AIRFIELD LIGHTS TOOLBOX – Version 4

Airfield Lights Toolbox (or AFLT for short) is a comprehensive utility for the creation of custom airfield lights for Microsoft Flight Simulator and Lockheed Martin Prepare3D (collectively referred to as "FlightSim") airports. AFLT includes typical 3D models for the usual airfield light fixtures and approach lighting structures from which you should be able to create just about any airfield light arrangement. Where the stock models are not sufficient for your purposes, you may replace or supplement them with your own.

Illumination of the models may be, depending on the FS version in use, either BGL_LIGHTS, standard effects, inversely-mipmapped effects or 3-plane lights that grow

in size as the user aircraft gets further away (LOD-variable), thus extending their visible range.

For FS9 and FSX, both the 3D models and the corresponding lights are implemented as scenery. Unfortunately, with P3Dv2, Lockheed Martin discontinued support for certain legacy technologies, necessitating the use of SImconnect-controlled "simobjects" for lights whose characteristics are more complex than simply off in the daytime and on at other times. However, for FPS-efficiency purposes, only the AFLT light sources are controlled with Simconnect; the 3D models are still placed as standard scenery items. AFLT will also optionally display user-specified images on the ground when a light itself (not the associated 3D model) is specified to be on the surface (e.g., centerline lights).

This version of AFLT introduces a powerful graphical interface. "Point" AFLT to either an .xml or .bgl file containing an airport definition and an image of the runways, taxiways, aprons and associated lighting will appear.

Characteristics of edge and or centerline lighting for each taxiway and runway are specified using simple dialogs. AFLT automatically configures all standard approach and PAPI/VASI configurations, or you can create your own. Practically every parameter is adjustable, but if you are happy with the defaults, configuring any approach – even ALSF-2 or Calvert-2 – requires but a single mouse click. Or, if you are in a hurry, AFLT will, with only a few mouse clicks, configure the lighting for an entire airport based on the existing Flightsim data. It doesn't get any better than this!

For simplicity, references in this manual to FSX apply equally to FSX, FSX-SE and P3Dv1. The term "P3D" includes P3Dv3 and later versions. P3Dv2 has "difficulties" that preclude use of AFLT custom lighting.

1. INSTALLING, EXECUTING and UNINSTALLING AFLT

Compatibility – Data created with AFLT2 or AFLT3 is not directly compatible with this version. However, you are able to import data from those earlier versions.

Installation (All Versions) - AFLT does not affect the system registry. To install, simply copy the files and folders from the downloaded archive into a new folder of your choice (referred to as "the AFLT folder). **Do not attempt to update an AFLT2 or AFLT3 installation with AFLT4. If you have previously generated AFLT2 or AFLT3 lights that you wish to display alongside any AFLT4 lights you may generate, please refer to the last paragraph of the section of this manual entitled Creating a Library of Elements.**

AFLT is a Microsoft NET.Framework 4.5 application. If NET.Framework 4.5 or later is not already installed on your computer, the "redistributable" can be downloaded from the Microsoft website at no charge.

Settings – To get the full benefit of AFLT's inverse-mipmapped effects, the following sliders under FlightSim's Options/Settings/Display should be set as follows (i.e., hard right):

- Scenery/Special effects detail: High
- Hardware/MIP mapping quality: 8

- Hardware/Hardware-rendered lights: 8
- Hardware/Global max texture size: Massive

Execution – To execute AFLT, double-click on *AFLT.exe*, or create a desktop shortcut to that file. To avoid "privilege" exceptions, AFLT installs with "Run as administrator" privileges. Consequently, the UAC will require confirmation each time you run AFLT.

Windows 7 users may wish to run AFLT in the XP compatibility mode. Running it otherwise may result in a "this program may not have installed correctly" message when AFLT is shut-down. Despite the error message, there is no known problem - other than the annoyance factor.

Initialization - When you shut-down AFLT for the first time, an additional file, *AFLT.ini,* is created and saved to the AFLT folder. AFLT "remembers" key settings from one session to the next in this file. The next time you run AFLT, those settings are restored.

FSX DX10 Preview Mode – AFLT is generally compatible with FSX DX10 Preview Mode – with one exception. When you pan around the airfield or approach from different directions, whole blocks of custom lights disappear and, eventually, re-appear. This is a known deficiency of FSX DX10 Preview Mode and affects several types of lights. To correct, this you must have the applicable *…_LightField.bgl* from Steve Parson's DX10 Fixer in the *\scenery* folder to which you save the AFLT lights and his *fx_dx10field.fx* effect in your *Effects* folder. Note that when you uninstall the DX10 Fixer libraries, that effect is deleted from the Effects folder, so you may have to replace it.

Alternately, use effects with FS9 models when in DX10 Preview Mode.

Automatic Updates - Whenever AFLT is started, it optionally checks the support server to determine if a more recent release is available. If so, AFLT will download that release for you. The updated release must be manually installed in the normal manner (except, of course, you may overwrite the earlier version).

Un-Installation - To uninstall AFLT, delete:

- the AFLT folder and all its contents, and
- any effects whose name starts with "fx_AFLT4_" from your *Effects* folder(s),
- for P3D, remove the *AFLT for P3D* folder from *Documents\Prepar3d v_ Add-ons,*
- any "purged" .bgls you may have saved to scenery folders (see section entitled Purge Airport Stock Data Function), any
- any other AFLT files (names start with "AFLT_") from relevant scenery folders.

2. AFLT STOCK FILES

Airfields Lights Toolbox comes with everything you'll need to start creating all the usual airfield lighting elements.

- a set of 3D base models for each of FS9 and FSX (FSX models are used for P3D and associated textures for the following fixtures are included:
    - runway/ taxiway edge lights ("Edge")
    - split light for runway thresholds ("Split")
    - ground- and tower-mounted strobe lights ("Strobe", "Strobe_T")

- approach lighting structures and approach lamps(“Approach_T”, “Approach”)
- hold-short warning lights (“Wigwag”)
- PAPI/VASIs (“PAPI_VASI”), and
- dual-headed obstruction lights (“Obstruction”)
- aeronautical beacons; flashes red continually and, optionally, strobes during the daytime while flashing red at night. (“Beacon_T”)

The names in parenthesis are the formal names used in AFLT. The Edge and Strobe models may be used in both uni- and omni-directional applications. (Approach lights are always uni-directional.) The 3D model files (.mdl), together with their textures, are saved in AFLT's *BaseModels* folder. Each model is more fully described in Appendix "A".

- a set of 2D images to be displayed when a light is to be at ground level, also described in Appendix "A".
- *BaseModels.txt* - a tabular text file specifying for each base model the function it serves and the offset from the base model’s reference point of the attachment point for the light(s). Its format is described in Appendix "A". If you replace or add a base model, you'll have to update/make a corresponding entry in this file before you will be able to use it.
- *Colors.txt* - a tabular text file specifying, among other things, the RGB value for each color available for use and the position of that color on the texture *obj_AF_Lights* in its various configurations. BGL_LIGHT color, effect color and the color of the model's light lens are controlled by this file. The format is described in detail in Appendix “B”. You may add up to three of your own colors or edit any of existing ones.
- *Lights.txt* - a tabular text file specifying for each light type the base model file to be used and its directional and visibility characteristics – including the size of the related effects. Its format is described in Appendix "C". If you add any base models, you'll also have to make corresponding entries in *Lights.txt* before you will be able to use them.
- *Import.txt* – cross-reference material supporting the import of AFT2 and AFLT3 project data. You will have no need to change this file.
- *Standards.txt* – a tabular text file specifying for each ground-illuminating standard, the 3D model to be used, the associated illumination texture files and the characteristics of the individual light heads. Each model is more fully described in Appendix "F".

3. PROJECTS

AFLT is project-oriented. Each project must have a unique identifier (project ID). Project IDs may be any character string. But, since the related files generated by AFLT will be prefaced with “AFLT*_projectID_*”, you’ll want to keep it short – perhaps the ICAO or IATA code for the airport.

When you create a project, you’ll first be asked to specify a project ID. Then, the Preferences dialog opens, allowing you to select the dimensional units you plan to use for the project. (You may change the selected units at any time later). Once that’s done,

an “open files” dialog will appear. Navigate to the .xml or .bgl file containing the definition of the airport of interest (“**airport reference file**”) and click Open. If the airport has been compiled with ADE’s FS9 complex split option, designate the base airport file. **You should not choose the copy of the airport .bgl in the scenery folder since, if you do, you will be unable to “purge” it later. Instead, make a copy of the “scenery” .bgl, move it elsewhere and use the copy as your reference file.**

Countries using the metric dimensional system generally use approach centerline light spacing of 30 or 60 m. (depending on the approach system) whereas those using the British dimensional system will typically use 100 or 200 feet instead. ICAO specifies the Calvert system using metric whereas the FAA specifies AFLS2, for example, in feet. But if the AFLT2 system is use in a metric country, a centerline spacing of 30m. may be used instead of 100’. So, direct conversion (i.e., using 3.28 ft/m) of the specifications may not be appropriate. For example, 30m. converts directly to 98.4’. But, in the other direction, 100ft converts to 30.49m. – a factor of 1/3. For convenience, PAPI and VASI parameters are specified internally in the British system.

AFLT allows you to program lighting systems in either ft. or m. and to switch between systems. If you have selected feet as your distance units, centerline spacing of ICAO systems will be converted to multiples of 100’. If, instead, you have selected meters, centerline spacing of FAA systems will be converted to multiples of 30m. Other parameters, including those for PAPIs and VASs which are specified internally in the British system, are handled similarly.

You may inhibit this behaviour by checking the Inhibit Interchange checkbox on the Preferences dialog – in which case 3.28 ft/m will be used for all conversions..

You can switch dimensional system at any time. Unless you have directed otherwise, conversions are as described above. Consequently, should you save the converted parameters, some light positions on the AFLT display may shift slightly because in doing so, you have actually changed their physical location.

It is expected you will use the same dimensional system for all actions affecting a given airport. So, conversion will not be a frequent occurrence once your project has been fully specified. But, where conversion has occurred, you should carefully check all parameters. AFLT’s methodology may not properly handle every instance. That being said, the difference between the two factors is only about 1%, so an uncorrected conversion is not likely to be noticeable in the finished product.

The AFLT folder contains a folder named “Projects”. All project data is saved in sub-folders named as the Project ID, including 3D .mdl files, associated textures, object libraries and placement data.

For FS9 and FSX, AFLT will optionally copy the object libraries it creates and textures to another folder of your choice – the Scenery Folder. If used, the folder’s path is entered on the Make Library dialog. Normally, the Scenery Folder would be the folder containing the airport’s *scenery* folder as specified in the Scenery Library and its associated *texture* folder. But, you can have the object libraries and textures saved to any location. For P3D, AFLT saves all files in the folder *Documents\Prepar3d v_ Add-ons\ AFLT for P3D* - even if you create custom lighting for more than one airport.

4. QUICK START

The first time you start AFLT, a blank drawing surface with a menu bar appears. Click Create New Project (Project menu). Enter a Project ID and select the dimensional units you intend to use. Then, navigate to the file you intend for the airport reference file. If there are no error messages, you should see an image of the airport showing runways, taxiways and aprons – and lighting based on the stock lighting specified in the airport reference. (Note, the positions of the lights will not match the positions of the stock lighting in FlightSim. AFLT uses a proprietary algorithm to place lights to better reflect the real-world.)

The custom lighting you see will have been generated with default parameters. Should this not reflect real-world conditions at that airport, select Default Parameters for This Airport (Options menu) and make any necessary changes. These changes will be applied and the display regenerated using them immediately upon closing the dialog. These default parameters (whether edited or not) are saved with each airport and will be automatically invoked whenever the airport project is loaded.

Move the mouse over a runway or taxiway (it turns orange) and left click (it turns red, i.e. selected). Right-clicking anywhere on the drawing surface brings up a context menu. Select the desired operation from the context menu and “fill in the blanks” on the light-specification dialog that appears. When you close that dialog, the lights you have specified will appear on the drawing surface connected by one or more narrow lines. You can change or delete any programmed lighting by selecting the airport surface, lighting strip or light element of concern, right-clicking and selecting from the context menu.

You may wish to exclude some or all of the stock lighting in your project. To do so, load the airport and delete all the lighting you don’t want to include. To delete all stock lighting clear the screen with Projects/Clear Placement Data. Then, Save Placement Data. This will create a *Placement.xml* file which will prevent the unwanted stock data from appearing on subsequent startups of AFLT. (If a project unexpectedly starts-up with a blank screen, perhaps you have an empty *Placements.xml* file in the Project folder.)

Should you delete some stock data you really wish to customize, it’s easy to retrieve. The bottom item in most of the context menus is “Use Stock Lighting”. Select it and the all “stock” lighting will be displayed over the airport image. A small dialog will also appear in which you can select from “stock” lighting in a variety of ways. Click Apply after each selection. When you close the dialog, the stock lighting will be replaced by your currently programmed lights plus whatever “stock” lighting you selected. You may view the “stock” lighting at any time by clicking on the Stock Data in the View menu. But, to adopt stock lighting, you must use the context menu.

If you wish to supplement your project with data from an earlier AFLT2/3 project, click Import AFLT2/3 Project Data under the Project menu. You will be invited to locate your AFLT2/3 Library Folder after which a small dialog will appear. Click the Import File button and navigate to the project file (.bgl, .xml or .def) to be imported. The main display will be updated with each file. Close the dialog when finished.

Once you have implemented the desired lighting plan (or at any other time), click Save Placement Data (Project menu). Each time thereafter this airport project is loaded, the

last-saved lighting data will be displayed. (The airport image is always derived from the reference airport file. At each startup, AFLT will automatically display the airport "stock" lighting adjusted as reflect lighting as was last saved.

To create the object libraries, click Compile Data (Project menu). The Make Library dialog will appear. Select the Flightsim version to which the object libraries will apply, specify the Scenery Folder (not for P3D), select the desired general characteristics of the lighting and click Create/Save Library. A message will pop up telling you where AFLT will save the library. (You can abort at that stage if it not where you want the files placed.) Then, you'll see some windows flash on and off your screen (the compiler at work) and, finally, a message confirming that the library has been generated.

Run Flightsim. Voila! Your lighting appears. But, any stock data in the airport .bgl also appears. Use AFLT's Purge Airport Stock Data function or edit the airport .bgl file (using ADE or another airport editor) to remove the stock lighting.

Your satisfaction with the custom lighting created will likely depend on your knowledge of the full capability of AFLT and your use of some of the additional features. Consequently, it is strongly recommended you read this manual from cover to cover, especially the section on SIMOBJECTS if you are creating lighting for use in P3D.

5. GRAPHICAL USER INTERFACE

Following is an overview of the operation of the graphical interface, which displays the runways, taxiways and aprons of the selected airport and associated custom lighting.

Displaced thresholds are indicated by a series of Vs on the displaced side. Taxiways are divided into segments comprising contiguous links not interrupted by a crossing taxiway or runway. Where necessary, links within a segment have been re-oriented so as to all point in the same general direction, i.e., the end of one link is the start of its immediate neighbour in the same taxiway.

