.

AI Aircraft Volume

If you wish to change the engine volume of the aircraft, controlled by World Traffic, use the up and down arrow keys in that menu to change the volume as desired.

Plugin Control of AI Aircraft

This option allows World Traffic to control the X-Plane multi-player aircraft. The purpose of this option is to allow the World Traffic aircraft to be visible on your TCAS display. Follow these procedures to use this function:

1. From the World Traffic Key Command Menu, select the Preferences option.
2. Make sure the last option shows that Plugin Control of X-Plane Aircraft is "Currently OFF". Press the ENTER key on that line if it is "Currently ON". This **must be off** before you change the number of X-Plane multi-player aircraft.
3. In X-Plane open the Aircraft – Aircraft & Situations menu.
4. Click the Other Aircraft tab.
5. Set the number of aircraft to 20 or the maximum aircraft that you want to have displayed.
6. From the World Traffic Key Command Menu, select the Preferences option.
7. Set the last option so that Plugin Control of X-Plane Aircraft is "Currently ON".

A stick plane will be drawn on the X-Plane showing showing the location of closest 20 planes. The plane used is a generic stick plane that you installed in section 2.1 Installation.

Ground Routes Required for Arrival Runways

If this option is set, only runways that have ground routes defined for the landing aircraft will be used. If no ground routes are defined, then any runway of suitable length may be used for arriving aircraft.

Planes Start on Runway if No Ground Route Defined

If this option is set, it will cause aircraft to appear and takeoff on a departure runway if no ground route files are available, suitable (eg. correct aircraft type), or defined for the departure airport. If the option is turned off, aircraft will only depart if suitable ground route files are found for the airport.

Toggle Ground Collision Avoidance

If this option is set, aircraft will try and not run into each other. This only applies to aircraft approaching other from behind. For aircraft approaching head-on, they will not stop for each other as they have no way of going around each other. Ground collision avoidance may be disabled to resolve deadlocks if they should occur.

Set Ground Collision Ignore Timeout

Every once in a while aircraft may end up in a deadlocked state if there is lots of ground traffic, where no aircraft are able to move. After an aircraft is stopped, due to ground conflicts a timer will start which is equal to that set in this menu. When the timer expires, the stopped aircraft will ignore conflicting ground aircraft for 25 seconds. This should resolve deadlock issues.

Set Aircraft Startup Time

This value can be set between 0 and 5 minutes. The default value is 2 minutes and specifies how long after an aircraft starts up before it begins taxiing. It can be set to 0 minutes for testing ground routes.

6.2.4 Resync

This option will restart all flights using the current time as a reference. Any flights determined to be in progress will have their planes positioned at the correct positions along their routes. Any instant flights will restart immediately. This is also a very handy option when testing new flight plans or ground routes. You can select the Resync option and not have to reload the plugin or restart X-Plane.

6.3 RADAR

Use the Radar command that you defined in section 3.2 Key and Mouse Setup to open the radar display. This will bring up the Radar display as shown below:

In the top-left of the radar window, you can enter the 3 or 4-character code of the airport you are interested in, in upper or lower case. Note that you can only enter an airport for which there is a loaded flight plan to or from as WorldTraffic only knows about these airports. You also should normally select

an airport within 80Nm of your current position. Beyond this range, aircraft positions are only calculated periodically.

The radar range may be selected by checking one of the boxes for 10, 20, 40, or 80 Nm.

On the top left of the radar display are three fields:

- AIRPORT: The selected airport at the center of the display.
- RANGE: The range selected from one of the range check boxes.
- OPERATIONS: The number corresponding to what airport operations are in effect if there is an airport operations file defined for the selected airport. Otherwise this will display N/A.

Reading the Aircraft Data:

- Aircraft highlighted in blue are arriving at the airport you have selected.
- Aircraft highlighted in green are departing the airport you have selected
- An aircraft highlighted in red is one that you have clicked on. Clicking the Track Camera button on the top right of the window will activate the track camera for this aircraft if it's within 80 Nm of the user. Clicking an aircraft again will toggle the information text above the aircraft or below it.
- The aircraft symbol is representative of the aircraft type. A big fat aircraft symbol represents and heavy or super-heavy aircraft. A cool looking F-18 symbol represents any fighter aircraft.
- The aircraft text is decoded as follows:
    - The text on the top left is the aircraft callsign, eg. UA719. The aircraft callsign is read from the flight plan. If not defined in the flight plan, the callsign is derived from the Operator IATA code and using a random number inside the flight plan number range defined in the aircraft definition file.
    - The text in the top middle is the aircraft name as read from the aircraft definition file.
    - The number on the top right is the flight plan number which can be correlated against that displayed in the Flight Information window or in the Track Camera information.
    - The number on the bottom-left is the aircraft's Flight Level (altitude divided by 100 feet).
    - The number on the bottom right is the aircraft's speed in knots indicated.

6.4 Air Traffic Control (ATC)

This menu allows the user to interact with the World Traffic Air Traffic Controller that routes its own planes around the X-Plane skies. The user aircraft is treated as just another aircraft by the plugin and it will perform routing functions and runway allocation and deallocation. The interface is simple and allows for STAR and visual approaches and SID departures. Pressing the key function that you defined in section 3 Setup brings up the ATC menu which gets displayed in the top-center in X-Plane.

One thing to note is that bringing up this menu will cause the Key Command menu if open to lose focus and bringing up the Key Command menu will close the ATC menu will cause the ATC menu to lose focus. The window with focus has a black border drawn around the perimeter. The window in focus will be the one processing the user's keystrokes.

The ATC menu is context sensitive and has several states. When you call it for the first time on the, it will ask you for your aircraft information. Also note, that ATC will only be operative for airports that you have flight plans defined for as these are the only ones that World Traffic is concerned about.

Note that if you missed an ATC command, you can use the previous ATC command key which you defined during setup. This will display the last command given to you by ATC as well as ATC's current state.

The ATC state machine is defined in the following sections. Note that the state machine will not rely on the user following procedure so will transition to whatever state is most applicable. For example if the user requests taxi to an active runway, but then takes off without clearance, ATC will transition to an in-air state once the user's plane in airborne.

6.4.1 Idle State

This is the initialization state for ATC. If the user's aircraft is on the ground and the user presses the ATC key, the aircraft Name, Operator, and Callsign will be requested. The aircraft name and Callsign are used for display on the radar. The operator along with the aircraft type which is determined based on aircraft MTOW and if the plane is a prop or a jet, are used to determine what ground routes are available, what runways are available, and which STARs and SIDs can be followed. After entering the Operator, a list of available gates is listed associated with valid ground routes if you are not already on a parking spot associated with a valid ground route. At this time, if desired, you may place you aircraft at one of the suggested gates or parking spots. If not, the application will query for which runway you want to use for departure after determining your destination.

Next your destination is queried. You must enter the 3 or 4 character airport ICAO identifier for which the airport is specified in a loaded flight plan. World Traffic only knows about these loaded airports. Once you enter the airport name, World Traffic loads SIDs, STARs, and ground routes for that airport and any of the surrounding ones within 120Nm into memory so there may be a delay when this happens.

ATC next transitions to the state ATC_DISPLAY_AVAILABLE_RUNWAYS_FOR_TAKEOFF if you are not parked at a valid ground route. A menu such as this will be displayed to the user if their tail number is N199UA and they are at KSEA.

```
N199UA to KSEA - Request taxi to runway 34R
>  16L
   16C
   16R
```

ATC will confirm the request or if you are parked at a gate for which there is a valid ground route, a departure runway will be assigned to you. Something like this message will be displayed:

```
KSEA to N199UA – Taxi to runway 34R via B, J
Expect to use SID KTSAP4.34 for departure
```

If you are following a ground route, a list of taxiway names to follow will be displayed. The SID that you will be following is also displayed in case you want to program your FMS now.

If the user's plane is en-route, ATC will transition to the ATC_ENROUTE_STATE and wait for user input.

6.4.2 Displaying Available Runways for Takeoff State

The user can either cancel the request and ATC will return to the idle state. If the user selects a runway, ATC will display a message telling the user to taxi to the request runway and hold short. ATC will then transition to the state ATC_WAIT_USER_HOLDING_SHORT.

