Air Traffic Controller

User's Guide

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Concept Created by David Mannering

Introduction

Air Traffic Controller (ATC) is a game that simulates the radar display of an air traffic control system. You are the air traffic controller charged with the responsibility for the safe and efficient flow of air traffic within a 20 by 25 mile area from ground level to 5000 feet in altitude. Within your area are two airports, two navigational beacons (navaids), and ten entry-exit fixes.

During your shift as controller, 26 aircraft will become active and under your control. They will come at various times, headings and altitudes. Some will depart from an airport, and some will enter via an entry fix. Some of them will be jets traveling at 240 miles per hour (4 miles per minute) and some will be props flying half that fast. They will come whether you are ready for them or not. Your goal is to get all of the aircraft to their destinations before your shift is over.

At your disposal are the computer-assisted radar display of the aircrafts' position in your control area and coded information concerning aircraft heading, destination and fuel supply. You can instruct the pilots of the aircraft to alter or maintain their altitude or heading, enter a holding pattern at a navaid, and execute an automatic approach to either of the airports.

Working against you are altitude and heading requirements for landing or exiting aircraft, fuel restrictions, and, of course, the clock. The biggest problem you will encounter, however, is the game's fundamental separation rule: no two aircraft can be less than three miles from each other at the same altitude.

IBM PC Equipment Requirements (1988)

To run ATC, you must have the following minimum equipment and software configuration:

> IBM-compatible PC, 64KB memory available
> 1 diskette drive (hard disk recommended for log playback)
> Any Color or Monochrome display, 80 columns required
> DOS version 3.00 or higher

Notes (2009)

ATC has been tested and found to run properly in every version of Windows through Vista *except* Windows NT and Windows ME. This simply means that ATC has not been tested on those Windows versions. It may run perfectly, and probably will.

The design of the SEELOG program was based on system timings from PCs contemporary to 1983. On modern systems it runs so fast that the playback can not be viewed. Consult the "Logging" section of this document on page 16 for details on how to control playback speed.

The author has never tested ATC on PCs with processors other than Intel's. As long as the processor is fully Intel compatible, there should be no problem.

Installing ATC

Extract all files from the ZIP file into a folder (directory) on your hard disk. For simplicity, name the folder ATC and place it at the root of one of your hard drives.

Running ATC

1. If running from Windows, open a DOS window. In Windows XP, click the Start button, click All Programs, click Accessories, and click Command Prompt. The technique is similar in older versions of Windows.

1a. When running ATC in a Window, the display can be altered by clicking on the icon in the upper left corner of the Window or right-clicking on the title bar, then selecting Properties. A larger font might provide better readability. ATC relied on the "squareness" of the original PC display; it may be difficult to achieve a perfectly square display in a Window.

2. Navigate to the directory/folder containing the ATC program. If you installed ATC in the ATC folder, the command would be `cd \atc`.

3. Enter the command ATC followed by the ENTER key. The game will begin. By default, the game will be 35 minutes long with 26 aircraft.

4. If you wish to play a game with a time limit different than 35 minutes, enter the command ATC followed by a space, then the number of minutes (from 16 to 99), then the ENTER key. For example, for a 28 minute game the command would look like this:

   ```
   ATC 28
   ```

5. If you wish to play a game with less than 26 aircraft, enter the command ATC followed by a space, then the number of minutes (from 16 to 99) followed by a space, then the number of aircraft (from 1 to 26), then the ENTER key. For example, for a 32 minute game with 16 aircraft the command would look like this:

   ```
   ATC 32 16
   ```

   To have a different number of aircraft, you must always specify the time first.

6. If you wish to leave the game before it ends, depress the escape key (marked Esc on the keyboard). You will be returned to DOS.

For more information on running the game and levels of difficulty, see page 14.

