SIERRA'S 3-D
HELICOPTER™
S I M U L A T O R

8.6 Feet
(2.62 Meters)

7.5 Feet
(2.30 Meters)

1.2 Feet
(0.35 Meter)

32.1 Feet
(9.77 Meters)

24.6 Feet
(7.49 Meters)

23.1 Feet
(7.03 Meters)

4.8 Feet
(1.45 Meters)

6.8 Feet
(2.07 Meters)

8.1 Feet
(2.47 Meters)

8.0 Feet
(2.45 Meters)

6.7 Feet
(2.03 Meters)

1.3 Feet
(0.40 Meter)

25.5 Feet
(7.76 Meters)

6.5 Feet
(1.97 Meters)

4.6 Feet
(1.39 Meters)

5.4 Feet
(1.66 Meters)

27.4 Feet
(8.34 Meters)

Sierra's
3-D Helicopter Simulator™

Programmed by Joe Wofford

TABLE OF CONTENTS

INTRODUCTION

Congratulations, you have just purchased the most advanced flight simulator available for personal computers. With it, you will learn the fundamentals of flying a helicopter in addition to enjoying exciting air-to-air combat against a computer-guided enemy helicopter or against a human opponent via modem.

This manual contains important information about the use of your "Helicopter Simulator" and you should read through the "Getting Started" section before you "boot" your disk.

About Sierra

Sierra On-Line, Inc. was founded in 1979 by Ken and Roberta Williams. Since that time, Sierra has introduced hundreds of different software products including Frogger, HomeWord, and the King's Quest series of games. Sierra is best known for its expertise in graphics and animation. Sierra's products have received hundreds of awards.

About the Author

Joe Wofford went to school at Clemson University in South Carolina receiving a Bachelor of Science degree in Physics. He is 26 years old and has been working on the 3-D Helicopter Simulator for over three years. Joe's interests include computer animation and artificial intelligence. He enjoys music, swimming, science fiction and telecommunications. Joe was assisted in development by John Hartin and Ken Williams. Documentation was written by Ken Williams and Jerry Albright.

A special thanks goes to Tom VanGilder and the staff at Mazzei Flying Service for their assistance on the 3-D Helicopter Simulator project.

Coming Soon

Sierra is constantly working to enhance its products. Watch for upgrades to your Helicopter as well as optional scenery disks.

BEFORE YOU GET STARTED

- Send in your Warranty Card!
  Sierra is constantly working on ways to improve our products. If you do not send in your warranty registration, we'll have no way to let you know about the advances we're making. Please send it in immediately.

- Make a back-up of your disk!
  Never run "3-D Helicopter Simulator" off of the original disk. Of course, it would execute just fine, but every time you use a disk you take a chance on damaging it. Just to be safe, follow the steps below to make a back-up.
  1. Format a disk using MS-DOS.
  2. From the DOS prompt enter "Copy A:*.* B:"
  3. Follow the onscreen prompts.

- If you have a hard disk, load the program onto your hard disk using the instructions below:
  1. Turn on the computer and allow DOS to boot.
  2. Insert the original program disk 1 in a floppy drive. Change the DOS prompt to the letter of the floppy drive containing the original program disk 1 by typing the letter of the drive followed by ":" and Enter.
  3. From the floppy drive containing your original program disk 1, enter the command "installh c:" where your hard disk is designated as drive c:. If your hard disk has a letter designation other than c:, use it instead.
  4. Follow the screen prompts to begin the hard disk installation.
  5. You will receive loading instructions on screen after the installation. Please note those instructions for later use.

A Word About Copy Protection

Copy protection is a nuisance. Unfortunately though, software piracy happens all too often and the rest of us have to pay for the actions of the pirates. Sierra has attempted to make our copy protection as easy to get along with as possible. Each time you run the program you will be asked to put the original diskette into a floppy drive just long enough for us to verify that you are the original purchaser. You may then put your original copy back in a safe place and you will not be asked for it again. We apologize for this inconvenience.