6.4.3 Wait for User Holding Short State

When the user presses the ATC key in this state, they are allowed 2 options displayed in this example:

```
N199UA to KSEA
>  Holding short runway 16L
   Cancel takeoff request
```

If the user cancels takeoff, ATC will transition back to the Idle state. If the user says they are holding short, ATC gets quite busy. If there is a plane on final approach to 16L, ATC will display the below message and transition to the state “Wait for no plane on final”:

```
KSEA to N199UA - Holding short runway 16L for arriving aircraft
```

If there is another plane further down the runway, this message will be displayed and ATC will transition to the state “Wait for no plane on runway”:

```
KSEA to N199UA – Taxi to position 16L and hold
```

If there is no plane on the runway, the takeoff runway is allocated and this message will be displayed and ATC will transition to the state, “Wait for user takeoff”:

```
KSEA to N199UA – Cleared for takeoff 16L
```

6.4.4 Wait for no Plane on Final State

If there is no plane on final, the takeoff runway is allocated and this message will be displayed and ATC will transition to the state, “Wait for user takeoff”:

```
KSEA to N199UA – Cleared for takeoff 16L
```

6.4.5 Wait for no Plane on Runway State

If there is no plane on the runway, the takeoff runway is allocated and this message will be displayed and ATC will transition to the state, “Wait for user takeoff”:

```
KSEA to N199UA – Cleared for takeoff 16L
```

6.4.6 Wait for User Takeoff State

When the user's aircraft is airborne, the takeoff runway is deallocated and ATC will transition to the state, “Enroute”.

6.4.7 Enroute State

When the user presses the ATC key in this state, a list of available airports within the local area are shown that may be selected as a destination. ATC transitions to the state, “Displaying Available Airports”.

6.4.8 Initial Arrival State

As you are enroute, World Traffic will start searching for the best STAR for your arrival once you are within 50 to 120 Nm of the destination airport that you entered.

This is an example of what might be displayed in this state:

```
CYVR to N199UA – Follow STAR CANUC3.08L in for arrival
```

You can now program the STAR into your FMS and ATC will also give you vectors along the approach.

6.4.9 Displaying Arrival Options State

Two arrival options are allowed for selection in this state as shown below:

```
Request approach type
> Straight in
  Overhead break
```

When the approach type is selected, ATC will transition to a state, “Display Approach Directions”.

6.4.10 Displaying Approach Directions State

ATC uses the same algorithm to determine the approach directions for your aircraft as it does for the aircraft under the applications control. It will use the aircraft type that you are flying to determine approach distance, approach speed and approach altitude and will vector you to a position from which you should be well set up to start your turn onto final or for an overhead break. This is an example of what you might see.

```
KSEA to N199UA – Cleared for approach runway 16L
Turn right to heading 321, maintain current altitude
```

ATC will allocate the approach runway for your aircraft keeping other planes safely away from you. After the initial approach clearance, you will receive steering directions such as this

```
Turn right to heading 040
Descend to 1500
Slow to 220
```

When the user aircraft has reached the final approach fix, ATC will transition to the “Display Landing Directions” state.

6.4.11 Displaying Landing Directions State

ATC will give you final directions to the runway in this state. This is an example of what you might see:

```
KSEA to N199UA – Turn left to runway heading, cleared to land runway 16L
```

From this state, ATC transitions to the “Wait for User Landed” state.

6.4.12 Wait for User Landed State

World Traffic will try and find a ground route for your aircraft when you touch down. If found it will provide you with a parking gate and a list of taxiways to follow to get there if these are defined in your ground route.

6.5 Runway Allocation Logic

Wind

Runways are chosen with wind speed and direction being one criteria. The initial active runway heading is based on the wind direction when you start X-Plane. The wind values are filtered over a period of 1 minute so the active runway does not flip back and forth in light and variable winds. For the active runway to switch directions, the wind speed must be consistently above 6 knots for about 1 minute in the opposite direction of the current active runway.

Length

This section provides a brief description of how planes are allocated runways for takeoff and landing.

Runways are given a length classification as follows:

1 – Greater than 8900 feet
2 – 6900 to 8900 feet
3 – 4900 to 6900 feet
4 – Less than 4700 feet

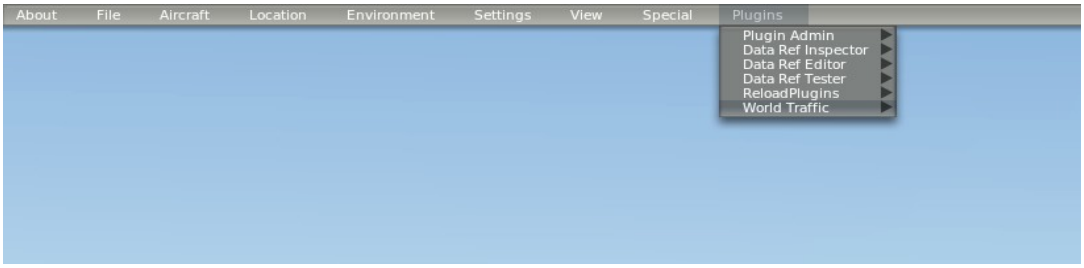
Aircraft types are also given the runway classifications that they are allowed to land on. They will first try and pick their runway class or higher and if they can't find one, they will try and pick a runway with one classification lower. If none is found (or if the crosswind is too high), they will probably circle for ever. Aircraft types use the following runway classifications as follows:

AIRCRAFT_TYPE_FIGHTER - 1
AIRCRAFT_TYPE_SUPER_HEAVY_JET – 1
AIRCRAFT_TYPE_HEAVY_JET- 1
AIRCRAFT_TYPE_LARGE_JET – 2
AIRCRAFT_TYPE_LARGE_PROP – 3
AIRCRAFT_TYPE_MEDIUM_JET – 2
AIRCRAFT_TYPE_MEDIUM_PROP – 3
AIRCRAFT_TYPE_LIGHT_JET – 2
AIRCRAFT_TYPE_LIGHT_PROP – 4

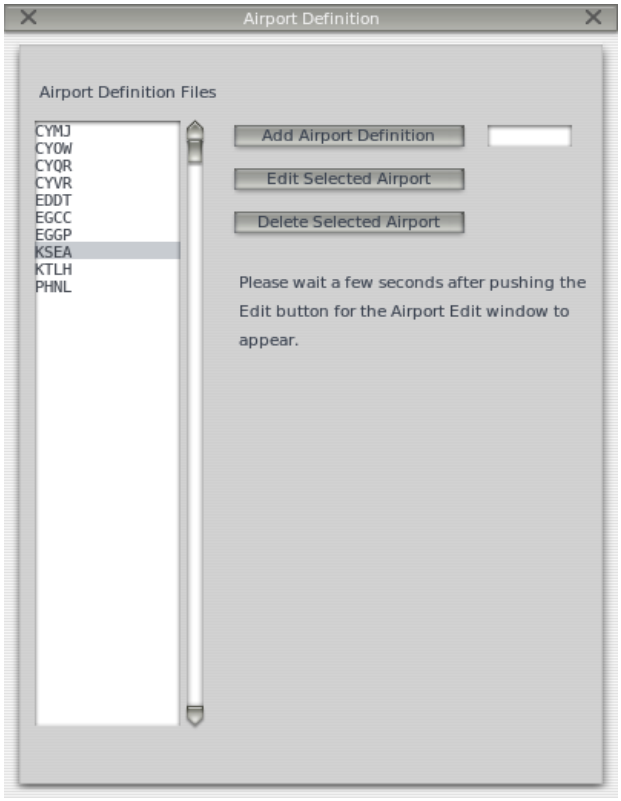
So a fighter jet will try and land on a runway that is 8900 feet or longer. If none is found it will try and find a runway between 6900 and 8900 feet. For the C-130 (MEDIUM_PROP), it will try and find runways 4700 to 6900 feet of length or longer and if none found, it should will be happy with a runway less than 4700 feet in length.