Radar Display Screen

```
. . . . . 1 . . . . . 2 . . . . . . . . . 3 . . . .     L0J #-9
. . . . . . . . . . . . . . . . . . . . . . . . . .     B7J 3-6
. . . . . . . . . . . . . . . . . . . . . B6. . . .     Q9J 4-% *
. . . . . . . . . . . . . . . . . . . . . . . . . .     A7P 5-4 *
. . . . . . . . . . . . . . . . . . . . . . . . . .
4 . . . . . . . . . . . . . % . . . . . . . . . . .
. . . . . . . . . . . . . . . . . . . . . . . . . .
. . . . . . . . . . . . . . . . . . . . . . . . . .
. . . . . . . . . . . . . . . . . . . . . . . . . .
. . . . . . . . . . . . . . . . . . . . . . . . . .
0 . . . . * . . . . . # . . . . . . . . . * . . . 9
. . . . . . . . . . . . . . . . . . . . . . . . . .
. . . . . . . . . . . . . . . . . . . . . . . . . .
. . . . . . . . . L4. . . . . . . . . . . . . . . .
. . . . . . . . . . . . . . . . . . . . . . . . 7
. . . . . . . . . . . . . . . . . . . . . . . . . .
. . . . . . . . . . . . . . . . . . . . . . . . . .
. . . . . . . . . . . . . . . . . . . . . . . . . .
. . . . . . . . . . . . . . . . . . . . . . . . . .
. . . . 8 . . . . . . . . 5 . . . . . 6 . . . .
```

```
 47:45   LS    L4J #-9 E   +
```

Your screen is a computer-assisted radar scope. North is at the top of the scope. The dots are mile markers, and the distance between two adjacent dots, whether vertically, horizontally, or *diagonally*, is one mile.

Navaids are displayed as asterisks (*), entry/exit fixes by their identifying number (0-9), and airports by their symbol (#, %); all are shown on the screen in their proper locations unless covered by an aircraft.

An aircraft (e.g., L or B above) will appear on the scope in its current position unless covered by another aircraft; its altitude in thousands of feet is also displayed (aircraft L at 4 thousand, B at 6 thousand).

Flight plans of active aircraft will appear in the upper right corner of the display. Aircraft become active 1 minute before they are due in your airspace.

The time remaining in the game (here 47 minutes and 45 seconds), your commands to pilots (here asking aircraft L for current status) and responses to commands (here showing flight plan, current altitude, current heading, and fuel remaining) will appear at the bottom of the radar scope.

Aircraft And Flight Plans

The first indication you will have of an aircraft about to become active is the appearance of a flight plan to the right of the scope. A flight plan looks like this:

```
L7J 0-% *
||| | | | |
||| | | +-- Indicates aircraft not yet active
||| | +---- Destination (airport %)
||| +------ Origin (entry fix 0)
||+-------- Aircraft type (jet)
|+--------- Entry altitude (7,000 feet)
+---------- Aircraft call-sign
```

Aircraft entering from fixes will become active one minute after their flight plan appears and will be level at their entry altitude (always above 5 thousand feet). Their initial heading is shown in the following table. Those aircraft destined to leave (as opposed to landing at an airport) will always leave at the fix shown in the table.

Entry Fix	Initial Heading	Exit Fix
0	E	9
1	S	8
2	SE	7
3	S	6
4	SE	5
5	NW	4
6	N	3
7	NW	2
8	N	1
9	W	0

Aircraft originating at airports must be given a command to take off before they become active. When an aircraft becomes active its flight plan remains on the right, but the not-yet-active designator (*) is removed. When an aircraft completes its flight, its flight plan is removed from the display.

Active aircraft (except those waiting to take off) are indicated at their proper positions on the radar scope with a two-character symbol:

```
K2
||
|+-- Current altitude (2,000 feet)
+--- Aircraft call-sign
```

An aircraft can be either a jet, flying at 4 miles per minute, or a prop, flying at 2 miles per minute. The radar scope is updated once every 15 seconds; therefore, jets move one mile per update and props move one mile every other update.