- Read The Read.Me File!
  Sometimes we fix bugs or add features to your product after we have printed this manual. For the most up-to-date information, make sure you look at the file "Read.Me" on your disk.
  1. Boot DOS.
  2. Put the 3-D Helicopter disk into any floppy drive.
  3. Enter "TYPE A: READ.ME"

                       ↳The drive letter that the helicopter disk is in

LOADING INSTRUCTIONS

From Floppy Disk
1. Load MS-DOS.
2. Remove the DOS disk from the drive.
3. Insert your copy of the 3-D Helicopter Simulator disk into the floppy drive.
4. Enter "HELI".

From Hard Disk
1. From the DOS prompt, enter "CD SIERRA".
2. Enter "HELI".

Graphics Mode
Sierra's 3-D Helicopter Simulator works with several different graphics cards. In most cases, the program will guess correctly which graphics card you have installed. If the 3-D Helicopter Simulator does not function properly on your computer, try entering "HELI ?". This will list the supported graphics modes and a parameter with which you can specifically request a given mode.

ORIENTATION

Wait! Although you may be anxious to get into the air, take the time to read this section and orient yourself with the aircraft.

What You See Onscreen
You should see the following:
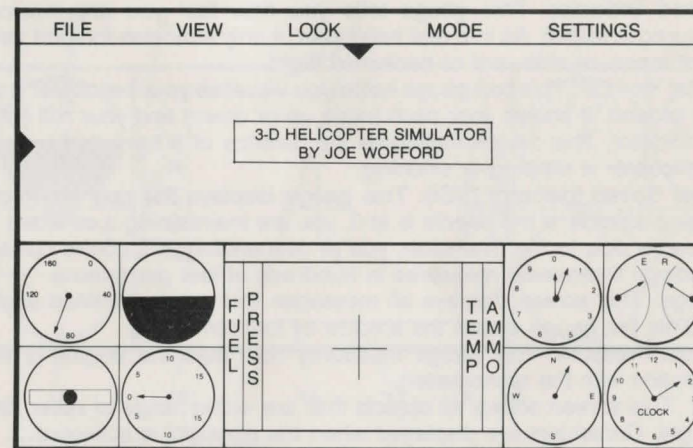
If you don't, try pressing the ALT-R keys. If that doesn't work, try loading the program again.
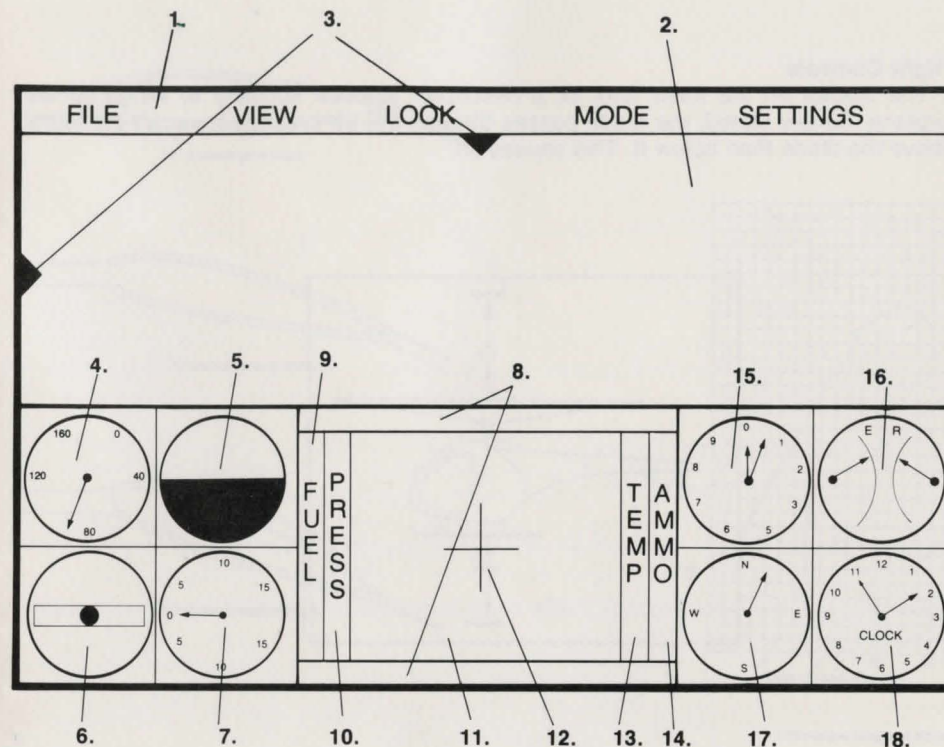
Note: Whenever you use the ALT key in conjunction with another key, you must press the ALT key first and hold it down while pressing the other key (much like the shift key on a typewriter).

