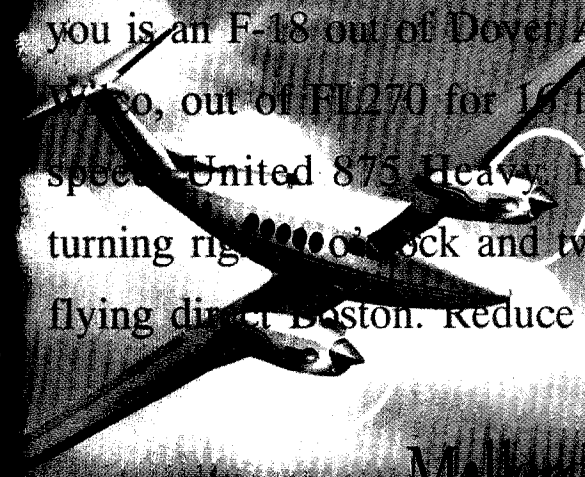


Saratoga, Chicago Departure, turn  
right heading 040, join J-104, climb and maintain  
Flight Level 160 to join J-104,  
leaving SL 25 Foxtrot  
Saratoga 337 Hotel,  
for weather  
Approach,  
advised  
Saratoga 337  
pilot's discretion to 16 thousand, fly heading 040,  
speed no slower than 200 knots, traffic to follow  
you is an F-18 out of Dover Air Force Base .....  
Waco, out of FL270 for 16 thousand at our best  
speed. United 875 Heavy. Hummer 28, traffic  
turning right one six and twelve miles is a 767  
flying direct Boston. Reduce speed to 200 knots.



Multimedia Creation Software  
For Microsoft® Flight Simulator®



Mallard



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## INTRODUCTION

### 1. Welcome

"Ever since desktop flight simulation became a reality with the first version of Flight Simulator, we armchair pilots have longed to fly simulations of our personal favorite airplanes. Version 4 of Microsoft's ever-popular Flight Simulator program and Aircraft and Scenery Designer (A&SD) provide us with configurable performance specifications. But alas, when we go to fly our creations, they still look like a Cessna, a Learjet, or one of the other standard Flight Simulator aircraft.

Now, with Aircraft Factory, you can make your simulated aircraft look the way you want it to. You can model an existing aircraft or design your very own from scratch. This graphic model can then be attached to a performance specification and flown in the Microsoft Flight Simulator world.

Just say 'yes' to the thrill of designing and building, then flying, your own aircraft. Imagine the heart-pounding exhilaration as you and your creation, your labor of love, rise from the earth's surface for the first time...."

--Don Simmons,  
Canadian Airlines pilot

### Overview

This program gives you two exciting modules: Aircraft Factory and Adventure Factory. Used with Microsoft Flight Simulator, they allow you to:

#### ■ Fly Three New Aircraft

A T-6 Texan advanced trainer, a Shorts 330-200 commuter craft, and a DC-10 are ready for you to uncrate in the Aircraft Factory and take out for a test flight.

#### ■ Build Your Own Plane

With Aircraft Factory, build any aircraft from the ground up, and give it a level of visual detail not possible using either Flight Simulator's experimental aircraft or A&SD.

#### ■ Create Your Own Flying Adventure

With Adventure Factory, you can create your own conditions and consequences. Swap adventures with your friends!

## About This Manual

### Organization

Chapters 1 and 2 of this manual are the Introduction. They present general information and installation instructions.

Chapters 3-9 make up the Aircraft Factory section, which shows how to load and fly the demo aircraft (Chapter 3); how to create parts, structures, and components; how to assemble them into an aircraft; how to "paint" the new aircraft; and how to make either a static (scenery) version or a flyable version of the aircraft.

The Adventure Factory section (Chapters 10 and 11 and the Appendix) tells you how to create files that guide you and other Flight Simulator pilots in adventures of your own creation.

Late-breaking information will be in the README file on the installation diskette.

### Mouse and Keyboard

Options, directories, or file names in Aircraft Factory can be selected using either the mouse or the keyboard. For example, where the manual says to "click on" a particular button, you can, if you are using the keyboard, press the TAB key until that button is outlined, then press the ENTER key. If a dotted line appears around the button name, just pressing the ENTER key will activate it.

Double-clicking a selection usually accomplishes the same thing as highlighting it and clicking on the OK button.

## About the Designers

Aircraft Factory was designed by Kikiware. Adventure Factory was designed by The Bruce Artwick Organization, Ltd. (BAO). BAO is a company of engineers, among them pilots with ratings from private to instrument flight instructor, who share an interest in aviation and computer graphics simulation.

The designers would like to thank the following individuals for use of the visual models for the demo aircraft: Ben Krauskopf for the T-6 Texan, Bryant Arnett for the Shorts 330-200, and Robert MacKay for the DC-10.

## Additional Resources

A list of resources you can turn to in designing your own Flight Simulator aircraft is available through Help on any Aircraft Factory menu bar (select the topic Resources). Technical support in using the Aircraft and Adventure Factory programs is available from Mallard Software; see the inside front cover of the manual for telephone numbers.

## 2. Installation

### Requirements

Hardware requirements:

1. IBM-compatible PC, 386-16 minimum
2. 2 MB of RAM (4 MB are strongly recommended for Aircraft Factory)
3. Mouse (not required for Adventure Factory).

Software requirements:

1. Microsoft Windows version 3.0 or later (not required for Adventure Factory)
2. Microsoft Flight Simulator version 4.0b or later.

Recommended but not required are:

1. MSDOS 5.0
2. To customize performance characteristics of your Aircraft Factory creations, Aircraft and Scenery Designer (A&SD)
3. For maximum benefit from Adventure Factory, the Sound, Graphics and Aircraft Upgrade (SGA) and a sound board compatible with SGA.

### How to Install

1. Determine your PC's path to the Microsoft Flight Simulator directory. This will typically be C:\FLTSIM4, but it could be something more complex like D:\GAMES\FS4.
2. Insert the Aircraft and Adventure Factory diskette into drive A or B. Type A: or B: as necessary to go to the prompt for that drive.
3. Type **install** and press the ENTER key.
4. When prompted, enter the complete path to the Microsoft Flight Simulator directory, and press the ENTER key.
5. When prompted, enter the letter of the hard drive where you want Aircraft Factory installed.
6. When prompted, enter the complete path to your Windows directory.

The install program will insert Adventure Factory files into your Flight Simulator directory, and will create the directory AAF for Aircraft Factory, directly under the hard drive you designated in Step 5. The project directories for the demo aircraft will be installed under AAF.

# AIRCRAFT FACTORY

## 3. Aircraft Factory Overview and Startup

### Factory Tour

Figure 1 shows the different areas of the Aircraft Factory. The connecting lines with arrows show where you can move between areas using Go to on the menu bar.

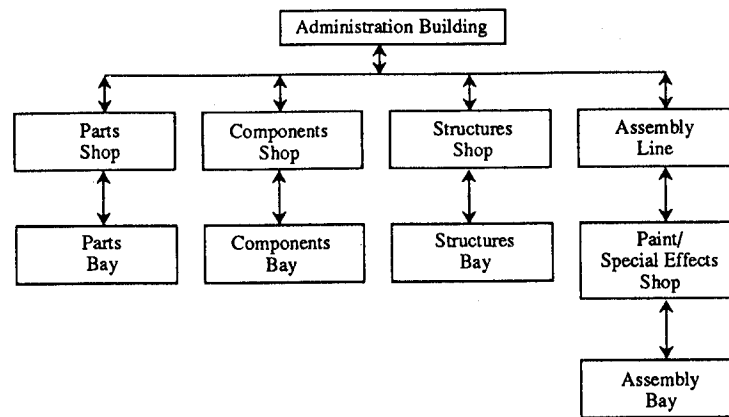


Figure 1. Aircraft Factory Layout

### Overview of the Design Process

#### Visual Design

To begin the design process, you will create a directory for your new aircraft (this is explained in **Setting up Your Project**, below). Before entering anything in this directory, you should have on hand accurate front, side, and top view drawings of the aircraft you use as your visual model.

Conceptually, it will be necessary to imagine the aircraft as an assembly of discrete parts, structures, and components, defined as follows:

- A discrete part is a single polygon or line (for example, a wing) that is not combined with other parts into a structure or component.

- A structure is a three-dimensional piece (such as fuselage or engine) generated in the Structures Bay from a Top template and Side template.
- A component is a group of parts (for example, the canopy framing or landing gear).

In the Parts Shop, you will create aircraft parts that will be used either as discrete parts, as templates for 3-D structures, or as elements in components. You will combine parts together in the Structures Shop and Components Shop, then assemble the entire aircraft on the Assembly Line.

The demo aircraft were built using Aircraft Factory. You can use any one of them to experiment with already-made parts, components, and structures.

#### Performance Design

Before flying your new aircraft, you must link it to a .SIM file that contains performance specifications. You can use an existing .SIM file, or create one of your own using Flight Simulator or A&SD.

### Starting Aircraft Factory

Aircraft Factory runs under Microsoft Windows. You can start it from Windows by double-clicking its icon. Or you can start Aircraft Factory from the DOS screen either by going to the Aircraft Factory directory and typing **win af.exe**, or by typing **win** and the full path name for **af.exe** from any other directory.

If you have no more than 2 MB of RAM, you may want to add **/mem** to the command line (**win af.exe /mem**), or to the command line for your icon's properties. If you use **/mem**, the Administration Building screen will be blank instead of showing an illustration of the factory grounds, but the program will run faster.

Starting Aircraft Factory should bring you to the screen titled **Aircraft Factory Administration Building: Planning**. From the Administration Building you can move to one of four other areas, either by selecting buttons on the illustration or by using Go to on the menu bar.

If you have your aircraft drawings (top, side, and front view) and want to start creating your own drawings right away, you can skip to **Setting up Your Project**. If you'd like to spend some time experimenting with the existing demo aircraft parts, components, and structures first, follow the instructions under **Selecting and Unpacking the Aircraft** in the **Demo Aircraft** section below.

### Demo Aircraft

The step-by-step instructions through the rest of this chapter tell you how to unpack and use the T-6 Texan aircraft provided with Aircraft Factory. You can use the same instructions for the Shorts 330-200 by substituting the directory SHRTS330 and the file names SHRTS330.AFX and SHRTS330.AFA

where appropriate, or for the DC-10 by substituting the directory DC10 and the file names DC10.AFX and DC10.AFA.

### **Selecting and Unpacking the Aircraft**

To select the T-6 Texan demo aircraft:

1. Select File on the Administration Building menu bar.
2. From the pulldown menu, select Change Project Directory. The Aircraft Factory Project Directory window will appear.
3. If T6TEXAN isn't the currently selected directory, double-click on the Aircraft Factory directory to see all of the aircraft subdirectories available.
4. Select T6TEXAN. (If you want this to be your default directory, click on the Make Startup button.) Then click on the OK button. The Aircraft Factory Project Directory window will disappear.

To unpack the aircraft:

1. Select File on the Administration Building menu bar.
2. From the pulldown menu, select Unpack Project from Import Crate (file). The Import/Export Dept. window will appear.
3. Highlight T6TEXAN.AFX and click on the OK button. The Import/Export Dept. window will disappear.

Unpacking the aircraft breaks down the .AFX file into parts files (.AFP), components files (.AFC), structures files (.AFS), and the assembly file (.AFA). Unpacking needs to be done only once per demo aircraft.

You can use the demo parts, structures, and components in the respective shops you'll be introduced to in the coming chapters. But for the moment, if you'd like, you can skip those steps and go straight to assembly so that you can view and/or fly the demo aircraft...just read on!

### **Assembling the Aircraft**

1. Select Assembly Line from the Administration Building menu bar, or click on the Assembly Line button in the illustration. The new screen title will be Aircraft Factory Assembly Line: Workorder.
2. Select File on the menu bar.
3. Select Load Assembly. The Assemblies Bin window will appear.
4. Highlight T6TEXAN.AFA and click on the OK button. The Assemblies Bin window will disappear.
5. Check that the aircraft is properly loaded by looking in the Documentation box for the labels Source SIM and Assembly Name

"T6TEXAN" should appear under Assembly Name. If it doesn't, reload the aircraft directory (at the Administration Building) and/or reload the assembly.