6.6 Airport Definition File and Random Flight Plan Generation

To open the Airport Definition window, select the **World Traffic** option from the X-Plane **Plugins** menu as shown below:



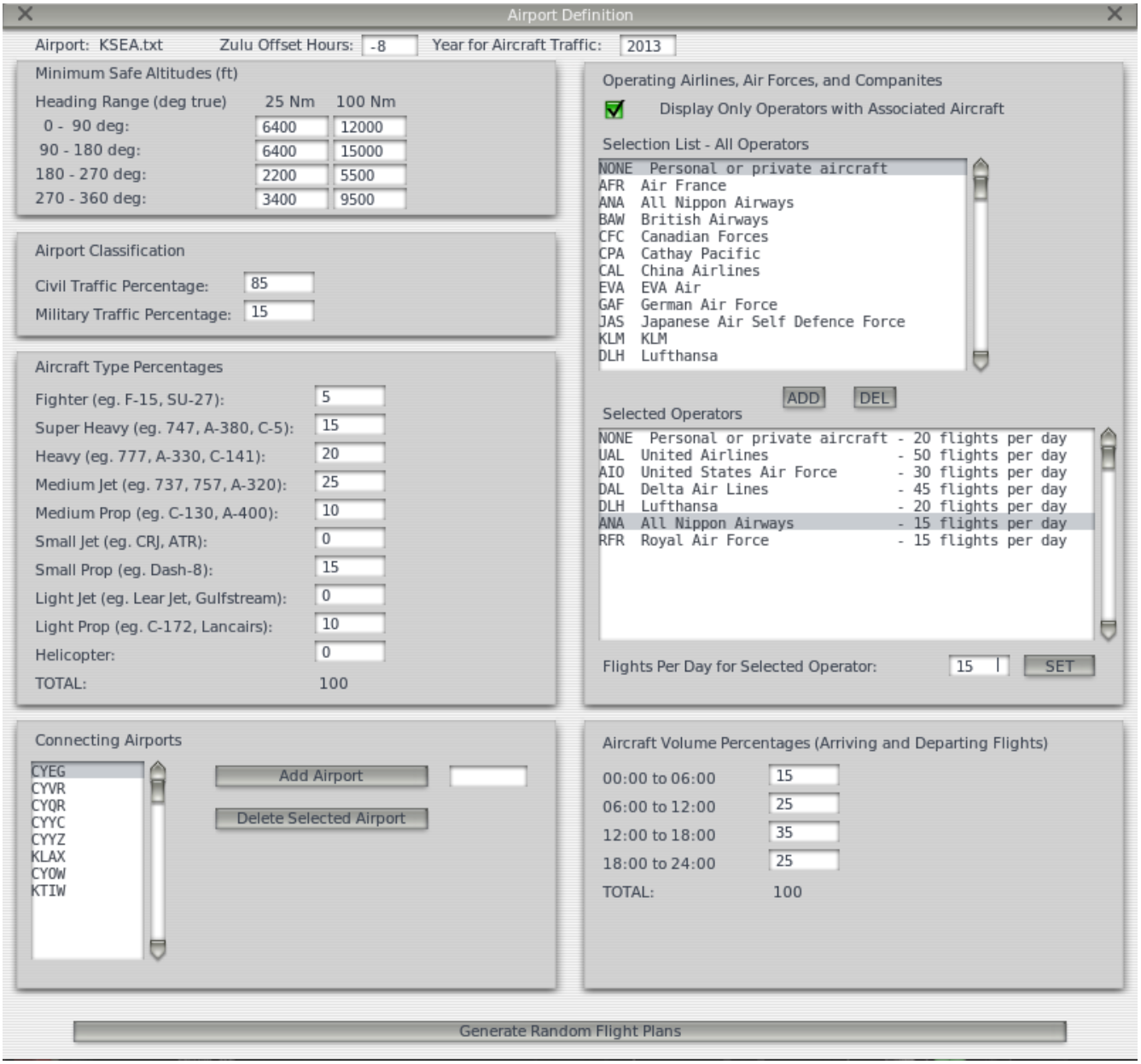
Selecting that option will bring up the Airport Definition Selection window as shown below:



You may add a new airport for editing by typing the airport name next to the **Add Airport Definition** button and then clicking that button. The airport name must be entered in upper case letters and must be the name of an existing airport existing in the main X-Plane apt.dat airport database. The application does not yet read airports from custom scenery packages.

The **Delete Selected Airport** option is currently not functional but you may delete the airport definition manually by deleting the airport definition file found in the *XPlane/ClassicJetSimUtils/WorldTraffic/Airports* folder.

You may select an airport to edit by clicking on an airport name in the left selection window and then clicking the **Edit Selected Airport** option. That brings up the main Airport Definition window as shown below:



This window is used to setup the types of aircraft flying in and out of the selected airport as well as the connecting airports. Random flight plans can then be created based on the data filled in.

Zulu Offset Hours

X-Plane time is in Zulu or UTC time. For this field enter the offset time for the airport being edited. If you are not sure of the offset, this web site has a list of them:

http://www.timeanddate.com/library/abbreviations/timezones/military/z.html

Valid values are between +12 and -12 hours. Times west of Greenwich have negative offsets and time east of Greenwich have positive offsets.

Year for Air Traffic

All aircraft definitions for World Traffic aircraft have operating year ranges. So if you've downloaded

the WWII planes from X-plane.org, set the year to something like 1942 to generate flights for those planes. For the modern airliners, you would enter the current year. This allows you to generate flights for whatever era you are interested in. Now we just need some more aircraft!

Minimum Safe Altitudes (MSA)

These can be found using aviation charts for the airport of interest. For KSEA, the MSAs can be found on this chart:

http://flightaware.com/resources/airport/SEA/IAP/ILS+OR+LOC+RWY+16L/png/1

You'll see a circle on the upper right side of the chart showing MSAs for each quadrant out to 25 miles. I'm not sure where you get the 100 mile values. I just look at the terrain in X-Plane but I know I've seen charts with these values.

Airport Classification

This is only used to determine if an airport is a military airport or a civil airport. If a military airport, arriving planes may use the overhead break arrival pattern and departing fighter aircraft may perform vertical departures. In the next update, classification will also be used to route military and civil aircraft to appropriate airports. Airports will also be matched by corresponding operators for connecting airports in the next version.

Aircraft Type Percentages

Along with the flights per day for selected operators, these values are used to determine the how many flights per day for specific aircraft types should be created. For every operator flight, aircraft are found for all possible types. Percentages are then normalized and a random number generator is used to pick a specific aircraft type. For example, if the operator currently being processed is AIO (USAF), the aircraft types available may be Fighter, Heavy (KC-10), and Medium Prop (C-130). The percentages for each in the example above are 5, 25, and 10 respectively. Normalized, the percentages become 12.5, 62.5, and 25 respectively so for the AIO operator (USAF) the current aircraft's type will be set to one of the three available types based on those normalized percentages.

Connecting Airports

After the random flight plan generator has determined an aircraft to use for the current flight plan it is generating, it will next try and find a suitable airport. A suitable airport must lie within an aircraft's minimum and maximum range and it must have runways of sufficient length. The maximum range for an aircraft is defined in the aircraft definition file. The maximum range used for a flight is set to 90% of that ultimate value. Below is a table showing how the aircraft minimum range is determined, what the minimum runway length both the home and connecting airports must have are, and what the chances are of an out and back flight.

NOTE: These values may be overwritten be editing the file "**GeneratorConfig.txt**" in the "**X-Plane/ClassicJetSimUtils/WorldTraffic"** folder.

Aircraft Type	Min Range (Percentage of Aircraft Range)	Min Runway Length at Home and Connecting Airports	Chance of out and back flight
Fighter	15.00%	7000 ft	80.00%
Super-Heavy (Civil)	9.00%	7500 ft	0.00%
Super-Heavy (Military)	5.00%	7500 ft	40.00%
Heavy (Civil)	7.00%	7000 ft	0.00%
Heavy (Military)	4.00%	7000 ft	40.00%
Small/Light Jet (Civil)	15.00%	5000 ft	0.00%
Small/Light Jet (Military)	15.00%	5000 ft	50.00%
Medium/Small Prop (Civil)	15.00%	3500 ft	0.00%
Medium/Small Prop (Military)	15.00%	3500 ft	60.00%
Light Prop (Civil)	15.00%	2000 ft	50.00%
Light Prop (Military)	15.00%	2000 ft	80.00%

In addition to the above criteria, there are some extra criteria for Super-Heavy and Heavy aircraft. These aircraft are required to fly to big airports only. A big airport is defined simply as one having 2 or more runways.

