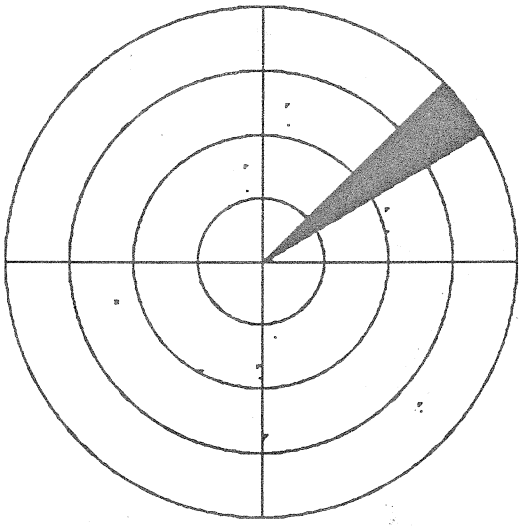
Professional Air Traffic Controller Simulator



A Computer Simulation for the Macintosh

Version 1.0

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Professional Air Traffic Controller Simulator
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1 Introduction

1.1 Purpose

Welcome to Professional Air Traffic Controller Simulator. The purpose of this program is to simulate an air traffic controller's radar screen. You are the controller and your job is to issue commands to all planes under your control in order to let them safely fly to their destinations. Pilots actually speak to you during the simulation by announcing their presence in your area and requesting altitude, speed, or heading values. Some planes will request to land on one of the four runways. Your main responsibility is to provide for the safe separation of aircraft; that is, to not let two planes get too close to one another at the same altitude. Your score is based upon how well you do your job.

Throughout this document, the term "PATCS" will be used to refer to Professional Air Traffic Controller Simulator.

1.2 Background

The design of PATCS is based on actual Federal Aviation Administration (FAA) radar displays in order to make the simulation as realistic as possible. For example, each plane on the radar screen has a data block which shows its altitude, speed, and identification. The controller can display a "warning" area around any plane which represents that plane's protected airspace. The controller can also project the future track, or path, of any plane to determine exactly where the plane will be after a selected number of minutes. When planes get too close, "conflict alerts" will occur, and the controller will get an audible message and the data blocks of the conflicting planes will flash. These features are all based on actual FAA displays.

PATCS does not attempt to simulate each and every aspect of an actual FAA display, however. That would be beyond the hardware capabilities of the Macintosh and would not be very interesting to the layman. The design of PATCS reflects some basic functions of FAA displays plus added features to make the simulation interesting and challenging and, it is hoped, entertaining for a general audience.

1.3 Hardware Requirements

PATCS requires any Macintosh computer with at least 512K of memory. This includes original Macintoshs upgraded to 512K, the Macintosh Plus, and the Macintosh SE. PATCS will not run on the Macintosh II since that computer does not support the speech synthesizer MacinTalk, which is used extensively by PATCS. This speech synthesizer requires no additional hardware since it is software-based and uses the Macintosh's internal speaker for speech output. An external speaker is recommended for better speech sound quality, but it is not required.

1.4 Software Requirements

The distribution disk contains a folder called "PATCS" that contains four items. "Professional ATC Simulator" is the simulator program itself. "MacinTalk" is the speech synthesizer software. "ATC params" is a parameter file that contains various settings for customizing the simulator to your own tastes. These three files must be in the same folder in order for the simulator to work. The fourth file, "ATC params/original" is a copy of the file "ATC params" and is included in case you wish to get back to the original parameter settings after you have customized the "ATC params" file (refer to section 9 to see how you can customize the simulation). None of these files are copy-protected, and you should copy the entire folder "PATCS" to your own disk and store the original distribution disk. The important thing to remember is that "Professional ATC Simulator" and "MacinTalk" and "ATC params" must be in the same folder. The folder does not have to be named "PATCS".

1.5 Legalese

If the distribution disk is defective in any way, simply return it to Advanced Simulation Systems at the above address and it will be replaced.

Any questions or comments about PATCS should also be sent to the above address. Suggestions for improving the simulation are encouraged, and all correspondence will be answered.

2 Operation

2.1 Getting Started With The Simulation

In order to get an idea as to what PATCS is like, choose "Demo mode" from the Signon screen. In this mode, the simulation will basically run itself, automatically giving commands to planes to send them to their proper destinations. This mode is similar to an "automatic pilot," since the computer takes over and allows the controller to sit back and watch what happens. It is recommended that the beginning user experiment with the simulation in demonstration mode for a while in order to become familiar with it's operation.

2.2 Screen Update

Actual FAA radar screens display planes based upon information obtained from remote radar receivers. Every few seconds, new radar information is received and the positions of the planes are updated on the screens. PATCS works much the same way. The number of seconds between screen updates can be set by the user and can range from 0 to 60. The effect of the screen update process is one of animation; planes "jump" from one location to another. How far and in which direction they move during each screen update cycle are determined by their speed and heading.

During each screen update cycle, the following process is applied to each plane. First, the plane and associated data block is erased from the screen. Then the new position for the plane is calculated based upon the current heading and speed. That is, the faster the plane is going, the farther it moves on the screen. Next, current altitude and speed are calculated (refer to section 3.3 to see how this is done).

Finally, the plane and associated data block are redrawn at the new location. These activities take place very quickly and result in the animation effect that can be seen on the screen.

2.3 Commanding Planes

How do you give a command to a plane? Simply move the mouse until the cursor (a crosshairs) is anywhere on the plane's data block and click the mouse button. When you do this, a little box will be drawn around the plane's data block, to remind you of which plane you are commanding. The data block is the two lines of text information attached to each plane under your control (refer to section 2.4 for a complete description of the data block). You may also click on the black dot representing the plane itself to give a command. This is useful if the data block has moved off of the screen. When you click on a plane's black dot or data block, a small window will open up at the top of the radar screen. The contents of the window will contain the complete information about the plane you clicked on, such as:

DL106 (100,54) (ALT 133/240/240) (SPD 27/45/45) (HDG 93/93/93) CMD:

What does all this mean? You clicked on Delta flight 106. Delta 106's current screen coordinates are 100 (X axis, or horizontal) and 54 (Y axis, or vertical). Delta 106 is currently at 13,300 feet climbing to an assigned altitude of 24,000 feet and has requested 24,000 feet as the final altitude. The current speed is 270 knots and the flight is accelerating to an assigned speed of 450 knots and has requested a final speed of 450 knots. The current heading is 93 degrees, and that is also the assigned and requested final heading. The three values shown for altitude, speed, and heading--current, assigned, and requested--are described in section 3.3.

The cursor will be positioned following the CMD: prompt. The simulation is waiting for you to enter a command. Section 5 contains a complete description of each of the 12 commands that you can give to a plane. Several commands can be entered at one time, separated by a slash. For example, the following command will direct a plane to turn to a heading of 135 degrees, climb to 32,000 feet , and reduce speed to 400 knots:

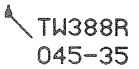
h135/a320/s40

Note that, when giving commands, altitude is expressed in hundreds of feet and speed is expressed in tens of knots. This is consistent with how this information is portrayed in the data blocks.

After you have entered the text of the command, press either the RETURN or ENTER key and the command will be spoken, just as if the controller had spoken it, and carried out. You can also press the RETURN or ENTER keys without entering a command. When the simulation is waiting for you to enter a command, all action stops until you press either the RETURN or ENTER key.

2.4 Plane Representation

This is how a plane appears on the radar screen:



There are three parts to this representation: the plane's dot, the leader line, and the data block. The black dot shows where the plane is actually located. The small line extending from the top of the dot is a

heading indicator line, and in this example TransWorld 388 is currently headed in a northerly direction. The larger line, connecting the plane's dot with the data block, is the leader line. The length of the leader line can be adjusted at any time, so you can move a data block closer to or farther from a plane to prevent screen clutter. The two line text part is the data block, and it's position can be adjusted at any time as well, relative to the plane's dot. The data block contains five pieces of information about the plane:

identification - TransWorld flight 388
special flag - (discussed below)
current altitude - 4,500 feet
ascending/descending flag - (discussed below)
current speed - 350 knots

The special flag is used to alert the controller to special conditions about the plane. It can be one of the following:

= - plane is holding at it's current position
R - plane is requesting to land
J - plane is requesting an airway and is on final heading
T - plane is requesting an airway and is not on final heading
* - assigned altitude, speed, or heading differs from requested
(blank) - plane is OK

The ascending/descending flag will be "+" if the plane is ascending, "-" if the plane is descending, or blank if the plane is in level flight.

Two additional features of a plane's representation, not shown in this example, are the "warning" circle and the project future track line. The "warning" circle feature provides the capability to display a five-mile circle around any aircraft to help the controller insure that no other plane at that altitude infringes on the selected plane, and the project future track line feature will draw a line that will show where the selected plane will be in a given number of minutes (or it can be drawn to the edge of the screen). These are described more fully in section 5.

3 Strategy

3.1 Goal

The goal of the simulation is to handle all planes in a safe manner, send them where they want to go, at the requested altitude and speed, and do not allow planes to get into dangerous situations. The key to success in the simulation is to make sure that you have assigned planes to their requested altitude, speed, and heading. If a plane leaves the screen at an improper assigned altitude, speed, or heading, then points are deducted from your score. "Improper," in this sense, means that the assigned values are different from the requested values. Your job is to comply with pilot's requests, except when such compliance would create a dangerous situation. What are "dangerous situations?" Refer to section 3.7 for a discussion of these.

3.2 Altitude, Speed, Heading

These are the three basic characteristics of each plane on the screen.

Altitude, of course, refers to how high the plane is. It is not important, in this simulation, whether this is height above ground level or above sea level, although a real controller has to understand this difference. In PATCS, planes can range in altitude from 1,000 feet to 40,000 feet. There are two types of planes--small and big. Small planes (like Cessnas) have an altitude range of 1,500 feet to 15,000 feet. Large planes (like TWA) have a range of 4,000 feet to 40,000 feet. No plane can go lower than 1,000 feet or higher than 40,000 feet. Any plane requesting to land can go down to 1,000 feet since that is the altitude of the runways.

Speed is measured in knots, or nautical miles per hour. Again, in this simulation it is not important whether this is ground speed or air speed, although to a pilot or a real controller that difference is significant. The speed range for small planes is 100 to 200 knots; for large planes it is 200 to 700 knots. Any plane requesting to land can (and should) slow to 100 knots.

Heading refers to the direction the plane is going. Heading is expressed in degrees, from 0 to 359. In the simulation, planes always move either horizontally, vertically, or diagonally. So, while planes can have any degree heading between 0 and 359, their movements on the screen will correspond to headings of 0, 45, 90, 135, 180, 225, 270, and 315 degrees. The following table shows the relationship between these degree headings and directional movement on the screen:

0 degrees	north
45 degrees	northeast
90 degrees	east
135 degrees	southeast
180 degrees	south
225 degrees	southwest
270 degrees	west
315 degrees	northwest

3.3 Current, Assigned, and Requested Values

For each of the three characteristics--altitude, speed, and heading--the simulator keeps track of three distinct values: current, assigned, and requested. A knowledge of what these values are and how they affect the simulation is essential to understanding how PATCS works.

Current

Current means just that. Current altitude is the plane's altitude right now. Current speed is the speed that the plane is going right now. Current heading means the direction the plane is going right now. The current values for altitude and speed will change by an increment of 1 (100 feet or 10 knots) during each update cycle if the current and assigned values are different. Current values are directly affected by assigned values. If you assign a plane an altitude of 16,000 feet and he is currently at 9,400 feet, then his current altitude will increase by 100 feet during each update cycle until he reaches the assigned altitude of 16,000 feet, at which point he will stop climbing and will be in level flight. Speed works the same way. Heading, however, is done differently; an assigned heading immediately becomes the current heading during the next update cycle.