Aircraft remain in straight, level flight unless instructed to do otherwise. The one exception to this is those aircraft that have an airport as their destination. Unless otherwise instructed, the pilot will place the aircraft in a holding pattern at the first navaid encountered.

Commands

All commands are typed at the computer keyboard. There are two kinds of commands: control commands and ATC commands.

There is only one control command. Depressing the Esc (escape) key will terminate the game and return you to DOS.

ATC commands, that is, your commands to the aircraft pilots, consist of two or three letters. The first letter is always the call-sign of the aircraft for which the command is intended. The second letter is the command, and the third letter is a parameter if required by the particular command.

Commands are echoed in the command area of the screen and are acknowledged in the response area. The pilot responds with "ROGER" if able to perform the action, "UNABLE" if the action cannot be taken, and "SAY AGAIN?" if the command is not understood. If the aircraft is not yet active or has completed its flight, no response is possible, a condition indicated by the dead air message "--------."

Commands are processed as soon as the final letter is typed. No ENTER key depression is required. Before the depression of the final letter, the command may be erased with the ENTER key, DELETE (backspace) key, or spacebar; either of these three keys clears the command and response areas.

Commands are not applied, with some exceptions, until the aircraft move, and usually can be undone with another appropriate command. The command to land (assume altitude 0) cannot be undone.

Typing a comma (,) will advance time by 15 seconds. Note that this is different than advancing to the next tick; if there are three seconds before the next screen update, and a comma is entered, the game will advance to a point 3 seconds before the following tick.

Commands -- Altitude

An altitude command looks like:

```
XA4
|||
||+-- Altitude to which to ascend/descend (4,000 feet)
|+--- "A" for altitude
+---- Aircraft call-sign
```

Aircraft can climb or descend at the rate of 1,000 feet per mile. They may be commanded to go to any altitude from 0 to 5 thousand feet, in units of 1 thousand.

Waiting aircraft are instructed to take off with an altitude command assigning an altitude from 1 to 5 thousand feet. Aircraft will take off in the direction of the active runway: northwest (NW) for airport % and west (W) for airport #. They will appear on the scope at 1 thousand feet after an appropriate interval for their take off roll.

Aircraft must be commanded to go to altitude 0 in order to land. After this command they enter landing configuration (hand-off to the airport controller with a corresponding change in radio frequency) and therefore can no longer accept your commands. Their status may still be examined.

An aircraft may be commanded to maintain level flight by issuing an altitude command with the aircraft's current altitude. That is, if aircraft X is descending and is currently at altitude 4 thousand feet, the command "XA4" causes the aircraft to maintain flight level 4 thousand. The maintain ("M") command has the same effect, as in

```
XM
```

and frees you from the need to enter the current altitude.

New altitude commands override any previous and still pending altitude commands. Altitude commands have no effect on previous turn, hold, or approach commands.

Commands -- Turns

A turn command looks like:

```
JR2
|||
||+-- Number of 45 degree increments to turn
|+--- "R" for right turn
+---- Aircraft call-sign
```

Aircraft can turn one 45 degree increment each time they move. After being given a turn instruction, an aircraft will continue on its current heading for one move, then execute the turn. If the aircraft below was given the command JR2 when positioned at the "2", it would continue on the path marked by the numbers 1 to 6:

```
. . . . . .      . . . . . .      . . . . . .
1 2 3 . . .      . . 4 5 6 .      . . 3 4 . .
. . . 4 . .      . 3 . . . .      . 2 . . 5 .
. . . 5 . .      . 2 . . . .      1 . . . . 6
. . . 6 . .      . 1 . . . .      . . . . . .
. . . . . .      . . . . . .      . . . . . .
```

Aircraft may be commanded to turn from 0 to 4 increments (0 to 180 degrees) to the left ("L") or the right ("R"). Left and right are always from the point of view of the aircraft, not the controller.

A turn of 0, in either direction, instructs the aircraft to continue on its present heading. The proceed ("P") command, as in

```
JP
```

is the same as a turn of 0.