Flights that are one-way are split evenly between either originating from the home airport and flying to the connecting airport, or originating from the connecting airport and flying to the home airport.

If either of the range or minimum runway length requirements can not be met for any connecting airport, the flight plan will not be generated.

Out-and back flights are set to average between 45 minutes and 2 hours.

Operating Airlines, Air Forces, and Companies

Each World Traffic aircraft has an operator defined for it in the aircraft definition file. For privately owned aircraft this value can be set to NONE. Otherwise, the operator will match a value in this selection list.

To select the operators operating at the airport being edited, select the operator from the top list and click the **ADD** button which will add it to the selected operators window below. To remove an operator from the selected operators list, click the operator name in the lower window and click the **DEL** button.

The list can be filtered to only show operators for which there are corresponding World Traffic aircraft by checking the **Display Only Operators with Associated Aircraft** box. This option should normally be left checked unless you want to see the list of all known operators.

After adding an operator, the number of flights in and out of the airport can be edited. Click the operator name in the lower window, type in the number of flights per day, and click the **SET** button. Both the flights per day values and the aircraft type percentage values are used to determine the specific aircraft type used by the flight plan being generated. The logic is described in the previous section.

If you develop an aircraft that does not have an operator defined in the list, let me know and I can add it in. The list looks completed in regards to airlines but it is missing some air forces and probably many defunct airlines and air forces that user may wish to support. I already added in JAS for the Japanese air force.

In the next update, the operators defined for connecting airports in their own airport definition files (if defined) will be used to determine suitable airports for flight plans being generated.

Aircraft Volume Percentages

Note: These values are local time, not Zulu time

These values are used to determine start times for the generated flights so that the aircraft arrive or depart during the various times according to the specified percentages. Usually more flights take off and arrive in the day, than in the middle of the night so these fields let you define those percentages.

If the flight is originating at the connecting airport, it's departure time will be set such that it arrives during the requested time range. For example in the Airport Definition window, say a flight plan is being generated so that it's arrival time is calculated to be 13:00 local time. The start time for the flight will be calculated based on the aircraft's cruising speed and flight distance so that it should hopefully arrive close to that time.

Generate Random Flight Plans

This button will generate flight plans in a region folder with the name of the airport being edited and a suffix named "_RANDOM" appended to the end. If flight plans already exist in this folder, they will not be deleted in case the user wants to add to whatever is there. To enable these flights, first do a **Resync** so World Traffic finds the new region folder, and then go to the "**Enable/Disable Regions**" key command option and enable the new region folder. Do a **Resynch** again to activate the changes.

Appendix A1 – Flight Plan File Format

Note: *All files are space-delimited (no TABS allowed) and file names can not include spaces.*

A flight plan is a file defining the path of an aircraft, vehicle or boat. It specifies the aircraft in the flight, and the flight characteristics. The flight plan files go in any of the region folders under the XPlane/ClassicJetSimUtils/WorldTraffic/RouteFiles folder. Note that the flight definition commands as described below can be defined in any order in the file. Several commands are optional.

A) Start Time

Specify the start time as follows:

```
STARTTIME
HH:MM TimeIntervalHours (Optional)
ENDTIME
```

Where the time is in entered in Zulu time. Set this value to -1 if you wish the flight to start immediately as soon as the plugin starts. If the optional time interval is set and the time is not set to -1, flight plans will be cloned using the start time and adding the time interval to generate flights for a day. If the time interval is 1.0 hours, for example, 23 flights will be generated for the day at 1 hour intervals. The minimum value for the time interval is 0.25 hours (15 minutes) and the maximum value is 23.75 hours.

B) Start Days (optional)

Specify the days of the week that this flight plan is active. If this section is not defined, the flight plan will be valid for all days of the week. Specify the active days as follows:

```
STARTDAYS
D1 D2 D3 etc.
ENDDAYS
```

Where the days are 0 to 6 with 0 being Sunday. One or more days can be entered in this section.

C) Aircraft Types and Tail Numbers

Aircraft names can be defined in this section with a maximum of 4 allowed if the flight plan is for a formation flight. Aircraft need not be the same, but they must have overlapping speed ranges between max takeoff flap speed and cruise speed so they can fly together.

Tail numbers can be defined for the aircraft if you want to have several flight plans define an aircraft's travel path from one airport to another. For example, if you have three flight plans defined all for one aircraft tail number for different times of the day, the application will determine on startup where the aircraft should be and only draw it in one location, parked at an airport on en-route. If no tail number is defined for an aircraft in a flight plan, on startup the application will place aircraft at the destination airport if the plane is not determined to be en-route. Aircraft names and tail numbers are defined as follows:

```
STARTAIRCRAFT
AircraftName1 TailNumber1 (optional)
AircraftName2 TailNumber2 (optional)
AircraftName3 TailNumber3 (optional)
AircraftName4 TailNumber4 (optional)
ENDAIRCRAFT
```

Where AircraftNameN is the name of one of the available aircraft in the AircraftTypes folder and where TailNumber is an optional tail number of the aircraft. Enter up to 4 aircraft if you want a formation flight.

D) Callsign (optional)

The callsign entered in the flight plan will be used on the radar display. It is recommended for airliner flights that this be set to the flight number for the aircraft, eg. UAL1022 for United Airlines flight 1022. For civilian aircraft, it can be set to the aircraft's tail number and for a military flight, they often have cool names like Hammer or Viper or whatever you think sounds typical. If no callsign is set here, the callsign will be derived using the operator ICAO code and the flight plan range as defined in the aircraft definition file.

```
STARTCALLSIGN
callsign
ENDCALLSIGN
```

E) Departure Airport (optional)

The departure airport is defined as shown below:

```
STARTDEPAIRPORT
AirportId
ENDDEPAIRPORT
```

Where AirportId is the 4 letter airport identifier as defined in the X-Plane airport database. If the departure airport is defined, the plane will take off from this airport if it can find a suitable departure ground route file. If the departure airport is not defined, the plane will start in flight at the position defined in the first steerpoint.D) Arrival Airport

The arrival airport is defined as shown below:

```
STARTDESTAIRPORT
AirportId
ENDDESTAIRPORT
```

Where AirportId is the 4 letter airport identifier as defined in the X-Plane airport database. If the arrival airport is defined, the plane will attempt to land at this airport if it can find a suitable runway. If no suitable runway is found, in the case where it is in use by another plane, or if the airport does not have a runway long enough, the plane will enter a holding pattern. Once the plane has landed, it will try and find a suitable ground route to a parking spot. If none are available or not defined, the plane will disappear once it comes to a stop.

F) Departure Type (optional)

The departure type can be defined as follows:

```
STARTDEPARTTYPE
DepartureType
ENDDEPARTTYPE
```

Where DepartureType can be one of the following:

- 1 – Normal Departure (default)
- 2 – Vertical Departure (used if the aircraft in the plan has a sufficient thrust to weight ratio to perform a vertical departure)

G) Arrival Type (optional)

The arrival type can be defined as follows:

```
STARTARRIVETYPE
ArrivalType
ENDARRIVETYPE
```

Where ArrivalType can be one of the following:

- 1 – Straight-in Approach (default)
- 2 – Overhead Break (planes fly 1500 feet over the runway and break from formation one at a time to circle in to land. This is frequently used for military aircraft arrivals for fighters and even large planes.
- 3 – Low Approach (not yet implemented – planes will fly low over the runway and break from formation one at a time and pitch up and circle in to land).

H) Flight Type (optional)

The Flight Type is defined as shown below:

```
STARTFLIGHTTYPE
FlightType
ENDFLIGHTTYPE
```

Where FlightType can be one of the follow:

- 1 – Civilian Flight (default)
- 2 – Military Tactical Flight (planes turn off lights when en-route)

I) Fly To Completion

Normally for a one-way flight, the aircraft will start searching for a STAR approach within 50 to 100 Nm of the destination airport. If you want the aircraft to follow its route to completion before looking for a STAR, set this field to 1.

```
START_FLY_TO_COMPLETION
FlyType
END_FLY_TO_COMPLETION
```

Where FlyType can be one of the follow:

- 0 – Don't fly to completion... use a STAR as soon as it's available
- 1 – Fly route to completion... only look for a STAR on the route's last leg.