As controller, you do not have the ability to immediately change the current altitude or speed of a plane. You have indirect control, since you can assign an altitude or speed, but it may take the plane some time to reach the assigned altitude or speed. The important point is to recognize the relationship between current and assigned: current altitude and speed will change by a unit of 1 during each update cycle until the

current value reaches the assigned value. An assigned heading will immediately become the current heading during the next update cycle.

Assigned

The assigned value represents what you have commanded the pilot to do. This is how you control altitude, speed, and heading. Assigned values do not change during each update cycle, like current values do. Assigned values only change in response to a command by you. You set the assigned altitude with the "a" command; you set assigned speed with the "s" command; and you set the assigned heading with either the "h" or "v" commands. "h" sets a degree heading, and "v" directs the plane to proceed to a designated VOR station. You can also set assigned altitude, speed, and heading at one time with the "dot" command. Refer to section 5 for a description of these commands.

The assigned values are very important. When a plane leaves your airspace by exiting from the edge of the screen, the assigned altitude, speed, and heading must be equal to the requested altitude, speed, and heading. If they are not, points are deducted from your score. When a plane leaves the screen, it is not important what the current values are; the requirement is that the assigned values be the same as the requested values.

Requested

These values are what the pilot wants, what he is requesting. Your job is to honor his requests. He may periodically request changes in altitude, speed, or heading; you should comply with these change requests. Your major responsibility--in addition to the proper separation of aircraft--is to make sure that all requested values are reflected in the assigned values. Requested heading can be one of three things: a degree value, an airway, or a runway. A degree value, of course, is a number from 0 to 359. An airway is one of the following: J36, J18, J09, J27, J04, J22, J31, and J13. These 8 airways, or "highways in the sky," are depicted on the radar screen as the four horizontal, vertical, and diagonal lines. For convenience, the airway identifier number corresponds to the degree orientation of the airway. Thus, J09 and J27 are the same horizontal line running east-west, and a pilot requesting vectors to J09 wants to fly eastbound on this line, while a pilot requesting vectors to J27 wants to fly westbound on the same line. A plane requesting to land on a runway will have a requested heading of one of the following: R36, R18, R09, or R27. Both R36 and R18 refer to the north-south runway, and R09 and R27 correspond to the east-west runway. Refer to section 4.5 to see how the airways and runways are depicted on the radar screen.

As controller, most of your commands will involve setting assigned headings to vector planes where they want to go. If a plane is requesting a degree heading, your job is simple: just assign him the degree heading he wants. If he is requesting an airway heading, you must assign him a degree heading so that he will eventually intercept the airway. When he finally arrives at the airway, he will turn onto it. If he is requesting to land on a runway, you must get him to the proper end of the runway. You can do that with the "h" command, of course, but an easier way is to use the "v" command to direct him to proceed to the corresponding VOR station. Refer to section 5 for a complete description of the "v" command.

3.4 Handling Degree Heading Planes

Planes that are requesting degree headings are the easiest to handle. When you first begin the simulation, all planes will be requesting degree headings and they will already be flying on the requested heading, so you don't have to do anything with them initially. However, when a new plane becomes active in your sector and is requesting a degree heading, you must assign the proper heading. There are two ways to do this. You can use the "h," or heading, command to assign a degree heading, or you can use the "dot"

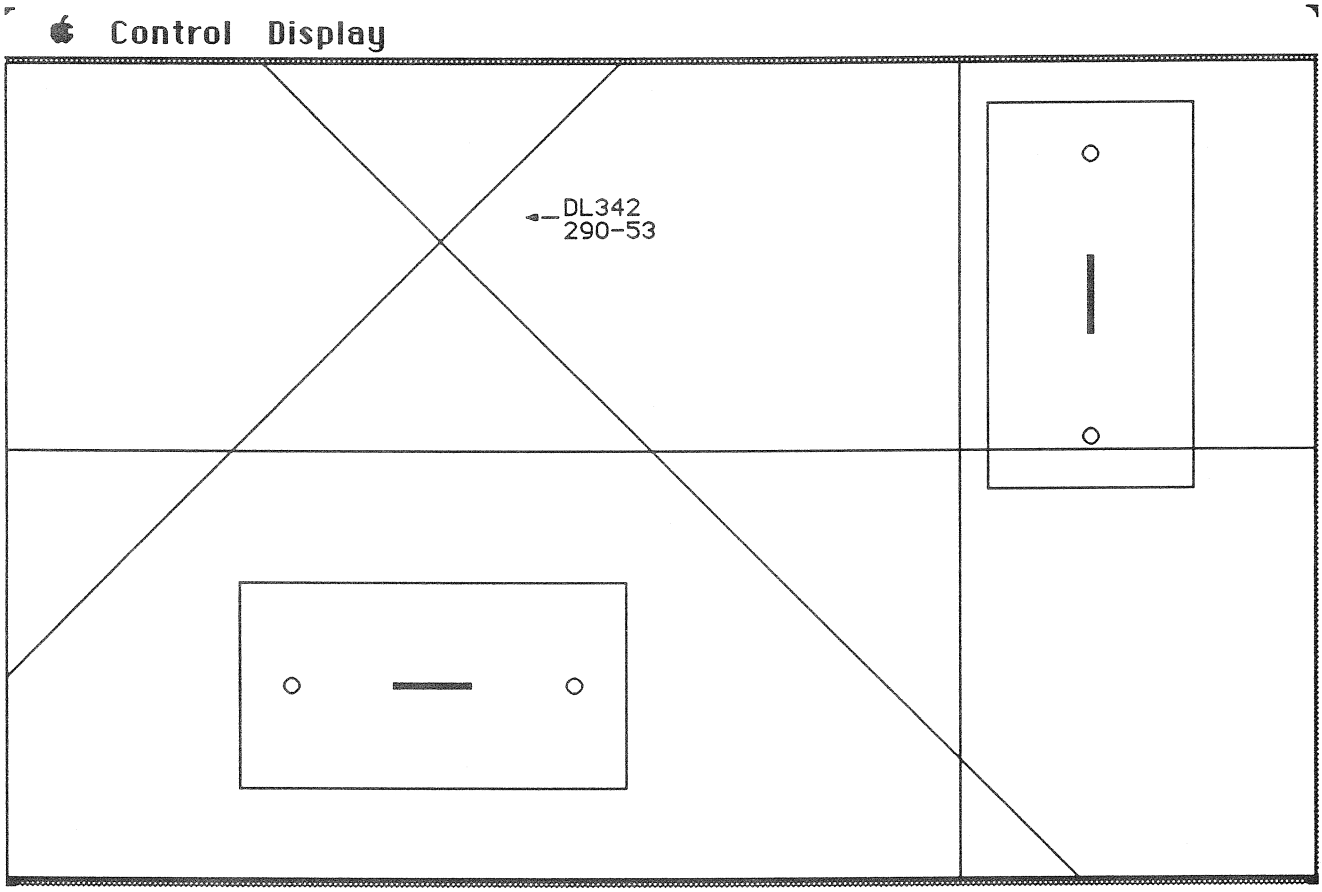
command, which is somewhat easier. If a plane requests a heading of 214 degrees, the command "h214" will cause the plane to turn to a heading of 214 degrees. The "dot" command will have the same effect, and it is easier to use (just press the period key and then RETURN).

You must assign the proper degree heading to new planes that join you throughout the simulation. In addition, planes already on your screen will request a heading change from time to time. You must give these planes new heading commands as well to send them to their desired destinations.

3.5 Handling Airway-bound Planes

When a new plane comes into your airspace and requests vectors to an airway, you should give him a heading command so that he will eventually intercept the desired airway. When he finally reaches the airway, he will automatically turn onto it. All you have to do is get him to the airway, and you do that via the "h" command.

The heading you assign to an airway-bound plane depends upon his position relative to the airway he wants to fly on. Consider the following radar screen:



If Delta 342 was requesting vectors to J04, you should assign a heading of 0 degrees, so that he would fly northbound for a few miles and then intercept J04. If he were requesting J22, you would assign a heading of 270. The following table shows what heading you should assign to Delta 342 in order to get him to the corresponding airway:

Airway	Heading
J36	90
J18	135
J09	135
J27	225
J31	270
J13	180
J04	0
J22	270

If a plane is requesting vectors to an airway, it doesn't really matter where he intercepts the airway; the important thing is for him to leave the screen on or near the requested airway and on the proper heading. The proper headings for planes exiting on an airway are:

Airway	Heading
J36	0
J18	180
J09	90
J27	270
J31	315
J13	135
J04	45
J22	225

Planes will normally turn to the proper headings automatically once they reach the airway, so you don't have to remember these headings. The important thing to remember about airway-bound planes is simply this: give them a degree heading that will cause them to intercept the desired airway, and they will pretty much take care of themselves.

3.6 Handling Runway-bound Planes

If a plane requests vectors to land on one of the four runways, you have to do several things. You have to get the plane to the proper end of the requested runway at an altitude of 1,000-1,500 feet and a speed of 100-150 knots and a heading corresponding to the runway (that is, heading of 180 for runway R18, heading of 270 for runway R27, etc.). If all of these conditions are met, the plane will land. If the plane is at the proper end of the runway and headed in the right direction, but it's altitude is above 1,500 feet or speed is over 150 knots, you will get a message that it is "not configured for landing," and you should send it around again to land. Fortunately, getting the plane lined up with the runway and on the proper heading is relatively easy since there is a VOR station a few miles from the end of each runway, and you can give the plane the "v" command to cause him to automatically fly to the specified VOR station. He will hold at the VOR when he gets there. At the same time you give him the "v" command, you should also begin establishing a proper altitude and speed as he begins his approach for landing. You can use the "a" and "s" commands to do this, or you can use the "b" command, which is easier. If the plane is some distance from the runway, you might give the command "b40" which will cause him to descend to 4,000

feet and reduce speed to 400 knots (you should only do this for "big" planes, however, since 400 knots is beyond the capability of "small" planes). As he gets closer to the airport, you can step him down and slow him down via the commands "b30", "b20", and finally "b10" which will set him up for landing at 1,000 feet and 100 knots. You do not have to incrementally step planes down like this in order to land them, but it is more realistic. In addition, you do not have to use the "v" command at all if you don't want to, but it makes setting planes up for landings much easier if you do. If you command a plane to fly to a VOR, he will hold once he gets there. You should keep him holding at the VOR until his altitude and speed are down to the 2,500 foot/250 knots range, then clear him to land (that is, release him from the hold) via the "=" command. He will then fly to the runway and land.

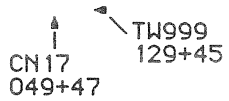
The thing to remember about landing planes is to send them to the VOR and get their altitude and speed down to 1,000 feet/150 knots and release them from the hold at the VOR at the proper time. However, be on the lookout for conflict alerts around VOR stations and runways, because planes tend to congregate at these locations at the same altitude. It is a good idea to make good use of the "w" warning circle command for planes flying close to one another in preparation for landing. Also, be careful not to land a plane at a "closed" runway (refer to section 7.5 for a description of closed runways).

3.7 Things To Avoid

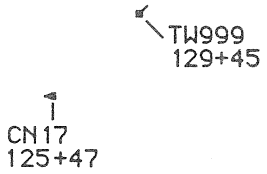
As controller, your main responsibility is to provide for the safe separation of aircraft under your control, while complying with pilot's requests. While doing your job, there are certain situations that you must avoid in order to perform safely. This section describes things that you have to always be on the lookout for and avoid.

Conflict Alerts

A conflict alert occurs when two planes get too close to one another at the around the same altitude. Specifically, you must maintain separation between aircraft of 5 miles horizontally and 1,000 feet vertically. You must always be on guard for planes that may get into a conflict situation. Consider the following radar display:



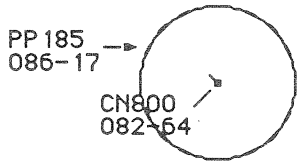
We have Continental flight 17, northbound, at 4,900 feet and climbing, and TWA flight 999, westbound, at 12,900 feet and also climbing. Is this a conflict situation? No, it is not. Although the planes are within 5 miles of each other, they are separated by 8,000 feet vertically, which is well above the 1,000 foot separation requirement. Now, consider this display:



Is this a conflict situation? No, because even though the planes are within 1,000 feet of one another (they are, in fact, 400 feet apart), they are not within 5 miles of each other and they are not on converging headings (Continental is headed west, and TWA is headed northeast). If, however, Continental requested

a heading change to 49 degrees, for example, and TWA requested a heading change of 231 degrees, and you assigned them to their requested headings, you would have a potential conflict situation as soon as the planes were within 5 miles of each other.

