

FS-ATC 3.0

Air Traffic Control software for Microsoft Flight Simulator Macintosh version 4.0

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FS-ATC is an air traffic controller software that operates with Microsoft Flight Simulator. It runs on the background and it uses some undocumented apple events to find out position, direction, altitude and speed of aircraft. Using this information FS-ATC sends messages to the pilot using notification manager dialog box or speaking the messages using Speech Manager.

This new version introduces a big change: controller files are still supported, but I didn't like to write the same sentences over and over again. Beginning today, you can set the weather you like as well as set aircraft characteristics, select sceneries you want to use, and finally make a simple flight plan by selecting departure and destination airports, and first VOR you fly toward. After that, you will hear ATIS message, and then ("Talk to controller") you just contact ground control and voila, you receive a clearance for an instrument flight.

Installation

Uncompress the **fs-atc-30.cpt** archive using Compact Pro or Stuffit Expander. FS-ATC folder will be created on the disk you select.

Before doing anything else, read possible README text files carefully.

Next you should drop the FS-ATC control panel on the System Folder icon. Then reboot to get it appear on the menu bar. For further instructions on the control panel see corresponding READ ME -file.

Getting started

The very first time you start FS-ATC 3.0 you are prompted to select FS World Scenery, which you should do. Actually FS-ATC 3.0 records the directory and volume reference numbers into FS-ATC preferences file in preferences folder in system folder. This information is used to switch scenery files automatically during the flight.

To fly with FS-ATC open a controller file, and open corresponding Flight Simulator situation. Then request takeoff clearance by choosing "Talk to controller..." Instructions for this are in document "FS-ATC 2.1 documentation".

...or, better yet...

Use Flight-menu to choose sceneries, aircraft specs, weather and route. Then listen to ATIS, and "Talk to Controller".

An automatic flight

The FS-ATC 3.0 is as realistic as possible. You will fly with instrument flight rules, that means your flight plan has been filed and a controller will know who you are and where you are going when you tell you are with him.

First you request a terminal departure. You will get a clearance, and after 30 seconds (to allow you repeat as necessary), you are told to contact ground for taxi clearance (again "Talk to Controller"). You will receive taxi clearance, and instruction to contact tower when you approach hold line. Go ahead...

As you approach the hold line, contact tower (always "Talk to controller") to tell that

you are ready for departure. You are then asked to position and hold on runway. Again, do what you are supposed to do. As FS-ATC detects you are stopped and correct position, it will give you direction and altitude to climb, and "cleared for takeoff". Full throttle...

Once airborne, you are told to contact departure. You do that, and are told to go direct to the first VOR you selected.

As you reach the initial altitude, you are told to climb higher and soon after that to contact center. Again, you hit command-8.

If you didn't select "direct routing" you are on your own now until you are 35NM from your destination. If you did select direct routing, after reaching the altitude, you are asked to turn (if necessary) and cleared direct to your destination. FS-ATC long range navigation instrument is activated automatically; it shows you a 6-mile-wide flight path to destination. You are also asked to climb your cruise altitude.

As the flight goes on, you are sometimes asked to contact other center. After contact, you receive new squawk code and soon after that a radar contact.

At distance specified by your descend rate and speed, you are told to descend, and later to contact approach.

Next you will get ATIS message, then controller will assign you a runway and will give you radar vectors to a VOR (located at destination airport) radial that intercepts ILS on the outer marker. A couple of miles before outer marker you are cleared for ILS approach and to contact tower. At 2-3 miles out you are cleared to land, and you are told to contact ground for taxi clearance. That's all there is. More details later.

Using Controller files

Open a controller file and "Talk to controller". Then follow instructions. Some controller files may require you hit "Talk to controller" for read backs.

Information for registered FS-ATC 2.1 users:

Controller source file format is slightly revised:

Line 1: Aircraft call sign

Line 2: Destination coordinates

Line 3: Destination name

FS-ATC 3.0 will open old compiled controller files normally, but FS-ATC 2.1 or earlier will not open controller compiled with FS-ATC 3.0.

A new controller file command to use the final approach vectoring:

```
#  
AutomaticApproach
```

0
<airportID>
#

"Automatic approach" tells the pilot immediately to contact approach control, and takes full control to the end of flight. "EndOfControllerFile" command is still needed.

What you should know to fly with FS-ATC?

You're required to fly with instruments all the time. You must use VORs for navigation and ILS for landing approach. They are explained in Flight Simulator manual. For long flights over areas that don't have any VORs you can use the FS-ATC navigation instrument (described below) that directs you along a six-mile-wide path. It is turned on and off automatically.