GAUGES

Take a moment to refer to the diagram to familiarize yourself with the various screen gauges.

1. Menu Bar.
2. Out of Window View. This display shows what you would see looking out the front window of your helicopter.
3. Viewpoint Needles. These two needles indicate your current viewpoint (horizontally and vertically).
4. Airspeed Indicator. This gauge tells you how fast you are moving forward (measured in knots). As in a real helicopter, it only indicates forward velocity, and will not measure sideward or backward flight.
5. Artificial Horizon. This ball gauge helps you visualize your helicopter's orientation to the ground. It shows your pitch (nose up or down) and your roll (left or right).
6. Slip indicator. This device measures the balance of a turn, and indicates when the helicopter is slipping or skidding.
7. Vertical Speed Indicator (VSI). This gauge displays the rate at which you are changing altitude. If the needle is at 0, you are maintaining a constant altitude. If the needle dips to the downside, you're descending; if it points upward, you're ascending. The needle measures in hundreds of feet per minute.
8. Message. This screen displays all messages that are transmitted and received.
9. Fuel. This bar gauge shows the amount of fuel remaining.
10. Manifold Pressure. This gauge measures how hard the engine is working (in conjunction with the tachometer).
11. Radar. This screen shows all objects that are within range of radar (2000 feet).
12. Gunsight. Crosshairs are displayed when the gunsight is activated.
13. Temperature. This bar gauge shows the current oil temperature.
14. Ammo. This bar gauge shows the amount of ammunition remaining (maximum ammunition = 60 missiles).
15. Altimeter. This gauge measures your altitude in feet. The short needle measures in thousands of feet. The long needle measures in hundreds of feet.
16. Dual tachometer. This gauge measures the RPM's (revolutions per minute) of the engine and main rotor.
17. Compass. The needle on this gauge indicates the direction the nose of the helicopter is pointing. Remember, in a helicopter, unlike an airplane, you don't need to be flying in the same direction you are facing.
18. Clock.

1. Menu Bar
2. Out of Window View
3. Viewpoint Needles
4. Airspeed Indicator
5. Artificial Horizon
6. Slip indicator
7. Vertical Speed Indicator (VSI)
8. Message
9. Fuel
10. Manifold Pressure
11. Radar
12. Gunsight
13. Temperature
14. Ammo
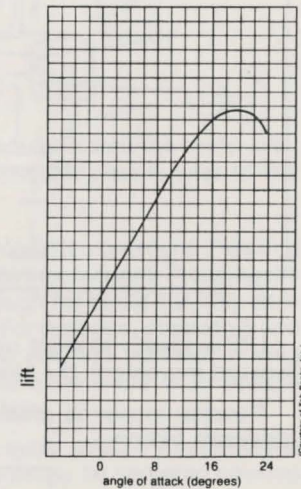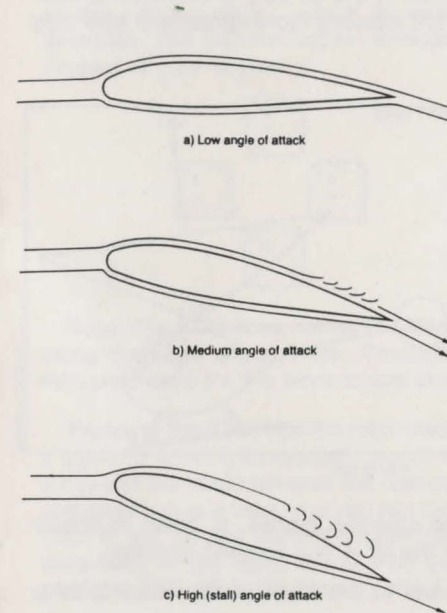15. Altimeter
16. Dual tachometer
17. Compass
18. Clock