It is easy to see if planes are within 1,000 feet of one another, by looking at their altitude in the data block, but how do you know if they are within 5 miles of each other? You use the "w" command to do this. When you issue the "w" command for a plane, a circle is drawn around that plane's 5 mile boundary, and the circle moves as the plane moves. This is what it looks like:



The 5 mile circle is drawn around Continental 800. As you can see, Piper 185 is just outside of Continental's 5 mile protected airspace. Now, if Continental was eastbound and Piper was westbound, this would not be a conflict situation. But, in this case, Continental is northwestbound and Piper is eastbound, and they are separated by only 400 feet, so a conflict situation is imminent. If corrective action is not taken immediately, a conflict will result and, in fact, a crash may result as well. In this case, one possible corrective action to take would be to turn Continental to the north and turn Piper to the south, on temporary headings. Then, when they are clear of one another, you would turn them back to their requested headings.

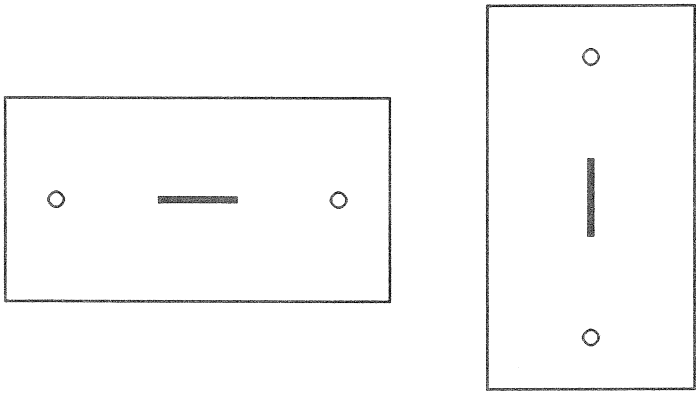
When you get into a conflict alert situation, you will get an audible conflict alert message and the data blocks of the conflicting planes will flash for a few seconds. A good controller will not get into conflict situations in the first place. He will scan the screen and take corrective action before the conflict occurs. This may include temporary altitude assignments, temporary heading assignments, or holding one or both aircraft. It takes practice to do this effectively. Once you are in a conflict situation, how do you resolve it? There are several ways, but the idea is to get the planes separated by 5 miles or 1,000 feet as soon as possible. Use the "a" or "h" commands to do this.

Crashes

When two planes get close enough to each other, and they are within a few hundred feet, they will crash. When they do, you will get a nasty message to call the National Transportation Safety Board at once and they will disappear from your radar screen. Your score is also severely affected by crashes, as you might imagine. In the following example, these 2 planes will crash:

Control Zone Violations

There are two control zones on the radar screen. A control zone is the area surrounding an airport and it's VOR stations. Here is how the two control zones are depicted on the radar screen:

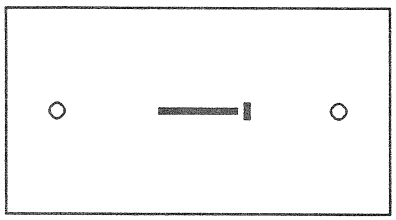


Control zones are special areas in that they are frequently filled with planes landing at the airports within them. In this simulation, there is one simple rule for control zones: no plane may be in a control zone at an altitude of under 5,000 feet unless that plane is requesting to land at the airport within that zone. What that means to you, as controller, is that you must make sure that no plane ventures into a control zone at an altitude under 5,000 feet unless he is bound for one of the runways within that zone. If a plane violates the control zone, you will get a message and points are deducted from your score. New planes may pop up anywhere, but if they pop up in the control zone they will have an initial altitude of over 5,000 feet. Notice that the control zone surrounding the airport with runways R36/R18 contains part of airway J09/J27. You must make sure that a plane travelling on J09/J27 is not below 5,000 feet when he transits the control zone. If a plane does violate the control zone, his data block will flash for a few seconds so you can quickly identify him. How do you handle it if a control zone violation occurs? Either turn the plane out of the zone ASAP or climb him above 5,000 feet.

Be especially aware of planes that come up in a control zone and are bound for a runway in the other zone. They will start descending and, if you don't give them a command, they may violate the control zone. Remember, a plane bound for runway R18, for instance, cannot descend below 5,000 feet while in the control zone for R27/R09.

Landing on Closed Runways

Periodically, a runway may be closed. When this happens, you will get a message and a little "blockade" symbol will be placed next to the closed runway, to remind you not to land any planes on it. The display will look like this:



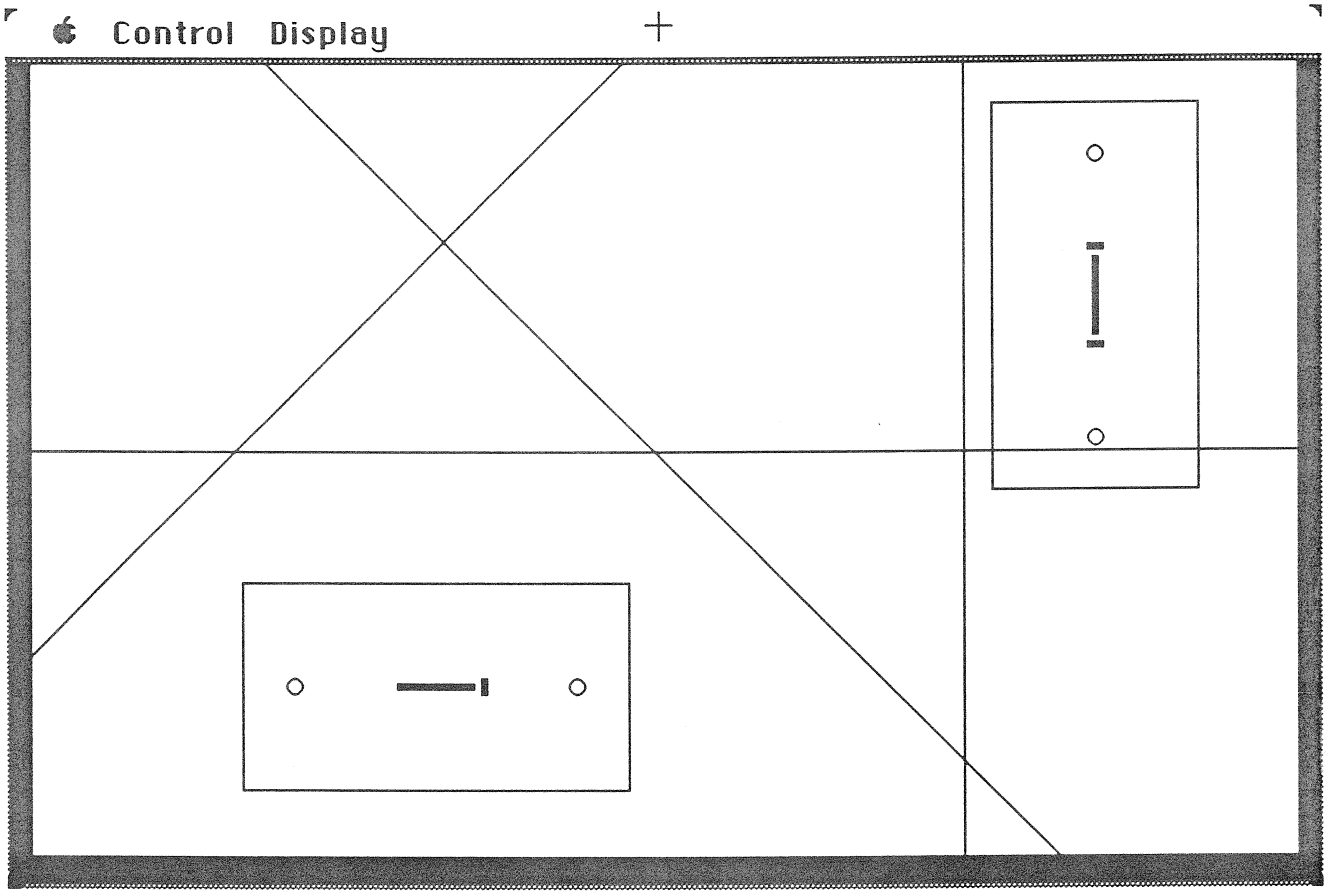
In this instance, runway R27 is closed. You should not land any planes on it. If you do, they will crash. You can still land planes on R09, however, since it is not closed (assume that R09 and R27 are two

physically separate strips, although in real life they would not be). If R09 were closed, it would have a little blockade symbol at the left end of the runway, similar to R27's symbol.

Closed runways are not closed forever; they will eventually open up again. If a runway is closed, you can divert any plane destined for that runway to any other runway that is not closed with the "d", or divert, command. Refer to section 5 for a description of the divert command. In this example, if you had a plane on final approach for R27, and that runway suddenly closed, you could divert the plane to runway R09 with the command "d09". You would then handle the plane just like he was requesting R09 (in fact, the command "d09" actually changes the requested heading to R09; the "d" command is the only way you can change the requested heading, and you can only issue the "d" command in certain circumstances).

Exiting Without a Proper Handoff

Whenever a plane leaves the edge of your screen and says goodbye, he is going into some other controller's airspace. The other controller may not be able to accept any additional planes in his space, because he has too many already to keep track of safely. Therefore, he may refuse to accept a plane that is leaving your area. In this simulation, this is called "handoffs suspended." Handoffs may be suspended to the north, south, east, west, or any combination thereof. If handoffs are suspended, you will get a message to that effect and a black bar will appear at the appropriate edge of the screen. In the following example, handoffs are suspended to the south, east, and west:



If handoffs are suspended, you should not let any planes exit in that direction. If you do, points are deducted from your score. You should either hold planes (via the "=" command) or divert them to land at one of the open runways, via the "d" command. You are only able to divert planes that are requesting headings that would be impossible to satisfy, given that handoffs are suspended in the direction they want to fly. For example, if handoffs are suspended to the north, you would be able to divert a plane with a requested heading of 20 degrees, since he would be headed directly toward the top of the screen; you would not be able to divert a plane with a requested heading of 52 degrees, since he would be headed northeast and could, technically, exit on the east side of the screen.

Like runway closings, handoff suspensions do not last forever, and after a period of time handoffs will be accepted again. When that happens, the black bar will go away and you will get a message that handoffs are now accepted.

Exiting at Improper Altitude, Speed, or Heading

You must not let planes exit the screen at an improper assigned altitude, speed, or heading. If you do, your score is adversely affected. The current values for altitude and speed are not important when a plane exits the screen. This is what is important: the assigned altitude must be equal to the requested altitude; the assigned speed must be equal to the requested speed; if a plane is requesting a degree heading, the assigned heading must be equal to the requested heading; if a plane is requesting an airway, then the plane must be on or near the requested airway and the assigned heading must correspond to the heading for that airway (these headings are listed in section 3.5). If a runway bound plane exits the edge of the screen, I don't even want to think about it (actually, it is considered leaving the screen at an improper heading).