New turn commands override any turn currently in progress. Turn commands have no effect on previous altitude commands. Turn commands cancel any previous hold or approach commands.

Commands -- Hold

A hold command looks like:

```
UH
||
|+-- "H" for hold
+--- Aircraft call-sign
```

The hold command instructs the pilot to place the aircraft in a holding configuration (a continuous left-turning circle) when it passes directly over a navaid. A complete pattern might look like:

```
      . . . . . .
      . . 6 5 . .
      . 7 . . 4 .
      . 8 . . 3 .
      . . * 2 . .
      . . . . . .
```

The hold will continue until a turn or proceed command is given or an approach command takes effect.

Hold commands have no effect on previous altitude or turn commands. Hold commands cancel any previous approach command.

Holds not yet in effect may be canceled by a turn, proceed, or approach command.

Commands -- Approach

An approach command looks like:

```
T#
||
|+-- Airport to approach
+--- Aircraft call-sign
```

This command instructs the pilot to execute an instrument approach to the specified airport. That is, the aircraft is to proceed to a navaid and turn "on a dime" in the direction of the airport.

For airport %, whose active runway goes northwest, the approach is a turn to the northwest.

For airport #, whose active runway goes west, the approach is a turn to the west.

Aircraft under instrument approach conditions cannot distinguish between navaids, and so will turn in inappropriate directions if they encounter the western navaid. Approach commands should only be issued for aircraft headed for the eastern navaid.

New approach commands override old approach commands. Approach commands have no effect on previous altitude commands. Approach commands do not affect any previous turn or hold commands until a navaid is encountered and the approach is executed.

Approach commands which have not yet taken effect can be canceled with a turn, proceed, or hold command.

Commands -- Status

A status command looks like:

```
WS
||
|+-- "S" for status
+--- Aircraft call-sign
```

The status command is a quick way to determine the flight plan of a single aircraft without having to search for it in the flight plan section to the right of the radar display. In addition, the status command provides other information that is not included with the flight plan. Note that the response to the status command includes up-to-the-moment information. The information to the right of the display only shows the original flight plan.

The status command may be issued to any aircraft. An active aircraft's digital transponder responds with information regarding its current navigational and operational status. The message is displayed in the response area and looks like this example:

```
W3P #-4 NW +
||| | | |  |
||| | | |  +-- Fuel left, in minutes (+ means 10 or more)
||| | | +----- Current heading (direction of next movement)
||| | +------- Destination (exit fix 4)
||| +--------- Origin (airport #)
||+----------- Aircraft type (prop)
|+------------ Current altitude (3,000 feet)
+------------- Aircraft call sign
```

If the aircraft is currently changing course, changing altitude, or both, your ATC computer will provide information to that effect. The additional information looks like this example:

```
W3P #-4 NW + [N 5]
                | |
                | +-- Altitude aircraft will assume when
                |     ascent or descent is complete
                +---- Course aircraft will assume when turn is
                      complete
```

If the aircraft is changing course but not altitude, only the new course is displayed. If the aircraft is changing altitude but not course, only the target altitude is displayed. Nothing is displayed if no course or altitude change is in progress. The information provided in this part of the status response should correspond to your last commands to the pilot.

In certain cases, your ATC computer will supply an additional message along with the transponder message. There are seven possibilities:

Awaiting Takeoff   The aircraft is active, but you have not yet ordered the pilot to take off.

Rolling!   The aircraft is taking off.

`Holding`	The aircraft is currently circling one of the navaids.
`Cleared`	The aircraft has been cleared for an automatic approach to an airport.
`Final Approach`	The aircraft is landing and is under the control of the airport's approach controller. Further ATC commands cannot be received.
`Landed`	The aircraft is on the ground at its destination.
`Departed Area`	The aircraft has exited at its destination fix.
`---------`	The aircraft is not yet tuned to your frequency (outside your control sector).