J) Landing Light Altitude

For aircraft with landing lights on the wings, these are often turned on when flying below 10,000 feet. You can specify this altitude in feet.

```
START_LANDING_LIGHT_ALT
Altitude
END_LANDING_LIGHT_ALT
```

K) Steerpoints

Define the steerpoints as follows:

```
STARTSTEERPOINTS
lat lon alt alt_type speed_kias max_bank_angle heading unused formation_type description
ENDSTEERPOINTS
```

Where the fields in order are:

- latitude – decimal degrees
- longitude – decimal degrees
- altitude – feet
- altitude type – ASL or AGL (use AGL for terrain following flights)
- speed – speed in knots indicated airspeed
- max bank angle – degrees
- heading – unused
- unused field
- formation type which can be one of:
    - 0 -ECHELON
    - 1 - FINGERTIP (not yet implemented)
    - 2 - BATTLE_SPREAD (not yet implemented)
    - 3 - FLUID_2 (not yet implemented)
    - 4 - FLUID_4 (not yet implemented)
    - 5 - TRAIL (not yet implemented)
    - 6 - ROUTE (not yet implemented)
    - 7 - BOX (not yet implemented)
- description – whatever you want to add here to identify the waypoint.

Appendix A2 – Ground Route File Format

Note: *All files are space-delimited (no TABS allowed) and file names can not include spaces.*

The ground route files are created for specific airports. They go in any of the airport folders under the Xplane/ClassicJetSimUtils/WorldTraffic/GroundRoutes/Arrival and Xplane/ClassicJetSimUtils/WorldTraffic/GroundRoutes/Departures folders. Create a new folder under those folders for a new airport. The folder name must match the airport name as defined in the X-Plane airport database. Note that the ground route definition commands as described below can be defined in any order in the file.

You can specify a ground route for a general aircraft type (eg. fighter, heavy), a specific type (eg. 747), an aircraft tail number, or an aircraft operator. You use one the following 4 command blocks. You can either specify one tail number, one aircraft name, or one or both aircraft type/s and operator. This is useful for many airports where a block of gates are used by a single airline for various aircraft types For example Concourse H at KORD consisting of several gates is used exclusively by American Airlines and its various aircraft types. Note that if you specify both type and operator, both values must match the arriving aircraft or it will not use that ground route.

A1) Specify Aircraft Tail Number

```
STARTTAILNUM
TailNum
ENDTAILNUM
```

Where TailNum is a specific tail number matching that defined in the flight plan.

A2) Specify Aircraft

```
STARTAIRCRAFT
PlaneName
ENDAIRCRAFT
```

Where PlaneName is the name of the aircraft (eg. 747, F-14), matching the name of one of the aircraft defined in the AircraftTypes folder.

A3) Specify General Aircraft Type

```
STARTAIRCRAFTTYPE
N N1 N2
ENDAIRCRAFTTYPE
```

where N, N1, N2 ... are aircraft types as follows:
0 - FIGHTER - F-18, F-16, F-15, F-14, SU-27, Mig-29, F-22, F-35
1 - SUPER_HEAVY_JET - A-380, C-5, 747, AN-225
2 - HEAVY_JET - A-340, A-330, 777, 767, 787, C-141, L-1011, DC-10
3 - LARGE_JET - A-320, 737, 757,
4 - LARGE_PROP - A-400, Hercules
5 - MEDIUM_JET - Regional Jets

6 - MEDIUM_PROP - Regional Prop planes
7 - LIGHT_JET - lear jet, Gulfstream, Global Express
8 - LIGHT_PROP - GA prop planes

So you could create a ground route for one aircraft type or you could make it for all aircraft types.

A4) Specify Aircraft Operator

```
STARTOPERATOR
Operator_ICAO_name1 Operator_ICAO_name2 Operator_ICAO_name3...
ENDOPERATOR
```

Up to 20 operators can be specified on a single line, where Operator_ICAO_name is the 3 character operator name of the aircraft (eg. AAL, ACA), matching the operator for the aircraft defined in the aircraft definition file and also matching one of the files in the ICAO_Operators.txt file in the "XPlane/ClassicJetsimUtils/WorldTraffic/ICAO_Operators" folder.

B) Specify Arrival or Departure Runway

After selecting one of the above 3 blocks, specify the landing runway that the ground route is for using this command:

```
STARTRUNWAY
runwayName
ENDRUNWAY
```

Where runway is the runway name, eg 16L, 34R. The runway name may be entered with or without a trailing zero. For example either 03L or 3L will work.

C) Specify Parking Spot Reference

After selecting one of the above 3 blocks, specify the landing runway that the ground route is for using this command:

```
START_PARKING_CENTER
NOSEWHEEL or MAINWHEEL (default)
END_PARKING_CENTER
```

If you want the location of the parking spot to specify the location of the aircraft's nose wheel, use the NOSEWHEEL option. If you want the location of the parking spot to specify the center of the main wheels, use the MAINWHEEL option. When taxiing, the steerpoint coordinates always specify the position of the center of the aircraft which is between the main wheels. Selecting the NOSEWHEEL option is quite useful when placing dissimilar aircraft at a gate where you want the nose of the plane to be in the same place for various aircraft types.

D) Specify Ground Route Priority

Ground routes are normally prioritized by their distance so a ground route with a shorter distance will normally be given priority. You can override the ground route priorities, however. Note, that if you must prioritize all or none of them. Use this command:

```
START_PRIORITY
priority_number
END_PRIORITY
```

Where priority_number can be 1, 2, 3, etc with 1 being the highest priority.

E) Specify the Steerpoints

Next define the steerpoints in between the STARTSTEERPOINTS and ENDSTEERPOINTS text as follows:

```
STARTSTEERPOINTS
lat  lon  speed  heading  runway_name  runway_control_id  taxiway_name
ENDSTEERPOINTS
```

For an arrival ground route, **the first steerpoint must be set to the runway threshold position**. For a departure ground route, the last waypoint indicates the position where the plane is on the runway and ready for takeoff. This can be the start of the runway for a large plane or the middle for a light aircraft not requiring the full runway length to take off in.

Steerpoints should be placed at a minimum of about 30 feet apart when the aircraft is travelling quickly (above 8 knots) and at a minimum of 15 feet when the aircraft is travelling slowly. Any closer, and the waypoint may get skipped. WorldTraffic aircraft anticipate the corners and will attempt to stay on the lines connecting waypoint to waypoint so you can define square corners for sharp turns. For long turns, you may need to have a coupe of waypoints throughout the turn. A waypoint will be considered as passed if the relative angle to it from the aircraft is more than 90 degrees and the distance to it is inside of the aircraft's calculated turn radius.

The fields in order are:

- latitude – degrees
- longitude – degrees
- ground speed – knots (if the first waypoint has a negative speed, a push-back cart will move it to the 2nd waypoint)
- heading – degrees (used to specify park heading for 1st or last waypoint, set this to -1 to indicate not to use the heading). This is used only when spawning aircraft on a parking spot to ensure that it is loaded at the correct heading.
- description – if this is a runway name (eg 16L), it is used to determine when the waypoint is on a runway for ground traffic control. If not a runway, it can be any text you want to identify the waypoint.
- runway control id (set to 0 if not used):
    - 1 – To specify this is holding point for the runway as specified in the description field above. When an aircraft is taxiing and sees a runway name in the description and a 1 as the control id, the plane will hold at this steerpoint if the runway is in use.

    - 2 – For when plane is on the runway as specified in the description field above. When an aircraft is taxiing and sees a runway name in the description and a 2 as the control id, this lets the application know that the plane is on a runway and will make sure ground conflicts with landing or departing aircraft are avoided.
- Runway Name (set to 0 if not used) – the name of the runway the aircraft is on or holding for. The name for either end of the runway is fine. This is only used if the runway control id field is set. The runway name may include or exclude a leading "0", eg both "08L" and "8L" are valid.
- Taxiway name – This gets used for display and for directing the user aircraft when the user is requested by ATC to follow a route to parking.