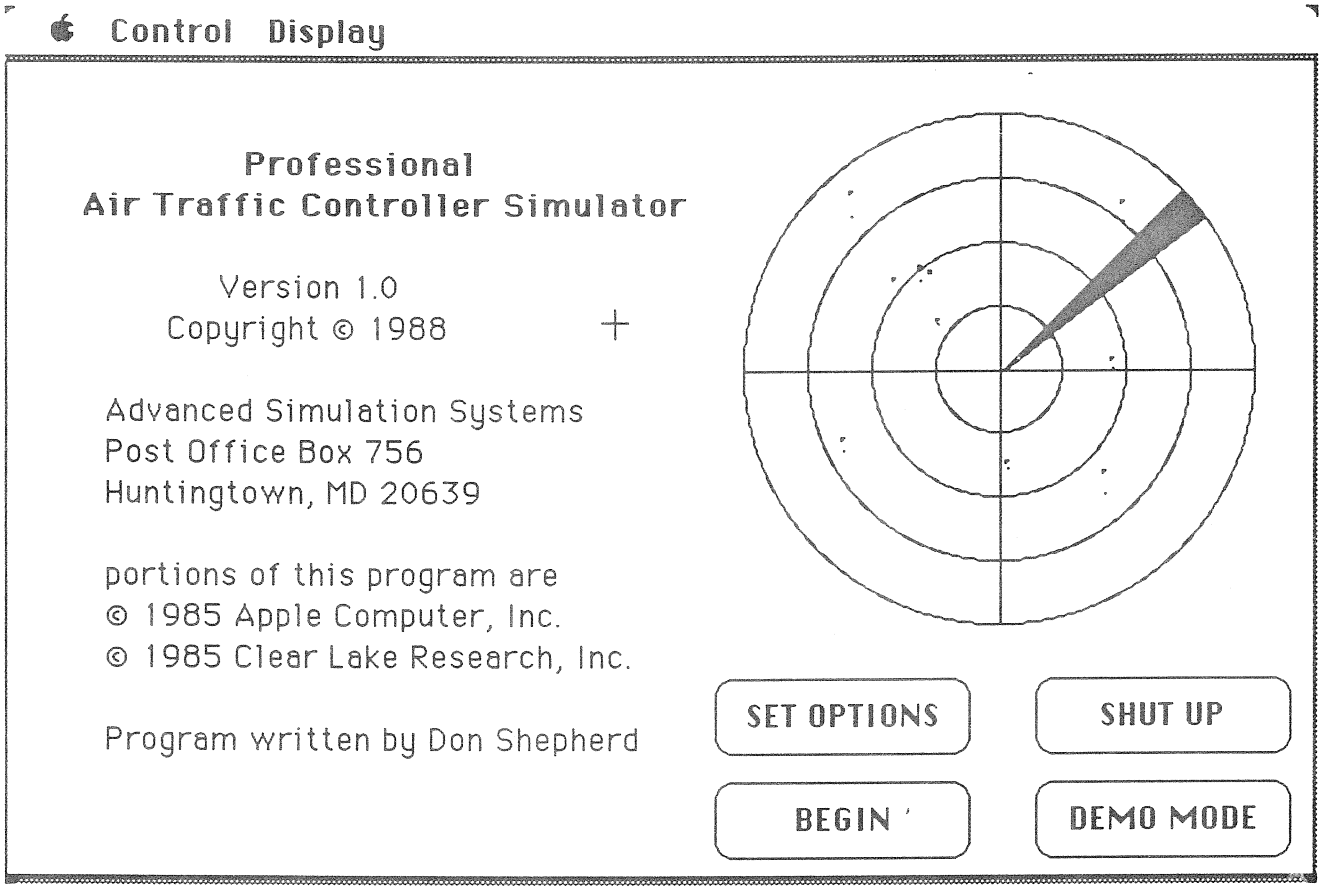
How can you be sure that a plane about to exit the screen is on the correct assigned altitude, speed, and heading? Simply look for an asterisk in the plane's data block. An asterisk in a data block should be like a red flag to you. It means that there is a discrepancy between the assigned values and the requested values, so you need to take action before that plane exits. If you put a plane on a temporary heading or altitude assignment in order to avoid a conflict alert or control zone violation, there will be an asterisk in the plane's data block as a reminder to you to get him back on course after the conflict conditions are over.

4 Screen Description

This section describes the various screens that available within PATCS.

4.1 Signon Screen

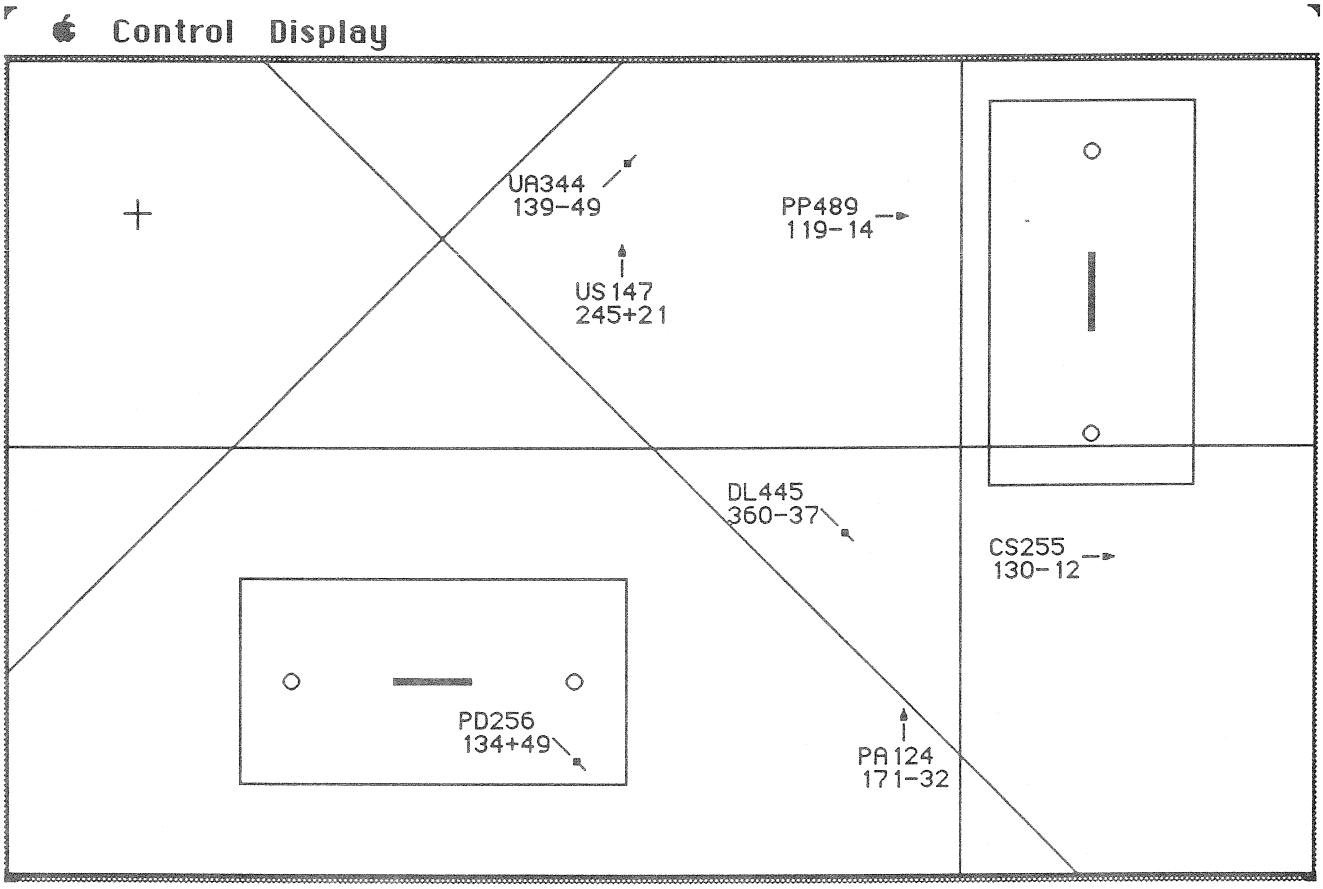
The Signon screen is displayed when you first begin the simulation. It gives the required legal credits for the program, lists the address of Advanced Simulation Systems, displays a small radar screen with a moving sweep-arm, and has 4 buttons to get the simulation started. It also speaks commands while it waits for you to press a button. Here is the format of the Signon screen:



You must click on one of the four buttons to continue the simulation. "Begin" will start the simulation. "Set options" will display the Options screen, where you can specify how many planes you want to start with, and many other parameters. "Shut up" will turn off the voice output and you will stay in the Startup screen. "Shut up" changes to "Talk to me" so you can turn the voice back on if you want. "Demo mode" starts the simulation running in demonstration mode, which allows the controller to sit back and watch the simulation run itself. You must click on "Begin", "Set options", or "Demo mode" in order to start the simulation. You may not choose any menu options while the startup screen is displayed. There may be a delay of several seconds after you click one of the buttons. This is normal.

4.2 Radar Screen

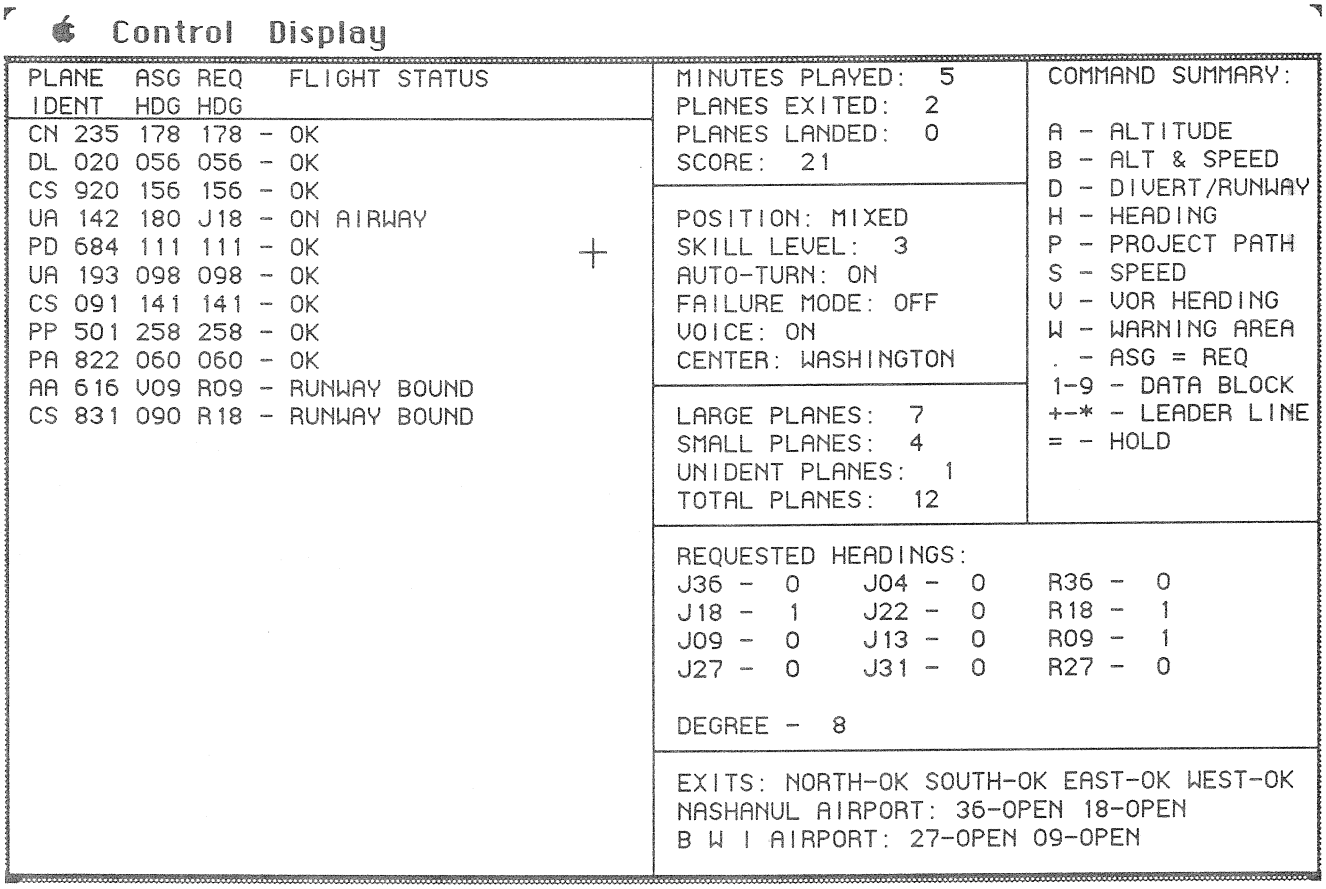
This is the main display in PATCS. The radar screen shows planes and their data blocks, airways, VOR stations, control zones, runways, runway closure "barricades," and handoff suspension "barricades." Here is the format of the Radar screen:



Refer to section 4.5 for a description of the features shown on the Radar screen.