6. Under the Make Aircraft Options, click on the Flyable button.
7. Click on OK as prompted.

The aircraft is now loaded into Flight Simulator's Aircraft Library.

### **Putting the Aircraft on the Runway**

Now you're ready to see (or fly) the aircraft in a Flight Simulator setting. To do so without exiting Windows to run Flight Simulator, follow these steps:

1. Click on the Flight Test button. You should be brought into Microsoft Flight Simulator. (If you aren't, return to the Administration Building and select Setup to see whether the path name to the Microsoft Flight Simulator directory is correct.)
2. Select the MODE menu.
3. Select AIRCRAFT LIBRARY.
4. Select See more aircraft, as many times as necessary until the T-6 Texan appears as one of the selections.
5. Select the T-6 Texan.
6. Press the space bar to reactivate Flight Simulator.

### **Viewing the Aircraft**

To view the aircraft, use slew mode or the Flight Simulator View Controls. To return to the Assembly Line, press CTRL+BREAK.

### **Setting up Your Project**

This section explains how to prepare a project directory for creating a new aircraft. Or, if you want to walk through the steps of creating an airplane with already-made parts, you can load an existing aircraft instead of starting a fresh project.

### **Starting a Fresh Project**

Use the Windows File Manager or a DOS window to create a new subdirectory in the Aircraft Factory directory. Then select File on the Administration Building menu bar, and Change Project Directory from the pulldown menu. Double-click on the Aircraft Factory directory to show its subdirectories, and highlight your new one. (If you want your new subdirectory to be your default project directory, click on the Make Startup button now.) Then click on the OK button.

## Unpacking an Existing Aircraft

To unpack one of the demo aircraft, an aircraft received from someone else in the form of an .AFX file, or an aircraft you've already started working on but have "crated up" into an .AFX file, follow the instructions under **Selecting and Unpacking the Aircraft** in the **Demo Aircraft** section above, substituting the proper aircraft directory and file names as appropriate. After familiarizing yourself with **Using Blueprints** (below) and then unrolling the Parts Bay blueprint (Chapter 4), you can skip **Creating a New Part** and read **Reworking a Part** to learn how to view or modify existing parts.

## Using Blueprints

The Parts Shop, Components Shop, Structures Shop, and Assembly each have a bay where you will be working with blueprints. Menu bar selections vary from bay to bay (the Parts Bay has the most extensive selection), but are similar enough that they are explained here, rather than duplicating material in the chapters dealing with parts, structures, components, and assembly.

The menu bar selections common to all the blueprints, with one exception, are **File**, **Go to...**, **View**, **Zoom**, **Settings** and **Help** (the Structures Bay does not have **Zoom**). An option that doesn't use the menu bar is **Recentering**.

### File

In the Parts Bay, **File** allows you to load another part, or a structure or assembly, to view in relation to the part you're currently creating or reworking. Other Parts Bay **File** options are to **Rework** an existing part or to **Save....**

**File** is not an active option in the Components bay. In the Structures Bay, **File** allows you to **Load TOP** Template and **Load SIDE** Template or select **Longitudinal Symmetry**, and **Save....** In the Assembly Bay, **File** allows you to start a **New assembly**, **Load** an existing assembly, or **Save....**

### View

**View** allows you to choose between **Side**, **Top**, and **Front** view.

### Zoom

**Zoom** allows you to adjust the scale used on the blueprint. When you increase the zoom factor, the number of feet represented by what you see on the blueprint decreases by the same factor. (Only the Parts Bay shows you the numerical scale used; see the **H[eight]** and **W[idth]** measurements on the top bar of the Parts Bay screen.) For example, say the blueprint originally represents an area of 25 by 33-1/3 feet (H=25.0, W=33.3). If you select a zoom factor of 1/2, the dimensions of the area represented will double (H=50, W=66.7).

Using the menu bar or the corresponding keys (x,1,2,5), you can adjust zoom coarsely by factors of five and two. For finer zoom control, available only in the Parts Bay, use the +, -, >, and < keys. To restore the original zoom factor,

select **Reset** from the **Zoom** menu or press the R key. When you save the part, the current zoom factor will be saved along with the part.

**Zoom** does *not* change the actual size of the part. It only changes how big the part looks on your screen.

## Recentering

Another feature that helps you view your blueprint is **Recentering**. If some of your part is off the edge of the screen even though the zoom factor isn't too large, you can reposition the center of your view. Point the mouse at the location you would like to be the new center of the screen/blueprint; then do one of the following: (1) hold down the SHIFT key and click the left mouse button, or (2) click the right mouse button. When you save the part, this new center will be saved along with the part.

To undo your new center, select **Reset** from the **Zoom** menu from menu bar or press the R key; this restores both zoom and centering. In the Parts Bay, **Reset** will restore zoom and center to the way they were when the part was loaded; in the other bays, **Reset** will automatically adjust zoom and center for the best view of the component, structure, or assembly.

## Settings

**Settings** allows you to change aspects of a blueprint's appearance on the screen. From any of the bays, you can change the **Colors** used in the blueprints. To use the new colors for the current session only, click on the **OK** button; for a lasting change, click on the **Save** button, then the **OK** button. To restore all of the selections to their default colors, click on the **Default** button.

Another selection available from **Settings** in all of the bays is **Cursor** (select **Arrow** or **Crosshair**).

The Parts Bay **Settings** menu allows you to change the following as well:

- Grid showing or not
- Axis lines showing or not
- Directional labels such as "FORE" and "AFT" showing or not
- Current coordinates showing in the working mode display box or not (DRAW or REWORK and the current point number will still show, regardless)
- **Save Settings** will save all of the above plus colors and cursor (zoom factor and centering are saved when you save the part, whether or not you **Save Settings**).

The default settings in effect when you first enter Aircraft Factory are to have Grid, Axis, Labels, and Coordinates all selected, and the arrow cursor.

## Help

Help allows you to choose from a list of online help topics, including sections of the manual that have been entered online and a glossary of aircraft terms.

## Parts Bay Menu Bar Options

Unique to the Parts Bay menu bar are the Create and Rework modes. Creating and reworking are explained in the next chapter.

## 4. Creating Parts

Phase One in building your aircraft is to create the necessary parts. For this task, you should have accurate front, side, and top view drawings of the aircraft to use in making your visual model. These drawings will be called your *paper drawings* in the rest of this manual.

Because you can't enlarge or reduce the actual size of a part once you create it, it's *very important* to be aware of the scale of each of your paper drawings, so that you create all of your parts to the same scale.

### Unrolling the Parts Bay Blueprint

To get to the Parts Bay blueprint, first go to the Parts Shop either by selecting Parts Shop on the Administration Building menu bar or by clicking on the Parts button on the Administration Building screen. If you're creating a new part, you don't need to fill in the Workorder yet; the nice thing about the Aircraft Factory Parts Shop is that you can do the fun part first, and save the paperwork for later! Just select Go to... on the menu bar and Parts Bay on the pulldown menu. This will show you an empty blueprint.

In the upper right hand corner of the blueprint is a box labeled DRAW. This is the working mode display box, which should read DRAW when you're creating a part, and REWORK when you're using one of the modes under Rework on the Parts Bay menu bar.

Depending on the settings selected, the Parts Bay blueprint may or may not show the following:

- Grid
- Axis lines
- Directional labels such as TOP and BOT
- RIGHT, FORE, and UP coordinates in the working mode display box, under DRAW.

### Creating a New Part

In the Parts Bay, you'll be transferring data from your paper drawings in one of two ways: by tracing parts directly onto the screen of your monitor, or by specifying the coordinates of a starting position and entering subsequent coordinates that define the exact outline of the part.

You may use up to 30 points to define each part, but be sparing with points. Every additional point will only add to the complexity of the aircraft design and eventually degrade the frame rate within the Flight Simulator environment. Along a curve, it's good to locate a point at the place where the curvature changes the most (to help determine where this is, you can use a straightedge to indicate tangents to the surface).



Though you'll usually be creating polygons or lines in two dimensions, you can enter coordinates in 3-D by switching views and reviewing part coordinates from all three Views, Side, Top, and Front. The canopy base of the T-6 Texan project (CANOPY1.AFP) is an example of a three-dimensional part.

### Tracing

To create parts by tracing, first enlarge or reduce your paper drawings on a photocopy machine as necessary to make the parts a good size for your computer screen. It's *very important* to stay aware of the scale of both your paper drawings and your Parts Bay blueprint, so that you create all of your parts to the same scale. Once you've entered a part into Aircraft Factory you can make it look larger or smaller on the screen (see **Zoom** in the *Using Blueprints* section in Chapter 3), but you can't change its actual size.

Next, you need a method of transferring the information to the screen. You may wish to use cling film and a permanent marker to trace part outlines from the paper drawings, and then place each outline on the screen (finally, a good use for static cling!). Or you could cut out profiles of the photocopied parts and apply the profiles to the screen (with removable tape, for instance).

By default, blueprints are ready for you to draw your parts on the screen. The working mode display box should read DRAW. If it doesn't, select **Create** from the Parts Bay menu bar and **Screen Entry** from the pulldown menu.

The fuselage is a good part to start with. But whether or not it's the first part you create, you should place the fuselage such that in Top view, the fore-aft axis runs through the center of the fuselage from front to back. If you use Symmetry to draw the fuselage from the Top view (clicking points along only one side of your paper or cling film drawing), the fuselage will be centered automatically. Symmetry is described in more detail in the *Symmetry* section below, and this chapter ends with a tutorial that will step you through creating a fuselage.

Click with the mouse on points around your outline; lines will automatically connect the points.

To undo the latest point you entered, press the BACKSPACE key or select **Rework** from the menu bar and **Undo** from the pulldown menu. Doing it again will undo the part before that, and so forth. To erase the whole part you're working on in the Parts Bay, select **Rework** from the menu bar and **Clear Part** from the pulldown menu.

If your part will be a solid piece or an enclosed outline (as opposed to a straight line or U-shape or some other open form), don't enter the last point. When you select Solid or Outline on the Parts Shop Workorder, Aircraft Factory will enclose the last section back to the first point for you, and you won't have to worry about trying to hit that exact point with a mouse click.

### Symmetry

If your part is symmetrical, you can select **Create** on the Parts Bay menu bar, then Symmetry Mode from the pulldown menu. Then, as you click points on the screen, each mouse click will create two points placed with left-right symmetry (or top-bottom symmetry if you are in Side view).

If you change views, Symmetry mode will be deselected and you will need to reselect it.

### Defining by Coordinates

When you define your parts by entering coordinates, you will be working around an origin that has the coordinates 0,0,0. The only rigid requirement about this origin is that the right-left center of aircraft has to be 0 left, 0 right. This means that from Top view, the fore-aft axis is centered longitudinally along the length of the fuselage. From the Side view, 0 front aft, up down can be anything convenient, but it's good design practice to place the origin somewhere on the fuselage.

To create a part by typing in the coordinates of points along its outline, select **Create** from the Parts Bay menu bar and **Data Sheet** from the pulldown menu. The Data Sheet window will appear. For each point, type in three coordinates separated by commas and press the ENTER key; when the part is finished, press the ENTER key again or click on the **OK** button to return to the blueprint.

Don't enter the coordinates of a part's last point if it's the same as the first point. When you save the part (see *Saving a Part*, below), select Solid or Outline on the Parts Shop Workorder, and Aircraft Factory will enclose the last section back to the first point for you.

### Using Reference Assembly/Structure/Part

Even as you're creating a part, you can choose to see its appearance, size, and orientation in relationship to an existing part or structure, or to an existing assembly if you've progressed so far as to assemble your aircraft. To do so, select **File** from the Parts Bay menu bar, then select from the pulldown menu either Load Reference **Assembly**, Load Reference **Structure**, or Load Reference **Part**.

You may load one reference assembly or structure, or as many reference parts as you like up to the limit on total aircraft parts (limits are detailed in online Help; select the topic Limits). If you want to use reference parts in addition to a structure or assembly, load the structure or assembly first, then add reference parts.

### Saving a Part

After you finish tracing or entering coordinates for each part, select **File** on the Parts Bay menu bar, then **Save...** on the pulldown menu. (Or you can **Go** to the Parts Shop, because this step does not accomplish any actual saving.)