Tips for creating ground routes:

There are some 3rd party tools now for creating flight plans and ground routes. Check them out here:

http://forums.x-plane.org/index.php?showtopic=89399

These procedures also work well if you want to create them manually:

A) Creating Ground Routes inside of X-plane.

- Open an aircraft in X-Plane of roughly the same type that you want to create a ground route for.
- In the Flight Information window, select the User aircraft, highlighted in red. This will show the lat/lon position for your aircraft.
- Put your plane on the landing runway threshold. The first waypoint in a ground route should always be the landing runway threshold. Set the speed of your first waypoint to a decent runway cruise speed like 30 knots.
- Now record waypoint lat/lon positions for your next waypoints all the way to your parking spot
- You need to use slow taxi speeds for sharp turns but for high speed exits you can use faster speeds.
- Don't put waypoints too close together (a few feet), otherwise it will ignore them.

B) Using WED

- Use WED to open your airport area and get the lat/lon coordinates from the editor.

Appendix A3 – Aircraft File Format

Note: *All files are space-delimited (no TABS allowed) and file names can not include spaces.*

The aircraft definition file is used to provide data used in the World Traffic flight model. It also has some information used in aircraft animations.

To define an aircraft to work with World Traffic, you need both an Aircraft Definition File and an Aircraft Object File. They both must have the same name with the Aircraft Definition file having a .txt suffix and the Aircraft Object file having a .obj suffix. An optional damaged aircraft model can also be provided with the suffix "_damaged.obj" appended to the name of the aircraft. If the aircraft is destroyed using the "destroy_ac" dataref, this object is drawn instead of the normal one.

The Aircraft Definition Files must reside in the X-Plane/ClassicJetSimUtils/WorldTraffic/AircraftTypes folder.

The The Aircraft Object Files must reside in the X-Plane/ClassicJetSimUtils/WorldTraffic/AircraftObjects folder.

The plane may be animated using the datarefs as listed in Appendix A4.

Aircraft Definition File

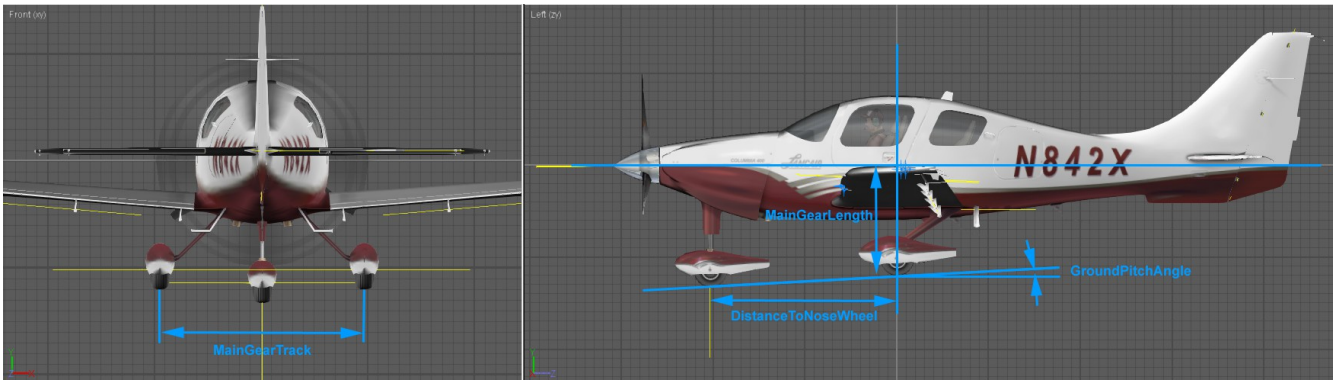
The aircraft definition is defined between the START and END key words. All other text outside of this block can be used for description. Again, note that all files are space-delimited (no TABS allowed) and file names can not include spaces. Fields can be in any order in the file. Fields may be excluded if they are not applicable. For example boats don't require AOA values and helicopters don't require wing spans. The following are the supported aircraft definition fields:

1) **Name** – Name of aircraft displayed in X-Plane in the flight/aircraft information windows.
2) **Key** – no longer used and if present will be ignored.
3) **Type** – **NOTE: Type must go before all other fields listed below!** Integer value used by the application for runway allocation and some performance modelling. See the table at the bottom of this section for more info on how to determine aircraft type. Available types are as follows:
    - 0 - FIGHTER - F-18, F-16, F-15, F-14, SU-27, Mig-29, F-22, F-35
    - 1 - SUPER_HEAVY_JET - A-380, C-5, 747, AN-225 (MTOW > 700,000 lbs)
    - 2 - HEAVY_JET - A-340, A-330, 777, 767, 787, C-141 (MTOW > 300,000 lbs)
    - 3 - LARGE_JET - A-320, 737, 757, ERJ-190 (MTOW > 100,000 lbs)
    - 4 - LARGE_PROP - A-400, Hercules (MTOW > 100,000 lbs)
    - 5 - MEDIUM_JET - Regional Jets, large corporate jets (MTOW > 40,000 lbs)
    - 6 - MEDIUM_PROP - Regional Prop planes eg. Dash8, ATR (MTOW > 12,500 lbs)
    - 7 - LIGHT_JET – LearJet, Cessna Citation, Honda Jet
    - 8 - LIGHT_PROP - GA prop planes
    - 9 - HELICOPTER
    - 10 - GROUND VEHCILE - car, tank, etc
    - 11 - BOAT
4) **BaseAircraft** – This links to another aircraft definition file if you want to use the values from that file. For example, there could be several aircraft definitions files for a 767 used by

different airlines. The base file could contain all aircraft attributes excluding the Operator, Operator_IATA, and flight number range fields since they are specific to a certain operator and everything else will be common such as aircraft length, wingspan, etc.

5) **hasFMS –** This defaults to 1 (true) for all aircraft aside from light props. If set to 0 the aircraft won't use STAR approaches or SID departures.
6) **NavSystemNPA** – Set to 1 if the aircraft has navigation systems to perform non-precision approaches or 0 if not. Default is 1 for all aircraft types.
7) **NavSystemRNAV** – Set to 1 if the aircraft has navigation systems to perform RNAV approaches or 0 if not. Default is 1 for all aircraft types.
8) **NavSystemILS** – Set to 1 if the aircraft has navigation systems to perform ILS approaches or 0 if not. Default is 1 for all aircraft types except for helicopters.
9) **NavSystemILS_CAT_I** – Set to 1 if the aircraft has navigation systems to perform ILS CAT I approaches or 0 if not. Default is 1 for all aircraft types except light props and helicopters.
10) **NavSystemILS_CAT_II** – Set to 1 if the aircraft has navigation systems to perform ILS CAT II approaches or 0 if not. Default is 1 for super-heavies, heavies, large jets, large props, medium jets and medium props.
11) **NavSystemILS_CAT_IIIa** – Set to 1 if the aircraft has navigation systems to perform ILS CAT IIIa approaches or 0 if not. Default is 1 for super-heavies, heavies, large jets, and medium jets.
12) **NavSystemILS_CAT_IIIb** – Set to 1 if the aircraft has navigation systems to perform ILS CAT IIIb approaches or 0 if not. Default is 1 for super-heavies, heavies, large jets, and medium jets.
13) **NavSystemILS_CAT_IIIc** – Set to 1 if the aircraft has navigation systems to perform ILS CAT IIIc approaches or 0 if not. Default is 1 for super-heavies, heavies, and large jets.
14) **Operator** – The optional operator of the aircraft. Leave blank for general aircraft types that you want to see everywhere like light privately-owned general aviation aircraft or use one of the 4 character ICAO operator codes from this list: http://en.wikipedia.org/wiki/Airline_codes-All
15) **Operator_IATA** – The 2-character IATA operator name if known. This is used along with the flight number range as defined below to randomly generate a callsign for display on the ATC radar if a callsign is not defined in the flight plan.
16) **FlightNumberRangeLow** – See comments above for Operator_IATA.
17) **FlightNumberRangeHigh** – See comments above for Operator_IATA.
18) **Civil** – Set this to 1 if the aircraft is a civilian aircraft and set to 0 for a military aircraft.
19) **StartYearOfOperation** – The year the aircraft entered service with the operator.
20) **EndYearOfOperation** – The year the aircraft stopped flying with the operator.
21) **EngineType** – Integer value used to determine sound type, engine performance, and to set animation values. Available engine types are as follows:
    - 0 - Fighter turbojet
    - 1 - Turbofan
    - 2 - Light jet (not yet supported)
    - 3 - Turboprop
    - 4 - piston prop
    - 5 - big prop, non-turboprop (not yet supported)
    - 6 - helicopter
    - 7 – boat (not yet supported)
    - 8 – car (not yet supported)
    - 9 - diesel vehicle (not yet supported)
22) **NumEngines** – Allowed values between 0 and 4
23) **Length** – Length in meters of the aircraft, used for ground collision avoidance and turn radius calculations.
24) **Wingspan** – Wing span in meters.