4.3 Status Screen

The Status screen shows general status information about the simulation. Here is the format of the Status screen:



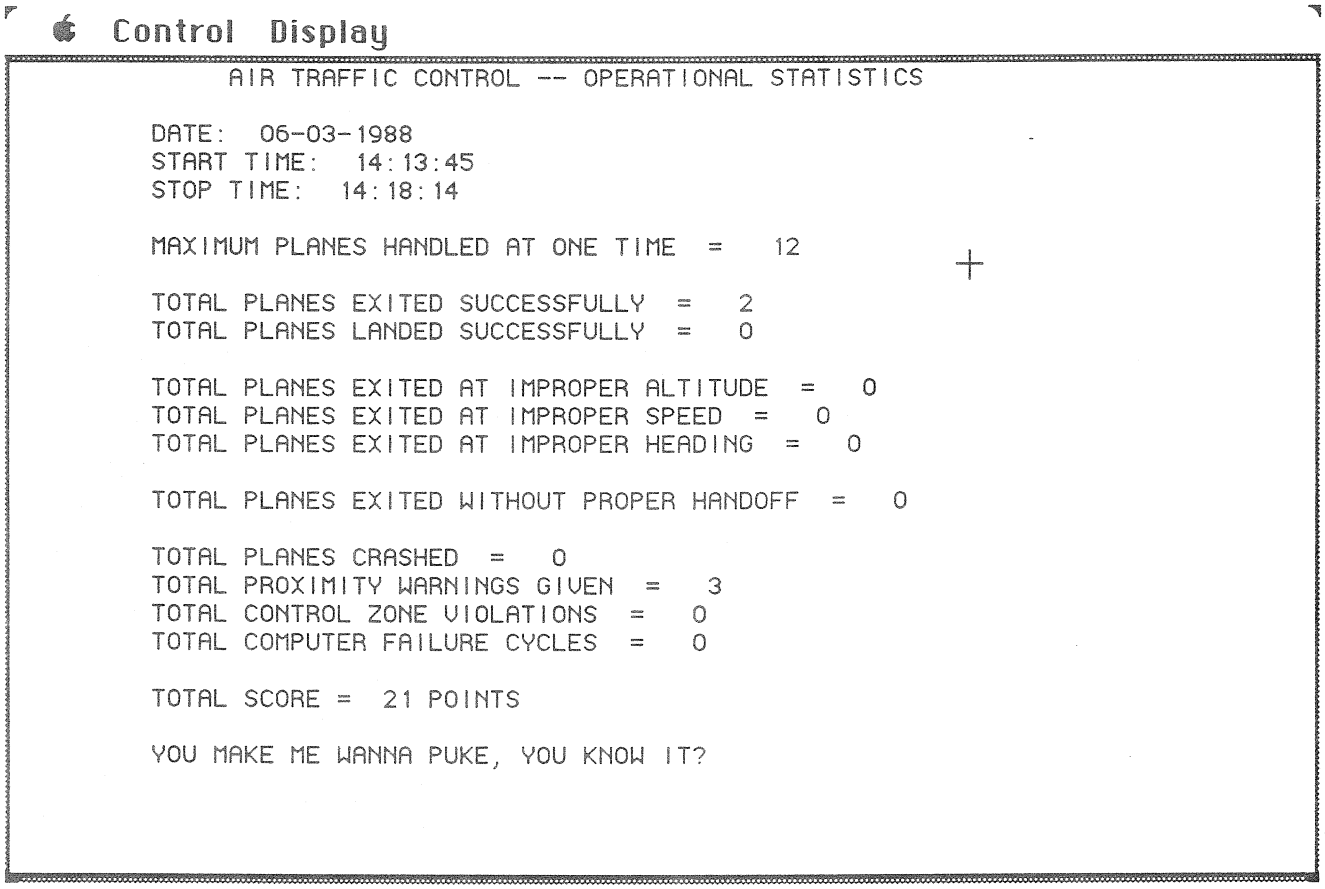
The left half of the Status screen shows the current status of each active plane, including each plane's assigned heading and requested heading. The entries under "flight status" can be one of the following:

OK	plane is proceeding on course, all is OK
ON AIRWAY	airway-bound plane is flying on the airway
ENROUTE TO AIRWAY	airway-bound plane is enroute to the airway
HOLDING INDEFINITELY	plane is holding with no release time specified
HODLING FOR n CYCLES	plane is holding for the specified number of cycles
RUNWAY BOUND	runway-bound plane is enroute to a runway
ON FINAL APPROACH	runway-bound plane has left the VOR and is headed for the runway
ALTITUDE ERROR	assigned altitude differs from requested altitude
SPEED ERROR	assigned speed differs from requested speed
HEADING ERROR	assigned heading differs from requested heading

The right half of the Status screen shows general status information about the simulator. Most of this is self-explanatory. The section with "position" shows the current values of selected parameters on the Options screen. The bottom three lines show current handoff and runway status information.

4.4 Score Screen

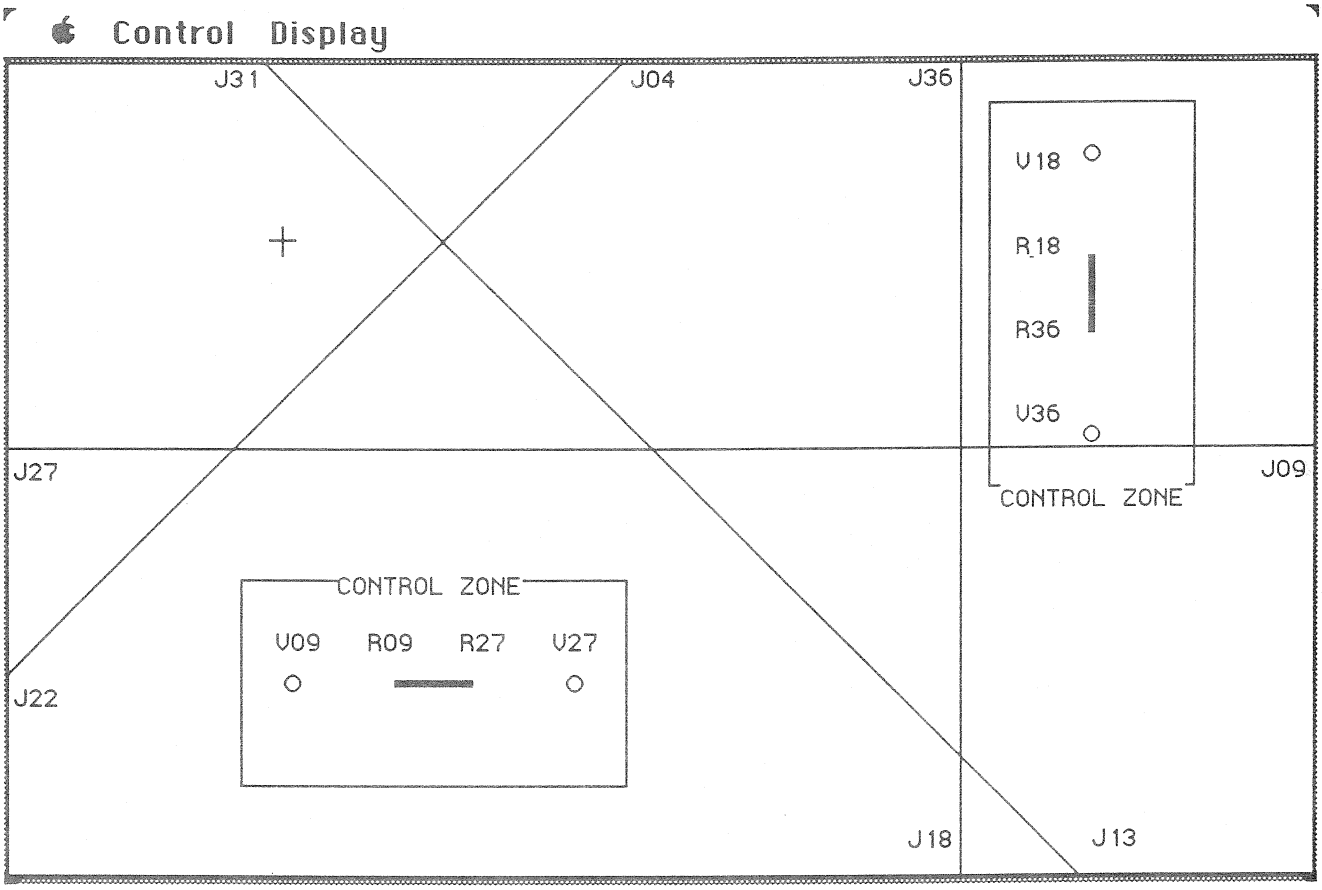
The Score screen shows the various components of your current score. Here is the format of the Score screen:



Refer to section 8 for a description of how the score is calculated.

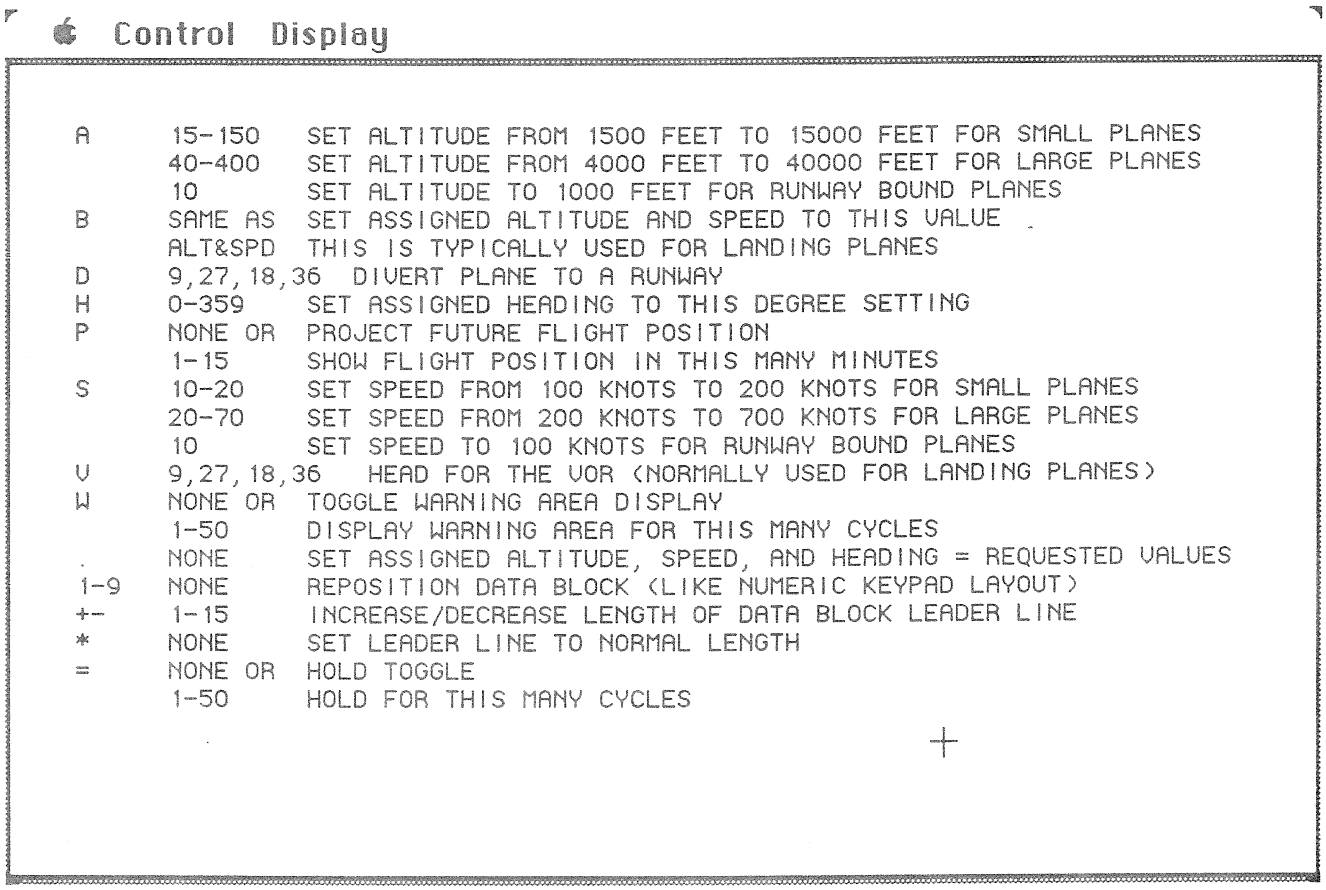
4.5 Reference Screen

The Reference screen is the same as the Radar screen with all of the features labelled, for easy reference. If you forget where J13 is, just call up this screen to find out. Here is the format of the Reference screen:



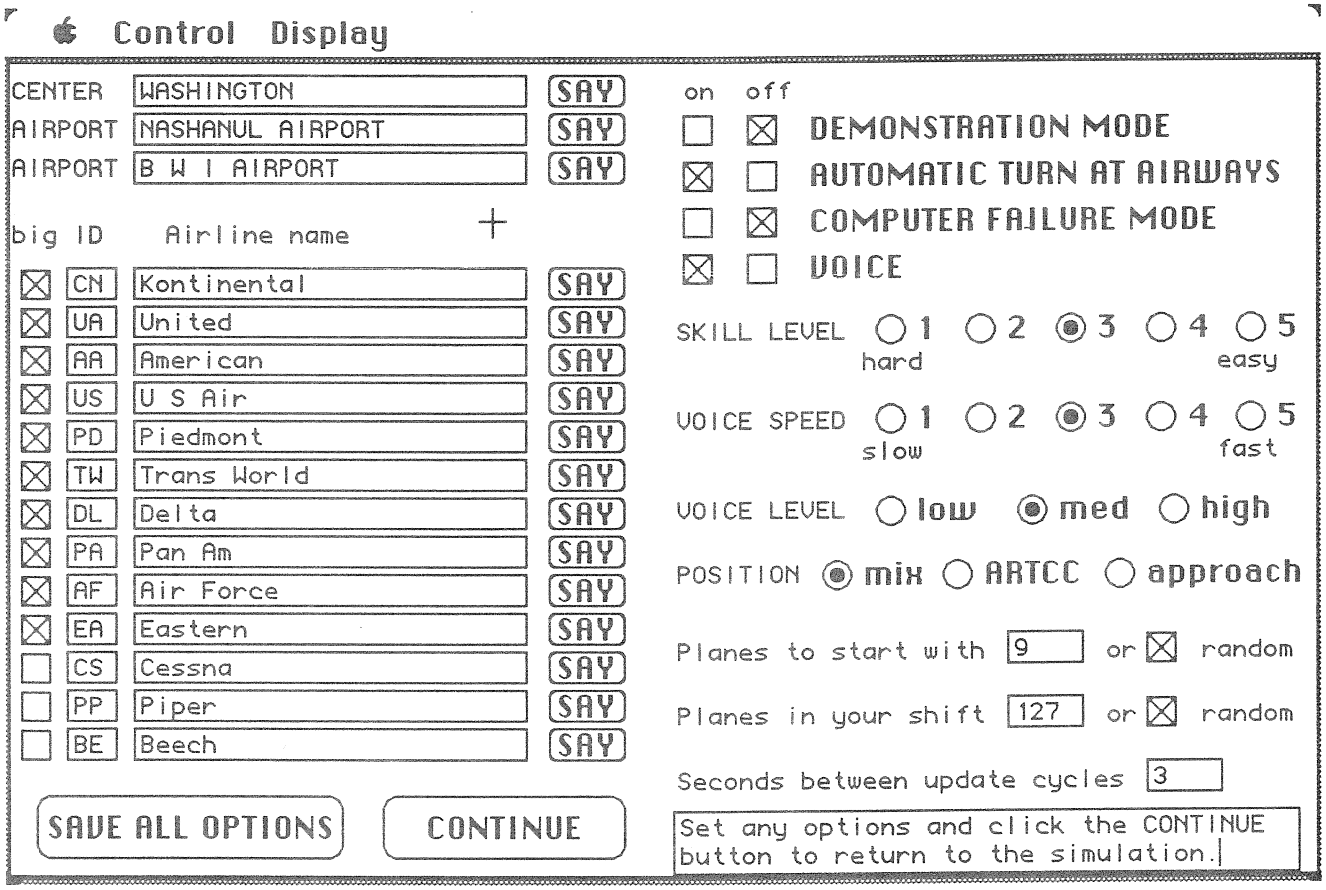
4.6 Command Description Screen

The Command Description screen gives a brief summary of every command that you may issue to a plane. You can use this screen if you have a question about what command or command value you should use. Here is the format of the Command Description screen:



4.7 Options Screen

The Options screen is used to set various operational parameters within the simulator. It is activated by choosing "Set options" from the "Control" menu. This screen lets you customize the simulator according to your own preferences. Here is the format of the Options screen:



Refer to section 9.1 to determine how to use this screen to customize the simulation.

5 Commands

This section lists all of the commands that you can issue to planes under your control. If you enter an invalid command, or a command with an improper value, a message will remind you of what the proper value range is, so you can then enter the command correctly.

A - set assigned altitude

Use this command to assign an altitude to a plane. Altitude is always expressed in hundreds of feet, so to command a plane to descend to 14,700 feet, the command would be "a147". After you issue this command, the plane's current altitude will be incremented or decremented by 1 during each update cycle until it reaches the assigned value. The altitude you may assign to a plane is dependent upon whether the plane is classified as "big" or "small." Big planes can range from 4,000 feet to 40,000 feet; small planes can range from 1,500 feet to 15,000 feet. However, any plane bound for a runway may descend to 1,000 feet to land.

B - set assigned altitude and speed

Use this command to assign an altitude and speed at the same time, with the same value. For instance, the command "b40" means go to 4,000 feet and adjust speed to 400 knots. While this command may be used with any plane, it is most useful in "stepping down" big planes that are going to land on a runway. If they are far away from the destination runway, you can issue the command "b40". Then, as they get nearer to the runway, bring them down and slow them down with "b30", "b20", and finally "b10." You may not use this command to exceed the altitude or speed limitations that apply to the type of aircraft you are commanding. For instance, the command "b30" will be rejected for a small plane because a small plane cannot go at a speed of 300 knots.

D - divert to a runway

This command can only be used in selected circumstances. It is used to divert a plane to land at a runway. The format is: d36, d18, d09, or d27. Only two types of planes may be diverted to land at a runway: planes destined for a runway that has been closed, and planes destined to leave the screen in a direction for which handoffs have been suspended. For instance, if a plane has a requested heading of R18, and runway R18 is closed, that plane may be diverted to runway R09, provided R09 is open. If R09 was also closed, you could not divert him to it. If a plane has a requested heading of 275 or J27 or J22, and handoffs to the west are suspended, then you could divert that plane to any open runway. Be aware that, once you divert a plane to a runway, his requested heading is changed to that runway and you will not be able to divert him again unless the runway is closed. This command is the only way that you can change a requested heading. It is never mandatory to use this command, since you can always hold planes that are bound for closed runways or exits where handoffs are suspended.

H - set assigned heading

Use this command to assign a degree heading to a plane. The heading value must be between 0 and 359. After you assign a new heading, it is effective during the next update cycle. Remember, no matter what the degree heading is, planes can only move in eight directions on the screen: north, northeast, east, southeast, south, southwest, west, and northwest.

P - plot future track

Use this command to draw a line extending in the plane's direction of travel, in order to project exactly where the plane will fly. If you issue the command "p" without a value, then the line will extend all the way to the edge of the screen. If you issue the command with a value from 1 to 15, like "p4", the line will show the path the plane will take during the next 4 minutes. This command is most useful in two situations: to determine if a plane will intercept an airway on his current heading, and to determine if a plane may be in a conflict situation with another plane. If the plot track feature is on and the plane's heading changes, the plot line is automatically changed as well in the new direction. This command is a toggle, so issue the "p" command again to turn off the track plot.

S - set assigned speed

Use this command to assign a speed to a plane. Speed is always expressed in tens of knots, so to command a plane to slow to 250 knots, the command would be "s25". After you issue this command, the plane's current speed will be incremented or decremented by 1 during each update cycle until it reaches the assigned value. The speed you may assign to a plane is dependent upon whether the plane is classified as "big" or "small." Big planes can range from 200 knots to 700 knots; small planes can range from 100 knots to 200 knots. However, any plane bound for a runway may slow to 100 knots to land.

V - assign VOR heading

Use this command to send a runway-bound plane to a VOR station. Actually, this command can be used for any plane, not just runway-bound planes, but it only makes sense for runway-bound planes. The format of the command is: v36, v18, v27, or v09. When you give this command to a plane, he will automatically adjust his assigned heading in order to fly to the assigned VOR station. When he arrives at the VOR, he will enter a holding pattern and, if he is bound for a runway, he will adjust his assigned heading to point him toward the runway. Then, all you have to do is wait for his altitude and speed to get down to around 2,500 feet and 250 knots, then release him to land via the "=" command.

W - display warning area circle

Use this command to display a circle around a plane to show it's 5 mile protected airspace. This command should be used anytime you think two planes may be coming into a conflict situation. By using this command, you will know if a conflict is imminent. If you want, you can issue this command with a value of 1 to 50 ("w10", for example); this will cause the warning circle to be displayed for the next 10 cycles, and then go away. If the warning circle is displayed, issue the "w" command again to turn it off.

(dot) - set assigned values to requested values

This is a very convenient command for a variety of situations. When you issue this command, the assigned altitude is set to the requested altitude, assigned speed is set to requested speed, and, if the requested heading is a degree value, then the assigned heading is set to the requested heading, otherwise the assigned heading is set to the final heading (for the airway or runway). You can use this command instead of the "a", "s", and "h" commands in many situations. Suppose, for example, a plane is on a heading of 138 degrees and he requests a heading change to 288 degrees. Instead of giving the command "h288", you could give the dot command, and the effect would be the same. You should use caution, however, in giving the dot command to planes that are enroute to an airway or runway. If you give them the dot command before they are on the airway or runway, their headings will be not what they intended. This command is never mandatory, and you need never use it if you want.

1-9 - reposition data block

Use the digits 1-9 (except 5) to reposition a plane's data block to prevent screen clutter. On the numeric keypad, think of the middle key (5) as the plane's dot, then enter 1-9 to place the data block in a new position relative to the plane's dot. If you do not have a numeric keypad, here is where the data block will be repositioned:

Number	Position
1	lower left
2	lower middle
3	lower right
4	left
6	right
7	upper left
8	upper middle
9	upper right

+-* - set leader line length

These commands are used to increase or decrease the length of the leader line which connects the plane's dot with the data block. This is useful in crowded sky situations. The leader line can be up to 15 times it's normal length. Use the "+" command to increase the length of the leader line; the "-" to decrease the length; and the "*" to reset the leader line to it's normal length. If the leader line is in it's normal position, then the command "+15" will move the data block as far away from the plane as possible. The command "+10" will move it two-thirds of the way away from the plane, and so on. The command "+" will increase the length by one unit.