When you move the mouse cursor over one of the airport surfaces, that surface will turn orange. Orange implies "captured". Moving the cursor over an individual light results in an orange circle around the light. Associated lights (e.g., runway edge lights) are connected on the display by a narrow line. Placing the cursor on that line causes the line to turn orange. As well, if you have selected the optional tooltips, a summary of the surface/light/line characteristics is shown.

For convenience, when the cursor is over a runway, a chevron is drawn at the primary end. When the cursor hovers over a taxiway the direction of the link under the cursor is indicated by a chevron.

Left-clicking on an orange surface, light (except members of arrays such as runway end lights, approach lights or PAPI/VASIs) or line selects (i.e., it turns red) that element for the subsequent operation. A single click on a taxiway link selects that link. Once a lighting or surface element is selected, a right-click anywhere on the screen brings a context menu into view listing the functions available for that element. To place an independent light or line of lights left-click anywhere other than an airport surface (to

deselect any selected surfaces or elements) and then right-click at the point where the light is to appear or the line is to start.

For runways, the context menu functions allow you to add, edit or replace each type of associated lighting individually, e.g., edge lights, approach lights, etc. or to delete same. For taxiways, the only unique variable is the left/center/right specification. All other taxiway lighting parameters are global and specified using Default Lighting Parameters (Options menu). For lines of lights, you can delete all members of the line or insert a new member. You can create, edit and delete individual lights.

Some of the element creation/editing dialogs may require positioning information. The location where the mouse-click selecting the context menu function occurred is retained for use in such dialogs. Most dialogs that uses positioning information will also accept user aircraft position instead if Flightsim is running.

Generally, light-specification dialogs open with only a single or a few field(s) enabled. All the other fields are disabled (grayed-out). Once data is entered into the key field(s), one or more other fields are enabled – and so on until all fields on the dialog are enabled - other than the Place Lights button. The Place Lights button is only enabled when all required data has been entered. If the Place Lights button is not enabled, there will be some textbox or set of checkboxes or radio-buttons that need attention. For further detail on these dialogs, please refer to the relevant section below.

When the Place Lights button is enabled and clicked, the dialog is closed and the symbols for the lights reflecting the specification appear on the airport display.

Generally, a line of lights or individual light whether in a line or not may be moved by selecting it and “dragging” it with the mouse.

Once you’ve created your custom lighting, click Make Library and select the Flightsim version. If you’ve done all this correctly, your AFLT light elements should be displayed the next time you “fly” to the airport of concern. Don’t forget to disable the corresponding lights in your airport definition file. The Purge Airport Stock Data function (Projects menu) will do this for you.) Otherwise, you’ll have both sets of lights.

6. OPERATING OVERVIEW

The starting point for every light created with AFLT (generally referred to as an "element"), is a base model, i.e., a 3D model of the light fixture, or support or whatever. AFLT provides a set of stock base models (mdl files) and textures for all usual light types for both FS9 and FSX. P3D uses FSX stock base models. These stock models should satisfy most of your requirements. Each of these models has a single "empty" attachpoint, the location of which AFLT uses to position associated lights, whether BGL_LIGHTS, effects or LOD-variable lights. The positions of the lights relative to the location of the attachpoint in each base model are defined in *BaseModels.txt*. Should you add or replace stock base models with your own models, you must make a corresponding entry in BaseModels.txt (see Appendix “A”).

Base models are assigned to one of the following “categories”:

- Edge General purpose edge light

- Split Displays different colors on the front and back sides
- Approach Uni-directional approach light head
- Approach-T Approach-lighting structure with one or more heads
- Strobe Fixed-frequency (2 cycles/second) flashing light
- PAPI-VASI PAPI/VASI applications in a variety of configurations
- Obstruction (Usually) building-mounted, dual headed red obstruction light
- Beacon Tower-mounted flashing red light with optional daytime strobe.
- Standard One of a variety of available ground-illuminating standards

The Edge and Strobe categories may be either omni- or uni-directional. Their colors and intensity are user-specified. These models as well as Splits may be specified as surface-mounted, i.e., the lights are displayed at ground level without the 3D model or optionally, with a suitable image on the ground.

Each “category” is expanded into one or more “styles”, primarily to reflect their directional and visibility characteristics. The “style” of each light (or set of lights) is user-selectable and should allow the creation of representative lights for all usual airfield applications. The file *Lights.txt* sets out the available light styles (see Appendix “C”). Users may add custom light styles by modifying *Lights.txt.* Following selection of a light style, the user assigns color(s), intensity and other characteristics as applicable.

AFLT supports a full range of pilot-controlled lighting, PCL, through the specification of on/off criteria using a system global variable (e.g., a COMS frequency or a transponder code) and, where appropriate, airport operating hours. With FS9 base models, if PCL is used during the daytime (for example, in low visibility conditions), in addition to the lights being on, the light lens "glow". (That's what the "day-glo" texture is used for.) Unfortunately, for technical reasons, this “glow” capability is not available with FSX or P3D models.

When used with P3D v3 or later, AFLT’s custom lights will turn on automatically in low visibility.

AFLT allows the user to select from four light sources at compile time:

- BGL_LIGHTS (not available for P3D)
- standard effects
- inversely-mipmapped effects
- variable-size, 3-plane models, referred to as “LOD-Variable” (P3D only)

The characteristics of each is described in Appendix “D”

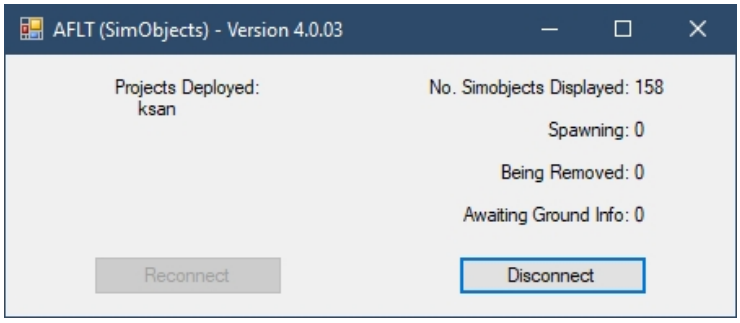
AFLT does not actually attach the lights to the 3D model with which they are associated. The 3D models are all compiled and saved as scenery. The separate .mdl files for the lights are created on-the-fly and positioned in accordance with the location of the attachpoint of their respective 3D model and the data in *BaseModels.txt*. Lights with identical on/off status, e.g., runway edge lights, are grouped and controlled by a single process. This, together with the separation of lights from the 3D models results in a significant reduction in FPS impact over earlier versions of AFLT, especially in P3D which would otherwise require each individual light to be a simobject.

Like any other scenery, in order to be rendered by Flightsim, the elements (other than simobjects) must be collected in an object library file. For Flightsim versions prior to

P3D v3, AFLT optionally copies the object libraries and textures to the *\scenery* and *\texture* subfolders of the airport with which they are to be used (as specified in the Scenery Folder field of the Make Library dialog). For P3D v3 and later, AFLT creates (or adds to) a P3D Add-on Package (folder) and places that Add-on Package, named *AFLT for P3D*, in the appropriate *Documents\Prepar3D v_ Add-ons* folder. For details of a P3D Add-on Package, please refer to the Add-ons section of the SDK.

After starting P3D, you'll notice a new icon in the Windows Task Bar. That's the SImconnect application controlling the Simobject-based lights. The associated dialog has no use normally, so it is minimized on opening and may stay that way. It will close automatically with P3D.

But, if you click on the icon, you'll see the dialog below. It shows which projects Simconnect has deployed at that moment, the total number of simobject-based lights under control and the number of those lights in transition. (Deployment of simobjects is metered. That is, once within range of an airport or, conversely, having left an airport area, the rate at which new lights are deployed and those no longer needed are removed is controlled by Simconnect on a light-by light basis, thus avoiding the instantaneous initiation or deletion of perhaps several thousand or more lights, a situation that would overload Simconnect and impact control of the user aircraft. As well, this dialog facilitates testing of AFLT by allowing an updated set of lights to be compiled and installed without stopping P3D. Once P3D's startup is complete, the Disconnect button will be highlighted. To "tweak" your lights, click Disconnect, make whatever changes are necessary and re-compile the lights. Then click Reconnect. The revised lights should appear.



Simconnect Dialog

If you open this dialog and close it other than by minimizing, the Simconnect application will close and you will lose all your Simconnect-controlled lights.

Please note, any lights that do not require on/off control other than day/night are implemented as scenery objects – even in P3D. The above dialog deals only with the Simobject-based lights controlled by Simconnect.

7. MENUS AND OTHER CONTROLS

AFLT's Main Panel is shown below. It is the primary "working surface". It provides:

- a detailed image of the runways, taxiways and aprons of the airport,

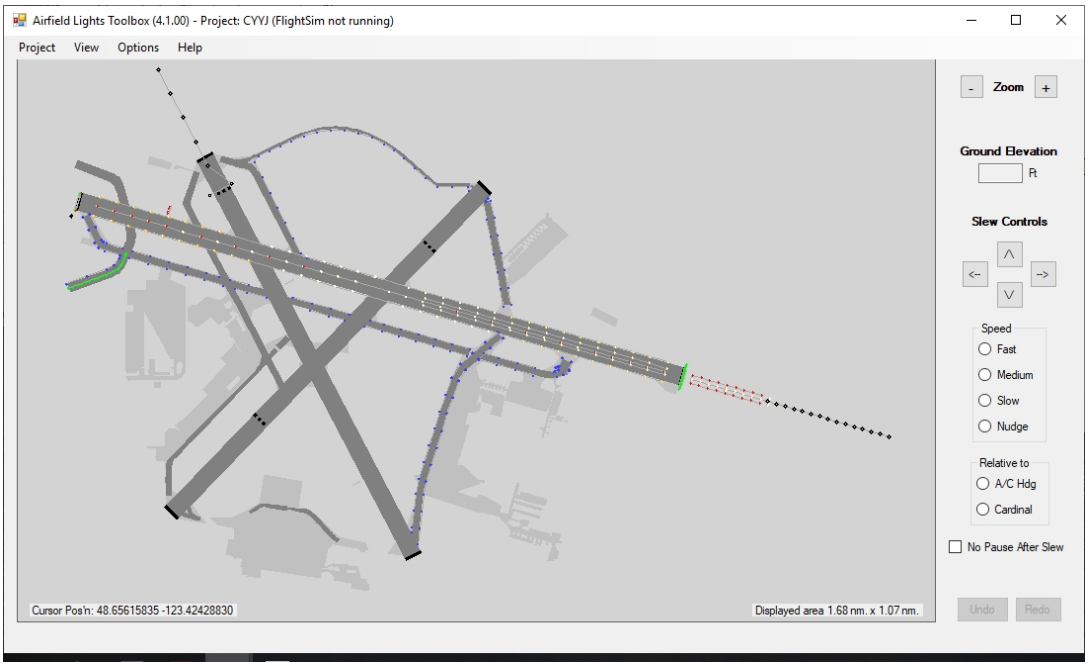
- currently-specified lights,
- menus of the various functions available,
- display zoom controls (the mouse wheel can also be used for zooming),
- user aircraft slew controls, and
- textual display of the geographic cursor position, the geographic size of the displayed area and the ground elevation under the user aircraft.

Across the top of this dialog is the main menu bar containing four items

- Project– creating, opening, importing and compiling data files and for designating an airport of interest
- View – selecting the airport surfaces/characteristics displayed
- Options – selection of options and display formats, and
- Help – version information and on-line access to this user manual.

When Flightsim is running, AFLT reports the ground elevation under the user aircraft near the upper-right corner of the Main Panel. The position of the user aircraft is also displayed

The Zoom controls are located in the upper right corner of the Main Panel. Left-clicking these buttons will increase or decrease the geographic area displayed by 10%. If you depress and hold-down the left mouse button while over one of these buttons, the displayed area will continue to increase or decrease for so long as the mouse button is held down. You may also zoom the display from the mouse-wheel with a 10% change per click. Scroll bars are displayed as necessary.



Main Panel

To change the center location of the display, depress the mouse-wheel with the cursor positioned anywhere in the display area and move the mouse. The display will follow. Alternately, a related item appears at the bottom of most context menus:

- Re-center at Mouse position – right-click where you want the new center to be and select this item.

When Flightsim is running (connection with AFLT will be automatic), you may slew the user aircraft:

- using either the Main Panel Slew controls or by moving the cursor over the aircraft symbol on the display,
- depressing the left mouse button and dragging the aircraft symbol (and the user aircraft) to the desired position, or
- with the Move User A/C to Cursor Position item in the context menu.

Normally, Flightsim will be paused following any slew operation. You may override this by checking the No Pause After Slew box.

Undo and Redo buttons are below the slew controls. (Ctrl-Z and Ctrl-Y may also be used.) If you delete or add back a node near the edge of the display, the data may re-center. Most operations on the display can be undone/redone.

Project Menu

The Project menu is used to start new projects, load and save placement data, create the object libraries and select the airport reference file. Several of these menu items have an associated listbox that displays the names of files recently selected for that purpose. To reselect one of those files, simply click on its name. To select a new file, click on the menu item and navigate to the file of interest.

The Projects menu contains the following items:

- Select Project – Select from a list of projects
- Create New Project – Start a new project. As noted earlier, you should not choose the copy of the airport .bgl in the scenery folder as your airport reference file since, if you do, you will be unable to "purge" it later. Instead, make a copy outside any active scenery folder of the "scenery" .bgl and use the copy as your reference file.
- Import Project Data from AFLT2/3 – Import data from a AFLT2/3 project
- Delete Project – Deletes the currently-selected project
- Save Placement Data – Saves current placement data to the Project Data Folder. Two files are created: *Placements.xml* and *LinkLight.xml*. A backup of each is saved in the Project Folder should you inadvertently save erroneous data. Should it be necessary, both should be restored.
- Save Placement Data as … - Saves the current placement data to another location
- Clear Placement Data – Clears any existing data from the display
- Compile Data - Opens the Make Library dialog.
- Purge Reference Airport Stock Data – Initiates The Purge Airport Stock Data function (see PURGE AIRPORT STOCK DATA FUNCTION below)
- (Re)Load Airport Image - Loads airport data from a .bgl or .xml file designated by the user and displays an image of the airport surfaces. If you have airport files with varying "stock" lighting arrangements, you may select from among them at

any time. If you have saved any placement data (Placements.xml in the Project Folder), you will have the option of preserving it for use with the new reference airport. **But, do not retain any earlier placements if those placements are not directly applicable to the new reference airport file. Also, when a new airport image is selected – even if it is identical to the earlier one - the records of all deletions from the earlier stock data will be lost.**

View Menu

The View Menu, as the name suggests, controls what is seen in the display area at any time.