**CAUTION:** your part is not saved until you've filled out the Parts Shop Workorder and selected File and Save from the Parts Shop menu bar. Keep reading!

### **Filling Out the Workorder**

After selecting Save... at the Parts Bay, you'll be brought to the Parts Shop. Fill out the Parts Shop Workorder with the information listed below. (Press the TAB key between fields, or use the mouse to point and click.)

1. Enter a job description (24 characters maximum). You'll see your job description for each piece of the aircraft when you're at the Assembly Line ready to assemble things together, so be sure to enter a meaningful, helpful description.

For example, you can use the description line to describe the circumstances in which you would use alternate parts. A description line for a part FLAPDN.AFP might be "extended flap." During assembly, you'd be able to assign to this part the special effect "Only when flaps extended" and to another part the special effect "Only when flaps retracted."

2. Enter a file name (8 characters maximum). When you rework a part or combine parts into components or structures, you will be choosing parts from a list of the parts' file names, so choose a descriptive, meaningful name. This name will be given the extension .AFP.
3. Select construction method: Solid, Outline, or Line.
  - a. If you want the part to be filled with a solid color when it's painted, select Solid. An example of a Solid part is the T-6 Texan's main wing (right), WING\_R.AFP.
  - b. If you want the part to be closed but not filled with color, select Outline. An example of an Outline part is the T-6 Texan's canopy base, CANOPY1.AFP.
  - c. Line is for open-ended parts that you don't want filled in with a solid color. CANOPY1.AFP. An example of a Line part is the inverted "U" member of the T-6 Texan canopy, INVU.AFP.
4. Select the part's function. If it's a standard part (as opposed to a template), select whether it will cast a shadow. If the part is to be used to manufacture a structure, select whether it is the Top or Side template.

### **Saving**

After filling out the Workorder, select File on the Parts Shop menu bar, then Save Part. The part and its description will be saved to the subdirectory exclusive to this aircraft.

### **Clearing**

To clear your blueprint for creating another part, choose *one* of these methods:

1. If you want to continue to use a reference assembly, structure, or part that you loaded for creating the previous part, you can Go to the Parts Bay, then select Rework from the Parts Bay menu bar and Clear Part from the pulldown menu. The reference piece will still be on the blueprint.
2. Select File from the Parts Shop menu bar, then New Part from the pulldown menu. This will clear both the current part and any reference piece(s).
3. Go to the Parts Bay, then select File from the menu bar and New. This will clear both the current part and any reference piece(s).

### **What's Next?**

When you're finished creating and saving all of the parts from your paper drawings, you can go back and rework the parts if desired, or proceed to either the Structures or Components Shop to combine groups of parts.

### **Reworking a Part**

You can rework (change) a part by returning to the Parts Bay. If you haven't left the Parts Shop, then the blueprint for the last part you created will still be out for viewing. If you have left the Parts Shop, or if you want to rework a different part, you can select a part for reworking in one of two ways:

- From the Parts Shop, select File from the Parts Shop menu bar and Load Part from the pulldown menu, or
- From the Parts Bay, select File from the Parts Bay menu bar and Rework Part from the pulldown menu.

In either case, the Parts Bin window will appear. When you select a part and click on the OK button, you will be brought to the Parts Bay if you're not already there.

Below are two different methods for reworking your part. Whichever one you choose, be sure to save your work when you're done (see **Saving a Part**, above).

### **Reworking with the Point Editor**

You can use the Point Editor to precisely edit all the point coordinates manually if they need adjustment. Before entering the Point Editor, you may want to select Settings from the menu bar and disable the blueprint's Grid. Disabling the grid will reduce the time it takes to redraw a part after you change a point.

To enter the Point Editor, select Rework from the Parts Bay menu bar and Point Editor from the pulldown menu. The Point Editor window will appear. If it overlaps your part, you can drag it out of the way with the mouse. You

can change the view by using the F2, F3, and F4 function keys for Side, Top, and Front view, respectively.

In the Point Editor window will be a listing of point coordinates under the headings RIGHT, FORE, and UP. Select a point by using the up and down arrow keys or using the up/down scroll arrows and clicking with the mouse. The currently selected point will be highlighted in the coordinates list, circled on the screen, and its coordinates will appear on the shaded bar below the coordinates list.

To modify the selected point, click on one or more of the coordinates in the shaded bar and type in the new value(s); then confirm the update by clicking on the Mod button (for modify) or by pressing the ENTER key on the keyboard. The coordinates will be updated and the drawing modified to reflect the change.

To delete the selected point, click on the Del button or press the BACKSPACE key.

Ins will insert a new point halfway between the selected point and the next one. In its original position, this new point is superfluous, but you can then edit it to change the shape of your part.

To return to the Parts Bay when done, click on the OK button.

### **Reworking on Screen**

If you want to edit points quickly without going in to the Point Editor, then select Rework from the Parts Bay menu bar and On Screen from the pulldown menu. Alternatively, you can click on the working mode display box so that it reads REWORK.

Each time you press the space bar, the next point in on the part will be highlighted. You can update any point by just clicking the new position. When you're done, deselect the On Screen mode by selecting Rework and On Screen once again, or by clicking on the working mode display box.

## **Special Parts: Tools and Tail Number**

### **Tools**

You can create tools such as rulers or jigs, save them as parts, and then mark these tools for deletion before final assembly (you may want to save a version of the aircraft [an .AFA file] that includes the tools first, in case you need to use them again!)

### **Tail Number**

If you create a tail number as a part, you will not actually draw it. On the Parts Shop Workorder, enter as the job description the exact letters and numerals you want the tailsign to display. Then assign a file name TAILSIGx.AFP, where x can be any letter or digit. Now save the part. All the rest of the work will be done during Assembly.

## **Parts Tutorial: Fuselage**

A typical start in the Parts Bay is to create the raw ingredients for the fuselage. (The fuselage in this case will not include the spinner or vertical stabilizer, because you may want to color those parts differently.) You'll be creating two parts that won't be used as discrete parts but rather as Top and Side templates to be merged later into a fuselage in the Structures Bay. Creating a structure out of these two templates is covered in **Structures Tutorial: Fuselage** in the next chapter.

### **Creating the Tutorial Project Directory**

To create a directory for your tutorial project,

1. Create a new subdirectory named TUTORIAL in the Aircraft Factory directory. Or, if this is the start of a real-live project for you, choose a project name for your budding aircraft.
2. Select File on the Administration Building menu bar, and Change Project Directory from the pulldown menu.
3. Double-click on the Aircraft Factory directory to show its subdirectories, and highlight TUTORIAL.
4. Click on the OK button.

### **Creating the Fuselage Top Template**

The Top template is normally symmetrical (left = right). We will be starting from the rear of the fuselage (this is a random choice) and working our way forward, tracing or drawing the outline of the Top template up to just behind where the spinner will be fitted. You won't need to close the front of the fuselage; the Solid coloring will take care of that.

1. Go to the Parts Shop.
2. Select File from the menu bar and New Part from the pulldown menu. You will be brought to the Parts Bay.
3. From View on the menu bar, select Top View (F3).
4. From the Create menu, select Symmetry. (If the directional labels such as "RIGHT" and "LEFT" aren't showing, you may also want to select Settings on the menu bar and Labels from the pulldown menu.)

Using symmetry forces a right-left 0,0 from the Top view; thus, your aircraft will automatically be centered along the fore-aft axis.

5. Use Zoom to scale your aircraft, setting the drawing width on the screen to represent the maximum length of the aircraft or to correspond to the scale of the paper or cling film drawing from which you may be tracing. You should plan for your fuselage to intersect the origin (0,0,0) of the blueprint.

6. The fuselage normally tapers to a point at the rear. Use the mouse to click on this first point, on the axis. The point counter in the working mode display box (top right corner of the screen) will update, indicating two points. The point count will increment two at a time because you're in symmetry mode.
7. Work your way forward, clicking each point on the fuselage where the curvature changes significantly. Try to approximate all curves with the minimum of straight lines. And don't worry if you can't get the coordinates exactly the way you want them at this stage. You can use the Point Editor to make any corrections later (see *Reworking a Part*, above).
8. Continue entering all points until the fuselage Top template is complete. Remember, you don't need to close in the front of the fuselage with a line.

### ***Saving the Fuselage Top Template***

1. Select File from the Parts Bay menu bar and Save... from the pulldown menu. You will be returned to the Parts Shop, where the paperwork has to be filled out.
2. Enter a job description (the contents are at your discretion).
3. Enter the file name TOPFUSE.
4. In the Function field, select Structure Template: TOP.
5. In the Construction method field, select Solid.
6. When you're done filling out the form, select File from the Parts Shop menu bar and Save Part from the pulldown menu.

### ***Creating and Saving the Fuselage Side Template***

Now you can create the Side template, the profile of the fuselage, with the following steps.

1. Clear the Parts Bay blueprint. (Alternative methods for this are explained under *Clearing* in the section *Saving a Part*, above.)
2. Select File, then Load Reference Part.
3. From the Parts Bin window, select TOPFUSE.AFP (the Top template of the fuselage you just created). This will allow you to check the exact length of the fuselage to ensure that the two views align correctly.
4. Select View, then Side. The Top template of the fuselage (reference part) will now appear as a horizontal line, but you can switch views any time to observe the construction. (Remember that changing views turns off Symmetry!)
5. Draw the Side template.

6. Select File and Save..., which will bring you to the Parts Shop.
7. Fill out the Parts Shop Workorder as follows: write in a job description, then specify a part name of SIDEFUSE. In the Function field, select Structure Template: SIDE. In the Construction method field, select Solid.
6. When you're done filling out the form, select File from the Parts Shop menu bar and Save Part from the pulldown menu.

Congratulations! You've created two of the most important parts necessary to produce a structure. The Structures Tutorial will step you through merging the two templates into a three-dimensional structure.

## 5. Building Structures

You can create a discrete part in 3-D, but it's often simpler to create a 3-D structure using the Computer Aided Design and Manufacturing (CAD/CAM) facilities available in the Structures Shop. You need to supply only a few bits of information, and the CAD/CAM facilities will do the rest. Most designers will use this facility for complex three-dimensional objects such as fuselages, engines, and fuel tanks.

### Selecting Templates

To build a three-dimensional structure, you must come prepared with two parts to be used as templates: one for the Top template and one for the Side template of the structure you wish to make. (Or, if your structure will be longitudinally symmetrical, you need only one template.) You make these templates in the Parts Bay as you would make any other part, but when you fill out the paperwork in the Parts Shop, select one of the Structure Template options under Function.

Once your templates are ready, go to the Structures Shop and select New Structure from the File menu; this will take you right into Aircraft Factory's CAD/CAM Structures Bay facility.

From the menu bar, select Files, then Load TOP template. From the Parts Bin, select the Top template for your structure and click on the OK button. Then select *either* Longitudinal Symmetry or Load SIDE Template. If you select Longitudinal Symmetry, the Top template will be used as the Side template as well. If you select Load SIDE Template, you next need to highlight the Side template in the Parts Bin and click on the OK button.

### Designing Bulkheads

Once you've provided the two templates, you need to specify what type(s) of bulkhead approximates the cross section shape of your structure. This is done through Choose Bulkhead Type on the Structures Bay menu bar.

When you select Choose Bulkhead Type on the Structures Bay menu bar, the Bulkhead Toolkit window will appear, showing the various bulkhead types by shape. When you click on a shape button, the name of that bulkhead shape type will be displayed on the wide OK button below the shape buttons. The bulkhead type names are: Triangle, Diamond, Rectangle, Keystone, Pentagon, Hexagon, Hexagon (flat), Octagon, and Point. You may use as many different types of bulkheads in one structure as you want. For example, if your fuselage tapers to a closed point at one end, you'll want the Point bulkhead just for that end.

Although you may use up to 20 bulkheads of the highest complexity (octagonal) in your structure, be warned that doing so will consume parts capacity, increase file size, and degrade frame rate. Each bulkhead counts as a part, and creating 3-D effect consumes additional parts. (Later, from Options on the Assembly Line menu bar, you can check with the Statistics Department

to see how many parts have been used in your assembly, but parts counting is not available per structure.) It's best to experiment to find the minimal bulkhead configuration to achieve your structure.