25) **BodyDiameter** – Approximate frontal area of the aircraft used in the drag calculation.
26) **Cd** – Aircraft drag coefficient used in the drag calculation. If you find that the aircraft is no accelerating as fast as it should or if can't reach its top speed, try lowering the drag coefficient or adjusting the BodyDiameter value.
27) **BrakingFactor** – (0.0 to 1.0). The default is 0.0. Increase it slightly if the aircraft landing distance is too long. Values between 0.0 and 0.2 are typical.
28) **GroundDragFactor** – (0.0 to -3.0). The default is 0.0. Decrease if the aircraft is accelerating too slowly on takeoff. Values of -2.5 are typical of regional prop planes like the Dash-8 or ATR.
29) **LandAOA** – Angle of Attack of the plane during landing, used for lift calculation. This should be about 6 degrees for a plane with slats and 3 degrees for a plane without slats. Some fighters like the F-16 have a landing AOA or on-speed AOA of 8 to 10 degrees.
30) **TakeoffAOA** – Angle of Attack of the plane during takeoff, used for lift calculation. It's normally about 3 to 5 degrees.
31) **CruiseAOA** – Angle of Attack of the plane at the entered cruise speed.
32) **GroundPitchAngle** – Pitch angle of the aircraft when it is on the ground used when drawing the aircraft. Change this value to level the aircraft if you find the nosewheel in the air or under the pavement.
33) **MainGearLength** – This is the length between the center line of the aircraft object to the bottom of the main landing gear when it is compressed. Below is a screenshot of an aircraft in AC3D showing how to determine these dimensions. Note that the aircraft object must be placed such that the rear-most part of the main landing gear is at the zero Z coordinate position and so that the center of gravity axis aligns with the Z axis. The aircraft will rotate about these axes. The center of gravity may not be quite at the same position as the rear landing gear but it's pretty close. The application depends on the aircraft being oriented like this since it calculates the distance from the ground to the landing gear based on this setup.



15) **MainGearWheelRadius** – Radius in meters of the main gear wheels, used for animation.
16) **MainGearMaxComp** – Distance in meters that the main gear compresses on the ground if any.
17) **NoseGearWheelRadius** - Radius in meters of the nose gear wheel/s, used for animation.
18) **NoseGearMaxCompression** - Distance in meters that the nose gear compresses on the ground if any.
19) **NoseGearParkedCompression** – not used
20) **DistanceToNoseWheel** – Distance in meters between the the Y axis and the center of the nose wheel.
21) **MainGearTrack** – Distance in meters between the left and right main gear.
22) **GearRetractTime** – Time in seconds for the gear to retract.

23) **FlapExtensionTime** – Time in seconds for the gear to extend fully.
24) **NumberFlapSettings** – If FBWflaps below is set to zero, enter the number of distinct flap positions available.
25) **FBWflaps** – Set to 1 (true) if the flaps are controlled by a FBW system and change position continuously in an infinite number of positions.
26) **VariableSpeedBrakes** – Set to 1 (true) if the speed brakes can be set to any position between retracted and extended, otherwise they will be open or closed only.
27) **Ceiling** – Max altitude in feet that the aircraft can fly at.
28) **Range** – The maximum range of the aircraft in Nm.
29) **ClimbSpeed** – Typical climb speed in knots (kias) that the plane will fly at in a normal climb (not max climb speed).
30) **CrusieMach** – The typical cruise Mach speed of the aircraft at its cruising altitude.
31) **CruiseSpeed** – The speed (kias) at which the CruiseAOA value is defined for, not necessarily the real aircraft's cruise speed. This is used only for for AOA calculations.
32) **MaxSpeed** – The maximum speed (kias) that the aircraft can fly at in level flight.
33) **MaxMach** – The maximum Mach value that the aircraft can fly at in level flight.
34) **LandingSpeed** – The normal final approach speed (kias) of the aircraft.
35) **TakeoffSpeed** – The normal takeoff speed (kias) of the aircraft.
36) **NoseDownSpeed** – The speed at which the nose gear drops during landing. This is normally equal to LandingSpeed except where the aircraft sits on its main gear during landing for aerodynamic braking. Planes like the F-16 and F-15 use aerodynamic braking with nose down speeds of around 100 kias.
37) **MaxLandingFlapSpeed** – The speed (kias) at which the flaps move to their full extension.
38) **MaxTakeoffFlapSpeed** – The speed (kias) at which the flasp move to their takeoff position which is 30% of full travel. The gear extension speed is set to 5 knots below this value.
39) **Weight** – Set to (MTOW – fuel weight).
40) **MTOW** – Maximum takeoff weight of the aircraft.
41) **TakeoffDistAtMTOW** – Entered in feet. This value can usually be found in wikipedia for most aircraft. It's the takeoff distance at sea level, no wind, and standard conditions at the aircraft's maximum takeoff weight.
42) **LandingDist** – This is the landing distance in feet of the aircraft with a light fuel load.
43) **AfterburnerThrust** (optional) – Total engine thrust of all engines combined with the afterburner on.
44) **MaxThrust** – Maximum, non-afterburning thrust of all engines combined. For prop planes, determine an effective thrust from the prop. A plane like a Lancair Columbia has a thrust:weight ratio of 0.28. A plane such as the C-130 Hercules has a thrust:weight ratio of 0.27. You can adjust thrust to increase or decrease acceleration and climb rate.
45) **RadarType** – for future use in X-Combat.
46) **HasSpeedBrakes** – Set to 1 (true) if the aircraft has speed brakes (used for drag calc and animation).
47) **HasRetractableGear** – Set to 1 (true) if the aircraft has retractable gear (used for drag calc and animation).
48) **NavSystemNPA** – Set to 1 (true) if the aircraft has basic navigation equipment to perform Non-Precision Approaches.
49) **NavSystemRNAV** – Set to 1 (true) if the aircraft has navigation equipment to perform RNAV approaches.
50) **NavSystemILS** – Set to 1 (true) if the aircraft has navigation equipment to perform ILS approaches.
51) **NavSystemILS_CAT_I** – Set to 1 (true) if the aircraft has navigation equipment to perform

ILS CAT I approaches.

52) **NavSystemILS_CAT_II** – Set to 1 (true) if the aircraft has navigation equipment to perform ILS CAT II approaches.
53) **NavSystemILS_CAT_IIIa** – Set to 1 (true) if the aircraft has navigation equipment to perform ILS CAT IIIa approaches.
54) **NavSystemILS_CAT_IIIb** – Set to 1 (true) if the aircraft has navigation equipment to perform ILS CAT IIIb approaches.
55) **NavSystemILS_CAT_IIIc** – Set to 1 (true) if the aircraft has navigation equipment to perform ILS IIIc approaches.