Airport designers often use closed or very narrow (0' or 1' wide) taxiways for special purposes. AFLT classifies as a "narrow" any taxiway whose width is less that a user-specified value (set from Set Taxiway Wide/Narrow Width). While narrow taxiways may be displayed, they are otherwise largely ignored.

Any combination of the following airport surfaces may be displayed:

- runways
- regular ("wide") taxiways > *n* (i.e. wider than the "wide/narrow" width)
- "narrow" taxiways < *n* (i.e., "narrow" taxiways)
- closed taxiways (processed as regular taxiways when in view)
- taxi- and parking-paths as well as an outline of parking stalls
- aprons

If you suppress the display of runways, the runway links are displayed instead.

The View Menu also contains the following functions

- Illumination – displays the illumination pattern of each standard
- Stock Data – the "stock" lighting from the current airport reference file is displayed in place of the programmed lighting
- Light Size Increase/Decrease/Auto – allows the user to control the size of the displayed lights
- Set Taxiway Wide/Narrow Width - the dividing line between "wide" and "narrow" taxiways
- Set Displayed Width of Paths/Narrow Links - unless set at 0, all paths and narrow taxiways are displayed using this width irrespective of their otherwise specified widths
- Show Light Count – displays the current total number of lights in each category
- Dark Background – displays the light symbols on a dark background for better contrast
- On with PCL – displays only those lights subject to pilot control or that are otherwise turned on in low visibility.

Options Menu

The Options Menu contains the following items:

- Show Tooltips – When checked, a tooltip is displayed whenever the mouse cursor hovers over a light strip or element or the user aircraft symbol displaying positional and other information.
- Display Formats/Units – opens a second dialog from which you select lat/lon display format and distance and elevation units.
- Select Proximity (pixels) - the maximum distance between the mouse cursor "hot-spot" and the center of a displayed node or the user aircraft symbol for selection of that node/symbol to occur.
- Mouse Breakout (pixels) – the minimum distance the mouse cursor must be moved before a node or the user aircraft symbol will be "dragged" from its position.
- Default Parameters – Opens a dialog (see next page) for specification of global runway and taxiway lighting and associated parameters, such as: color, spacing and offsets. Dimensional items are specified in both feet and meters. One set of default parameters is saved for the purpose of initializing new projects. But, so that you may easily use different defaults in each project, a set of default parameters is held with each project.

  To open the dialog, click on either:
  - Default Parameters for This Airport, or
  - Default Parameters for New Airports,

  depending on which set you wish to edit. If you wish to apply a change to more than one project, you'll have to edit each project individually.

  Please note, Spacing and Min Spacing are only effective on straightaways. Placing edge lights across from each other on straightaways requires a light on each side at each end of a straightaway. So, on very short straightaways, the spacing of those lights may violate the Min. Spacing specification. Resolution of such situations requires manually moving/deleting lights.

  Several parameters require explanation:
  - C/L Relative Size – Runway and taxiway centerline lights often appear distractingly large when drawn at the same size as the respective edge lights. This control allows you to reduce the size of centerline lights to a proportion of the edge light size

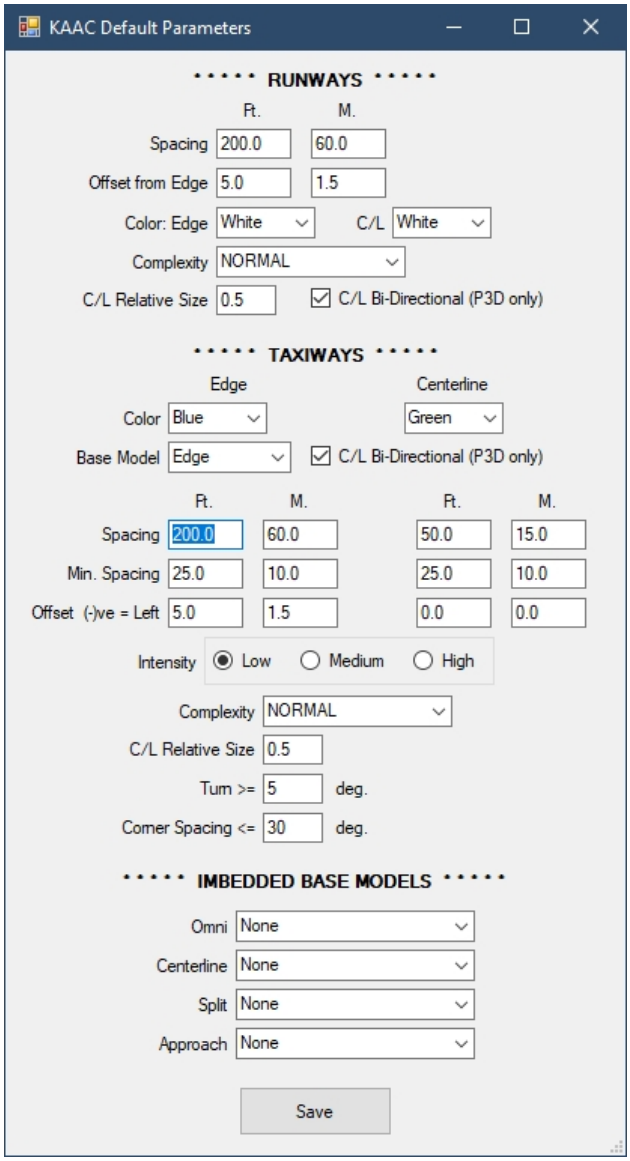
  - C/L Bi-Directional (P3D Only) – Centerline lights are usually embedded in the runway or taxiway surface and, while nominally omni-directional in face are two lights, one aimed forward, the other back. When this control is checked centerline lights specified as "Edge" type will be shown as two such light sources. This feature is available only with P3D.

  - Turn >= - If the heading of two consecutive taxiway links differs by more than this amount, their intersection will be handled as a "turn", i.e., an edge light is placed at the beginning and end of the turn and intervening lights spaced evenly based on the following parameter.
  - Corner Spacing <= - Within a "turn", edge lights are evenly spaced based on a subtended angle less than the specified value.

While AFLT does not display a base model when a light is on the surface, it will place another model or display an image of your choice on the ground. As discussed in Appendix "A", AFLT includes three images of typical inset light units:

- 8"/22cm for omni-directional applications (filename "Surface_Omni")
- 8"/22cm for centerline applications (filename "Surface_Bi_Small")
- 12"/30cm for applications where a larger bi-directional unit is needed, e.g., surface-mounted approach lights (filename "Surface_Bi_Large").

These images may be replaced or supplemented by your own or (if you've got lots of processing power) by custom 3D models.



Default Parameters Dialog

The application of these images is specified near the bottom of the Default Parameters dialog. Four categories of surface-mounts are available:

- Omni (for taxiway and runway edge light applications),
- Centerline (typically the small bi-directional image, but the associated light will be omni-directional),
- Split (e.g., runway end applications with displaced thresholds), and
- Approach (typically, the larger bi-directional unit).

- Don't Purge PAPI/VASIs - Stock PAPI/VASI lighting may be superior to AFLT's at close range. However, until P3Dv4, PAPI/VASI visibility was far too short - a situation overcome by AFLT with inverse-mipmapped and LOD-variable lighting options. Consequently, in some situations, it may be desirable to have both stock and AFLT lights. Checking the Don't Purge menu item accomplishes this (but you will have to adjust the position of the relevant AFLT PAPI/VASI to agree with the stock item.
- Check for Updates at Start-up - AFLT can access its website server to determine if a new general release or development release is available. When either is checked, AFLT will attempt to find an updated version at start-up. If that operation is suppressed and you click on this item, AFLT searches for an update immediately. You can also check for an update from the Help menu.
- Reposition Aircraft when Data Loaded – When checked, if FlightSim is running when a project is loaded, the user aircraft will be repositioned to the geographic center of the data.

8. CREATING/EDITING/DELETING LIGHTS

Taxiways are divided into surfaces comprising the contiguous links (segments) not interrupted by a crossing taxiway or runway. A single click on a taxiway link selects that segment only. Use <Ctrl> and <Shift> to select multiple links in a surface. Double-click to select all links in the surface. Once a surface or taxiway link, light or line is selected, a right-click anywhere on the dialog brings-up a context menu listing the functions available for the selected element. To add a single light or a line of lights, right-click with nothing selected. The context menu will contain an appropriate subset of the following:

Selected	Functions	Cursor Posn Used
Runways	Add/Edit Edge and C/L Lights	No
	Add/Edit Approach Lighting	No
	Add/Edit PAPI/VASI	Yes
	Add/Edit Runway End Lights	No
	Delete (each of the above)	No
Taxiways	Add Dual Light Bars	Yes
	Edit Link Lighting	No
Individual Light [1,2]	Edit Light	No
	Move Light to User A/C Position	No
	Copy Light	No
	Paste Light	Yes
	Join Lights	No

Selected	Functions	Cursor Posn Used
	Delete Selected Light(s)	No
Line of Lights [2]	Edit Line Parameters	Yes
	Insert Light into Line	Yes
	Join Lights	No
	Delete Line	No
	Extend Line	Yes
None	Add Single Light	Yes
	Add Line of Lights	Yes
	Add Light Standard	Yes

[1] Certain of these functions are not available for taxiways that have been moved or otherwise edited.

[2] Certain of these functions are not available for runway end lights, approach towers or PAPI/VASIs. Use the custom editors instead.

The following function is always available from the context menu:

- Re-center (display) at Mouse Position

and, if Flightsim is running, also:

- Move User A/C to Mouse Position; if a light is selected at the time, the heading of the aircraft will point to that light.

Regarding deletions, for taxiway lights, you may either use a “delete” function or choose the Edit Link Lighting from the context menu and adjust the lighting as necessary. When you delete lines of lights associated with a runway, e.g. an element of an approach array, AFLT will delete the same item from stock data. If you delete a line of lights not associated with a runway, that lighting cannot automatically be deleted from stock data. To delete such lighting from stock data, select Stock Data from the View menu and delete the item again. While you may delete individual lights from a line in placement data, there is no way for AFLT to accomplish the same deletion from stock data. The alternative is to delete the entire line from stock data and re-create the line in AFLT

Note that the centerline light at taxiway intersections will not be lit if more than two taxiways intersect. This is to avoid the “spider web” of lights so common in Flightsim. Such intersections require manual placement of centerline lighting where desired.

When pasting/inserting individual lights, if the cursor is hovering over a line of lights, the light is inserted into that line. Otherwise, the light is placed at the location of the cursor. Select the light to be copied, right-click and select Copy Light from the context menu. Then, at each point where the light is to be pasted, right-click again and select Paste Light from the context menu. Lights may be pasted into existing lines by right clicking on the line when the light is to be pasted. If the light you are pasting is dissimilar to those already in the line, AFLT will ask for confirmation.

Additional segments can be added to a line by selecting the light at the end where the segment is to be added, right-clicking and clicking on Extend Line in the context menu.

Joining lights allows multiple (previously) individual lights or lines of lights to be handled as a single entity. To join lights, select either:

- the individual light (that will become the first or last light in the line), or
- the first or last light in an existing line of lights,

right-click to bring up the context menu and select Join Lights. This enables the "hot cursor". Then, hover the cursor over (capture) the individual light or the light at the end of the line to which the selected element is to be added, and then left-click. If the light you are adding is dissimilar to those already in the line, AFLT will ask for confirmation.

Initiating Other Functions - Upon selecting a context menu function, a new dialog will appear to support the creation or replacement of the selected element. If the selected element (e.g., edge lights) already exists for the selected surface, the dialog will be initialized to reflect that element. Otherwise, the dialogs are all initialized with representative default parameters.

Once the new specification is complete, click the dialog's Place Lights button. The dialog will close and the results will appear on the airport surface displayed as a series of connected symbols.

Selecting Delete simply deletes the lights of that type following confirmation.

Some of the element creation/editing dialogs may require positioning information. The position of the mouse when right-clicked to bring up the context menu is retained and made available to the selected dialog. Most dialogs that use cursor-positioning information will also accept user aircraft position if Flightsim is running.

All the lights in a line are initially placed:

- at, or in the case of tower-mounted lights a fixed distance above, ground level or the specified elevation,
- using a single, specified light style, and
- unless surface placement is designated, with a 3D model.

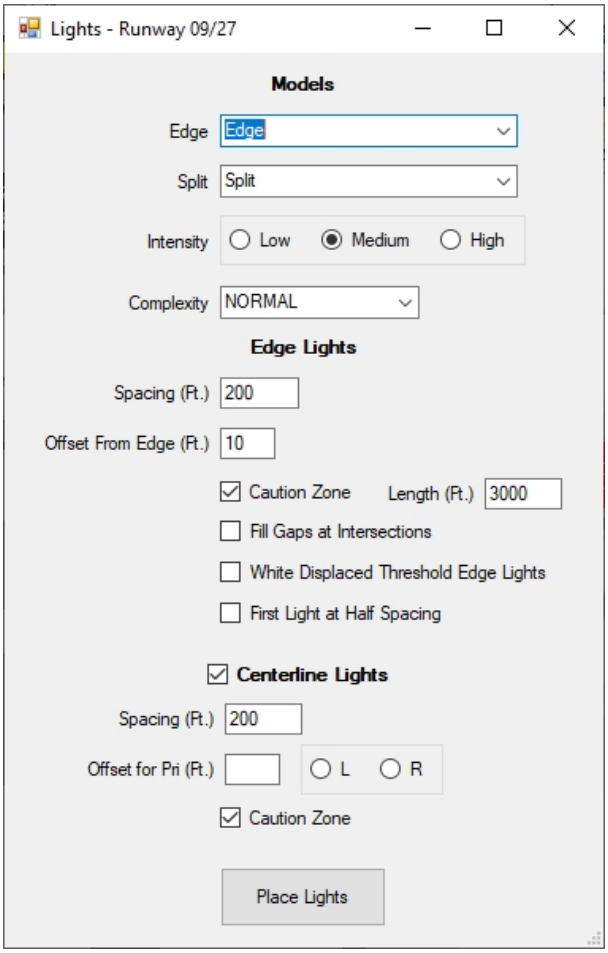
If you wish to vary these characteristics for an individual light in a strip, following initial placement, select and edit that light as desired.

Moving Lights – Lights may only be moved by "dragging". An entire line of lights may be selected and "dragged". Within a line, individual lights may be moved as follows:

- in a line created as a line of lights, the end lights and those at "corners" may be – "dragged" in any direction; upon completion of the "drag" operation, intermediate lights (between ends and/or "corners") are automatically moved to form a series of straight lines; only ends and corners may be selected;
- in other lines (e.g., edge lights or approach light elements), individual lights may only be moved in the direction of the line.

Illustrated below are the various light specification dialogs. For the most part, these dialogs are self-explanatory.