Select a bulkhead type by clicking on the shape button first. Then click on the OK button (which also shows the name of the shape type you selected) to confirm. Double-clicking on the shape type button will not work here, to avoid accidental selections.

The Bulkhead Toolkit window will disappear when you click on the OK button. Avoid clicking the mouse again until you're ready to lock the bulkhead into place. On the blueprint, you'll be presented with a composite Top and Side view of the structure.

Click the mouse button where you want to place a bulkhead. To place a bulkhead at the end of the structure, click beyond the end of the structure and the bulkhead will be placed exactly on the end. In general, you'll place bulkheads at the ends and at locations where there is a radical change in the Top or Side view. (Note that you are looking at both the Top and Side view simultaneously; thus, View is not available from the menu bar at this time.) A bulkhead shows as a dashed vertical line.

If you put a bulkhead in the wrong spot, you can undo all of the bulkheads by selecting Manufacture Structure from the menu bar, then Reject from the pulldown menu. Your structure will stay on the blueprint, but the bulkheads will disappear. You can't delete an individual bulkhead.

You may mix bulkhead types on a structure. Just go back to the Bulkhead Toolkit (by selecting Choose Bulkhead Type from the menu bar) to change bulkhead types at any time. Some combinations of bulkhead types are more satisfactory than others; experiment for the best effects in your design situation.

### Manufacturing a Structure

Once you're satisfied with the selection and placement of bulkheads, select Manufacture Structure and Start. Grab a cup of coffee, phone your spouse to explain why you'll be home late again tonight and sit back as the Aircraft Factory's CAM does its work. (Really, it takes only seconds at the most!)

### Saving a Structure

When your structure is complete, give yourself some time to look it over from different views. If the bulkheads aren't satisfactory, select Manufacture Structure and Reject to redo them.

When the structure meets your satisfaction, select File from the Structures Bay menu bar and Save... from the pulldown menu.

**CAUTION:** your structure is not saved until you've filled out the Structures Shop Workorder and selected File and Save from the Structures Shop menu bar.

Back at the Structures Shop, you need to provide a job description and file name on the Workorder. After you've done so, select File from the Structures Shop menu bar and Save from the pulldown menu.

## **Reworking a Structure**

Once you've saved a completed structure, you can reload it into the Structures Shop. But doing so will *remove* all of the bulkheads you've already placed. If you want to proceed, select Load from the Structures Shop File menu. Highlight the structure you want to rework, click on the OK button, and you will be taken into the Structures Bay. The Top and Side templates will already be combined, but the bulkheads will have been cleared.

The Bulkheads Toolkit will already be open for you. Insert new bulkheads and save your work.

## **Structures Tutorial: Fuselage**

To use this tutorial, you must have completed *Parts Tutorial: Fuselage* in the previous chapter.

### **Selecting the Directory**

To build a structure from the Top and Side fuselage templates you created using the Parts Tutorial, first be sure the TUTORIAL directory—or other project directory name you chose at Step 1 of *Creating the Tutorial Project Directory* in the Parts Tutorial—is selected. (If you haven't changed project directories or exited Aircraft Factory since doing the Parts Tutorial, it will still be selected; but you can check Change Project Directory at the Administration Building File menu if you're unsure.)

### **Loading the Templates**

1. Go to the Structures Shop and select New from the menu bar. This will bring you into the Structures Bay.
2. Select File from the Structures Bay menu bar and Load TOP Template from the pulldown menu.
3. In the Parts Bin, highlight TOPFUSE.AFP, then click on the OK button. An outline of the part will appear on the blueprint.
4. Select File again, then Load SIDE template from the pulldown menu.
5. In the Parts Bin, highlight SIDEFUSE.AFP and click on the OK button. The outline will be superimposed on the Top template.

### **Selecting and Placing the Bulkheads**

1. Select Choose Bulkhead Type from the Structures Bay menu bar.
2. Select Point by clicking on its shape button (the last one in the group of shape buttons), then on the OK button.

3. Move the mouse *beyond* the pointed end of the fuselage and click the left button. A dashed line will appear at the pointed end of the fuselage, indicating where the bulkhead has been placed.
4. Select Choose Bulkhead Type again, select a shape that reflects the cross section of the rest of your fuselage, and click on the OK button.
5. Click the mouse button off the broad end of your fuselage to place a bulkhead at the end, then at any place along the bulkhead where the curvature changes significantly in either the Top or Side template (both of which you're viewing at the same time).

## **Manufacturing and Saving the Structure**

1. When you've placed the bulkheads, select Manufacture Structure from the menu bar and Start from the pulldown menu. You will see a 3-D representation of the fuselage.
2. Select Save... from the Structures Bay File menu, which will bring you to the Structures Shop Workorder.
3. Fill in a job description and file name for your structure, then select Save from the Structures Shop File menu.

You now have a structure that you can connect to other aircraft pieces in the Assembly Line.

## 6. Building Components

When designing and constructing an aircraft, it's often useful to treat a group of parts as a single unit, called a component. Whenever you expect a group of parts to be assigned to the same Paint Specialist Group (see Figure 2 in the *Assembling and Painting* chapter), have the same coloring, the same relative orientation (that is, they won't change orientation with respect to each other), and the same special effects, then these parts are good candidates for being grouped into a component. An example component is the canopy of the T-6 Texan (CANOPY.AFC), which includes a base frame and several inverted "U" frame members.

### Loading the Parts

The first step in building your component is to go to the Components Shop and load the parts you need. Select **New Component** from the **File** pulldown menu. Then select **Add Part** from the menu bar. A selection of parts available in your current project directory will appear in the Parts Bin window. Select one and click on the **OK** button. The part description and file name will be written to the Components Shop Workorder list.

If you want to see the blueprint, pull down the **Go** to menu and select **Components Bay**. (In the bay, you may need to reset the **Zoom** setting.) The current part will be a different color than any parts you have already put into the component.

At the Components Shop, continue adding the remaining parts. You can insert the same part more than once—for instance, if you want a row of windows, you can add the same window part again and again, then position each window differently when you move parts around to build the component.

### Moving the Parts

Now it's time to move the parts into their final locations in the component. To move a part, highlight it on the Components Shop Workorder list, go to the blueprint, and drag it with the mouse. For three-dimensional relocating, change views and drag as required. Use **Zoom** and **Recentering** if you want a better look at your work.

### Saving a Component

When the parts are positioned to your satisfaction, go to the Components Shop and fill out the rest of the Workorder (Job description and File name). Save the component by pulling down the **File** menu and selecting **Save Component**.

At any time you may return to the Components Shop and reload this component for further work.

## 3-D Simulation Example

You can simulate three dimensions in the way you combine parts into a structure. For example, you can combine two line parts, one a semicircle and the other a straight line, in such a way that this simple component makes a convincing air scoop when assembled onto the lower part of your aircraft:

## 7. Assembling and Painting

The Assembly Line, which contains the Paint/Special Effects Shop, is where your complete aircraft is assembled, gets its paint job, and is wheeled out for a test flight. This phase will be one of the most challenging and rewarding of your activities as Chief Designer.

The steps necessary for successful completion of Assembly include:

- Listing all the pieces (parts, structures, and components) to be used in the project, and specifying their locations on the aircraft
- Designing the paint scheme
- Adding special effects
- Specifying performance characteristics.

### Starting or Resuming an Assembly

To begin assembling an aircraft from the parts, components, and structures you've created, select **File** from the Assembly Line menu bar, then **New Assembly** from the pulldown menu.

To rearrange or change colors on an existing aircraft or to resume work on an assembly you've already started, select **File** from the Assembly Line menu bar, then **Load Assembly**.

Once again, the paperwork can wait. Proceed to the Paint/Special Effects Shop, which is between the Assembly Line and the Assembly Bay. Most of your activities will take place here.

### Listing the Pieces

#### Choosing a Piece to Add to the Assembly

In the Paint/Special Effects Shop, select **Add to Assembly** on the menu bar for the first or next part, component, and structure you want to include in your aircraft. From the pulldown menu, select **Structure**, **Component**, or **Part**; you will be shown the appropriate bin, listing all the pieces of that type from your project directory. Highlight the piece name you want to add to your assembly.

#### Assembly Techniques

If you selected a **Part** or **Component**, three assembly technique options will appear in the Parts or Components Bin, under the listing of available parts or components. These options are:

- Normal handling. This is the default.
- Add left-right pair. This is the same as selecting a part or component and specifying Normal handling, then selecting the same part or component

again and specifying **Fit to opposite side** (the last of the three assembly options).

- **Fit to opposite side.** This will add the part or component as you created it in the Parts or Components Bay, but with a mirror image orientation with respect to left and right.

### Verifying your Selection

After highlighting the desired piece, and selecting an assembly option if appropriate, click on the **OK** button. Your selection will be sorted into the appropriate list on the Paint/Special Effects Shop Workorder.

### Color/Special Effects Assignments: Overview

To the right of the Structures, Components, and Parts lists on the Paint/Special Effects Shop Workorder are three boxes: **Paint Specialist Group**, **Special Effects** (display conditions), and **Assembly techniques**. You can assign your pieces to a **Paint Specialist Group** and specify **Special Effects** either as you add each piece to the assembly, or all at once after you're finished listing the pieces. Assembly techniques will take care of itself, based on the assembly technique option you selected at the Parts or Components Bin.

Whether you make the assignments as you go along or after listing all the pieces, you will do the following for each piece: At the **Paint Specialist Group** box, you will select the aircraft section that best describes where the current piece will be located, so that it will be assigned to the right **Paint Specialist Group** (more details forthcoming in **Painting**, below). At the **Special Effects** (display conditions) box, you will usually want to select **Always**; see **Special Effects/Conditions**, below, for more details.

### Removing a Piece

To remove a piece from your assembly, select **Mark for Removal** from the Paint/Special Effects Shop menu bar, and highlight the piece you want to remove. The piece will still appear in the listing, but the **Assembly Techniques** box will show the selected assembly technique in red and crossed out. The part will not be saved when you save your assembly.

### Maximum Number of Pieces

After selecting a piece, and assigning **Paint Specialist Group** and **Special Effects** category if you wish, you're ready to select **Add to Assembly** to proceed to the next piece. When you get to the bottom of a list on the Workorder, you'll be able to scroll through the list. You can have up to 100 discrete parts, 20 structures, and 20 components in an assembly. The total number of parts and bulkheads and such used inside structures, plus parts in components, plus discrete parts may not exceed 182. From the Assembly Line menu bar you can check the number of discrete parts, structures, components, and total parts used by selecting **Options**, then **Statistics Department**.



## Saving Your Work in Progress

If you want to take a break and save what you've done so far, Go to the Assembly Line. Assign an assembly name (the Assembly Name field is in the Documentation box) and a job description. Choose the job description carefully! This is what will appear as the description line in the Flight Simulator Aircraft Library. Next, select File from the menu bar and Save Assembly from the pulldown menu. You can later Load this assembly using the same pulldown menu (see *Reworking an Assembly*, below). Before flying the aircraft, you will also need to assign a .SIM file (see *Saving Your Assembled Aircraft*, below).

## Painting

Either as you enter each piece, or once all the pieces are installed and positioned correctly, you should make the work assignments necessary to get the aircraft painted.

Painting is a very compartmentalized task. You can think of it as a highly unionized paint shop with a number of different workgroups, each specializing in a different aspect of the job. You must be diplomatic and honor this division. To help you survive, Figure 2 shows you a comprehensive listing of the specialties and provides some examples of when to ask for them.

Paint Specialist Group	Possible use
body, main	fuselage
canopy/high wing	canopy, high wings
nose	nose, spinner
nose, left	engines, propellers
nose, right	engines, propellers
smoke/splash	
tail, center	vertical stabilizer, rudder
tail, left, lower	horizontal stabilizers attached to fuselage
tail, left, upper	horizontal stabilizers attached to tail
tail, right, lower	
tail, right, upper	
undercarriage	
wing, left, low	wings attached to fuselage
wing, left, mid	same
wing, right, low	same
wing, right, mid	same

Figure 2. Paint Specialist Groups

The Paint Specialist groupings determine not only the color for that section of the aircraft, but also determine what piece dominates (goes on "top") during assembly if two pieces are trying to occupy the same space.