Other Guidelines:

- The Nav Systems defined for the aircraft are used in conjunction with the nav systems supported by the various runways as defined in the Airport Operations file. Using the current weather ceiling and visibility and the aircraft nav systems and the nav systems supported by the runways, World Traffic determines if the aircraft can land or not.
- Wikipedia is a great place to get aircraft specs from. For example all the numbers required for a 787 can be found here: http://en.wikipedia.org/wiki/Boeing_787_Dreamliner
- To reiterate, the aircraft object should be placed so that the z axis goes through the center of gravity on the aircraft as shown in the figure above. This is the axis that the aircraft will be rotated around when banking.
- The cruise AOA that is set is used at the aircraft cruise speed and should normally be around 0 to 2 degrees. Lower this value if the aircraft seems to be flying with the nose excessively high or set the aircraft cruise speed lower. The cruise speed is only used for determining AOA.
- Cruise speed and max speed are in knots indicated and should be set using the published cruise Mach and max Mach numbers as published with the altitude set to 25,000 feet. Use this calculator here to determine the cruise speed and max speed in knots: http://www.hochwarth.com/misc/AviationCalculator.html In the very bottom section, set the altitude as 25,000 feet, enter the Mach number and press the "Compute CAS/TAS/EAS" button. Use the CAS speed. The cruise speed is used mostly for calculating the AOA. The plane is limited by the lesser of max speed and max Mach.
- Aircraft weight should be set to the aircraft's MTOW minus the fuel weight.
- Thrust should be set to the maximum available thrust so for the 787-8, this value would be 64,000 lbs X 2 = 128,000 lbs. Afterburner thrust if defined should be set to thrust if the aircraft has no afterburner.

Here is the work flow I follow when creating aircraft definition files:

- Set takeoff speed to Vr at MTOW in the aircraft definition file. If it can't be found, use a value from a comparable aircraft.
- Set climb speed to a normal value. I think I use 290 knots for most of the jetliners.
- Cruise speed is only used for AOA calcs and should be set to 295 for jetliners or about 80% max speed.
- Set MaxSpeed to Vmo.
- Set MTOW to data found online
- Set Weight to MTOW minus fuel capacity in pounds.
- Set LandingSpeed equal to landing speed at Weight value above (not MTOW)
- Set NoseDownSpeed to LandingSpeed for most planes except planes like F-15s or F-16s that

use aerodynamic braking.

- Set TakeoffDistAtMTOW to data found online
- Set LandingDist equal to landing distance data for the aircraft weight set to the weight value above (not MTOW).
- Create a flight plan with departure and arrival airports as far apart as possible so that aircraft will takeoff at MTOW. Make sure that the departure airport is at sea level and the winds are calm. Test that the aircraft takes off at the specified takeoff distance at MTOW. If it's taking off in too little runway, reduce the thrust a bit. If it's taking too much runway to takeoff, increase thrust slightly, but not more than 10%. If still using too much runway, set the "GroundDragFactor" from 0 to -3.0 min to reduce calculated drag. This seems to be required for some prop planes like the Dash-8 for which I have this value set to -2.5.
- Check out the landing distance for the aircraft to make sure it's close to specs. If the plane takes too much runway, increase BrakingFactor. It's often at around 0.4 for the smaller jets.
- Create a flight plan such that an AI plane is level at 35,0000 feet and flying at its cruise Mach Speed. Adjust Cd so that engine speed is at around 88%.
- Make sure that the type is correct. This table below shows how aircraft should be classified:

Fighter - Any jet with a thrust:weight ratio greater than 0.5:1 - Type 0

SR-71, Mig-31, F-15, F-16, SU-27, Bae Hawk, Alpha Jet, etc.

Super-heavy > 700,000 lbs - Type 1

AN-225	1,411,000 lbs
A-380	1,268,000 lbs
C-5	840,000 lbs
747	735,000 lbs
777-200LR	766,000 lbs
A-340-500/600	840,000 lbs

Heavy - 300,000 - 700,000 lbs - Type 2

777-200/ER	656,000 lbs
A340-300	610,000 lbs
767	350,000 lbs
L-1011	430,000 lbs
KC-10	590,000 lbs
C-141	342,100 lbs
B-52	488,000 lbs

Large Jet > 100,000 to 300,000 - Type 3

ERJ-190	114,000 lbs
737	150,000 lbs
757	272,500 lbs
A-318	
A-319	
A-320	
A-321	

Large Prop > 100,000 lbs - Type 4

C-130	155,000
A-400	310,000

Medium Jet > 40,000 lbs - Type 5

ERJ-170	79,000 lbs
Global Express	95,000 lbs
CRJ-100	53,000 lbs
CRJ-700	86,000 lbs

Medium Prop > 12,500 lbs - Type 6

Dash-8-400	65,000 lbs
ATRs	

Light Jet < 40,000 lbs - Type 7

Learjet	23,500 lbs
Gulfstream G280	39,600 lbs

Light Prop < 12,500 lbs - Type 8

Cessnas, Pipers, Lancairs, etc.

Appendix A4 – World Traffic Datarefs

These datarefs are as follows and are all single floating point numbers unless otherwise specified.

All ratios vary between 0.0 and 1.0 with 0.0 being closed or retracted.

Writable Datarefs for Aircraft Animation:

cjs/world_traffic/hstab_ratio
cjs/world_traffic/rudder_ratio
cjs/world_traffic/aileron_ratio
cjs/world_traffic/flaperon_ratio_L
cjs/world_traffic/flaperon_ratio_R
cjs/world_traffic/taileron_ratio_L
cjs/world_traffic/taileron_ratio_R
cjs/world_traffic/lef_ratio
cjs/world_traffic/tef_ratio
cjs/world_traffic/speed_brake_ratio
cjs/world_traffic/door_ratio
cjs/world_traffic/main_gear_wheel_angle
cjs/world_traffic/main_gear_retraction_ratio
cjs/world_traffic/main_gear_deflection
cjs/world_traffic/nose_gear_wheel_angle
cjs/world_traffic/nose_gear_steering_angle
cjs/world_traffic/nose_gear_deflection
cjs/world_traffic/nose_gear_retraction_ratio
cjs/world_traffic/gear_door_ratio1 // opens and closes with gear
cjs/world_traffic/gear_door_ratio2 // opens before gear and closes after gear
cjs/world_traffic/gear_door_ratio3 // only open when gear is extending or retracting
cjs/world_traffic/tail_hook_ratio
cjs/world_traffic/nozzle_position
cjs/world_traffic/landing_lights_on
cjs/world_traffic/wing_landing_lights_on
cjs/world_traffic/taxi_lights_on
cjs/world_traffic/nav_lights_on
cjs/world_traffic/beacon_lights_on
cjs/world_traffic/strobe_lights_on
cjs/world_traffic/afterburner_on
cjs/world_traffic/pilots_in_plane
cjs/world_traffic/engine_rotation_angle1
cjs/world_traffic/engine_rotation_angle2
cjs/world_traffic/engine_rotation_angle3
cjs/world_traffic/engine_rotation_angle4
cjs/world_traffic/engine_rpm1
cjs/world_traffic/engine_rpm2
cjs/world_traffic/engine_rpm3
cjs/world_traffic/engine_rpm4
cjs/world_traffic/engine_rad_per_sec1
cjs/world_traffic/engine_rad_per_sec2

cjs/world_traffic/engine_rad_per_sec3
cjs/world_traffic/engine_rad_per_sec4
cjs/world_traffic/thrust_reverser_position
cjs/world_traffic/drag_chute
cjs/world_traffic/wiper_angle
cjs/world_traffic/ground_speed
cjs/world_traffic/mach
cjs/world_traffic/altitude_asl
cjs/world_traffic/altitude_agl // Only available for landing aircraft or when in terrain-following flight mode as specified in the flight plan.
cjs/world_traffic/destroy_ac // Pass in aircraft id as found in the "id" integer array described above to destroy specified aircraft and to display damaged model (integer).

Readable Aircraft Telemetry Datarefs:

cjs/world_traffic/num_aircraft // Number of aircraft currently being rendered (integer)
cjs/world_traffic/aircraft_trackcam_id // Aircraft id currently being viewed by track camera
cjs/world_traffic/aircraft_type // Aircraft Type – see Appendix A3 for types (integer array)
cjs/world_traffic/id // Aircraft Identifier (integer array)
cjs/world_traffic/alt_asl // Altitudes of all aircraft (float array)
cjs/world_traffic/speed_kias // Speeds of all aircraft (float array)
cjs/world_traffic/heading_degT // Heading of all aircraft (float array)
cjs/world_traffic/aircraft_lat // Position of all aircraft (float array)
cjs/world_traffic/aircraft_lon // Position of all aircraft (float array)