Place Runway Edge and Centerline Lights

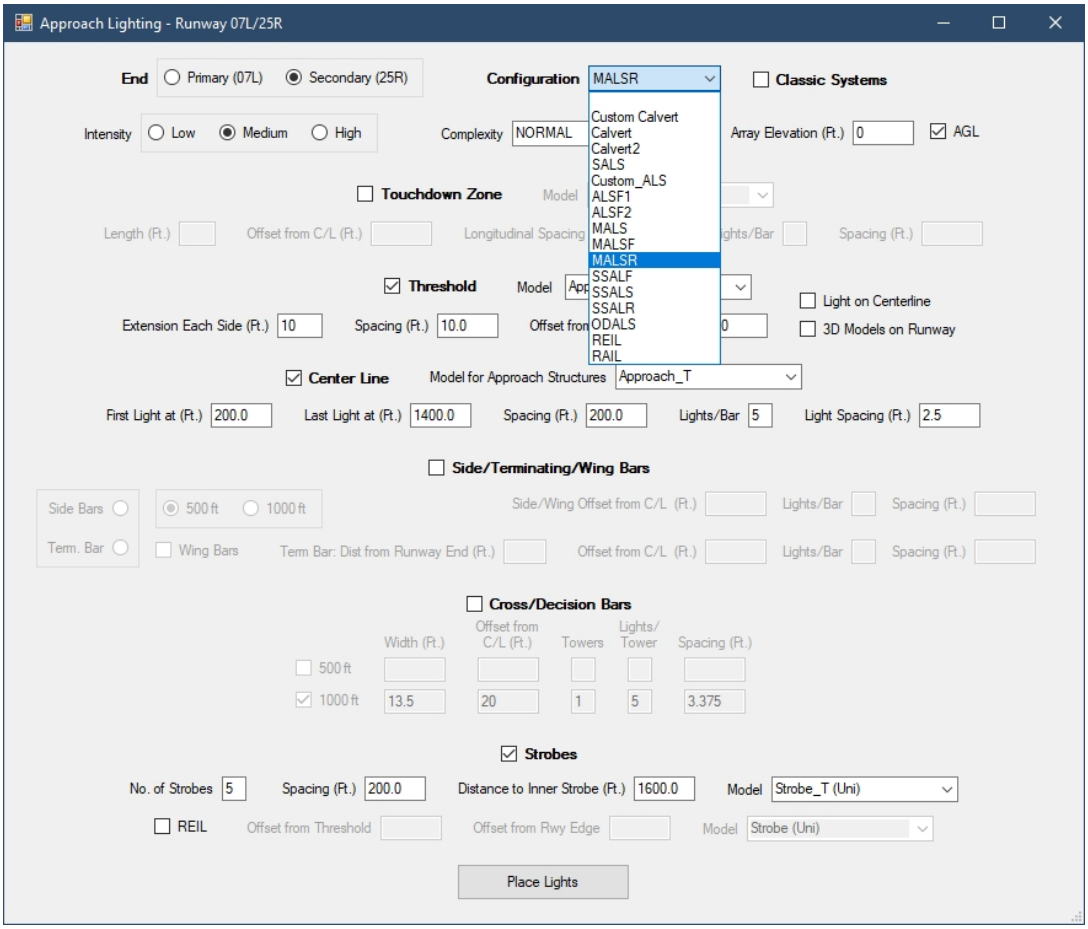


Place Runway Lights

Place Runway Approach Lights

AFLT supports all the modern approach lighting systems included in Flightsim. However, in the case of AFLT, you can tweak these systems to your heart's content. AFLT also supports a variety of classic Canadian and US systems. To access these systems, you must first click the Classic Systems checkbox.

The dialog for modern FAA systems is shown immediately below.



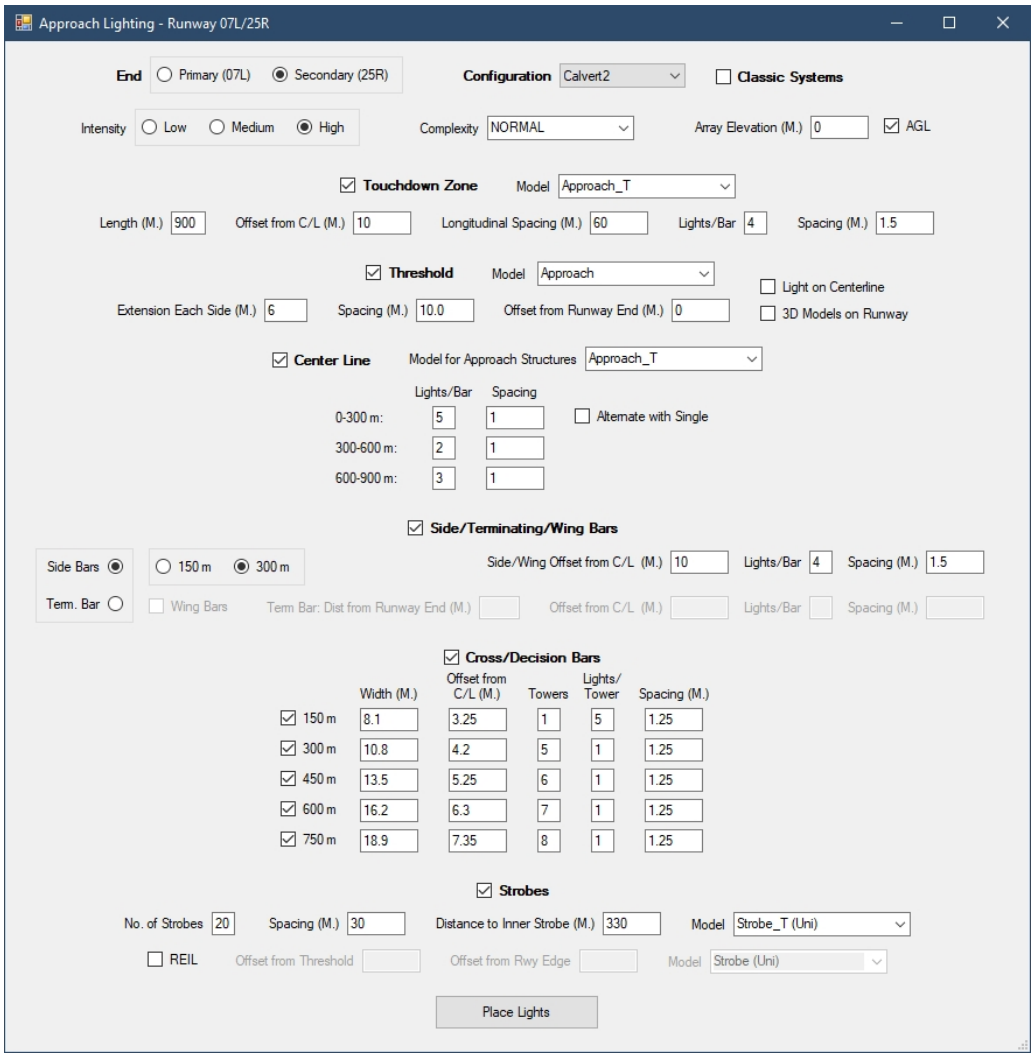
Place Approach Lights (FAA)

Most items should be self-explanatory to those familiar with the configuration specified. However, two in the upper right-hand quadrant bear explanation:

- 3D Models on Runway checkbox under Threshold Lighting - AFLT automatically suppresses the 3D model for any runway, taxiway or approach light on a runway surface and displays element as a surface light instead. However, threshold light bars in approach lighting systems are often located just on the runway surface (where the 3D model would normally be suppressed). Checking this box – which is only enabled when needed – ensures all lights in the bar have 3D models.
- Array Elev and associated AGL checkbox – The FAA recommends that all lights in an approach array be in a horizontal plane. By default, AFLT places all approach lighting elements on the ground (i.e. 0 AGL). If the terrain is relatively

flat (or has been flattened), AFLT is generally compliant. If the approach is over water (in which case any elements in the water are at sea-level) or over undulating terrain, this control forces all lights to the same elevation. If the elevation is set to “0” when AGL is checked, the elevation checkbox will be set to ARP elevation. Otherwise, it’s up to you to specify the desired elevation.

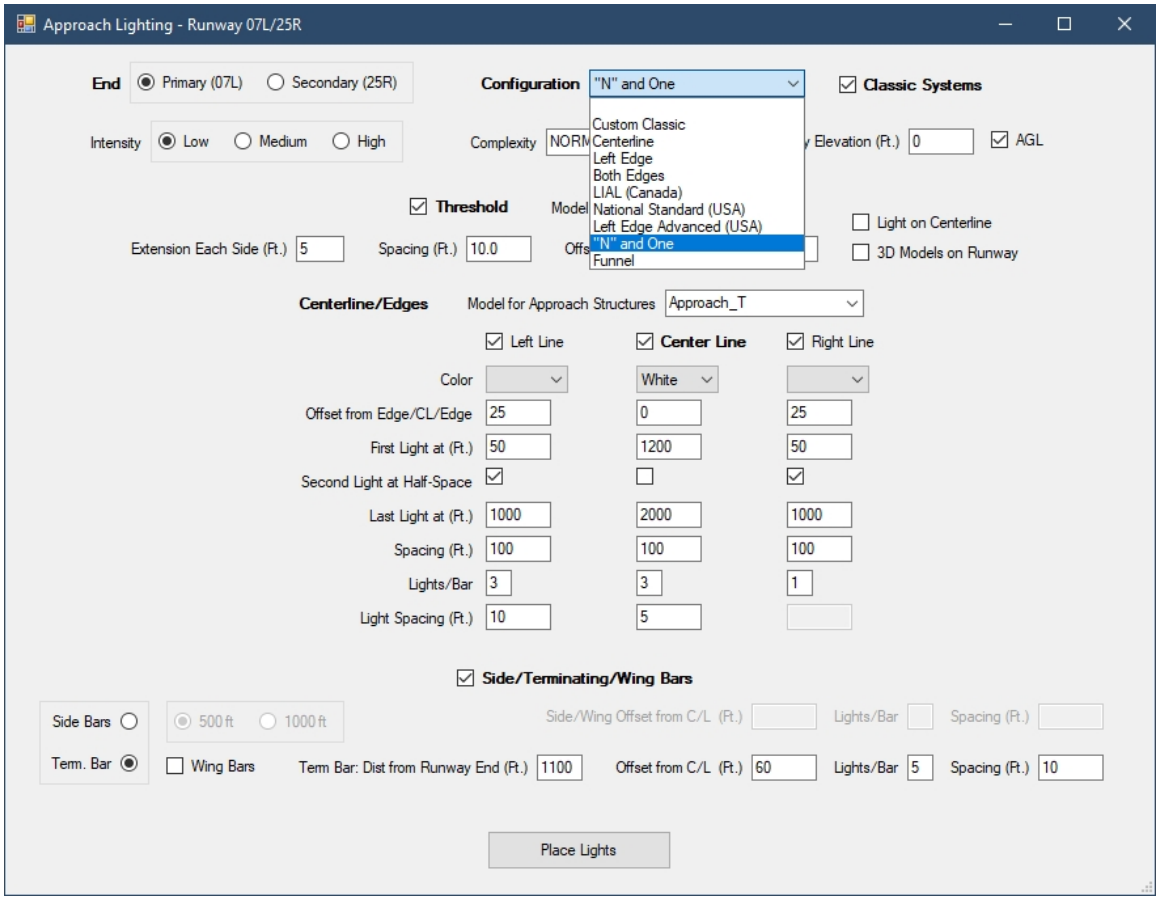
While you may select either end of the runway in the Approach Lights dialog, and also in those for Runway End lights and PAPI/VASIs, only one end may be added or edited at a time. When you click on Place Lights, only the lights for selected end of the runway will be updated.



Place Approach Lights (Calvert)

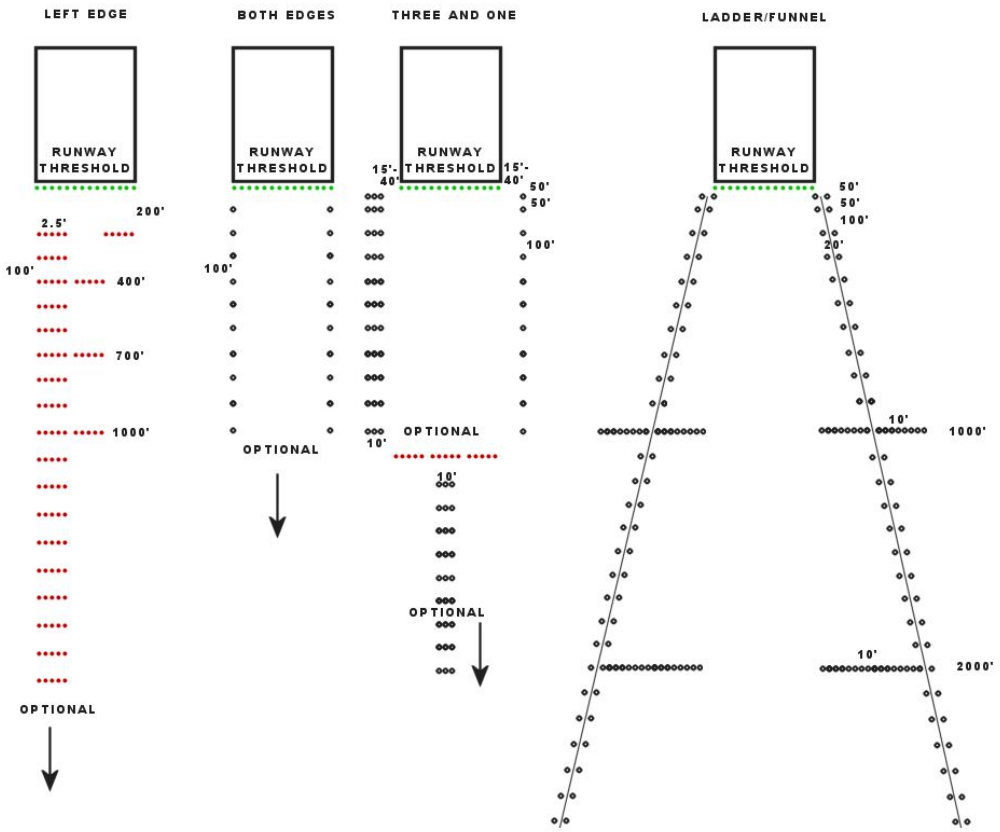
If you select a Calvert-based system, the dialog takes on a somewhat different appearance as shown below. Again, the titles of the fields should clearly indicate t5heir purpose

Finally, the classic systems. Most, but not all of, the classic systems use the dialog below. While the list of pre-formatted systems concentrates on Canada and the USA, between the three dialogs, each of which includes a “custom” mode, you should be able to specify just about any approach lighting system that exists.



Place Approach Lights (Classic)

Shown below are the basic patterns of several of the classic approach systems. The one labeled Left Edge in the illustration is called Left Edge Advanced (USA) in the Configuration dropdown box. Left Edge in the Configuration list is a simple line of one or more lights extending from the left edge of the runway. LIAL is an early Canadian system and is still in use at smaller airports. National Standard (USA) is an early version of MALSF. The “N” in “N and One” stands for the number of lights along the left edge of the array. Three and One in the illustration below is an example of “N and One” with 3 lights per tower along the left edge.