= - holding pattern toggle

Use this command to cause a plane to go into a holding pattern. The plane's position will not change once he goes into a holding pattern. A plane that is holding will have a "=" in his data block to remind you that he is holding. The "=" command is a toggle; enter it again to let the plane proceed. If you enter a value with this command, like "=20", the plane will hold for the next 20 cycles, then proceed automatically. The value must be less than 50. The hold command with a value is useful for a runway-bound plane reaching a VOR; if he gets to the VOR and holds and his altitude is 4,500 feet and you want him to hold until his altitude is 2,500 feet, then you can issue the command "=20" and he will hold for the next 20 cycles and then proceed automatically, without you having to release him.

6 Menus

6.1 Control

These menu items are used to control the simulation.

Quit (⌘Q)
This menu item is used to quit the simulation.

Play Again (⌘P)
This menu item will restart the simulation with the current set of parameters in the Options screen.

Set Options (⌘O)
This menu item will bring up the Options screen, enabling you to customize the simulation.

6.2 Display

These menu items control which screen is displayed. Only one screen can be displayed at a time. A mouse click in any screen except the Radar screen will cause the Radar screen to be displayed again.

Radar Screen (⌘R)
This menu item causes the normal Radar screen to be displayed. The simulation only "runs" while this screen is displayed.

Status Screen (⌘S)
This menu item causes the Status screen to be displayed.

Score Screen (⌘A)
This menu item causes the Score screen to be displayed.

Reference Screen (⌘Z)
This menu item causes the Reference screen to be displayed.

Command Description Screen (⌘C)
This menu item causes the Command Description screen to be displayed.

7 Special Events

While the simulation is running, certain events will happen at random. How often these events happen is determined by the difficulty level set on the Options screen. The harder the difficulty level, the more frequent these events will occur.

7.1 New Planes

When a new plane comes into your airspace, he announces his presence by telling you his identification, what quadrant he is in, and what his heading intentions are. If you think of the radar screen being divided into four quadrants by the airways J36/J18 and J27/J09, then quadrant 1 is the upper left corner, quadrant 2 is the upper right corner, quadrant 3 is the lower left corner, and quadrant 4 is the lower right corner. Don't worry about remembering quadrant numbers, they are only used by new planes to tell you where they will appear on the screen. The heading intentions of a plane can only be one of three things: a degree heading, vectors to an airway, or vectors to land at a runway. Even though a runway may be closed, new planes may still request to land on it. Whenever a new plane joins you, his assigned altitude and speed will correspond to his requested altitude and speed, so you don't have to issue "a" or "s" commands immediately. In addition, if the plane is requesting a degree heading, his assigned heading will already be set correctly also. All you really have to do when a new plane joins you is assign the proper heading for airway-bound planes and runway-bound planes. In addition, for runway-bound planes you should assign intermediate altitude and speed restrictions if they are some distance from their intended runways.

Under Your Control

Every plane with a data block is, by definition, under your control, and you are responsible for safely commanding him to his intended destination.

Not Under Your Control

When you see a dot on the Radar screen with no data block attached to it, that is a plane that is in your airspace but is not under your control, and you are not responsible for him. He has no data block, so you cannot command him; in fact, you know nothing about him other than his position, direction (by watching which way he moves), and speed (by seeing how fast he moves). These planes represent VFR (visual flight rules) traffic that have not filed flight plans and are, therefore, not your responsibility. The catch, however, is that they may be flying at altitudes they should not be at, and they can cause conflict alerts with planes that are under your control. In fact, they can cause planes under your control to crash. You will not hear anything about these aircraft unless they cause a conflict alert, and then the message will be "conflict alert: Piedmont 411 and unidentified aircraft." Since you cannot control the unidentified aircraft, your only option is to get Piedmont 411 out of there and away from the intruder. Unidentified aircraft cannot conflict with each other, however, since you would be powerless to do anything about it. They also cannot cause control zone violations or exit the screen improperly, again because you cannot control them. What you have to do is just watch them when they get near to aircraft under your control, and if you start to get a conflict alert, be ready with a plan to get your responsible aircraft away from them.

7.2 Change Requests

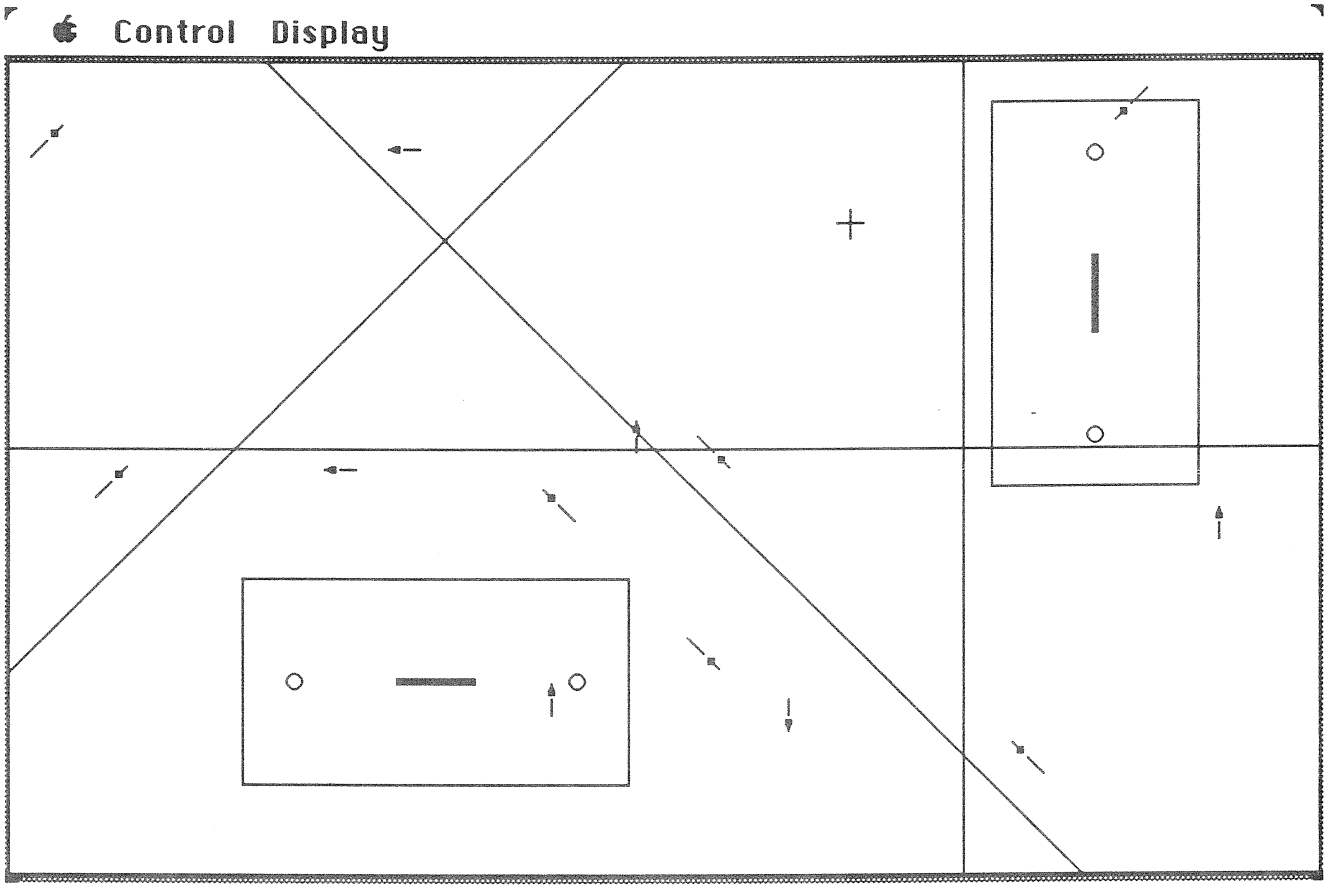
Planes that are already on your screen will periodically request changes in altitude, speed, or heading. You must issue the proper commands to comply with these change requests. Sometimes a plane requesting vectors to J09 will announce that he wants a change to request vectors to J09. You need take no action in that case, since he is obviously a confused pilot. Planes requesting vectors to a runway will not request changes, since they know they want to land; only planes requesting degree headings or vectors to airways will request changes.

7.3 Mistakes

So that you do not get too complacent in your job as controller, be advised that, periodically, "mistakes" will occur. There will be no announcement of these. What happens is the pilot has misunderstood what you commanded him to do, and his assigned altitude, speed, or heading is changed to something other than what you commanded him. If you don't notice this and catch it and correct it, he may leave the screen in an improper configuration. Fortunately for you, there is an easy way to tell if a mistake has occurred: look for an asterisk in the data block. Remember, the asterisk means that the assigned values and the requested values differ. If you see an asterisk in a data block of a plane that was just fine a second ago, then you know that a mistake has occurred. The solution is simple: set assigned altitude, speed, or heading back to what it should be, and the plane will be fine.

7.4 Computer Failures

One of the things that a controller worries about is a computer failure. What is he supposed to do when all of the information he needs to safely control planes is not shown on his screen, but the planes are still up there in need of direction? In PATCS, computer failures are represented like this:



What happens is, the computer loses all track of the planes data block information. The display reverts back to just a raw radar picture of blips representing planes, with no accompanying data block information. You can still see where the planes are, but you can't tell their altitude, speed, or identification by looking at the screen. You can still distinguish planes under your control from planes not under your control by the presence of the leader line (planes not under your control will just appear as blips, like they always do; planes you are responsible for have a leader line attached to the blip, but no data block). To give a command to a plane, click where the data block would be if it were there. When computer failure occurs, which happens infrequently, you can still run the simulation, but it is much more difficult. You much watch carefully and see where a new plane is; you much watch and see which plane wants to change altitude, speed, heading, and so on. To compensate for this added degree of difficulty, you get extra points for playing in computer failure mode. While in this mode, the Status screen will not show status information for individual planes, and the "p" and "w" commands are inoperative, so you may not plot tracks or display warning circles. You can turn computer failure mode off (and on, for that matter), and get back to normal, via the Options screen.

7.5 Runway Closings

Periodically, runways will close. This is indicated by the blockade symbol next to them on the Radar screen (see section 3.7). You should not land a plane on a closed runway. If you do, it will crash and

your score will be adversely effected. You must either hold any plane bound for the closed runway or divert it to another runway that is open. After a while, closed runways will reopen.

7.6 Handoff Suspensions

Periodically, handoffs to adjacent sectors will be suspended, because the controllers in those sectors are too busy and are overloaded. They cannot accept any more planes from you. You will get a message to that effect and a black bar will appear on your Radar screen in the direction for which handoffs are suspended. You must not let any plane exit in that direction, or your score will suffer. You must either hold or divert planes bound for that direction. After a while, handoffs will be accepted again.

7.7 Automatic Data Block Position Adjustments

This is really a good feature of the simulation, not something bad like the other things just described here. When two data blocks start to overwrite one another, the position of one is adjusted so that it will not overwrite another data block. Also, when a plane's black dot is overwritten by another plane's data block, the data block is moved off of the other plane. Just watch the screen and you will see how data blocks are automatically adjusted so as to keep the Radar screen neat and clear. If the screen is extermely crowded, however, sometimes it will not be possible to move a given data block so that it does not overwrite another plane. You cannot turn this feature off (I'm not sure why you would even want to). Just remember that when data blocks start to move themselves automatically, there is a reason for it.

8 Score

Your current score is shown on the Status screen and is broken down in detail on the Score screen. The score is based on several things, and reflects how well you have done your job as controller. Here is how the score is calculated:

score = number of minutes played (stop time minus start time, whole minutes)
+ maximum planes handled at one time
+ total planes that have exited successfully
+ 2 * total planes that have landed successfully
- 2 * total planes that exited at an improper altitude, speed, or heading
- 5 * total planes that exited without a proper handoff
- 20 * total planes that have crashed
- total number of conflict alerts (or proximity warnings)
- total number of control zone violations
+ total number of computer failure cycles / 5
+ 5 point bonus if no planes exited at an improper altitude, speed, or heading

At the bottom of the Score screen will be a message which reflects a judgement on your score.