To assign any piece of your aircraft to a selected Paint Specialist Group, highlight that piece in your listing of included pieces. Then pull down the Paint Specialist Group menu, and click on your choice.

The current day/dusk/night colors that this Paint Specialist Group is using will appear and may be reassigned, if desired. To reassign a color, double-click on the color box and select a new color from the Paint Inventory window. (See the topic Aircraft Colors in online Help for suggestions about colors.) Remember that the colors shown for the selected Paint Specialist Group will be used for *all* pieces painted by this group.

## Special Effects/Conditions

The menu below Paint Specialist Group is the Special effects menu. Usually you'll want to select the "Always" setting, but occasionally you might need something special. For example, if you're designing retractable gear, you can select the "Only when gear down" special effect display option for those elements comprising the gear.

Most special effects or conditions are self-explanatory, except for Insignia; see the subsections *Insignia* and *Tail Number*, below, for examples of these.

Conditions such as "Only when below speed (in knots)" and "Only when above RPM" require further input; when you select one of them, use the scroll bar to set the speed/RPM boundary.

### Insignia

Insignia are like decals to be applied to the surface of a component, a structure, or another part. They can be used as visual decoration and detailing (such as stripes, nose art, or windows), or as an aid in proper visual appearance, to cover awkward views that tend to arise in aircraft manufacturing (for the latter, see *Insignia: Advanced Use*).

The Insignia special effects category allows you to assign a color independent of the Paint Specialist Group color for the area of the aircraft where you apply the insignia. When you highlight the Insignia category for the part you've selected, a second set of three color boxes will appear. Use this second set of boxes, not the set above Paint Specialist Group, to assign day/dusk/night colors to your insignia.

Next to the second set of color boxes is a button labeled Orient. Click on it to select from what side of the aircraft the insignia will be visible. The selection will be between right and left, or front and back, or top and bottom, or some combination, depending on what plane the two-dimensional insignia part was drawn. You can select only one of the orientations offered; an insignia is visible from one side only.

To avoid problems during orienting, an insignia must be two-dimensional: it may not be 3-D or a straight line (you can't orient a line because you can't tell which plane it's in). The insignia also must not contain duplicate points.

### **Insignia: Advanced Use**

The Paint Specialist groupings determine not only the color for that section of the aircraft (which doesn't apply to insignia), but they also determine what grouping will dominate from a particular view if two pieces are trying to occupy the same space. What grouping will dominate follows logical deduction; for example, the canopy/high wing group will dominate from the Top view. Awkward views can sometimes arise in aircraft manufacturing; something may show through that you don't want to. Insignia can be used to cover these awkward views--just be sure to put the insignia in the Paint Specialist Group that dominates the offending view, because insignia follow the Paint Specialist Group domination rules, even though they are exempt from the color designations.

An example of an awkward view is that the T-6 Texan's canopy is somewhat embedded in the fuselage. Because it has been assigned to the canopy/high wing grouping (things above the fuselage), it has the power to show through the fuselage when you view the aircraft from above. To cover this, Solid parts have been planted in the fuselage, to the front and rear of the canopy.

These parts are shaped like partial bulkheads, conforming to the bulkhead type of the fuselage, so as not to stick out. They have been assigned to the canopy/high wing Paint Specialist Group (the dominant group when viewed from above); but when assigning them to the Insignia Special Effects category, the insignia color was chosen to match the fuselage. The rear blocking insignia was oriented to display only when viewed from the rear, and the front one only from the front (chosen via the Orient button). Thus the two insignia will block the previously awkward views of the canopy.

### **Tail Number**

A tail number (tailsign) part should be saved as TAILSIGx.AFP (x being any letter or digit), with a description consisting of the exact letters and numerals you want the tailsign to display.

When you place TAILSIGN.AFP in the assembly, assign it to the appropriate Paint Specialist Group (usually main body, or tail, center). Assign Insignia as the special effect. Select the day/dusk/night color you want, but ignore the Orient button because Orient will have no effect in this special application.

In the blueprint you will see the tail number depicted only as a guideline indicating where the first character will be placed. You will probably have to move this guideline around a bit (see *Aligning/Center of Rotation*, below) before you're satisfied. The placement should be at least slightly to the right or left of the aircraft's centerline, to force display to the appropriate side.

## **Aligning/Center of Rotation**

### **Moving the Pieces**

At any time during the assembly process you may pop into the Assembly Bay and view the blueprint to make sure that the parts are going in the right places. The only piece you may move is the one currently highlighted in the Bin in the Paint/Special Effects Shop. In the Assembly Bay, this piece will appear highlighted on the blueprint. You may drag it in the two available dimensions using the mouse. If you need to make position adjustments to the piece in the remaining dimension, just select a different View.

Recentering and Zoom are available to help achieve precision alignments.

### **Center of Rotation**

When the pieces are arranged the way you want, set the center of rotation for the aircraft. You do so from the Assembly Line menu bar. Select Options, then Set Center of Rotation; you'll be brought back to the Assembly Bay and you will be in Side view. The aircraft is automatically centered from left to right, so side view is all you need to set the center of rotation in the up-down and front-back directions. Point the mouse cursor where you want the center of rotation to be, and click on the left mouse button. That's all there is to it!

If you have Scenery Enhancement Editor (SEE) and are planning to make your aircraft a static, scenery model, you can still set a center of rotation, but its purpose is different: it establishes the point at which the aircraft will be pulled in as scenery. Since you don't need to be concerned about liftoff and motion and such, the best place for the center of rotation is at the bottom of the wheel; then you don't need special altitude directions to have the aircraft sit on the ground instead of being embedded in the ground up to its center of rotation.

## **Saving Your Assembled Aircraft**

To save your assembled, painted aircraft, Go to the Assembly Line from the Paint/Special Effects Shop.

If this is the first time you are saving this assembly, do the following three steps:

1. On the Assembly Line Workorder, enter a job description. What you enter will be used as the aircraft's description line in the Flight Simulator Aircraft library, so be more specific than "my plane"!
2. After the job description, enter an Assembly Name for your aircraft (in the Documentation box).
3. Unless you're just using the aircraft as a piece of scenery, you need to choose a .SIM file that your aircraft's .SIM file will be modeled after. If you don't want to use the default Source SIM shown, click on the circle in the Source SIM box and select from the .SIM options listed in the Performance Dept. window.

Those were the essentials; you can change the other configurable items on the Assembly Line Workorder as you wish.

Now you can save your aircraft by selecting **Save Assembly** from the **File** menu. Don't exit yet—you need to decide whether to create a flyable or static version of your creation.

If you own Scenery Enhancement Editor (SEE) and would like your aircraft to be a scenery object, click on the **Static** button. Then read the MAKELIB1.TUT through MAKELIB6.TUT tutorials in SEE for how to make your aircraft into a scenery object.

To create a flyable Flight Simulator version of your aircraft, click on the **Flyable** button and confirm with **OK** as necessary. This loads your aircraft into the Flight Simulator Aircraft Library.

## Reworking an Assembly

To add to or modify an existing assembly, select **File** from the Assembly Line menu bar, then **Load Assembly**. Highlight the .AFA file in the Assemblies Bin window and click on the **OK** button. When you go the **Paint/Special Effects** shop, the structures, components, and parts lists will show all of the pieces selected for the assembly so far.

To remove a part or component or structure, highlight it at the **Paint/Special Effects Shop**, and select **Mark for Removal** on the menu bar.

If you want, you can make a new and different assembly out of the same parts, components, and structures. To do so, select **File** from the Assembly Line menu bar, then **New Assembly**. Assign a different assembly name. Note that whenever you change a part, structure, or component from that project directory, the piece will be changed in *any* assembly that includes it. If you want to "freeze" an assembly, pack it up into an .AFX export file; for instructions, see *Sharing Your Aircraft* in Chapter 8.

## Printing Hard Copy

You can print out a hard copy of your assembly from the Assembly Bay. Select **Go** to from the Assembly Bay menu bar, then **Souvenir Shop**. When you do so, the current view of your aircraft in the bay is saved to the clipboard, which you can then print from.

# 8. Using and Sharing Aircraft Files

## Using Your Aircraft

To take a test flight of the aircraft you have just saved,

1. Click on the **Flight Test** button on the Assembly Line Workorder. You should be brought into Microsoft Flight Simulator. (If you aren't, return to the Administration Building and select **Setup** to see whether the path name to the Microsoft Flight Simulator directory is correct.)
2. Select the **MODE** menu.
3. Select **AIRCRAFT LIBRARY**.
4. Select **See more aircraft**, as many times as necessary until your aircraft appears as one of the selections.
5. Select your aircraft.
6. Press the space bar to reactivate Flight Simulator.

## Sharing Your Aircraft

There are two forms in which you can transmit your aircraft to others who have Aircraft and Adventure Factory. The first form is the Flight Simulator version, which is unmodifiable. It consists of two files with the same name, one with no extension and the other with the extension .SIM.

The second form in which you can transmit your aircraft is the Aircraft Factory version (.AFX export file). It allows the recipient to modify, customize, or recolor the aircraft.

To package all of the .AFP, .AFC, .AFS, and .AFA files into one file for convenient transfer of your Aircraft Factory version, go to the Administration Building and select **Pack up Project in Export Crate (file)** from the **File** menu. In the Assemblies Bin window, highlight the .AFA file and click on the **OK** button. You should now have in your project directory a file with the same name as the .AFA file, but with the extension .AFX.

The recipient can then select **File** on the Administration Building menu bar and **Unpack Project from Import Crate (file)** from the pulldown menu to unpack the .AFX file into separate files for parts, components, structures, and the assembly.

Using either the Flight Simulator or Aircraft Factory form, you can share aircraft over an electronic bulletin board such as CompuServe.

## ***Cleaning Your Files***

Be sure to have a backup of your project directory before doing this!

Once you have your aircraft the way you want it, you may find you have excess files in your project directory that you didn't use in the assembly and no longer need. One way of cleaning these out is to export your assembly (pack it up in an .AFX file), delete the remaining files using DOS or Program Manager, then reimport your assembly using Unpack Assembly from Crate (file) from File on the Administration Building menu bar.

## ***9 Advanced Topics & Troubleshooting, Aircraft Factory***

### ***Changing Your Configuration***

You can change your Aircraft Factory configuration in the following areas:

#### ***Colors***

Change the colors of blueprint elements by selecting Settings from the menu bar in any one of the bays.

#### ***Aircraft Factory Project Directories***

When you install Aircraft and Adventure factory, the demo aircraft project directories are installed under it. You may put your aircraft project directories in the same location, but you don't have to; the only requirement is that all of the project directories be on the same hard disk drive.

If you relocate your Aircraft Factory directory to another location on the same drive, use Change Project Directory from File on the Administration Building menu bar to reselect your current project directory if it was moved along with the Aircraft Factory directory.

If you move your Aircraft Factory project directories to another drive, you need to delete your AF.INI file in your Windows directory, because the AF.INI file will still be pointing to the drive where Aircraft Factory and demo aircraft project directories were originally installed. (A new AF.INI will be created for you the next time you start Aircraft Factory.) Be sure to keep all of your project directories on the same hard disk drive.

If you relocate your Aircraft Factory directory (containing the AF.EXE file) and you use a Windows icon to access Aircraft Factory, you need to change the icon's properties. Highlight the icon. Select File from the Program Manager menu bar, then Properties from the pulldown menu. Change the directories for Command Line and Working Directory as appropriate. *The working directory must always be the directory containing the Aircraft Factory .EXE file.*

#### ***Default Aircraft Factory Project***

To designate a particular aircraft as your default Aircraft Factory project, follow these steps:

1. Select File on the Administration Building menu bar, then Change Project Directory from the pulldown menu. The Aircraft Factory Project Directory window will appear.
2. Double-click on the Aircraft Factory directory to show a list all of the aircraft subdirectories under the Aircraft Factory directory; or click farther up in the directory list to range more widely.
3. Select (highlight) your desired project from the list.
4. Click on the Make Startup button, then the OK button.

### **Flight Simulator Path**

If you change the location of your Flight Simulator directory, you need to go to the Administration Building and select Setup from the menu bar to notify Aircraft Factory of the change.