CLASSIC APPROACHES

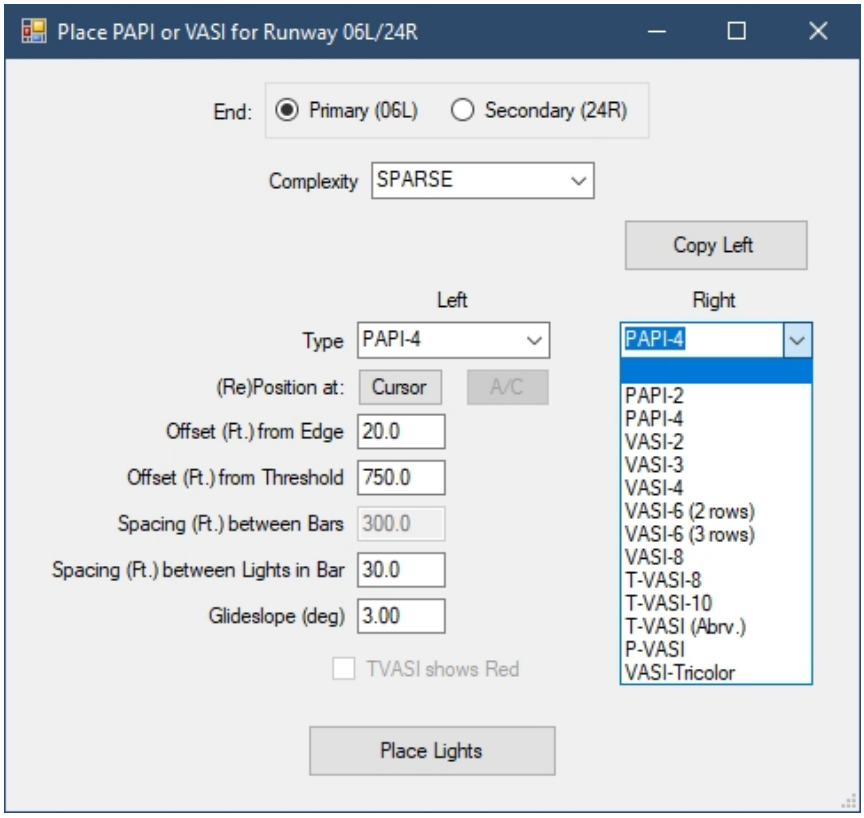
Drawn by Tom Gibson

NOT TO SCALE

Place PAPIs and VASIs

The dialog for specifying PAPI/VASI position and characteristics is shown below. While covered by the Type combobox "dropdown", there are an identical set of controls for the right hand side as for the left. The purpose of most controls is obvious. But Two require explanation:

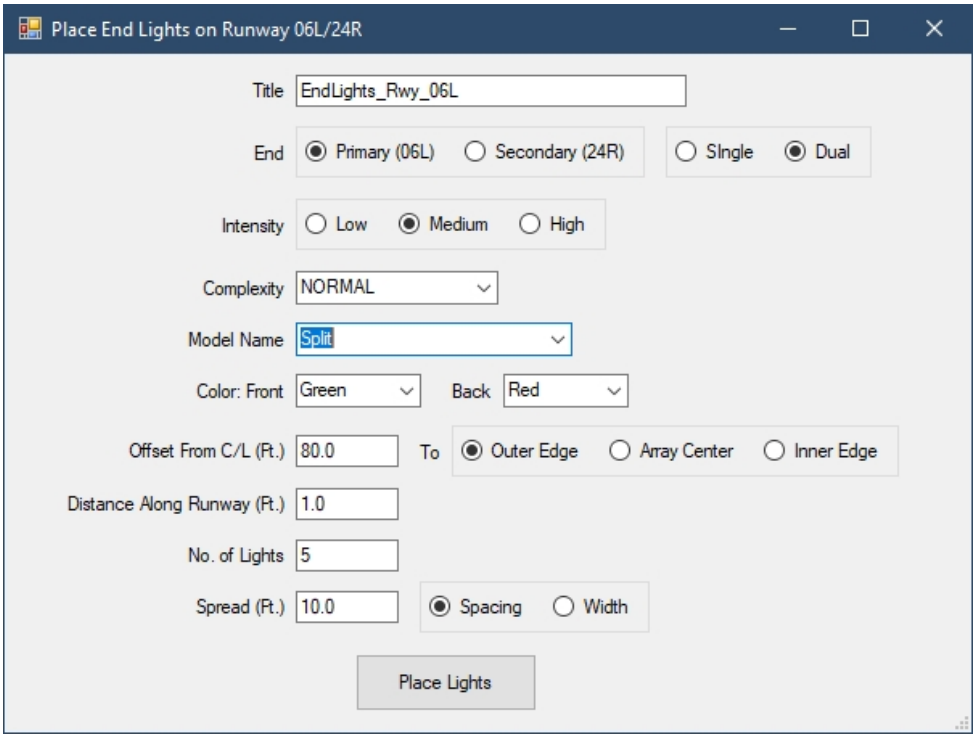
- Copy Left button – Usually, the left and right side units are identical. As the name suggests, this button allows you to copy all the specifications for the left side into the right side controls.
- (Re)Position at Cursor and A/C buttons - Clicking either the Cursor or A/C buttons overrides the position specification in the bottom portion of the dialog and places the specified PAPI/VASI arrangement at the position of the cursor when previously double-clicked or at the current position of the user aircraft respectively.



Selection of PAPI/VASI

Some of the available light source options don't provide sufficient intensity in daytime for PAPI/VASI operation beyond about 1 mile. However, by checking the Don't Purge PAPI/VASIs item in the Options menu, you can have both stock and AFLT glideslope. Specify the position and glideslope parameters for the AFLT lights exactly as indicated in ADE or other airport editor. Because AFLT and Flightsim use different reference points and computational precision, the lights would not normally coincide. But, should you opt for this approach, AFLT automatically applies corrections to ensure that the position and timing of the switch in above/below indications of its lights and those of the stock data are very close together – likely indistinguishable beyond a few hundred meters. If you need perfection, you'll have to experiment with the parameters for PAPI/VASI configurations. Don't be afraid to experiment. The worst that can happen is that you can't get fully-simultaneous operation.

Place Runway End Lights



Place Runway End Lights

The Single and Dual radiobuttons specify either a single row of lights across the end of the runway, or two short rows, one on either side. Runway end lights always display a 3D model, even if they are on the runways surface – except of course at displaced thresholds. If the selected end of the runway has a displaced threshold, then similar entry fields for a second set of parameters appears below the first, together with a checkbox that allows you to select whether or not additional lights are to be generated.

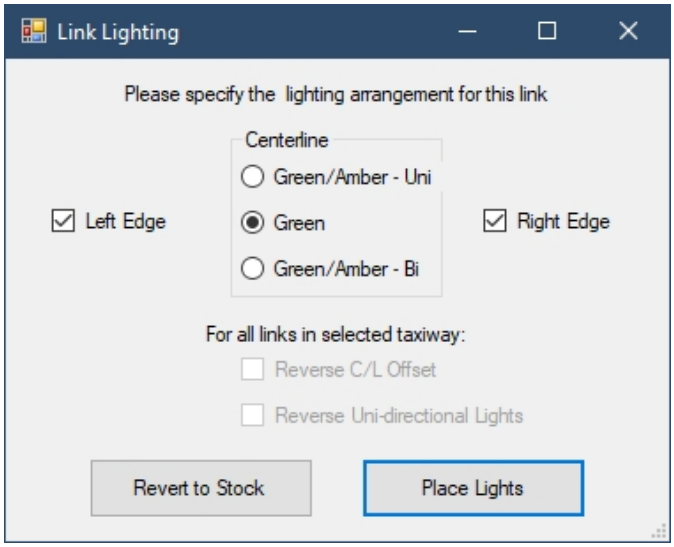
Place Taxiway Edge and Centerline Lights

Taxiway lighting position and other characteristics are specified using the Default Parameters dialog available under the Options menu. The dialog below allows you to adjust the edge and centerline lighting of the taxiway links. Select one or more links in the same taxiway and right slick. Choose the Edit Link Lighting item from the context menu. The dialog is initialized as a compendium of the current lighting arrangement of the selected link(s).

Application or removal of edge lighting is simple. Just check/uncheck the applicable check. For centerline lighting you may choose between all green or alternating green/amber. If the latter you may use either omni-directional lights or bi-directional. To remove centerline lighting, uncheck the selected radio-button.

AFLT allows you to offset centerline lighting. But, while all li9nks in a taxiway segment are oriented in the same direction, abutting taxiways may be oriented differently. Should that be the case and you have specified a taxiway centerline offset (using the Default Parameters dialog), the offset in those taxiway will be opposite. You can correct this by

selecting all the links in one of the taxiway segments and checking the Reverse C/L Offset checkbox. (This control is only enabled if you have specified a centerline lighting offset.



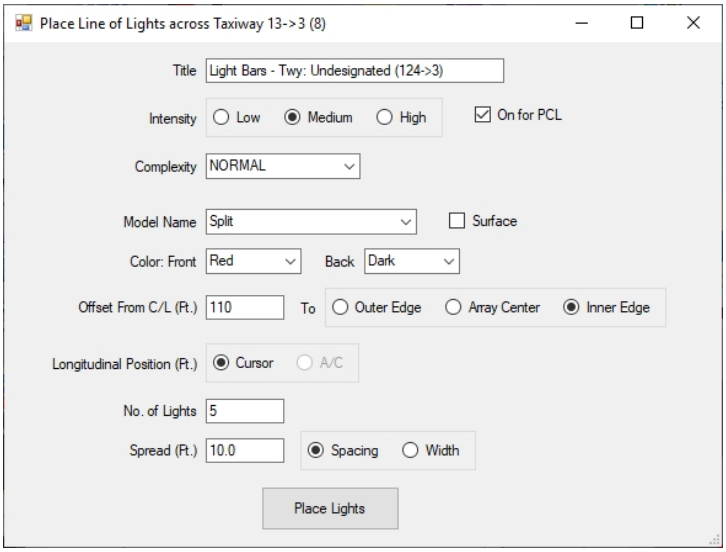
Place Taxiway Lights

Similarly, if you specify uni-directional alternating green/amber centerline lights, those lights may be oriented incorrectly.. You can correct such situations by selecting links with lighting in the wrong direction using the Reverse Uni-directional Lights checkbox.

Finally, to revert the selected links back to stock data, click the Revert to Stock button.

In all cases, when you have made your selections, click Place Lights.

Place Taxiway Dual Light Bars

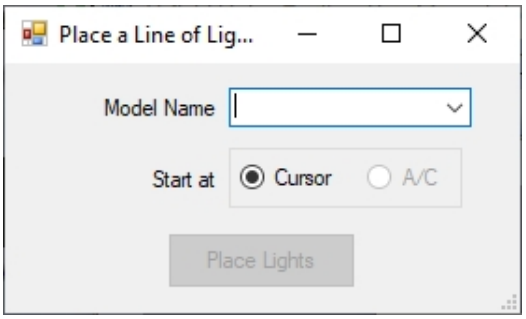


Place Dual Light Bars on a Taxiway

Light bars may be placed on either side of a taxiway by selecting the taxiway, positioning the cursor on the taxiway at the location where the light bars are to be placed (to the side) right-clicking and selecting Add Dual Light Bars from the context menu.

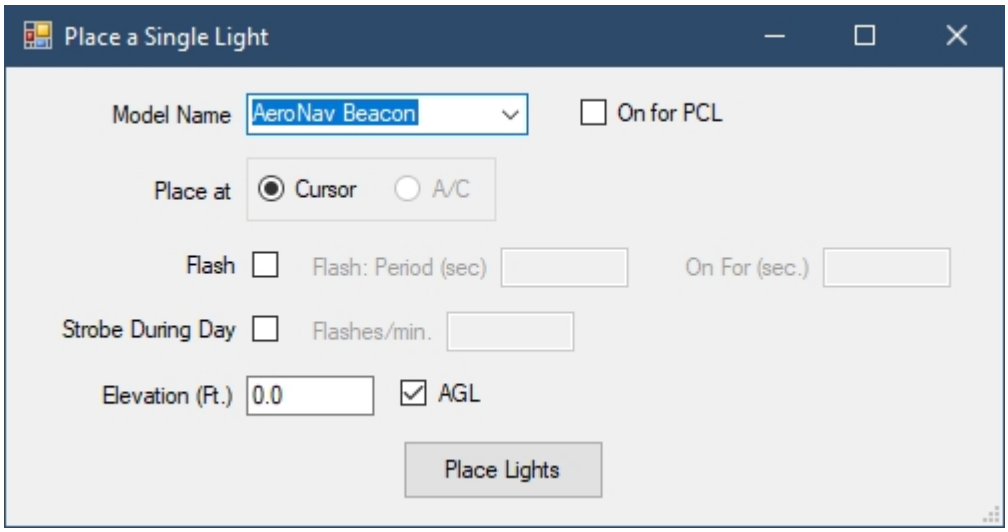
Add/Edit Individual Light or Line of Lights

You are first greeted by:



Place Individual or Line of Lights

Once you specify the name of the model you wish to place, a dialog similar to one of the two below will appear. If Flightsim is running, the Start at A/C radio button will be enabled and, if checked, the line will start at or the light will be placed at the position of the user aircraft. The actual format of the new dialog will vary, depending on the type of light being placed, i.e., additional fields may appear and others shown may be missing.

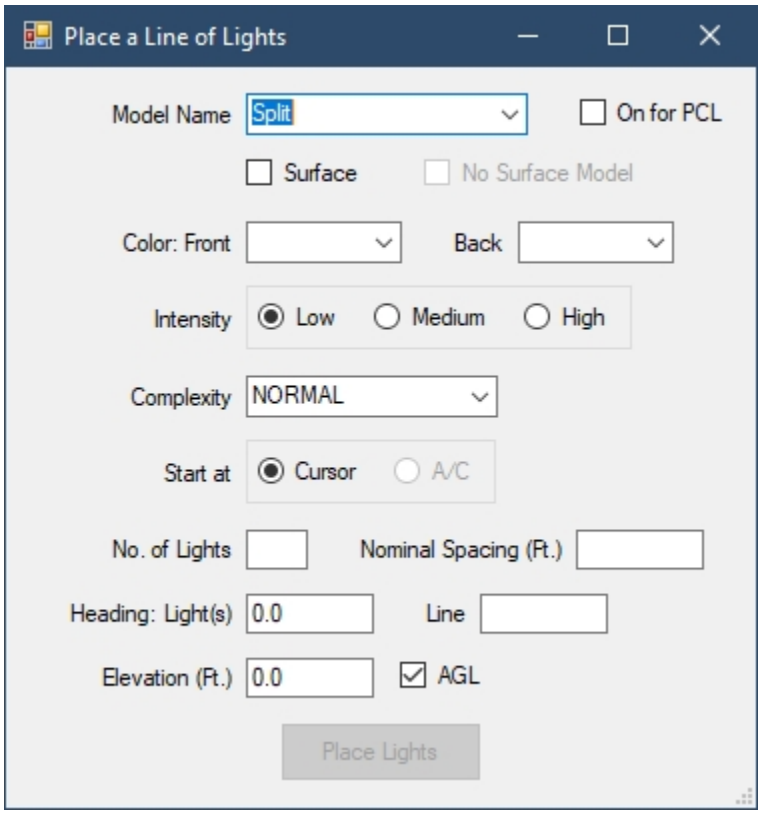


Place a Single Light

You may enter either No. of Lights or Nominal Spacing. When all selections have been made, click Place Lights. The dialog will close and AFLT will enter the “hot cursor” mode, (i.e. each left click will place a line node).