The altitudes above 17999 feet are called flight levels. 18000 is flight level 180, 21000 is 210, 33000 is 330 and so on. (This is partly true... in real life air pressure is hardly ever 29.95 as Flight Simulator always has. But we only refer to altimeter readings here, not the actual distance between sea level and the aircraft.)

When you fly below 10,000 feet you must not exceed 250 knots.

You must also be able to perform a standard turn at approach speed as well as a procedure turn inbound if you are asked to. Also, you have to be able to intercept radials and ILSs quickly and efficiently. These are described later in chapters "Turns" and "Intercepting VOR radials".

Turns



You will need a "standard-rate turn". That's a 4-minute turn on a jet, and a 2-minute turn on single-engine prop. During approach vectoring, these turns should be done in approach speed. (Default 150 knots).

Tighter turns are not required at any situation.

Intercepting VOR radials

First set OBS to given radial.

If you are less than 10 degrees off the radial: turn radial $\pm 15^\circ$ to direction of the needle.

If you are more than 10 degrees off the radial: turn radial \pm 60° to direction of the needle, and when the needle starts to move, turn to radial \pm 15° direction of the needle.

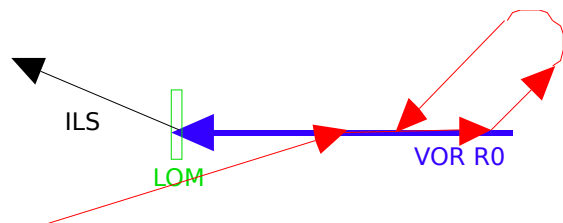
Note that FS-ATC usually sets you already to 60° intercept heading before giving intercept command.

Procedure Turn Inbound

If your initial approach position is less than 10NM to destination, it's sometimes quicker to make you execute procedure turn than do lots of vectoring.

You are first asked to intercept an outbound **[FROM]** VOR radial, and you are told to expect a procedure turn inbound in few minutes.

When you are headed outbound on the given radial, you are asked to turn left to intercept inbound **[TO]** VOR radial.



1. Intercept R0 outbound (R0 \pm 180 FROM radial)
2. Procedure turn inbound:
 - standard turn 45° left
 - after one-minute straight&level flight,
 - standard turn 180° left
 - intercept R0 inbound

Note that the idea is just to get yourself back to the same radial at opposite direction.

Scenery Manager

Sceneries for this flight:

	First
<input type="checkbox"/> FS World Scenery	<input type="radio"/>
<input type="checkbox"/> SD-7	<input type="radio"/>
<input type="checkbox"/> SD-9	<input type="radio"/>
<input type="checkbox"/> SD-11	<input type="radio"/>
<input checked="" type="checkbox"/> SD-12	<input checked="" type="radio"/>
<input type="checkbox"/> SD-EUROPE	<input type="radio"/>
<input type="checkbox"/> SD-HAWAII	<input type="radio"/>
<input type="checkbox"/> SD-JAPAN	<input type="radio"/>

First, you must select the sceneries you want to use during your flight. Note that some sceneries overlap each other partly — selecting both will result lots of unnecessary scenery changes.

Some overlap examples:

New York,Boston: FS World Scenery & SD-12

Chicago:FS World Scenery & SD-9

The "First" radio button lets you choose the first scenery used.

Trick: If you want immediatly an automatic scenery change based on current aircraft location at Flight Simulator, select a wrong "First" — FS-ATC will make the selection for you. No more struggling with Flight Simulator Open-command!

Note:Scenery changes are based on distance of nearest VOR.

Aircraft Specifications

Aircraft specs:

Call sign:

Climb rate (ft/min)

Climb speed (kts)

Descend rate (ft/min)

Descend speed (kts)

Cruise altitude (ft)

Cruise speed (kts)

Approach speed (kts)

These are the default values, you can select whatever you want! All instructions (climbs, descents, turns) are based on these values.