9 Customizing The Simulation

One of the best features of PATCS is the fact that you can customize it to suit your own tastes. If you want to change Piedmont Airlines to Chester McGillicuddy Airlines, you can do it. If you want to change the airport names to Heathrow or Tokoyo International, you can do it, and you can save these settings in the parameter file so that they will automatically be in effect whenever you run the simulation. You customize PATCS by changing entries in the parameter file called "ATC params". This file is read at the

beginning of each run, and contains general simulator parameters. There are two ways that you can customize PATCS: via the Options screen and by directly editing the parameter file.

9.1 Options Screen

The following parameters are directly changeable on the Options screen. Once you are done setting the desired options, you can click the "save all options" button to write all of your customized options to the standard parameter file "ATC params", or you can just continue the simulation by clicking the "continue" button. You may not choose any menu items while in the Options screen.

Center name

This is the name of the ATC center, which pilots sometimes mention in their radio broadcasts to you. You can click in the window and enter a new name, and test pronounce it by clicking on the SAY button.

Airport names

The names of the two airports can be changed by clicking in the window and entering a new name. Airport names are used by pilots who want to land on one of the runways. You can test pronounce your new name by clicking on the SAY button.

Airline types, IDs, and names

You can designate any airline as "big" by clicking in the big box. "Big" only affects how high and fast planes for that airline may go. You can change the ID and the airline name by clicking in those windows and entering new values. The ID is what appears in the data blocks. Use the SAY button to test pronounce what your new airline name will sound like. You may have to play around with the spelling to get it to sound right (like "Nashanul airport" instead of "National airport").

Demonstration mode

You can turn demonstration mode on or off by clicking the appropriate button. Demonstration mode allows you to run the simulation and have the computer issue all of the commands, instead of you having to do it. It is meant to be a feature to demonstrate how the simulation operates. It handles new planes and change requests, but it will not do everything. For instance, here is what it does:

- assigns planes to requested altitude, speed, and heading
- responds to change requests
- handles new planes
- vectors airway-bound planes to the proper airway
- vectors runway-bound planes to the proper VOR
- releases runway-bound planes from the VOR when altitude and speed are 2,500 feet and 250 knots or less

Here is what it will not do:

- prevent conflict alerts
- prevent crashes
- prevent control zone violations
- prevent landing on closed runways
- prevent exiting while handoffs are suspended

In essence, then, demonstration mode lacks the judgement of a controller. It sends planes exactly where they want to go without regard to the safety involved. Do not expect to achieve a high score while in demonstration mode, because is just doesn't handle planes safely, it just blindly sends them where they want to go. It's main value is simply to demonstrate the simulator.

Automatic turn at airways

This feature can be turned on or off by clicking the appropriate button. When this is on, any plane bound for an airway will automatically turn onto it when he reaches it. If this is turned off, he will announce that he is at the airway, but he will not turn onto it, you must command him to turn onto it at the proper heading (the dot command will do it). Why would you want this feature ever turned off? For one simple reason: to avoid conflict alerts or control zone violations. Consider the case of an airway-bound plane already on the airway, proceeding along nicely, and he comes into conflict with another plane in his path. You try to turn him off of the airway, and he immediately comes back and says that he is turning back onto the airway (because airway-bound planes normally automatically turn onto the airway once they are near it). In essence, you cannot turn an airway-bound plane off of his airway unless you turn this automatic turn feature off. You may never need to use this feature, but if you do, it is available.

Computer failure mode

You can turn computer failure mode either off or on by clicking on the appropriate button. Refer to section 7.4 for a discussion of computer failure mode.

Voice

You can turn the voice output on or off by clicking on the appropriate button. Running the simulation without voice is tricky, because you won't hear new planes, change requests, control zone violations, conflict alerts, and so on; but it can be done. Turn voice off if you don't want to disturb those around you.

Skill level

You can set the skill level from 1 to 5, 1 being hard and 5 being easy. In PATCS, skill level controls how quickly new planes come up, change requests occur, runways are closed, handoffs are suspended, and things like that. You can make your job easier or tougher by adjusting the skill level.

Voice speed

You can adjust how quickly (or slowly) the pilots talk to you with this parameter. As you get more proficient and more used to PATCS, you may want to quicken the voice speed.

Voice level

This parameter sets the controller voice level to a low pitched voice, medium pitched voice, or a high pitched voice. This command affects the controller voice level only--each plane has an individual, variable voice level, to correspond to male pilots and female pilots. If you, as the controller, are a REAL MAN, put it on low; if you are a wimp, put it on medium; if you are a girl, put it on high. Incidentally, the use of the terms "him" and "he" in this manual is not intended to be sexist; it's just easier to write that way. I know that many of the best controllers are women, and that is why I added this voice level parameter.

Position

In real life, there are many types of controller positions. In PATCS, you can choose from ARTCC (or enroute controller), approach controller, or a mixture of the two. ARTCC stands for Air Route Traffic Control Center, also called an enroute center. These controllers control planes enroute from one city to another during the middle portion of their flight, when they are not near the airports of departure or destination. They are mostly concerned with separating planes and sending them on the proper headings. Approach controllers are in charge of sequencing planes getting ready to land at the destination airport. They are mostly concerned with getting planes setup to land. In PATCS, you can choose to be either an enroute controller (ARTCC), approach controller, or a mixture of the two. If you choose ARTCC, then all new planes will request either degree headings or vectors to airways; no planes will request to land. If you choose approach controller, then all new planes will request to land; none will request degree headings or vectors to airways. If you choose mix, then you will get a mixture of degree heading, airway-bound, and runway-bound planes. In terms of difficulty, approach controller mode is the more difficult position since all planes will normally be converging on the VOR stations at around the same altitude, and your separation task will be much more difficult.

Planes to start with

You can start with a random number of planes (by checking the box) or a fixed number of planes by entering a number in the window. If you want to start with a fixed number, don't forget to "uncheck" the random box, because if the random box is checked you will get a random number, not your intended number. In the beginning, you may want to start with 1 or 2 planes, to get a feel for what the simulator is like. After you set the number of planes to start with, you should choose the menu item "Play again" from the Control menu. You will not be able to start with more planes than the maximum planes parameter, which is discussed below in section 9.2

Planes in your shift

You can specify how many planes you want to handle in your shift, or have it be a random number. After the specified number of planes have been handled, no new planes will appear, and the simulation will, effectively, be over. You can always raise this number during the simulation to add more planes to your shift.

Seconds between update cycles

This controls how many seconds there are between update cycles. This number can range from 0 to 60. If you enter 0, the simulator will go very fast, and planes will move around the screen like gangbusters. If you enter 60, you will get bored pretty quickly. Incidentally, while the Radar screen is displayed, if you click the mouse button and the cursor is not on a data block or plane dot, you will cycle the simulation through one cycle.

9.2 Parameter File

The file "ATC params" contains all of the parameters described in the previous section, and then some. There are two parameter settings that you can only change by editing the parameter file. These are the actual MacinTalk parameter values for the voice speed (5 numbers) and voice level (3 numbers). This section describes the parameter file in detail.

Record 1 - Center name

The first record contains the name of the ATC center.

Record 2 - Airport 1 name

The second record contains the name of the airport with runways R36/R18.

Record 3 - Airport 2 name

The third record contains the name of the airport with runways R09/R27.

Record 4 through 16 - Airline information

There is a separate record for each of the 13 airlines. The first value specifies whether the airline is big (1) or small (0). The second value is the airline ID, which appears in data blocks. The third value is the airline name.

Record 17 - On/off settings

This record contains an on (1) off (0) indicator for demonstration mode, automatic turn at airways, computer failure mode, and voice.

Record 18 - Level settings

This record contains the setting for skill level (1-5), position type (1-3, 1=mix, 2=ARTCC, 3=approach), voice level (1-3, 1=low, 2=medium, 3=high), and voice speed (1-5). Note that the order of these parameters within this record differs from the order of the display of the parameters on the Options screen. Don't ask why.

Record 19 - Planes to start with, planes in shift, and seconds between updates

This record contains planes to start with, random flag (1=random, 0=not), planes in your shift, random flag (1=random, 0=not), and seconds between updates. Seconds between updates should be between 0 and 60.

Record 20 - MacinTalk settings for the three voice levels

This record contains three values which are the MacinTalk parameters for the three voice levels of low, medium, and high. As shipped, these values are 65, 150, and 235. You can change them if you like, but the range for these values must be between 65 and 500. Using values greater than 250 or 300 cause a very squeaky voice. These values are not directly changeable from the Options screen, you can only change them by editing the parameter file (with Edit or MacWrite, etc.)

Record 21 - MacinTalk settings for the five voice speed settings

This record contains five values which are the MacinTalk parameters for the five voice speed levels. These numbers are basically "words per minute." As shipped, these values are 175, 225, 275, 350, and 425. You can change them if you like, but the range for these values must be between 85 and 425. These values are not directly changeable from the Options screen.

Record 22 - Maximum planes

This record contains a single value--the maximum number of planes that may be active at one time. This value should be between 1 and 100. By no means should you make it greater than 100, since the internal array to hold data for each plane is dimensioned big enough to hold data for 100 planes. If you make this value more than 100, you will likely as not crash the simulation. Don't come crying to me (you can't really damage it, you will only crash the current run). When shipped, this value is 100. You may want to lower it if you find that there are too many planes on the screen at once for you to handle safely.

10 Interesting Scenarios

There are several interesting scenarios that you can set up by adjusting parameters in the Options screen. If you are just beginning to learn PATCS and want to only deal with one or two planes, then set planes to start with to 1 or 2 and planes in your shift to 1 or 2, and "uncheck" the two random boxes associated with these parameters. Then, click the "continue" button and choose "Play again" from the Control menu, and you can practice with one or two planes.

In addition, if you are just starting out and don't want to fool with setting planes up for landing, then choose the ARTCC position. In this position, all planes will request either vectors to airways or degree headings, and no planes will request to land. If you want to practice to be an approach controller, then choose the approach position.

If you want the simulator to run as fast as possible, do the following on the Options screen:

- turn demonstration mode off
- turn automatic turn at airways off
- turn computer failure mode on
- turn voice off
- set skill level to hard
- set planes in your shift to 9999 (uncheck random box)
- set seconds between updates to 0
- click on the "continue" button
- select "Play again" from the Control menu

As you can see, planes dart around like crazy in this scenario. Don't expect a good score, however, because conflict alerts, crashes, control zone violations, landings at closed runways, exiting at improper altitudes, speeds, and headings, and exiting without proper handoffs will abound.

If you want to see how runways close and handoffs are suspended periodically, do the following on the Options screen:

- turn demonstration mode off
- turn automatic turn at airways off
- turn computer failure mode on
- turn voice off
- set skill level to hard
- set planes to start with to 0 (uncheck random box)
- set planes in your shift to 0 (uncheck random box)
- set seconds between updates to 0

- click on the "continue" button
- select "Play again" from the Control menu

You can see the runways close and reopen, and handoffs to adjacent sectors be suspended and enabled.

If you want to see a controller's nightmare, do the following on the Options screen:

- turn demonstration mode off
- turn automatic turn at airways off
- turn computer failure mode on
- turn voice off
- set skill level to hard
- set planes to start with to 100 (uncheck random box)
- set planes in your shift to 9999 (uncheck random box)
- set seconds between updates to 0
- click on the "continue" button
- select "Play again" from the Control menu

Check your score after a couple of minutes, and you will understand why this is a nightmare. If you really want to make matters worse, choose approach position and select "Play again." In that position, all planes will come up at an altitude under 6,000 feet, and you will probably have 20 crashes in 5 minutes.

To see another real nightmare, repeat the procedure above except turn computer failure mode off. Then, the data blocks for all 100 planes will appear, and your screen will be a glorious mess as they try to reposition themselves so they do not overwrite each other.

If you discover any scenarios that are particularly interesting, jot them down and send them in. I'd like to hear about them.