If No. of Lights has been entered, that number of lights will be placed in a line after the first left-click and AFLT will exit the “hot cursor” mode. Otherwise, following each left-click, the required number of lights will be evenly placed between the current and

previous cursor positions based on the Nominal Spacing entry. Either double-click when placing the final node in the line or right-click after placing the final node to exit the "hot-cursor" mode.



Place Line of Lights

When a light (or line of lights) is specified to be on the surface, the corresponding surface mount image can be suppressed with the No Surface Model checkbox. This is to avoid a situation where surface mounts are the default and two or more images are placed on top of one another with flickering resulting.

Please note that, when placing aero-navigational beacons, the Elevation field refers to the height of the tower whereas, for other light types, it generally refers to the elevation of the model base.

Add/Edit Ground-Illuminating Light Standards

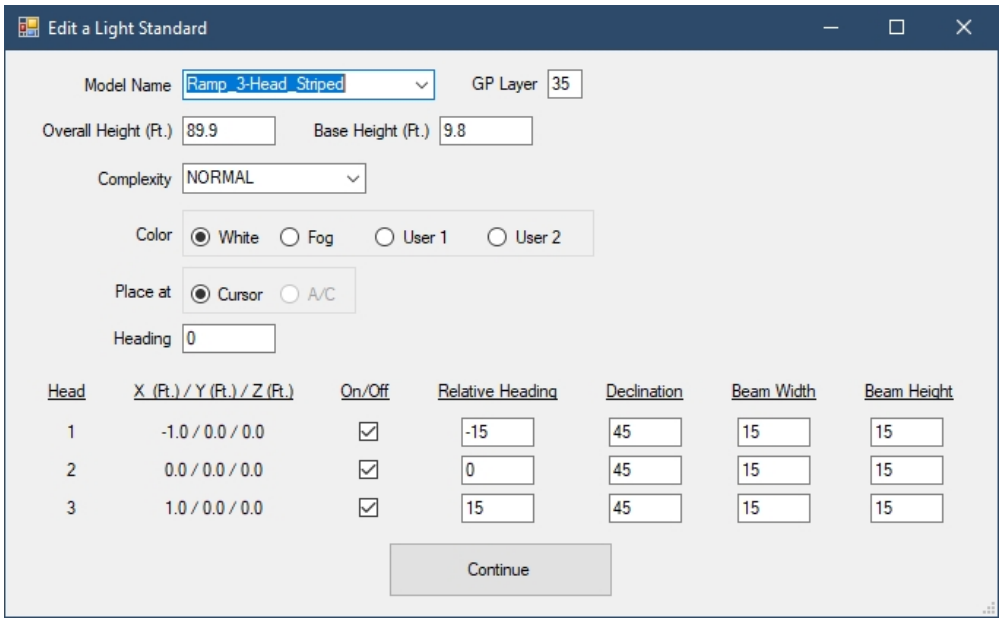
AFLT includes a variety of 3D models suitable for ramp, parking, sidewalk and street illumination. And, you may add your own as described below.

Traditional ramp lighting programs create a .bgl file that includes one or more slightly elevated, horizontal illumination planes for each light standard – a generic term used for the 3D model associated with ramp lighting, street light, etc.. Unfortunately, these planes cause flickering if the plane(s) for one standard overlaps the plane(s) of another. AFLT on the other hand effects ground illumination through the use of a single ground-poly.bgl

no matter how many standards are programmed. Thus illumination plane overlap – which adds a great deal of realism, especially at larger airports, is possible.

The available light standards are light standards are specified in the file *AFLT\standards.txt* (Appendix "F"). The corresponding .mdl files are saved in the "Standards" subfolder of *AFLT\BaseModels\relevant Fightsim version*.

When you create a new light standard, you are first asked to specify the name of the 3D-model for the standard using a simple combo box. Once selected, a dialog in the form below opens. When editing an existing standard, the dialog opens immediately.



Add/Edit Ground-Illuminating Light Standard

Some of the fields on this dialog require explanation:

- GP Layer is the layer at which the illumination-planes are displayed. This is the same layering scheme as is used in ADE-GP. The value entered in this field must be higher than that of any airport GP over which it lies. Otherwise, the airport GPs will be displayed on top of the illumination. (This maay be what you want for special effects.) Further, to ensure all your ground illumination is displayed without flickering, you may have to assign different layer numbers to adjacent standards. (Illumination GPs are rectangular. If the illumination of one standard lies in the dark area of another with the same layer number and the latter is drawn last, the brighter areas of the first may be overwritten.) You'll need to experiment when the illumination of one standard overlaps that of another with the same layer number.
- Overall Height/(concrete) Base Height – the height of the displayed model and its concrete base respectively.
- Color – The color of the ground illumination. Two stock colors (White and Fog) are provided. Provision is made for two additional colors to be added by the user.
- Heading – the value entered should be:
  - for ramp lights, the direction in which the light is to be cast,

    - for parking standards and street lights, such that the light is cast to the left, or to both sides for dual-headed standards
    - for sidewalk lamps, it the light is cast straight down, it doesn't matter. If the illumination is to be directional, such that the light is cast to the left
- Heads – Many of the provided models have multiple illumination heads. AFLT allows (but does not require) you to specify a light beam for each head to better simulate the actual lighting at your airport.
    - X / Y / Z – the physical position of each head relative to the top of the standard
    - On/Off – to enable/disable a beam
    - Relative Heading – the nominal heading of the beam relative to the standard orientation
    - Declination – the vertical angle of the beam below horizontal
    - Beam Width – the nominal; width of the beam
    - Beam Height – the vertical angle covered by the beam

With a little imagination, you should be able to accurately simulate the illumination coverage at any airport.

Standards are usually displayed on the AFLT surface as a simple dot with a small arc indicating the heading of the standard. To see the shape/size of the illumination pattern, select Illumination under the View Menu

Important: While the illumination GPs and associated textures may be saved to any location, the associated .bgl containing the 3D models is subject to any excludes for your airport if saved outside the primary airport folder at a lower scenery-library priority than the base airport folder. This is not an issue for P3Dv3+, since the illumination standards are saved to the DocumentPrepar3D v…\Add-ons folder. But, for FS9 and FSX, when using ground-illuminating standards, the scenery folder specified on the Make Library panel should be your primary airport folder.

9. CREATING A LIBRARY OF ELEMENTS

Clicking Compile Data (Project menu) brings up the Make Object Library dialog.

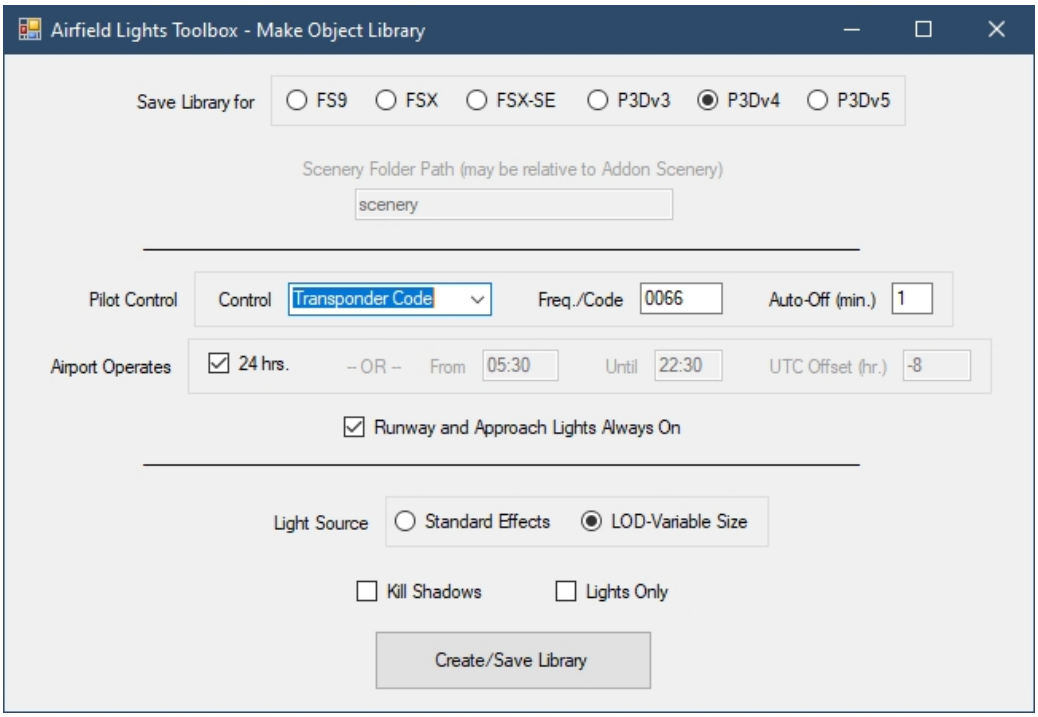
The top line of the dialog will reflect which versions of Flightsim are installed on the system. Select the version to which the library about to be made is to apply.

For FS9 and FSX, the object libraries and required textures will be copied to the Scenery Folder if that folder is specified in the Scenery Folder Path textbox. If the Scenery Folder is a sub-folder of FlightSim's *Addon Scenery* folder, you need only specify the path relative to *Addon Scenery*. (The full path name for each Flightsim version will be automatically derived.) Otherwise, you must specify a fully-qualified path for the selected Flightsim version. If the specified path ends with "\scenery", AFLT assumes a companion *texture* subfolder. If the path does not end with "\scenery", AFLT assumes a folder containing both the *scenery* and *texture* subfolders. If either anticipated subfolder does not exist, AFLT will create it/them on the first save. Once a Scenery Folder is specified, the same folder will be used for all Flightsim versions unless changed.

For P3D, a “P3D add-on package” containing all the required files is generated, a folder named ”AFLT for P3D” is created in the appropriate *Documents\Prepar3D vn Add-ons* folder and the add-on package copied into that folder.

AFLT supports pilot-controlled lighting (PCL), i.e. the ability for pilots to turn on airport lights outside normal hours for the airport. In real-life, usually this is done by keying the COMM transmitter a certain number of times. Unfortunately, there is no way for Flightsim to report depression of the “mic-key”. So, AFLT offers several (albeit unrealistic) alternatives. Instead, you may use a certain transponder code or tune one of the COMM, NAV or ADF systems to a frequency of your choice (within its range). You may also control how long the lights stay on after you trigger PCL. If you don’t set an auto-off value, the lights will go off immediately upon you deselecting the specified transponder code or frequency.

If pilot-controlled lighting (PCL) is required at your airport, select a pilot-controlled lighting control from the Control/Variable combo box (radio/navigational systems. Then, specify the "lights-on” value for the control/variable in the Freq/Code textbox. Enter the value exactly as the value will appear on the control (e.g., 1234 for the transponder or 123.70 otherwise). If COMM is selected, please note PCL is only triggered if the COMM unit then-currently selected for transmit is tuned to the specified frequency. Note that runway and taxiway lights are automatically selected as being operational under PCL. Other types of lights must have been manually designed as being operational under PCL when they are created/edited in AFLT.



Make Library Dialog

If you want to be able to deselect the PCL lights-on criteria once PCL has been invoked but have the lights remain on, enter the number of minutes after which the lights will automatically be turned off in the Auto-off (min.) text box.

For airports having 24 hr operation, check the 24 hrs. checkbox. Otherwise, enter the operating hours (i.e., the hours outside of which the lights will normally be off) in local time and the airport's UTC offset in hours (decimal hours if necessary).

Some large international airports operate with their runway and approach lights (at least for the active runway) on all the time. The Runway and Approach Lights Always On checkbox allows you to select this capability for your airport.

Please be aware, pilot-controlled lighting, specified airport operating hours, and Runway and Approach Lights Always On necessitates additional processing for each light. Hence, they may have a detrimental impact on FPS. So, these features should be used only where required. However, only the most “challenged” systems should be significantly affected.

The same light source is used for all lights in an object library. As noted earlier, depending on the version of Fligfhtsim selected you have a choice of up to 3 of the following sources: BGL_LIGHTs (FS9 and FSX), standard effects, inversely-mipmapped effects, and for P3D, LOD-variable-sized 3-plane lights.

AFLT generates all required effect (.fx) files on-the-fly. During development, it was found that a one-size-fits-all approach with standard effects was not practical. So, AFLT provides the ability to easily customize effects (see Appendix “D”). However, AFLT ships with effect configurations that should serve as a starting point for your further customizations.

Shadows are expensive in terms of FPS. (Shadows are essentially 2D models.) Shadows are automatically suppressed for lights mounted on towers. (3D tower models are usually of a long, fixed length to allow for variable height of tower-mounted lights). Consequently, the bottom of a tower generally will be well below ground level. However, Flightsim always displays a shadow for the full length of the tower, thus generating shadows for the below-ground portion as well.) To suppress all shadows, check the Kill Shadows checkbox.

If you have a FPS-challenged system but still wish to realize some of the benefits of AFLT, try suppressing the display of the 3D models by clicking the Light Only checkbox. While the display in Flightsim will not likely be much different than stock lighting, AFLT still allows you a lot of customization not otherwise available. You can also use this feature to check the FPS-impact of the 3D lights.

Finally, click the Create/Save Library button. If no Scenery Folder has been specified, a warning will be issued. Whether or not a Scenery Folder is specified, the object libraries and .mdl files are also saved in */Files* subfolder of the Project Folder. As well, if effects (either type) are used, all required effects are normally generated on-the-fly and copied to the *Effects* subfolder in the case of FS9 or FSX, or to the add-on package if P3D.

When compiling for FS9 or FSX, you’ll see the window flashing on and off rapidly. That’s the compiler, which I have been unable to find a way to hide

Run the relevant FlightSim version to see the results.

Ensure you have only one version of an airport in your Flightsim scenery folder. Especially during development or testing of a lighting scheme, you may have created two or more projects for the same airport. AFLT assigns different guids each time a project is compiled. If more than one library covering the same lighting elements exist in a scenery folder, this effective specifies two or more guids for each element – in which case Flightsim will not display that element. So, if some or all of your 3D models are missing in your Flightsim display, first check your scenery folder for duplicate libraries.