Weather

Weather settings

Wind speed (kts)

Wind direction (deg)

Cloud ceiling (ft)

Clouds

Temperature (F)

Visibility (NM)

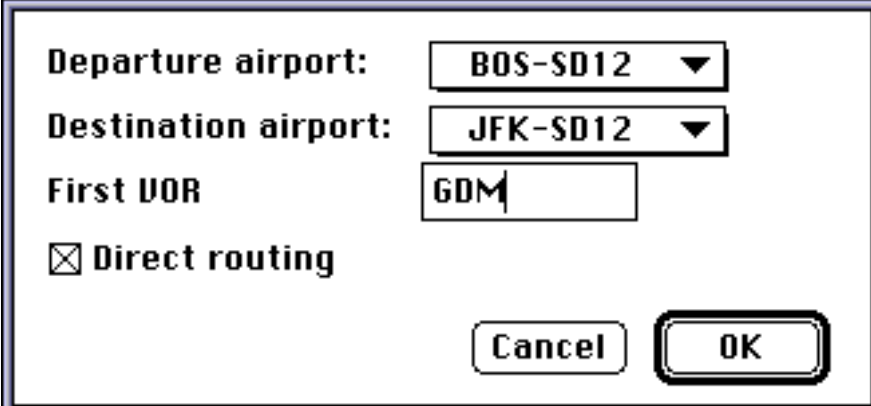
Altimeter

Runways will be assigned primarily by direction (approach or departure) and secondarily by wind. You are not supposed take off or land in tail wind.

Weather information is also used to build ATIS messages.

There is no link and there will not be any link between FS-ATC and Flight Simulator weather, so you have to set both yourself.

Route



The screenshot shows a dialog box with the following elements:

- Departure airport:** BOS-SD12 (dropdown menu)
- Destination airport:** JFK-SD12 (dropdown menu)
- First VOR:** GDM (text input field)
- Direct routing**
- Cancel** button
- OK** button

Here's a FS-ATC flight plan for Boston Logan international to New York John F. Kennedy International. You have to set the **3-letter code of the first VOR** you are going to use to navigate, in this case Gardner. These codes can be found from a textfile that I have included.

[Mac-FS4-VORs.txt]

Check direct routing if you want to use FS-ATC long range navigation instrument. It will be turned on and off automatically. **[Cleared direct]**

If you leave direct routing unchecked, you are expected to navigate freely to destination. Center handoffs and scenery changes will be done, as well as your altitude will be tracked, but otherwise you are on your own.

After clicking OK for this window, FS-ATC checks you have given a valid VOR code, if not you'll hear a beep, and you either type it correctly or hit Cancel to check the code from the VOR list, and try again soon.

After succesful OK, your flight is about begin. You will hear or see ATIS message, and then you contact clearance delivery...

Departure Manager

Departure manager includes clearance delivery, ground control, tower and departure control. Ground control gives you taxi clearance and tower clears you for takeoff. Departure control will give you climb commands and clear you to first VOR.

Note that instead of taxiing, departure manager can automatically move you to

assigned runway. Handy on some less-detailed airports, or airports with lots of runways. This feature can be turned on and off from Preferences.

Center Manager

Center Manager takes care of handoffs between air traffic control centers. It will assign new squawk codes. It also clears you to cruise altitude as well as asks you to descend at distance calculated from your descend rate and descend speed. It will hand you off to approach control of your destination airport.

Always nearest center is tracked. That's not always realistic, but there isn't much choice — I don't know where I could get the real boundaries and how I would track them quickly.

Approach Manager

Approach Manager takes care of full approach, tower and ground control. It will give you ATIS message, select runway and vector you as necessary. It also handles missed approach.

After runway assignment message [**Expect ILS approach to runway...**] Approach Details window is available to view the numbers, so you don't have to use pencil to copy the clearance.

If the current scenery doesn't have ILS for the assigned runway, and there would be one in real life, FS-ATC now has ILS window to serve you. Outer and middle marker sounds will be played as you pass them.

Altitude Manager

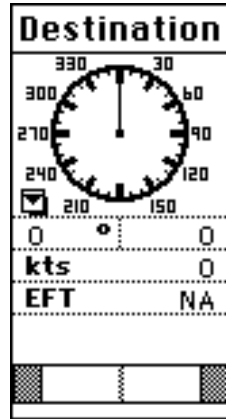
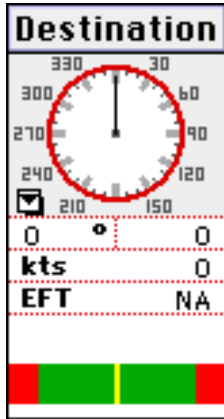
Departure, Center and Approach managers use Altitude Manager for altitude control.

You can select how much tolerance you need. By default it's 300 feet.

Every time you have reached an altitude that you are told to climb or descend to, FS-ATC starts to track your altitude. If you are more than \pm amount of your tolerance away, you are told to maintain specified altitude.