Air Traffic Control Rule Book

Proper air traffic control requires adherence to certain rules. In general, failure to adhere to these rules results in immediate termination of the simulation. In those cases where the game is terminated, a message indicates which aircraft caused the error.

Requirements -- Landing

Aircraft must be instructed to land with an altitude command to descend to 0 thousand feet. After this command the aircraft will be on final approach and will no longer be able to respond to your commands.

To land, an aircraft must be level at 0 thousand feet and on the heading for its destination airport in the direction of the active runway (northwest for %, west for #). Aircraft are not required to make an instrument approach – they may be landed manually.

Aircraft that do not conform to these rules will be called off by the airport controller (a missed approach) and will return to your airspace at altitude 1 thousand feet after crossing the airport. Note that if a landing aircraft does not cross the airport, it will continue at its current heading and at altitude 0 until it runs out of fuel or into the edge of your airspace.

Requirements -- Exiting

Aircraft with an exit fix as their destination must leave your airspace at that fix, flying level at 5 thousand feet. They may be heading in any direction which will take them out of your airspace on the next movement. An aircraft that flies eastbound over fix 6, for example, will continue east past the fix.

Leaving the airspace in any other way results in a BOUNDARY error and terminates the game.

Requirements -- Fuel

Jets have 15 minutes of fuel from the time their flight plans are posted. Props have 21 minutes. Aircraft waiting for takeoff burn fuel at the same rate as airborne aircraft, so excessive ground time may make it impossible for the aircraft to reach its final destination.

Allowing aircraft to run out of fuel before reaching their destination results in a FUEL EXHAUSTED error without any warning and terminates the game. Fuel status may be examined with the status command.

Requirements -- Separation

Case I: Aircraft at the same altitude must be separated by 3 miles or more.

Case II: Climbing or descending aircraft may not cross within three miles.

Violation of these separation rules results in a CONFLICT error and terminates the game.

Aircraft waiting for takeoff (at altitude 0) will not conflict with aircraft approaching for landing (at altitude 0). However, when the aircraft finally takes off and achieves altitude 1 thousand feet, conflict rules will apply.

Careful attention to the conflict rule is necessary, especially in close calls, and is the most likely cause of error on your part. The rule operates consistently in all cases, although Case II situations may not appear to be valid unless closely examined. The termination message will indicate which two aircraft caused the conflict. The following applies to the error:

Case I: Both aircraft will be at the same altitude.

Case II: The aircraft are usually at different altitudes.

Game Operation

The DOS command to start ATC has the following form:

    ATC [minutes [aircraft]]

Brackets indicate optional entries. The following conditions apply:

minutes   must be in the range 16 to 99. If smaller than 16, 16 will be used. If greater than 99, 99 will be used. If no entry is supplied, the game defaults to 35 minutes.

aircraft   must be in the range 1 to 26. If smaller than 1, 1 will be used. If greater than 26, 26 will be used. The minutes must be included in the command if the aircraft are specified. If no entry is supplied, the game defaults to 26.

Level Of Difficulty

The playing time affects the difficulty of the game. All aircraft will enter during the time specified, and none will enter in the last 15 minutes of any game. The approximate ratings for a 26 aircraft game are:

80-99   Beginners only. You should leave this level as soon as you can remember the rules.

60-79   Easy games. Use them to build proficiency.

40-59   Average games, but can often be challenging. You'll lose a few.

30-39   Hard games. You'll have developed your own style by now and won't panic when a difficult situation arises. But you won't win them all.

20-29   Expert games. Just watching someone play one of these can boggle your mind. Losses will greatly outnumber wins.

16-19   Nearly impossible games. Unless you are an air traffic controller already, it's possible you'll never win one of these. But keep trying!

Training Games

For practice, try games with just a few aircraft. Interesting games can be had at 16 minutes with 3 to 5 aircraft. 10 aircraft in 16 minutes range from hard to expert in difficulty.