Also, if you have previously used AFLT2 or AFLT3 to generate lights for P3D you wish to keep along with your AFLT4 lights, you must:

- **rename the AFLT2 or 3-created folder *…\Documents\Prepar3D vn Add-ons\AFLT for P3D*, and**
- **edit the second line of the file "add-on.xml" in that folder to agree**

prior to compiling for P3D with AFLT4 (which will create another folder named "AFLT for P3D". Otherwise, AFLT4 will add it's own files to the AFLT2 or 3 folder and the mixture won't work.

10. PURGE AIRPORT STOCK DATA FUNCTION

If you simply add AFLT library .bgls to an airport's scenery folder, you will see not only the AFLT lights/models but also the stock lighting. The Purge Airport Stock Data function creates an airport .bgl or .xml file (whichever you defined as the airport reference file) "purged" of all the stock lighting which has been used/replaced by AFLT. Note you may designate in the Options menu that PAPI/VASIs not be purged. You would then use the "purged" file to replace the earlier airport .bgl or .xml file.

If you created the project with a .bgl file, that file will have been compiled for a particular version of Flightsim. Its use, therefore, will be limited to other compatible Flightsim versions. Consequently, AFLT's Purge Airport Stock Data function asks for a Flightsim version specification before purging the lighting specifications.

If you started with a .xml file, its use too is restricted because it may contain data not compatible across all Flightsim versions. If you are creating lights for use with several Flightsim versions, you may have to load the airports .xml for one or more of the versions currently loaded in order to create "purged" .xml files for each version.

If you attempt to create a purged file for FS9 but the airport reference file is for a version later than FS9, AFLT will detect the situation and ask you to designate a FS9 version of the file. Unfortunately, AFLT cannot do the same with an .xml airport reference file. So, using a .xml reference file and the purged file either won't load or doesn't have the desired effect, you should suspect a version mismatch.

In either case, the purged file name is suffixed with the entered version.

Purged files are always saved to the Project Folder. You would normally replace the airport .bgl file in your scenery folder with the purged .bgl. If a .xml file, you would

normally load it back into your airport editor to create a new version of your airport .bgl without the stock lights you replaced.

At the time a bgl file is purged, if the specified version of FlightSim is installed, you are given the opportunity to have that file saved to your scenery folder. (The original airport .bgl file name will be suffixed with ".xxx" to disable its processing). If you choose not to have AFLT so save the file for you, you will have to apply it appropriately, manually, later.

AFLT will not let you replace the airport reference file with a purged version, since doing so would defeat AFLTs ability to (re)generate custom lights. If you have chosen the .bgl in your scenery folder as the airport reference file, make a copy of that file and select the copy as your reference file. Similarly, if you've chosen an .xml file as the reference file, make a copy of it and "purge" the copy.

11. SPECIAL CIRCUMSTANCES

Lights in Close Proximity - It appears that FS9 has difficulty initializing the rendering of certain lighted models in very close proximity when approaching from a distance, resulting in a "crash". Given the complete absence of diagnostic information at the time of the "crash", the precise cause of the problem is not known. FSX does not appear to be similarly affected.

In the case where the problem was discovered, when the light source was BGL_LIGHTs, two strobes 2.5'/0.7m apart triggered the crash, but two others 5'/1.5m apart were OK, suggesting a minimum separation of 3.5'/1m. When effects were substituted for the BGL_LIGHTs, the latter two strobes also resulted in a crash, indicating FS9 is less tolerant of effects. On the other hand, steady lights as close at 1'/0.3m were rendered without difficulty, suggesting that blinking lights, e.g., strobes and, aeronav beacons. are most susceptible.

So, should you experience a unexplainable FS9 crash when approaching an airport with AFLT custom lighting, review the spacing of the lights - especially that of strobes and aeronav beacons.

Large Number of Effects - From our testing on large airports, it appears there is an internal (to Flightsim) limit to the number of effects that can be displayed. The version of KLAX we were testing had nearly 7000 lights. (Each light requires an effect) Flightsim "struggled" when effects were used as the light source at KLAX. Exactly where the limit is has not been determined - and it may be dependent on processing power and/of FPS. If your airport has lights numbered in the thousands, you may experience similar difficulty. Should that occur, try a light source that doesn't involve effects.

12. TWEAKING AND FINE_TUNING

AFLT ships with a set of default values for all functions. These are commonly used values for the respective airport lighting features. However, these defaults may not be the most appropriate value for a given airport. Consequently, virtually all aspects of AFLT are "fine tunable". That includes airport surface parameters, e.g. runway edge light offset, light characteristics.

Familiarity with Appendices “B” through “D” will be an asset in understanding the balance of this section.

AFLT supports four types of lights:

- BGL_LIGHTs (FS9 and FSX only)
- Standard effects
- Inverse-mipmapped effects
- LOD-Variable lights (P3D only)

AFLT’s default light size is about 1m/3ft in diameter – generating a light-ball approximately the size of a BGL_LIGHT. Appendix “C” specifies the size of each type of light relative to this default size. As you can see from Appendix “C”, the default size for strobes and PAPI/VASIs is somewhat larger. For all but BGL_LIGHTs, you may change these relative size values as necessary. This size can be further adjusted:

- based on the Light Size Adjustment specified in appendix “C” for the color of the light, and
- to reflect light intensity (effects for higher intensity lights being large than those for lower-intensity light).

BGL_LIGHTs are very processing-efficient - more so than effects. BGL_LIGHTs together with simple 3D models have a minimal affect on FPS. However, the size of BGL_LIGHTs is fixed. Their brightness is a function of the specified intensity for the light. BGL_LIGHTs are rendered in FS9 only. In FSX, a light element specified to use BGL_LIGHTs is rendered as an automatically-created effect the same color as specified for the BGL_LIGHT. BGL_LIGHTs cannot be used in P3D.

AFLT’s “standard” effects are based on the file *BaseEffects.fx* in the AFLT\Effects folder. Essentially, this is a “dummy” effects file certain of whose parameters are adjusted at compile time using specifications in the applicable BaseEffects_*version*.fx file in the same folder. This allows for customization on a per Flightsim version basis. . Please refer to Appendix “D” for further detail on customization of effects.

AFLT’s inverse-mipmapped effects use a special texture with inversely-sized mipmaps, i.e., the relative size of the image in the mipmaps *increases* as the distance from the light increases, increasing the visible range of small effects. Inversely-mipmapped effects are based on the file “BaseEffect_Mipped_FS9.fx. Unfortunately, FSX’s and P3D’s handling of effects preclude use of inversely-mipmapped effects

The other alternative for light source is variable-sized 3-plane models. These are not lights *per se*; rather, they are brightly-colored models comprising 3 circular planes in the X, Y and Z axes. They are designed so that their size varies inversely proportionally to Flightsim’s internal level of detail (LOD) of the model at any time, i.e., the lights are rendered at minimum size at LOD_100 and at maximum size at LOD_1. Light size increases or decreases in small increments as the user aircraft moves towards or away from the light. This concept was pioneered by Christian Bahr. These lights can be made visible up to 18 nautical miles (the distance at which Flightsim begins to discard scenery models) by adjusting the Range entry in *Lights.txt* (see Appendix “C”). The minimum size of each light is controlled by the Light Size (Medium Int.) – Bahr entry in *Lights.txt*.

AFLT's settings in *Colors.txt* and *Lights.txt* give a reasonably uniform appearance of lights across all light sources and Flightsim versions. However, these settings may not be ideal in your application. If the color of a light is not to your liking (in particular the blue taxiway lights), experiment with the RGB and Light Intensity Adjust values in *Colors.txt*.

The size of effects and LOD-variable lights in *Lights.txt* controls the approximate size of the bright section of the light bloom at very close range. It is a trade-off between close-up appearance and the way the lights fade as the user aircraft moves away. Some experimentation will be required to achieve the most suitable size. So, when judging the close-up size, view the light from a representative distance, recognizing that the user aircraft will seldom be VERY close to a light.

As shipped, AFLT displays all colors at their maximum intensity. This may result in certain lights appearing too bright. The brightness of each color may be reduced by adjusting the Color Intensity Adjust setting for the color in *Colors.txt*. Depending on the color and the magnitude of the change, this adjustment might also be useful in reducing the apparent close-up size of lights.

AFLT saves the placement data for each project in a XML files named, imaginatively, "Placements.XML". Depending on your skill level, you may find it more convenient to make certain adjustments to your data by directly manipulating this file. If you do so, be sure to make a back-up copy before editing. And be aware, the file can become unreadable due to something so insignificant as a missing or extra quote mark. So, be forewarned. I will not be able to help you recover your data. Appendix "E" described the data formats (to the extent useful for manual editing).

13. SUBSTITUTION/ADDITION OF BASE MODELS

You may replace the provided base models and add new ones. But, before doing so, you should examine the stock textures *obj_AF_Lights, obj_AF_Lights_Dayglo* and *obj_AF_Lights_LM* (found in the *Base Models\Textures* folder) to appreciate how they are used and their inter-relationship.

Other than for wigwags, the only firm requirement is that a custom base model contain a single, empty attachpoint. Both the attachpoint and the model can be named as you wish. The location of the attachpoint is not important. But it will be necessary to specify in BaseModels.txt offsetting information for the light sources.

You may use any texture for the model and lens – or different textures for each. But, if you wish the light lens to be colored to match the light, you must either use the stock texture *obj_AF_Lights* or implement a similar scheme on your own texture.

For FS9 models, if you use the stock texture *obj_AF_Lights.bmp* for the light lenses, AFLT will automatically apply *obj_AF_Light_Dayglo.bmp* whenever the lights are on. If you use your own texture, AFLT will look for a file (.bmp or .dds) named "*texture*_Dayglo" and use it when the lights are on. If it doesn't find a "dayglo" texture it will complain, but the model will still be useable (however, of course, the lens will not "illuminate" in the daytime). Unfortunately, "dayglo" textures cannot be used with FSX models. If you provide it, a "_LM" texture will be applied as usual.

For custom wigwag models, in addition to the attachpoint, the two light lens must be:

- a separate element of the model,
- displaced negatively in the Y-dimension sufficiently far from other portions of the model to avoid flickering,
- displayed unconditionally (no LOD assignment), and
- textured with a file whose name ends with "_WigwagLens".

For FS9 models only, AFLT will alternately apply the noted texture and one whose name ends with "WigwagLens_On" – which should be more brightly colored than *texture*_WigwagLens but otherwise identical. Please refer to the stock "WigWagLens" textures.

Place each version (FS9/FSX) of your model in the applicable Base Models folder and, if you use non-stock textures, place a copy of your new texture (32 bit, DXT and/or DDS formats as necessary) in the *Base Models\Textures* folders.

If you are simply replacing a stock base model (using the same name) and your attachpoint is in the same location as in the stock model, you need do nothing further. However, if you have moved the attachpoint, have renamed the file or are adding a new base model, you will have to make a new, or update an existing, entry in *BaseModels.t*xt (see Appendix "A") and perhaps also Lights.txt (see Appendix "B").

14. DISTRIBUTING YOUR AIRPORT

You are permitted to distribute AFLT-generated custom lighting with your airport so long as your airport is made freely available and its distribution and use does not involve an end-user paying a fee of any kind.

With simobjects-based lighting, you need only include a copy of the *AFLT for P3D* folder in your *…\Documents\Prepar3d v*n *Add-ons.* If you have created custom lights for more than one airport but don't intend to distribute them all, you may wish to delete from the included *SimObjects* and *XML* folders the sub-folders for the airports not to be distributed. (Leaving them will do not harm other than possibly prompting your users to ask about them.) Your user need only copy this folder into his/her own should "*user*\Documents\Prepar3d v*n*\Add-ons" folder. P3D will detect it automatically.

For FS9 and FSX, you'll need to provide your users with:

- the purged airport .bgl(s),
- the relevant AFLT_*xxxx*_Bases _*v*.bgl and AFLT_*xxxx*_Lights_*v*.bgl files, and
- all the effect files with names beginning "fx_AFLT4_" in your Flightsim *Effects* folder, collected in a folder named "Effects" (AFLT's effects are identical for each FlightSim version).

Your users must copy these effects into their own Flightsim *Effec*ts folder. The other files should be placed in an active scenery folder.

Of course, you should also include detailed instructions to your users for installing these files and for disabling their original airport .bgl file(s).

15. SUPPORT

Airfield Lights Toolbox's support forum is located in the Scenery Design - Airport Design support area at http://www.fsdeveloper.com. Please direct your problem reports, suggestions for improvement and other comments there. When you report problems, please include relevant details. In particular, the AFLT version number, the exact error message and a summary of what you were doing at the time are likely to be particularly helpful. If you are asking for support with a particular lighting issue, please attach the complete Project sub-folder. Without it, it's unlikely I can be of much help.

I also have a support website at http://stuff4fs.com for all my airports and development utilities. (Navigate to the User Applications / AFLT page.) Among other things, the site lists all known problems with the latest release. The most recent release of Airfield Lights Toolbox is available from that site as are occasional development releases of new features.

While I can't promise to resolve every issue you report or include every feature addition you propose, I will undertake to support and enhance Airfield Lights Toolbox in a manner consistent with it becoming and remaining the tool of choice airfield lighting for Microsoft Flight Simulator and Lockheed Martin's Prepar 3D.

Enjoy,
Don Grovestine
don@stuff4fs.com

END USER LICENSE AGREEMENT

As used in this end user license agreement, the terms "Airfield Lights Toolbox" and "AFLT" shall be construed as encompassing the full contents of the downloadable archive (.zip) file created and/or posted for distribution on "download sites" by the author, including without limitation: the executables file AFLT.exe, AFLT(exe).exe and AFLT (Install).exe, the associated user manual, the files BaseModels.txt, Colors.txt, Lights.txt and any files proprietary to third parties including but not limited to the files BGLC_9.exe, bglcomp.exe, bglcomp.xsd and Ionic.Zip.Reduced.dll.

You are granted a free, non-exclusive right solely to install and use Airfield Lights Toolbox on your computer system(s) for your own personal enjoyment and, subject to what follows and the rights of others, to use and distribute work products created or modified with Airfield Lights Toolbox ("derivative files") as described in the section of this manual entitled DISTRIBUTING YOUR AIRPORT WITH SIMOBJECTS.

You may not:

- upload Airfield Lights Toolbox in whole or in part to any file distribution system,
- reverse engineer, disassemble or decompile any part of Airfield Lights Toolbox,
- incorporate Airfield Lights Toolbox in whole or in part into any commercial product or facility, "shareware" or "freeware", or
- use Airfield Lights Toolbox or any derivative files in the development, marketing or support of, or incorporate derivative files in, any commercial product

without the express written permission of the author. Use as may be permitted for commercial purposes may be subject to a license fee.

Your use of Airfield Lights Toolbox is entirely at your own risk. You assume and are responsible for any and all liabilities and damages arising therefrom no matter how caused.

By installing or otherwise using any part of Airfield Lights Toolbox, you are deemed to have agreed to the foregoing.