### **Minimum Memory Flight Simulator for Flight Test**

When you take a test flight, Aircraft Factory is running Microsoft Flight Simulator from within Windows. This can create memory shortages if your Flight Simulator environment includes other programs such as A&SD. To avoid memory problems, Aircraft Factory runs test flights with a minimal Flight Simulator configuration by default. This means that if you want to make *performance* changes to your Source .SIM file, it's best to exit Aircraft Factory and run Flight Simulator from DOS.

If you deselect minimum memory (by clicking on the box by "minimum memory" below the Flight Test button to clear the x from the box), then for the current Aircraft Factory session you will have your fully functional Flight Simulator environment available during your test flight. However, you should deselect minimum memory only if all three of the following are true:

1. You want the add-on programs listed in your Flight Simulator configuration file (CONFIG.FS#, where # is the Flight Simulator version number, 4 or later) to be available during Flight Test.
2. Your machine has plenty of RAM
3. Extended memory is *not* selected on the Flight Simulator Sound Control Panel. (To deselect extended memory, enter Flight Simulator from DOS and select the MODE menu, then Sound Control Panel. Set the extended memory option to "No," then select Save default settings.)

### **Undoing**

To undo the latest point you entered on the Parts Bay blueprint, press the BACKSPACE key or select Rework then Undo from the Parts Bay menu bar.

To erase the whole part you're working on in the Parts Bay, select Rework from the Parts Bay menu bar and Clear Part from the pulldown menu.

If you have selected Save... at the Parts Bay menu bar but do *not* want to save your latest changes, then do *not* select Save Part at the Parts Shop Workorder; load another part, or exit to the Administration Building without saving.

If you put a bulkhead in the wrong spot, you can undo all of the bulkheads by selecting Manufacture Structure from the menu bar, then Rectify from the pulldown menu. Your structure will stay on the blueprint, but all bulkheads will disappear.

If you've made and saved a part, component, or structure you don't want to use in your assembly, just don't include it in your lists at the Paint/Special

Effects Shop. If it's already included on a list and you don't want it, highlight it and select Mark for Removal (during assembly) from the Paint/Special Effects Shop menu bar.

### **Problems You May Encounter**

#### **System Fails While Entering Flight Test**

The system will fail while entering flight test if minimum memory has been deselected and the extended memory option on the Flight Simulator Control Panel is set to Yes.

If you deselect minimum memory, you should make sure that the extended memory selection at your Flight Simulator Sound Control Panel is "No." To do so, enter Flight Simulator from DOS and select the MODE menu, then Sound Control Panel. Set the extended memory option to "No," then select Save default settings. If you don't want to deselect extended memory, you'll have to exit Windows and start Flight Simulator from DOS to test your aircraft creations.

If minimum memory (this is the default) is selected for your Aircraft Factory Flight Test, the Sound Control Panel will be absent from the MODE menu, thus avoiding system failure due to extended memory.

#### **System Crash During Flight Test**

If your computer system goes down during a test flight, the original Flight Simulator configuration will be in ~ONFIG.FS# (where # is the Flight Simulator version number) unless you deselected minimum memory. To restore your original Flight Simulator configuration, go to your Flight Simulator directory and copy ~ONFIG.FS# into CONFIG.FS#.

#### **Blank Administration Building Screen**

If Aircraft Factory loads without the picture but the buttons "Components" "Assembly Line" "Parts" and "Structures" appear, you may be experiencing memory limitations (in which case you can run Aircraft Factory with the /mem option as described in **Starting Aircraft Factory** in Chapter 3); or you may need to change the working directory selected for the Aircraft Factory icon to be the directory containing the AF.EXE file.

If neither the illustration nor the buttons appear at the Administration Building screen, the /mem option has been selected. To deselect it, quit Aircraft factory and invoke win af.exe, or delete /mem from the command line for the Aircraft Factory icon.

#### **Excessive Time when Changing Shops**

Excessive time in changing shops may be due to limited memory. Run Aircraft Factory with the /mem option (see **Starting Aircraft Factory** in Chapter 3).

### ***Assembly Bin is Empty When Trying to Load an Assembly***

The .AFA file won't appear in the Assemblies Bin unless the .AFX file has already been unpacked.

### ***One Aircraft Part Bleeds Through Another***

As the view angle changes, so does the domination of one Paint Specialist Group over another. Occasional bleedthrough can be expected. To fix persistent bleedthrough, try assigning one of the conflicting parts to a different Paint Specialist Group, or assign the same color to the conflicting groups.

### ***Insignia and Tail Number Problems***

If an insignia or tail number displays on one side only: This is the normal function of these features. For dual sided insignia, add the insignia to your parts list twice, assigning opposite orientation.

If the insignia won't orient correctly: is it two-dimensional? If your insignia needs to bend (3-D), break it up into one or more two-dimensional parts.

If the wrong insignia dominates a multi-insignia design, it means you assembled the insignia in the wrong order; each insignia you add displays on top of the previous one.

If the tail number doesn't appear, make sure the special effect is set to insignia and that a contrasting color is selected.

If your tail number is missing one or more characters: Not everything on the keyboard is allowed in tail numbers. Only alphanumeric characters, hyphen, period, and equals sign will work.

### ***Source SIM Rejected***

If the Source SIM you select on the Assembly Line Workorder is the same as your Assembly Name, Aircraft Factory will reject it. Rename your Source SIM.

### ***Print Screen Key Doesn't Reset Mode***

Under Windows, the Print Screen key is reserved for copying to the clipboard. When you are running Flight Simulator under Windows (such as in Aircraft Factory Flight Test), use SHIFT+Print Screen to reset the mode.

## **ADVENTURE FACTORY**

### **10. Adventure Factory Overview and Startup**

Embarking on an adventure is just as easy as selecting an aircraft in Flight Simulator. You can choose from the demo adventure provided with Aircraft and Adventure factory, commercially marketed adventure packages, your own personally created adventures, or adventures shared over electronic bulletin boards.

A simple adventure may play a segment of the theme from *Rocky* every time you land safely. Another adventure may be a guided tour of an A&SD scenery area that someone has designed. Yet another may allow your own key or mouse combinations to access several Flight Simulator variables or options. Other more developed adventures may be complete flights, including all ATC commands. Historical situations may be recorded, or past accidents, conflicts, or other instructional situations may be recreated. Aviation jokes can be animated in multimedia. The variations and permutations are truly endless and mind-boggling.

Creating an adventure requires some programming skills. If you haven't programmed computers before but would like to try your hand at creating an adventure, you might want to purchase a book on QBasic (Quick Basic), which is similar to the programming language used for adventures. QBasic is included with MSDOS 5.0, but a QBasic manual is not, and the online reference help won't teach you the necessary programming *concepts*. One book available at the time of Aircraft and Adventure Factory's release is titled *QBasic Made Easy*, by Don Inman and Bob Albrecht, published by Osborne McGraw-Hill.

### **One-Time Settings: Sound (Board) Control Panel**

Before embarking on your very first adventure, whether it be the sample or your own, you'll want to do some one-time parameter settings for your sound board. Adventure Factory supports the same sound boards as does the Sound, Graphics and Aircraft Upgrade (SGA), plus it supports Mediavision's Pro Audio Spectrum line. The full list of supported sound boards is:

AdLib Music Synthesizer Card  
ATI Stereo F/X  
Covox Voice Master  
Mediavision Pro Audio Spectrum  
Mediavision Pro Audio Spectrum Plus  
Mediavision Pro Audio Spectrum 16  
Sound Blaster  
Sound Blaster Pro  
Thunderboard

## Windows Conflict

Exit Windows before starting Flight Simulator to make the sound control panel selections listed below. Otherwise, you may not select extended memory.

## Setting the Parameters

Through the Flight Simulator MODE menu, select the Sound Control Panel, where you set parameters concerning your sound board. On the Sound Control Panel, you can do the following:

- For Sound Blaster Pro or ATI, adjust the volume (00 through 10) with the + and - keys.
- Select a sound board for playing FM synthesized tones. If your computer doesn't have a sound board, select PC Speaker. If your board is Pro Audio Spectrum Plus or Pro Audio Spectrum 16, select Thunderboard.
- Select a digital board for playing digital sound files (files with the extension .VOC). If you have an AdLib sound board or if your computer doesn't have a sound board, select PC speaker. The PC speaker will play .VOC files provided with SGA or Aircraft and Adventure Factory, but your own recorded digital sound files won't play through the PC speaker.
- Specify a base address. This is the base of the port addresses used by Sound Blaster, Sound Blaster Pro, or ATI. See your sound board manual for details. The base values can be set to the following hexadecimal values: 210, 220, 230, 240, 250, 260. When using AdLib, Covox, Pro Audio Spectrum, or PC speaker, base address is not used and can be set to any value.
- Set the interrupt level (0-7). This is the interrupt used with Sound Blaster, Sound Blaster Pro, or ATI. See your sound board manual for details.
- Select text-to-speech conversion for all messages, COM/ATIS only, or none. (For Sound Blaster or Sound Blaster Pro with SBTALKER.)
- Select whether or not to view scrolling text. If you select Yes for this parameter *and* you selected text-to-speech conversion for messages in the previous parameter, you will both hear and see messages.
- Select default or user-defined digitized effects.
- Select whether to use extended memory. Adventure Factory will run more quickly if you use extended memory, but if you want to use it from a Windows DOS box, set this option to No.
- Save the settings you have just selected as the default settings.

To select a DMA channel, include the channel number (0-3) on the sound.drv line in your CONFIG.FS4 file. For example, sound.drv 3 selects DMA channel 3. If no DMA channel is specified, channel 1 is the default.

You can use the demo adventure to test out your sound panel selections. See the next section, *How to Fly an Adventure*.

## How to Fly an Adventure

Installing Aircraft and Adventure Factory adds "Adventure Factory" to your Flight Simulator MODE menu. A demo adventure featuring a Boeing 747-400 is already in the Adventure Factory menu's adventure list, ready for you to select and fly.

You select an adventure from within Flight Simulator. For higher speed performance, start Flight Simulator from DOS (not a Windows DOS box). If you selected extended memory at the Sound Control Panel, you *must* start Flight Simulator from DOS and not from a Windows DOS box.

In Flight Simulator, select the MODE menu, then Adventure Factory. The Adventure Factory menu will read "Current Adventure:" followed by a list of adventures on the left and a list of options on the right. Before selecting an adventure, make sure the following options from the list on the right are set the way you want them:

- **Mixing Engine Noise**

If Mixing Engine Noise is Off, engine noise will cut off when you receive a voice message or when a digital sound effect plays. If Mixing Engine Noise is On, engine noise will not stop when you receive voice messages or other digital sound effects. The digital sound effects are only half as loud when engine noise is mixed in.

- **Load Adventure with Mode**

If you select Yes, Flight Simulator will use the .MOD file with the same name as the .ADV adventure name you select.

Now select one of the .ADV files listed at the left. (If necessary, select the See More Adventures option until your new adventure appears in the list.) The name you select should appear after "Current Adventure:".

When you press the space bar, you enter the world defined by this adventure.

## How to Create Your Own Adventure

An adventure is a customized set of conditions and consequences. For example, you can change the weather (consequence) based on location and time of day (conditions).

To create your own flying adventure, you'll type Adventure commands into a text file, using your choice of text processor. (Chapter 11 describes the Adventure commands.) Next, you'll compile this text file and put the compiled Adventure file, which will have the extension .ADV, in your Flight Simulator directory. Then you can experience your adventure by choosing it from the Flight Simulator menus as described above.

You can swap adventures with other Adventure Factory users over an electronic bulletin board. Be sure you send or receive not only the .ADV file, but also any related .PCX and/or .VOC files used by the adventure that are not provided with the Aircraft and Adventure Factory package.

### **Creating the Adventure Text File**

To create a text file for your adventure, open a new file in any directory and begin entering Adventure commands (these are listed and explained in the next chapter). You can use any text processor. Using subroutines, you can nest up to ten levels.

Resources you can use in creating your text file are:

- Chapter 11, which lists and explains the Adventure commands
- The Appendix, which lists Flight Simulator variables
- The .TXT file for the demo adventure provided with Aircraft and Adventure Factory. (This is the text file from which the demo adventure was compiled.) You can find it in the SAMPLE subdirectory to your Flight Simulator directory. You can examine this .TXT file for ideas to use in creating your own adventure, and by flying the corresponding (demo) adventure you can see first hand how the routines work.