If you get a message to maintain altitude, and you really are there, use "Calibrate Altimeter" on the FS-ATC system-wide menu to calibrate FS-ATC altitude manager.

The Destination window



ColourBlack&White

The ADF-like gauge at top shows direction of destination airport.

If you are flying an ILS approach, the ADF-gauge points to NDB beacon located at outer marker. You can use the pop-menu to switch between destination and NDB display.

The number at top left shows the offset in degrees between your heading and destination.

The number at top right shows distance to destination in nautical miles or in kilometers.

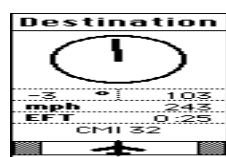
Second line shows speed in nautical miles per hour (=knots!) or in kilometers per hour.

EFT is estimated flight time calculated from current speed directly to destination airport.

The last line tells the destination.

At the bottom is the FS-ATC long range navigation instrument that shows a six-mile wide flight path. It is turned on and off automatically. An aircraft symbol is displayed on it when it is in use.

The FS-ATC long range navigation instrument



Color Black&White

The FS-ATC long range navigation instrument is in use when the aircraft symbol is displayed. It shows aircraft location on the six-mile-wide flight path. The ADF-like gauge points to end of the given flight path.

The green (white on B&W systems) area is six miles wide. The red (grey on B&W) area is two miles wide, but the aircraft symbol will remain visible even if you are more than five miles away from the center of the path.

When the aircraft symbol is in the middle you are on the center of the path. When it is on the red (or grey in B&W systems) you are out of the path and you should correct heading to opposite direction.

The example display tells that you are on the middle of the path but to maintain there you should turn three degrees left.

This instrument is turned on and off automatically, usually the controller will say "radar contact" meaning that this instrument is turned on. It goes off without notification when it is no longer needed, ie. when you have been given new instructions.

Ten pixels correspond one nautical mile and that means one pixel is 0.1 NM. In meters 10 pixels is 1852 meters and one pixel is 182.5 meters. The accuracy is worse than in GPS system, but I hope you don't mind...(more accurate readings would require much wider display!)

Speech

FS-ATC supports both Speech Manager and Macintalk Pro that come with Macintosh System 7.5

The Speech Manager has lots of different voices to offer. You can select one voice for pilot and two alternating voices for controllers. This can be a lot of fun!

I have even made a dictionary resource to clarify pronunciation of some airman terms, but it's very time consuming work, so there are some mistakes and inconsistencies, and some of the messages are unclear, and sometimes single letters that should be just single letters are read out in the airman slang.

Note that if you want to use high quality voices, you must increase FS-ATC memory setting to about 1500K. Be aware that TTS voices crash the system if the pronunciation dictionaries are in use. Version 3.0 has a workaround to this problem: for details see the voice selection dialog box.

Microsoft Flight Simulator 4.0 coordinate system

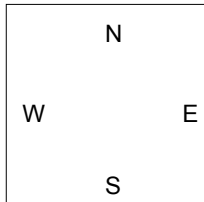
The information describing coordinate system on page 79 of Microsoft Flight

Simulator User's guide is incorrect.

The coordinates are of format (North,East)

The boundaries of Flight Simulator world map are:

65536,0 65536,65536



0,0 65536,0

7.2580 units correspond one nautical mile. The distance between W and E is ≈ 9029 nautical miles, so the grid covers 81,522,841 nautical square miles.

Conclusion: Flight Simulator grid does not cover whole world.

Flight Simulator manual tells that on some areas the coordinates are canted some degrees to compensate for orthogonal grid overlaid on Lambert conformal conic projection.

Real map



And after canting it is placed on the Flight Simulator grid and the coordinates have been digitized.

In addition on some areas North has variation of few degrees.

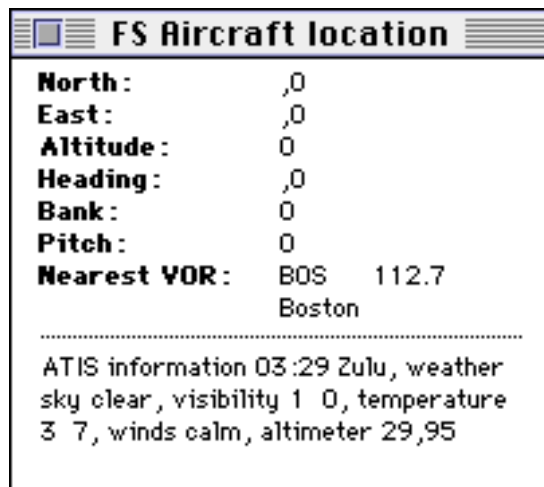
I have studied carefully the FS World Scenery by Microsoft and SD-7, SD-9 and SD-11 World Sceneries by Mallard Software. These scenery files are digitized so that the cities are on correct locations on the Flight Simulator world map grid – you can fly cross-continent by changing sceneries.