Airfield Lights Toolbox - Copyright © D. Grovestine 2013 - 2021

Appendix "A" - Base Models Supplied

Base models for all but surface mount applications must fall into one of the following categories:

- *Approach* - uni-directional light intended as a threshold light in approach lighting configurations either as a threshold light or mounted on a tower.
- *Approach_T* – a simple horizontal mounting bar 1m. long, which will be adjusted on-the-fly as needed and to which will be attached one or more posts and one or more light heads. Two associated base models are required:
  - *Approach_Post* – post to be attached to *Approach_T*
  - *Approach_Head* –uni-directional light to be attached to *Approach_T*
- *Beacon* - a 50 m. high tower. You may choose to have a blinking light atop it or a blinking light at night and a strobe during the day
- *Edge* – a basic light mount intended primarily for taxiway and runway edge lighting applications
- *Obstruction* – dual obstruction light assembly on a 5' post
- *PAPI_VASI* – a simple box mounted on legs used in all PAPI/VASI configurations
- *Split* - bi-directional light primarily for runway end applications
- *Strobe* - strobe light mounted on a 5' pole
- *Strobe-T* - strobe light mounted on a 30' tower
- *WigWag* - typical wigwag with two alternately-blinking amber lights

AFLT includes a least one base model in each category. As well, a surface-mount .mdl, *Surface*.mdl, i.e., a singe buried triangle (fulfilling the requirement for a surface to which things can be attached) used for lights element that do not include a 3D-model

Elements on towers or supports may be set to any height. The unneeded portion of the tower/support will be "buried".

None of these models will cast shadows normally. Custom shadows (provided - model file name suffixed with "_Shad") may be applied to all models except *Approach*_T.*mdl*, *Beacon_T.mdl*, *Obstruction.mdl, Strobe.mdl and*, *Strobe-T.mdl. Obstruction.mdl* is generally used in locations where a shadow would add little realism. In the other noted exceptions, a portion of the model usually will be buried but would still cast a shadow.

BaseModels.txt includes four fields for each base model:

- Name – calling name
- Category –category in which the base model falls
- m/f – indicates whether the following field dimensions is feet or meters
- Light Positions – the x/y/z position of each light relative to the models reference point. A separate x/y/z position must be specified for each light source. For example, for Splits and PAPI/VASIs, there must be two x/y/z positions.

You may add to this set of base models or replace individual models. Base models compiled for FS9 are saved in the *BaseModels\FS9* folder. Similarly, models compiled for FSX or P3D are saved to *BaseModels\FSX* and *BaseModels\P3D respectively.* It is

recommended you not change the names of stock elements. If you do, or if you add new elements, you will have to add or edit the corresponding line in *BaseModels.txt* and *Lights.txt*.

AFLT does not normally display a mounting base for lights on the surface. But, as explained earlier under Option Menu, you may optionally configure AFLT to display such models A .mdl file for such applications may be either 2D or 3D but, unlike other base models, need not contain an attachpoint. These models are also held in the Base Models folder.

AFLT ships with three models (actually 2D models with an image) for this use:

- Surface_Omni.mdl - 8”/22cm diameter for omni-directional applications
- Surface_Bi_Small.mdl - 8”/22cm diameter, primarily for centerline and runway end applications
- Surface_Bi_Large.mdl - 12”/30cm for applications where a larger bi-directional unit is needed, e.g., surface-mounted approach lights.

If you add your own surface models, their file name must take the form “Surface_xxxxx.mdl”.

Users who intend to create their own models are reminded that FlightSim interchanges the Y- and Z-axes and then inverts the Z-axis. Models created with Flightsim gamepacks for Gmax and 3DS will comply with this convention. Models developed with other tools must include the applicable transforms.

Appendix "B" - Colors.txt Format

Colors.txt contols the displayed colors of all lights. It provides the RGB value for BGL_LIGHTs and effects and the texture sheet offsets for LOD-Variable lights. As well, it controls the displayed size of effects by color.

AFLT supports six user-specifiable light colors:

- amber
- blue
- dark (used for split lights on which only one side is illuminated)
- green
- red
- white

and five system colors:

- BEACON
- PAPI_RED
- PAPI_WHITE
- STROBE
- WIGWAG

Up to three “custom” colors may be added by the user. All colors may be adjusted by the user as desired.

Each color has the following attributes:

- Name – the name by which the color is called
- The brightest RGB value that can be used to display the color:
- VERT (Bahr) coordinates on the LOD-Variable texture sheet *Lights_Bahr.dds*
  - Umin - X-value for the lower left-hand corner
  - Umax - X-value for the upper right-hand hand corner
  - Vmin - Y-value for the lower left-hand corner
  - Vmin - Y-value for the upper right-hand corner
- Color Intensity Adjust – The RGB value above is for the maximum intensity of the color. The displayed intensity of the color (not to be confused with the Lo/Med/Hi intensity setting of a light) will be the maximum intensity adjusted by this (%) value.
- Effect Size Multiplier - Visibility differs between colors and, hence, affects the visible range of lights drawn with an effects. This item is used to automatically increase or decrease the “standard” size of effects, thus increasing or decreasing the range of the effect
- Custom Effect Name – AFLT effects are named “fx_AFLT4_*color _ characteristics*.fx” and are regenerated whenever the data for a given FlightSim version is compiled. If this field is not blank, AFLT will instead use the named effect. Users must ensure an effect so named exists in the Effects folder of the relevant Flightsim version or, in the case of P3D, in the Effects folder of that version’s Documents “addon” folder.

Appendix "C" - Lights.txt Format

Each line in Lights.txt applies to a specific model type, as follows:

Column 1 - Name

Column 2 - Name of base model used for this light

Column 3 - True or False indication of whether the light is omni-directional

Column 4 - Default horizontal spread of light(s) in degrees. A blank entry implies full (360 degree) visibility. No effect on omni-directional lights.

Column 5 - Default vertical spread of lights, centered about light tilt if any. A blank entry implies full (90 degree) visibility. No effect on omni-directional lights

Column 6-8 The size relative to AFLT's default of medium intensity LOD-variable lights and lights whose source is mipped-effects and "standard" effects, respectively. That base size will be automatically adjusted + or – 25% to reflect the specified intensity of the light. A relative size of 1.0 means that light will be drawn at AFLTs default size. To make a light twice as large, specify the relative size as 2.

Column 9- The desired visible range (in nautical miles) of LOD-variable lights or, in the case of effects, a cut-off range.

Appendix "D" – Light Characteristics

AFLT supports four types of lights:

- BGL_LIGHTs (FS9 and FSX only)
- LOD-Variable lights (P3D only)
- Standard effects
- Inverse-mipmapped effects

BGL_LIGHTs are very processing-efficient - more so than effects. BGL_LIGHTs together with simple 3D models have a minimal affect on FPS. However, the only control you have over the display of BGL_LIGHTs is their brightness – which is adjusted by varying the applicable RGB value in *Colors.txt*. Their maximum range is sometimes a problem – particularly when used in VASI/PAPI applications. BGL_LIGHTs are rendered in FS9 only. In FSX, a light element specified to use BGL_LIGHTs is rendered as an automatically-created effect the same color as specified for the BGL_LIGHT. BGL_LIGHTs cannot be used in P3D.

LOD-Variable lights - not lights *per se* but, rather, they are brightly-colored simple models comprising 3 circular planes in the X, Y and Z axes. They are designed so that their size varies inversely proportionally to Flightsim's internal level of detail (LOD) of the model at any time, i.e., the lights are rendered at minimum size at LOD_100 and at maximum size at LOD_1. This concept was pioneered by Christian Bahr. Light size increases or decreases in small increments as the user aircraft moves towards or away from the light, so small that the change is not easily discernible. These lights can be made visible up to 18 nautical miles (the distance at which Flightsim begins to discard scenery models) by adjusting the applicable LOD-Variable Max (size) entry in *Lights.txt* (see Appendix "C"). The minimum size of each light is controlled by the LOD-Variable Min (size) entry

It should be noted that LOD is calculated differently in P3D than in the earlier versions of Flightsim. In P3D, LOD is calculated as a multiple of the model radius (RADI block in the .mdl file) whereas in the earlier versions of Flightsim, LOD is a function of the rendered object size relative to the vertical pixel count of the display window. Thus, the maximum range may differ in each case. So, you may need to use different size and range values to get consistent results across all Flightsim versions. It can do no harm to experiment.

Standard Effects may be used with any version of FlightSim. However, due to the differences in handling across the various flightsim versions, it is unlikely that an effect created for one version can be used directly in another version. Also, without special handling, the range of effects is relatively limited.

To address these characteristics, AFLT uses a multi-emitter base effect whose critical parameter are adjusted on a per version basis. The BaseEffect.fx file in the AFLT\Effects folder is a basic 3-emitter effect. The first emitter is for close-up use and quickly fades. The second emitter is somewhat larger, so, as the first emitter fades, it takes over. The third emitter is for distance and is sized based on the desirable visible distance. Unfortunately, even though its alpha value is as low as possible, its halo is still visible at close ranges. But, this seems unavoidable. On the up-side, with this approach the visible range of effects can be extended well beyond the typical 10,000m limit

Supplementing the base effect is the file *AFLT\Effects\Control.txt*. It specifies the critical parameters for each emitter in the base and is structured such that a different effect may be specified for each lights type in each version.

At the start of the file is a model type cross-reference. For example, Edge lights are model type 1 and PAPI/VASIs are model type 5.

Following this cross-reference are as many sections as needed to specify the full complement of effects across all Flightsim versions. The structure of each section is:

- File – the base effect file to be used (initially, *BaseEffect.fx* or *BaseEffect_Mipped.fx).*
- Version - the Flightsim variant (FS9, FSX or P3D) followed by 0 or more model types separated by commas and preceded by "/". So "P3D/3,4" would apply to model types Approach and Approach_T in P3DV2 or later. If no model types are specified, the parameters will be used for all model types for which a specific section has not been encountered. Consequently, sections for those model types requiring special treatment must precede the default section for the Flightsim variant.
- SizeMult – a size multiplier applied to the base size determined elsewhere. One size multiplier must be specified for each emitter.
- ColorDiv – the value by which the color RGB specified in *colors.txt* is to be divided to reduce the intensity of the color. To avoid an overly bright halo close-up, the final emitter, at least, usually requires a lower intensity
- Alpha – the alpha value (1-255) to be applied to the color. Normally, a high alpha would be used for the first emitter and a vey low value for the last to minimize its effect closeup.
- Texture – the name of the texture for each emitter. Two stock textures are provided: AFLT_Additive.bmp and AFLT_Alpha.bmp. As the names suggest, the first uses the Additive blending mode while the other uses the Alpha mode. The blending mode is selected automatically, Additive being the default unless the texture name includes the character string "alpha".
- Face – The face value to be applied to all emitters in the effect.

There must be one section applicable to every effect to be generated. Otherwise, the base effect will not be modified and nothing will be displayed. No warnings are generated.

While initially thought to hold the most promise, inversely-mipmapped effects are only useable with FS9. AFLT's inversely-mipmapped effects are based on the single-emitter *AFLT\Effects\BaseEffect_Mipped_FS9.fx*. To give some user flexibility, a similar customization approach to that used for their "standard" counterparts is implemented. The Flightsim version name is supplemented with " Mipped". Face is unchanged. The remaining parameters serve a similar purpose, but only for a single emitter. Two textures are provided for inversely-mipmapped effects: AFLT_Mipped.bmp and AFLT_Mipped_PV.bmp, the latter being intended primarily for use with PAPI/VASIs.

Appendix "E" – Placements.xml Formats

Placements.xml, found in each Project Folder, fully defines the lighting and associated 3D model configuration for the associated airport. It holds a series of "strip" definitions (a strip being a set of one or more associated lights), each strip containing one or more "placement" definitions for each such light.

Airports, when decoded, become a set of "surfaces", either a runway or taxiway link, referenced by a unique identifier, or an apron. In the case of a runway, that identifier is the runway designator. For taxiway links, this identifier is the hyphenated starting and ending taxiway point IDs (from the airport reference file). Each identifier is called a "surfaceRef", Aprons are for visual purposes only, so do not need a surfaceRef.

A "strip" has two attributes: "surfaceRef" and a plain English "type", and a series of parameters that apply to all placements:

- flags: 0x3 - *Intensity mask 0x3 (low=1, med = 2, high = 3)
  0xc - End Mask (Primary=0x4, Secondary 0x8)
  0x10 - Dimensions are in feet (otherwise meters)
  0x20 - *Lights on when pilot-controlled lighting triggered
  0x40 - *Lights on when airport open
  0x80 - *Lights at ground level
  0x700 - *Scenery complexity mask
  0x800 – Elevation of lights is AGL
- config: internal configuration name
- modelNames: applicable base models, separated by "|"
- params: No. of Towers (if applicable)
  *No. of lights per tower
  Spacing of towers (if applicable)
  *Spacing of lights on tower
  *Offset from runway end
  *Offset form runway edge
  *Offset from runway centerline
  Length
  Three additional parameters whose purpose varies with light type

Each strip includes one or more placements, which has a single attribute, "params". These "params" (separated by "|") - some of which may override a corresponding "strip" flag - are:

- base model
- *color(s) – must use system color names from *colors.txt*
- flags: 0x3 - *Intensity mask 0x3 (low=1, med = 2, high = 3)
  0x7C - Strobe sequence mask
  0x80 -* PAPI/VASI on left side
  0x800 - *suppress display of surface-mount image
  0x1000 - *light at ground level
  0x2000 - *elevation is AGL
  0x4000 - *light is omni-directional
  0x8000 - internal use

- *Latitude
- *Longitude
- *Slope
- *Elevation
- *Heading
- *No. of lights
- *Spacing of lights

* May be edited by users. **Do not attempt to edit any item not so identified**

A reminder, the Placements.xml file can become unreadable due to something so insignificant as a missing or extra quote mark. So, always make a backup before attempting to edit this file. Otherwise, there is no way to recover lost data other than manual re-construction.

Appendix "F" - Standards.txt Format

Each line in Standards.txt applies to a specific model type, as follows:

Column 1 - Name

Column 2 - Name of base model used for this light

Column 3 - Name of illumination texture for this standard

Column 4 - Heading offset to have light-standard properly oriented (orientation of standard in .MDL file may not be appropriate)

Column 5 - Ft./M. flag declaring units of following dimensional data

Column 6 - Head/Beam characteristics for each head separated by semi-colons (individual characteristics separated by forward slash):

- X/Y/Z offset of head from the top of the standard
- Default heading offset of beam
- Default declination
- Default beam width
- Default beam height

The procedure for adding new types of standards involved three steps:

- create the base model; it may have any name;
- save it to the Standards subfolders in the applicable BaseModels folder, similar to the procedure for a new base model; outlined in Appendix “A”; and
- update Standards.txt.

You may also add new ground illumination colors for use with new or existing light standards. A color file consists of a simple 256 x 256 pixel texture having the desired color and named either Iillum_Color_User_1.bmp or Iillum_Color_User_2.bmp saved to the *Textures\Illum* folder, replacing the stock file (copy of Illum_Color_White.bmp) already there.