When you save your Adventure text file, you may name it anything you like. However, it's best *not* to give it the same name as an existing .MOD file, because you may want to create a .MOD file to go with your adventure.

### **Compiling Your Adventure**

The text file for your adventure can be in any directory and can have any name, but the compiled version must be in your Flight Simulator directory, and must have the extension .ADV to be recognized by Flight Simulator.

The name of the Adventure compiler, installed into your Flight Simulator directory, is aaf. Supposing your text file to be C:\PLAY\ADV1.TXT, you would compile it by typing the following at your Flight Simulator directory:

```
aaf c:\play\adv1.txt adv1.adv
```

When the compilation is complete, you will either be given one or more error messages or notified that the compilation was successful. Possible error messages are listed in the **Problems?** section below. When your compilation is successful, you will be shown the length of your .ADV file, in bytes (the maximum allowable length is 64 KB). Now that your adventure is successfully compiled and located in the Flight Simulator directory, you can fly it according to the instructions in *How to Fly an Adventure*, above.

### **Creating a Mode File for Your Adventure (Optional)**

If you fly your adventure without a mode file, the environmental conditions, aircraft, etc. will be whatever is set for Flight Simulator when the adventure is started.

To specify a set of conditions to be active for an adventure every time it's started, you need to set these conditions in the adventure file itself, or set up a companion mode file. If your compiled adventure is named ADV1.ADV, your mode file is assumed to be ADV1.MOD. See your Flight Simulator documentation for more information about modes.

Once you have your mode file, select the Flight Simulator MODE menu, then Adventure Factory. From the list of options on the right, toggle Load Adventure with Mode to Yes, then select Save Default Settings.

## **Problems?**

### **Adventure Factory Won't Run in Windows**

To run Adventure Factory from a Windows DOS box, you must select "No" for extended memory option at the Sound Control Panel. See *One-Time Settings: Sound (Board) Control Panel* at the beginning of this chapter.

### **The Sounds Don't Come Out Right...**

If you changed your sound board settings in your current Flight Simulator session, exit Flight Simulator and restart it to see if that fixes the problem.

If you selected PC speaker from the Flight Simulator Sound Control Panel because you have an AdLib sound board or your computer doesn't have a sound board, the PC speaker will play .VOC files provided with SGA or Aircraft and Adventure Factory but your own recorded digital sound files won't play through the PC speaker.

If you have a Sound Blaster board and have problems with digitized engine noise (which is continuous digitized sound), select the AdLib card for FM synthesized tones, but leave Sound Blaster as the board for digitized sound files.

### **Flight Simulator Stops After I Select a Sound Board**

If Flight Simulator locks up after you select a sound board from the Sound Control Panel menu and save the settings, you may have made an error in the settings. Delete the SOUND.DEF file from your Flight Simulator directory; this will delete your sound board settings. Restart Flight Simulator and do your Sound Control Panel settings again.

### **Error Messages**

Unknown variable  
Duplicate Label  
Syntax error in IF command  
Unknown condition



**Too many labels - Aborting!**

The number of labels and IF statements, combined, may not exceed 4,000 per adventure.

**Too many label references - Aborting!**

The number of label references may not exceed 4,000 per adventure.

**Too many nested IF statements - Aborting!**

IF statements may be nested to a maximum of 10 levels.

**Syntax Error****Aborting!!!****IF .. ENDIF mismatch**

The number of ENDIF statements should match the number of IF statements.

## 11. Adventure Commands

This chapter lists the commands and conditions you can use in your Adventure text file. Each command must start a new line. You can insert a comment at the beginning of a line or after a command. A comment must begin with a semicolon (;).

### Flow Commands

You direct the flow of your adventure with the following commands, which may be entered in either upper or lower case:

```
EOF
GOSUB label
GOTO label
IF condition THEN ... ENDIF
ONCRASH label
ONSTALL label
RESET
RETURN
RETURN2
```

EOF stops execution of the adventure.

Use GOSUB to do a subroutine and return. All subroutines except ONCRASH or ONSTALL must end with the command RETURN.

Use GOTO to skip to the specified label without returning.

ONCRASH designates a subroutine to be performed only when the airplane crashes. ONSTALL designates a subroutine to be performed only when the airplane stalls. An ONCRASH or ONSTALL subroutine must end with the command RETURN2.

RESET restarts execution of the adventure from the beginning and resets the mode.

RETURN returns from a subroutine; processing continues with the line after GOSUB. RETURN2 does the same for an ONCRASH or ONSTALL subroutine. ( You don't need to put RETURN or RETURN2 on the line after a RESET command.)

### Labels

A label must appear on a line to itself and be followed by a colon. Only letters and numbers are allowed in a label, up to 40 of them. No distinction is made between upper and lower case. The compiler will allow you to use a reserved word (such as RETURN2) or a Flight Simulator variable as a label, but it's highly recommended not to do so.

The number of labels plus IF statements must not exceed 4,000 per adventure.

## Conditions

The conditions you can use for the IF *condition* THEN ... ENDIF command will return a value of true or false. The command(s) between THEN and ENDIF will be executed only if the condition is true. You may nest up to 10 levels of IF *condition* THEN ... ENDIF statements.

Where a value is being tested as to whether it's between LOW and HIGH, LOW and HIGH are inclusive. If you want to specify a single value, make LOW equal to HIGH. However, a single value may be too narrow for a pilot to realistically maintain. For example, a quarter mile range for the CYLINDER command might be appropriate: CYLINDER(NORTH,EAST,1.875,2.125).

Legal values are -32767.99999 to 32767.99999 for numbers, -32768 to 32767 for integers. You use variables only with VARTEST and VARMASK.

You may enter any value for NORTH and EAST coordinates, but when the command is executed, NORTH and EAST will each be truncated to an integer.

You can choose from the following conditions:

- ADF(FREQ)  
True when the automatic direction finder is tuned to the frequency FREQ.
- AIRSPEED(LOW,HIGH)  
True when airspeed, in knots, is between LOW and HIGH, inclusive.
- ALTAGL(LOW,HIGH)  
True when altitude above ground level, in feet MSL, is between LOW and HIGH, inclusive.
- ALTITUDE(LOW,HIGH)  
True when altitude, in feet MSL, is between LOW and HIGH, inclusive.
- BANK(LOW,HIGH)  
True when bank, in degrees, is between LOW and HIGH, inclusive.
- BUBBLE(NORTH,EAST,LOW,HIGH)  
This condition is true when you are flying in the bubble, which is shaped like a dome. The central point of this dome is at ground level at coordinates NORTH,EAST. If LOW is 0, the dome is half a sphere with a radius of HIGH miles. If LOW is not zero, the dome has an inner wall at a radius of LOW miles from the central point, and an outer wall at a radius of HIGH miles from the central point.
- COM(FREQ)  
True when the COM radio is tuned to the frequency FREQ.
- COURSE(LOW,HIGH)  
True when the resulting vector of heading and wind correction, also corrected for magnetic variation, is between LOW and HIGH degrees, inclusive.

- CYLINDER(NORTH,EAST,LOW,HIGH)  
True when you are in a vertical cylinder, either solid or hollow, defined as follows: NORTH and EAST mark the coordinates of the cylinder's centerline; LOW is the radius of the cylinder's inner wall, in miles; HIGH is the radius of the cylinder's outer wall, in miles. If LOW is 0, the cylinder will be solid.

You can use the CYLINDER and ALTITUDE conditions to create an ARSA, ATA, TCA, or TRSA.

- DME(LOW,HIGH)  
True when the distance in miles from the NAVAID is between LOW and HIGH, inclusive.
- FLAPS(LOW,HIGH)  
True when the current flap position, in percent extension (0-100), is between LOW and HIGH, inclusive.
- GEARDOWN()  
True if gear is down.
- GEARUP()  
True if gear is up.
- GOUNDSPEED(LOW,HIGH)  
True when groundspeed, in knots, is between LOW and HIGH, inclusive.
- GSLOPE(NORTH,EAST,LOW,HIGH)  
True when glideslope, in degrees (0-90), as measured from the point at ground level with the coordinates NORTH,EAST, is between LOW and HIGH, inclusive.  
  
Most glideslopes in the United States are 3 degrees. For an airport approach, you can use the north and east coordinates of the runway touchdown zone, then 2.3 and 3.7 as LOW and HIGH, to allow for a glideslope of 3 degrees plus or minus 0.7 degrees tolerance.
- HEADING(LOW,HIGH)  
True when uncorrected heading, in degrees, is between LOW and HIGH, inclusive. To take wind and magnetic variation into account, see the condition COURSE.
- JETENGINE()  
True if the aircraft has a jet engine.
- KEY("key")  
True if the key pressed is *key*. *key* must be a single, unshifted character that has an ASCII value (don't use shifted numerics such as \$).
- KEY(SCANCODE)  
True if the key pressed matches the designated scancode.

- NAV1(FREQ)  
True when NAV1 is tuned to the frequency FREQ.
- NAV2(FREQ)  
True when NAV2 is tuned to the frequency FREQ.
- PITCH(LOW,HIGH)  
True when pitch, in degrees, is between LOW and HIGH, inclusive.
- POWER(LOW,HIGH)  
True when power, in percent (0-100), is between LOW and HIGH, inclusive.
- PROPENGINE()  
True if the aircraft has a propeller.
- RADIAL(NORTH,EAST,LOW,HIGH)  
True when the airplane's angle from the point NORTH,EAST, in degrees, is between LOW and HIGH, inclusive.
- VARMASK(VARIABLE,X)  
True when the logical AND between VARIABLE and X is nonzero.
- VARTEST(VARIABLE,LOW,HIGH)  
True if VARIABLE is between LOW and HIGH, inclusive. See the section **Variable Commands** for information about using VARIABLE.
- XPNDER(FREQ)  
True when the transponder is set to FREQ.

### Example of Flow Commands

```

; if pilot stalls, do stall
  onstall stall
; if pilot crashes, do ouch
  ONCRASH ouch

; quit if pilot presses "d"
  if key("d")
    goto done
  endif

stall:
  print "nose down!"
  wait(5)
  return2

ouch:
  print "Uh-oh...is your aircraft insurance paid up?"
  wait(10)          ; wait 10 seconds
  RESET             ; start over

done:
  EOF

```

## Variable Commands

With the variable commands, you can control any number of Flight Simulator or Adventure Factory variables: altitude, ceiling, aircraft--you name it!

### Variables

A user variable can be a letter from A to Z, and can store a 16-bit integer value between -32768 and 32767. The appendix lists current Flight Simulator variables and their data sizes.

Two other variables you may find useful are REMAINDER and RESULT. The remainder of the most recent divide will be stored in the variable REMAINDER. The variable RESULT will contain the value to be compared against the latest LOW,HIGH condition; for example, RESULT contains your exact course if the latest LOW,HIGH condition was IF COURSE(LOW,HIGH) THEN ... ENDIF.

Only 16-bit operations are performed on variables. If you want to test or use a byte-sized Flight Simulator variable, see the subsection **Using 8-Bit Variables**, below.

### Variable Arithmetic

Using :=, you can assign a variable the value resulting from arithmetic and/or logical operations on other variables. For example:

$$X := A + B * C - D / E \mid F \& G \wedge H$$

where | is logical OR, & is logical AND, and ^ (SHIFT+6) is EXCLUSIVE OR. The operations are performed in a straight linear fashion, left to right. No parentheses are allowed; either order your operations to achieve the desired result without parentheses, or use multiple statements. Multiple statements will slow down execution.

No constants are allowed when assigning a value to a variable using :=. To use a constant (an integer value, called INTVALUE in the command descriptions below), you must first assign it to a variable using the SETVAR command explained below.

### List of Variable Commands

You can control a variable with any of the following commands:

```

ADDVAR(VARIABLE,INTVALUE)
MOVEVAR(TARGET VARIABLE, SOURCE VARIABLE)
PRINTVAR(VARIABLE,"prefix string")
RANDOM(VARIABLE)
SETVAR(VARIABLE,INTVALUE)

```

SETVAR sets the variable to INTVALUE. ADDVAR increments the variable by INTVALUE (use a negative value to subtract). INTVALUE must be an integer value between -32768 and 32767, inclusive.