Games of very long length (60 minutes and up) with a few aircraft (between 5 and 10) can provide a good practice medium. Use the comma command to advance time; such a game will rarely use more than 10 minutes of real time. These games allow great opportunity to practice your traffic control skills without producing terminal conditions.

Game Generation

You will probably never play the same game twice. The program is capable of producing over 500,000 different games.

All games can be won, mathematically speaking. This is assured by the following built-in characteristics of the game generator:

- All aircraft entering at a particular fix enter at different altitudes. Therefore, you are provided with a game free of initial conflicts.

- Every aircraft has enough fuel to reach its destination, and usually quite a bit more.

- Because no aircraft arrive after the fifteen minute mark, every aircraft has enough time to reach its destination.

Although every game is free of *initial* conflicts, watch out! Conflicts can develop very quickly around the two navaids because they are each on three flight paths and are close to the edge of your sector.

Logging

A log of each game is written to a file named ATC.LOG. If ATC.LOG exists when the game starts, it is overwritten.

The SEELOG.EXE program, also included on your disk, will display an animated playback. The format for invoking the program is:

   SEELOG [logfilename[.ext]] [-S] [-Hx] [-P]

All parameters are optional and may be typed in either upper or lower case. If present, they have the following meaning:

logfilename	The name of the file containing the log. .LOG is the default extension and ATC.LOG is the default name.
-S	Playback the log in slow motion.
-Hx	Highlight a particular aircraft during replay. x is the call sign of the desired aircraft. This allows specific flight paths to be reviewed more easily. More than one aircraft may be specified, as in -Haqm.
-P	Replay on slow machines like the IBM PC.

SEELOG can operate at one of two speeds. At full speed, the log is replayed until it is exhausted. In slow motion, playback pauses at each clock tick; tapping any key will advance the playback to the next clock tick.

Regardless of the command line selection, the playback speed can be changed during playback. The F key engages fast playback and the S key engages slow motion. The ESC key terminates playback.

Replay speed is paced for contemporary machines, like the IBM PC/AT. For older, slower machines, use the -P switch to accelerate the replay.

You may save games for later playback with SEELOG by changing the name of the ATC.LOG file as desired. Remember, ATC.LOG is overwritten by each new game.

Several sample game logs are included. Use the command DIR *.LOG to find their names, then play them back with commands like:

   SEELOG ATC35

Note: For contemporary systems with fast processors and fast video subsystems, the fast playback mode is too fast. The best way to view the playback is to specify the -S option, then hold down a key on the keyboard to advance the display. This technique runs the playback at the keyboard's typomatic rate.

Command Summary

Commands:

<aircraft>A0	cleared to land (no further commands accepted)
<aircraft>A<1-5>	go to assigned altitude (if at 0, take off)
<aircraft>M	maintain current altitude
<aircraft>L<0-4>	left turn n*45 degrees
<aircraft>R<0-4>	right turn n*45 degrees (turns cancel H,#,% commands)
<aircraft>P	proceed on current heading (cancels H,R,L commands)
<aircraft>H	left circle at navaid, cancel #,%
<aircraft>#	turn west at navaid, cancel H
<aircraft>%	turn northwest at navaid, cancel H
<aircraft>S	status of aircraft, if active
Esc	terminate game

Requirements:

destination #	land level at 0, headed west
destination %	land level at 0, headed northwest
destination fix	exit level at 5 thousand
separation	different altitude or 3 miles
fuel	jets 15 minutes, props 21 minutes

Other:

- Commas advance time by 15 seconds.
- Aircraft burn fuel while waiting to take off.
- Landing aircraft have an implicit hold (H) command.
- Commands are executed upon detection of last needed keystroke. (i.e., ENTER is not required).
- Upper or lower case input accepted.

Notes:

- The % and # commands could be called "clear to approach."
- Missed approaches are possible. After an xA0 command, the aircraft will no longer accept commands. However, if it crosses the wrong airport it will be returned to altitude 1 instead of landing and will once again accept commands.
- Turns take effect during the NEXT 15 second interval, not immediately.