Unfortunately Europe has been digitized to wrong place on Flight Simulator map grid. It overlaps with Midwestern US. This means that you can not fly overseas realistically. – This is also confirmed by the dimensions of Flight Simulator grid!

There are similar problems with Japan and Hawaii.

[note: the overseas workaround introduced in FS-ATC 2.1 that can be used in controller files is not included in the automatic routing system]

The “FS Aircraft location” window



This window shows the information that FS-ATC 3.0 uses to control the pilot. Coordinates are the same as in the Flight Simulator. Altitude is measured from ground level, but the elevation is set according to departure and destination airport. You can also use the system-wide menu command "Calibrate altimeter" to correct the elevation, if you get wrong "...maintain XXXX" messages.

Heading tells the direction on the Flight Simulator grid and the value is different the one displayed in compass of Flight simulator. However, you can convert the values with following formulas:

FS Compass = FS-ATC heading + degrees coords are canted + Variation
FS-ATC heading = FS Compass - (degrees coords are canted + Variation)

Example 1:

FS-ATC says you are flying heading 90 at San Fransisco. Flight simulator will display:

Coordinates are canted at -20 degrees
Variation -16 degrees

$$90 + (-20) + (-16) = 90 - 36 = 54$$

Example 2:

Flight Simulator heading 90 in New York.FS-ATC will display

Coordinates are canted +10 degrees
Variation +12 degrees

$$90 - (10 + 12) = 68$$

Bank and Pitch are ignored by FS-ATC.

Preferences



You can choose if you want FS4 to be silent when FS-ATC gives messages to you. You can select if you want messages as text (Notification Manager) or spoken (Speech manager). To select Speech Manager voices click the button.

Finally, the Automatic position at RWY lets you choose if you want to taxi yourself to departure runway or skip there from gate.

How the position is tracked?

There are different ways to detect position of aircraft. The basic way is to compare distance from destination. When the aircraft is at specified distance or nearer, a message is displayed.

Second way is to set up a circle with center coordinates and radius in miles. When the aircraft comes into the circle, message is displayed.

[Example: Position and hold at runway...]

Third way is to use coordinates of a VOR, and check when the aircraft intercepts a specified radial counted from a circle that has the VOR coordinates as center. This is very accurate and useful when giving landing approach instructions.

[Example: intercept radial...]

Fourth way is to check altitude.

[Example: contact XXX departure...]

Sources

Complete source code is not available for public.

Registered users will receive THINK C source examples for extracting data from Flight Simulator using Apple Events and for converting that data to understandable format.

Bugs, performance problems?

This software has been written and tested with Macintosh Colour Classic (16MHz 68030,4MB, System 7.1). Beta testing has been done with some Quadra and latest PowerMac models.

I'm sure there are bugs that I haven't found. If you find any, please report them to me. Address is below.

Thanks to

Jeffrey N. Fritz for extensive testing and for lots of ideas and suggestions for improvements.

Robert Dorsett for providing me lots of documentation that has been used to build the Airport database.

Literature and references

Sollman with Harris: Mastering instrument flying (2nd edition)
Illman: The Pilots Air Traffic Control Handbook

Related internet newsgroups:
rec.aviation.simulators
rec.aviation.ifr

comp.sys.mac.games.flight-sim

FTP-site for lots of free simulator stuff:
<ftp://ftp.iup.edu/>

WWW-site for airport and navaid databases:
<http://www.cc.gatech.edu/db1/fly/>

Shareware policy

Old registered user: please contact me by email for information.

New user: If you like this software, send
10\$ US funds in Cash, to

Miika Asunta
Helsinginkatu 42 A 29
00530 HELSINKI
FINLAND
EUROPE

Unfortunately I can't accept checks or money orders.

For price of the shareware fee you get documentation for FS-ATC controller source file format, THINK C source examples for extracting data from Flight Simulator, and the next version of software, if there is one. I would like to distribute the package via email, so let me know your address. But snailmail works, too.

Suggestions and comments are welcome, you can email them to
Miika.Asunta@csc.fi

You may redistribute this program freely. Please include all files.

The technicalities are discussed with registered users only.
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