MOVEVAR copies a value from one variable to another. PRINTVAR prints *prefix string*, followed by the value of the variable, in the message box. For example,

```
PRINTVAR(hderr,"Your heading error is: ")
```

RANDOM assigns to VARIABLE a random integer value between -32768 and 32767, inclusive. If you want to cut down on this range, you can subsequently add to or subtract from VARIABLE with ADDVAR, or use the REMAINDER variable. For example, if you want a number between 0 and 99, do the following to use b as your random variable:

```
setvar(a,100)
x:=random/a
b:=remainder
```

### Using 8-Bit Variables

An example of converting an 8-bit variable (stlwrn, which is the stall warning) to a 16-bit variable:

```
setvar(a,255)
B:=stlwrn & a
```

An example of setting an 8-bit variable (spdwrn, which is the overspeed warning):

```
setvar(a,-256)      ;-256 is 0xff00 hex
spdwrn:=spdwrn & a | 1
```

An example of testing whether an 8-bit variable is true or false:

```
if varmask(stlwrn,255)
```

### Example of Variable Commands

```
if course(0,0)
endif
printvar(result,"Your course is: ")

;hitting w key toggles turbulence on/off
if key("w")

    if varmask(w0turb,4)
        setvar(w0depth,0)
        setvar(w0turb,0)
        goto turboff
    endif
    setvar(w0depth,1000)
    setvar(w0turb,4)
turboff:
endif

;are we on the ground?
if varmask(ground,1)      ;check if on ground
    setvar(c,0)           ;reset for ground
endif
```

## Other Commands

The remaining commands include several Adventure commands and one demo command, \$PLAY.

```
PLAY "file.VOC"
PRINT "text"
SETPOSITION(NORTH,EAST,ALTITUDE)
VIEW(SECONDS,"file.PCX")
WAIT(SECONDS)
$PLAY "file.VOC"
```

If you use the PLAY command you need to insert, between quotation marks, the name of a digital sound file in your Flight Simulator directory, or the full path to a digital sound file elsewhere. It must be an uncompressed .VOC file (having the extension .VOC) with the voice record being the first and only record in the file. You can use one of the many .VOC files already installed into your Flight Simulator directory; or you can create a new .VOC file according to the instructions for your sound board; or you can convert a Microsoft Windows sound (a different kind of digital sound file, with the extension .WAV) using the command wav2voc. For example:

```
wav2voc buzz.wav buzz.voc
```

To PRINT instead of PLAY a message in your adventure, you put the message itself between the quotation marks. To make the message box disappear, use PRINT "", with nothing between the quotation marks.

SETPOSITION puts the aircraft at the position defined by the given Flight Simulator NORTH and EAST coordinates, and ALTITUDE in feet.

VIEW will display an image of up to 320 x 200 pixels and 256 colors in the upper left corner of the screen. You need to (1) specify the number of seconds you want the image to remain on the screen, and (2) insert, between quotation marks, the name of a PC Paintbrush file with the extension .PCX (provide a full pathname if it's not in your Flight Simulator directory). In the adventure, Flight Simulator will stop the simulation while the image is being displayed, then resume where it left off.

For WAIT, specify the number of seconds you want the action to pause.

\$PLAY is not a command to insert in an Adventure text file; it is a command that enhances your demo-making capabilities. The Flight Simulator documentation explains how you can stop a demo and insert a text message that will be inserted at that point in the demo the next time it's run. Using \$PLAY, you can specify, instead of a text message, a digital sound file (.VOC format) to be played at that point.

Happy Adventuring!

## Appendix: Flight Simulator Variables

This appendix lists Flight Simulator variables you might want to manipulate in your adventure. The listing is copyright 1981-1992 by Bruce Artwick. All rights are reserved. The information contained in the listing may not be transmitted in any form to any individual or group other than a purchaser of Aircraft and Adventure Factory, copyright 1992 BAO, Ltd.

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### \*\*\* UNSUPPORTED FUNCTIONALITY \*\*\*

Variable Name	Data Size	Comments
tod	word	bit 2,1,0=night,dusk,day
altmsl	word	altitude in meters above ground
hour	byte	
minute	byte	
menu_level	word	+1=menu bar suppressed +0=top level (menu bar) -1=1st level (enviro menu) -2=2nd level (clouds menu)
fulltower	word	
titles	word	
shadflg	word	
sysmode	word	0=Normal Flight, 1=Flight Analysis 2=Flight Instruction 3=Review Logbook, 4=Entertainment, 5=Demo 6=Quit
sndflg	byte	master sound on/off flag
sound2	word	user request sound flag (menu/Q key)
pauflg	word	0=run nz=paused
auto_coord	word	
smoke_enable	word	
atc_com	word	
smoke_now	word	non-0 if elapsed time to emit smoke
smoke_plane_ptr	word	pointer to plane to make smoke
season_cycl	word	
cfpd	word	
efis_active_cycl	word	
efis_type_cycl	word	
scenery_cycl	word	
cmfreq	word	com radio freq
hederr	word	heading error

### \*\*\* UNSUPPORTED FUNCTIONALITY \*\*\*

barom	word	barometric pressure effect. 0=calibrated max=+500 units=feet alt.
trans_ident_flg	word	
nvfreq	word	NAV1 radio freq
nav1_vorrad	word	current nav1 vor radial we're on
pvfreq	word	NAV2 radio freq
aerflg	byte	0=stable flight mode 0=aerobatic mode
hedlsb	byte	heading error lsb
bpupdt	byte	=1=update bot panel of screen
sound_rpm	byte	{0..255} sound rpm value
emrgcy	byte	if emrgcy bit 2 = 1, left tank fuel leak if emrgcy bit 3 = 1, right tank fuel leak if emrgcy bit 1 = 1 then drop oil pressure if emrgcy bit 0 = 1, set oil hi-temp
ground	byte	ff=ground 00=air
stlwrn	byte	stall warning 0=no warning 1=5kts before stall
spdwrn	byte	overspeed warning 0=no warning 1=warn
plane_height	word	cockpit height
gndbias	word	airport elevation to add
vely	word	Velocity UP
vel_x	word	quarter knots
vel_y	word	
vel_z	word	
vel_p	word	65536=4 rotations/sec (pseudodegrees*4/sec)
vel_b	word	
vel_h	word	
magcom	word	mag compas position
obi	byte	obi for VOR 1
oldrpm	byte	
pbi	byte	obi for VOR 2
tod_master	word	time of day generated by clock bit 2,1,0 = ngt,dsk,day
gen_model	byte	bit 0=inside view=1 bit 1=outside view=1 bit 2=shadow on=1 bit 3=downward view bit 4=straight ahead view (no pitch or heading)
flaps	word	flaps 0=up 32k=down
gear	byte	gear 0=up ff=down
lights	byte	lights 0=off ff=on

# \*\*\* UNSUPPORTED FUNCTIONALITY \*\*\*

magno	word	magneto 0=off 1=left 2=rgt 3=both 4=strt 5=lean
carbh	byte	carb heat 0=off ff=on
strokes	byte	strokes 0=off 1=on
strobe_flash	byte	tells strobe to flash on model & screen
pan_active	byte	0=off 1=on
pan_gen	byte	used to supress panel
lear_airspeed	byte	0=not on nz=on
engine_type	byte	0=piston engine, 1=jet engine, 2=no engine
retractable	byte	0=fixed gear, 1=retractable gear
adf_flag	word	0=not on nz=on
ail_rud_lock	byte	lock aileron & rudder if auto_coord=1
cntr_ail_5key	byte	center aileron if keypad 5 is pressed
cntr_rud_5key	byte	center rudder if keypad 5 is pressed
cntr_elv_5key	byte	center elevator if keypad 5 is pressed
yoke_ind_y	word	yoke Y position -16k=yoke pushed full in
yoke_ind_x	word	aileron -16k=yoke turned full left
rudped_ind	word	rudder -16k=left pedal pushed full in
throtl_ind	word	0=cut 16k=full
elvtrm_ind	word	elevator trim position -16k=full nose down
brake_ind	word	0=off 16k=full brakes
elev_pos	word	elevator position -16k=down full
ailer_pos	word	aileron position -16k=down full
rudder_pos	word	rudder position -16k=down full
fuellf	byte	lft tank fuel 0..7f:ffff (scaled)
fuelri	byte	rgt tank fuel, not real units, but %age
oiltmp	word	oil temp 0-7fff (typical OAT *128)
oilprs	word	oil pressure 0-7fff (default to none)
dmeffc	byte	dme tenth miles
dmemil	byte	dme miles
dmedist	word	dme distance 16-m units
dmespeed	byte	0=distance readout, 1=speed in kts readout
dmeblk	byte	1=dme readout is blanked
dmesource	byte	0=nav 1 1=nav 2
dme_update	byte	countdown variable to create update rate
ils_dmedist	word	dme for ILS to use while vor2 using dmedist dme_update_rate =12

# \*\*\* UNSUPPORTED FUNCTIONALITY \*\*\*

vornew	byte	VOR1 needle position -127=lft 0=center 127=rgt
pornew	byte	VOR2 needle position -127=lft 0=center 127=rgt
gsnew	byte	GLIDESLOPE ndl postn -127=up 0=center 127=down
iomact	byte	IOM active flags
tfflag	byte	VOR1 to/from flag 0=off 1=to 2=from
pfflag	byte	VOR2 to/from flag
omiold	byte	
nfvor	word	north dist from VOR
efvor	word	east from VOR
date_year	word	
date_month_day	word	
time_hours_min	word	
time_seconds	word	
cloud_dev_fract	word	random deveation fraction set on
cloud2top	word	cloud level 2 tops in meters
cloud2bot	word	cloud level 2 bot
cloud2cover	word	0=clear ..... 8=overcast
cloud2dev	word	deviation
cloud1top	word	cloud level 1 tops in meters
cloud1bot	word	cloud level 1 bot
cloud1cover	word	0=clear ..... 8=overcast
cloud1dev	word	deviation
cloud3top	word	cloud level 3 tops in meters
cloud3bot	word	cloud level 3 bot
cloud3cover	word	0=wide scat 1=scat 2=dense
cloud3spd	word	speed
cloud3dir	word	direction
w9vel	byte	
w9turb	byte	
w9dir	word	
w6vel	byte	
w6turb	byte	
w6dir	word	
w3vel	byte	
w3turb	byte	
w3dir	word	
w0vel	byte	
w0turb	byte	
w0dir	word	
w9top	word	meters
w9bot	word	
w6top	word	meters
w6bot	word	

# \*\*\* UNSUPPORTED FUNCTIONALITY \*\*\*

NOTES :

w3top	word	meters
w3bot	word	
w0depth	word	meters
tmpvar	byte	airport temp variance
in_the_clouds	byte	bit 0=in the clouds 1=clear sky above 2=visible ground below
pause	word	
mouse	byte	0=no mouse 1=mouse
mouse_mode	byte	mode, 0 = cursor nz = yoke
mouse_button	byte	
curs_x	word	pixel position in pixel coordinates
curs_y	word	
mouse_brake	word	
autop_master	word	autopilot master on/off
wing_leveler	word	wing leveler on/off
nav1_lock	word	nav 1 lock on/off
heading_lock	word	heading lock on/off
head_lock_var	word	heading lock direction
altit_lock	word	altitude lock on/off
altit_lock_var	word	altitude lock altitude in meters
wind_up_vel	byte	
weather_turb	byte	
weather_clouds	word	
weather_fronts	word	
weather_winds	word	
weather_turbulence	word	
mixture_pos	word	mixture control position 0..3fff
fuel_flow	word	same as fuel tank units; rate @4Hz
displace	word	in cubic inches of aircraft
prop_leng	word	prop length, in inches
oilamt	word	about 5 quarts 0..7fff (8 qt.)
nrpm	word	true rpm, down the the rev
bhp	word	brake horsepower (55 = 1hp/s)
thp	word	thrust hp (1/10th real units)
gear_smoke	word	non-0 means show smoke at gear
smoke_cntr	word	performs former function of smoke
crash_protector	byte	

**NOTES :**



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