Flight Controls

The blades on the main rotor of a helicopter function similarly to wings on an airplane. Simply stated, the blade passes through the air creating lower air pressure above the blade than below it. This causes lift.
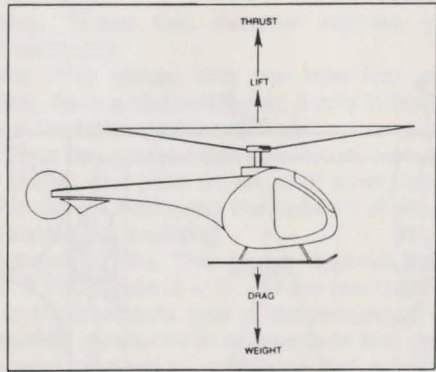
The faster the blade passes through the air, the more lift that is created. In a conventional airplane, the propellor pushes the plane forward causing air to pass over the wings. When the air passes over the wings fast enough the plane ''lifts'' from the ground. Each blade on a helicopter's main rotor serves the same purpose as an airplane's wings.

Where the difference between a plane and a helicopter is most recognizable is in the way that steering occurs. There are two ways to vary the amount of lift created by a moving blade, the first of which is to vary the speed at which wind passes over the blade. The second way is to vary the path that the air takes as it passes over the blade. Most airplanes steer by changing dynamically the shape of the wings (using ailerons). Air flow is redirected in such a way that more lift is created on one side of the plane than the other. Hence, the plane tilts and turns to the side of lower lift.


a) Low angle of attack

b) Medium angle of attack

c) High (stall) angle of attack

Airflow Separation With Increasing Angle of Attack

angle of attack (degrees)

Lift versus Angle of Attack

As the angle at which the blade attacks the wind increases, so does lift, up to a limit.

Tilting the plane causes it to turn because the wings are not only lifting upward but also to the side.

horizontal component of lift
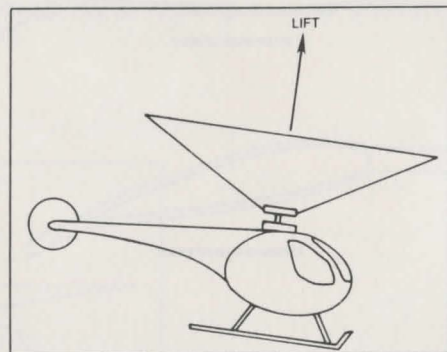
total lift

Aircraft in a bank
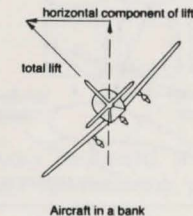
The concept of using lift to control the direction of the aircraft is common to both helicopters and airplanes. However, helicopters are infinitely more versatile in how they can re-direct lift.
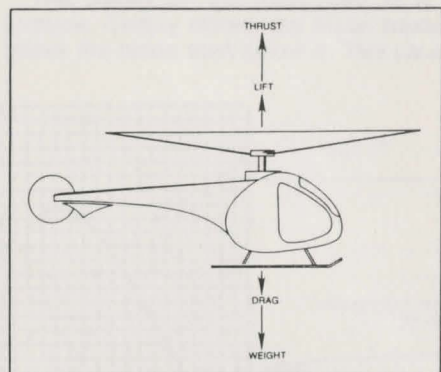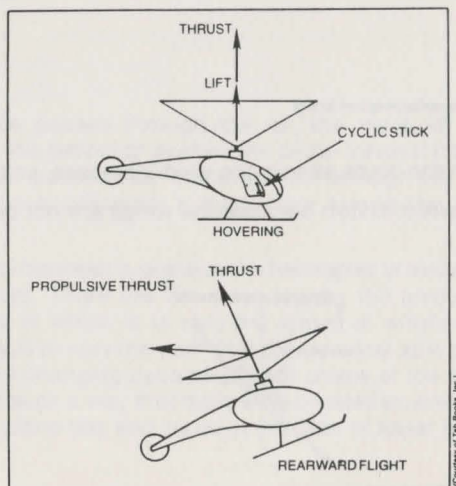

During vertical ascent, thrust acts in same direction and in line with lift.


Forward flight.

Lift is always straight up from the top of the spinning blades. In order to create forward movement, the blades are tilted so that the lift is in a forward direction.

Reverse motion is created by tilting the blades to the back of the aircraft, as is sideways motion.
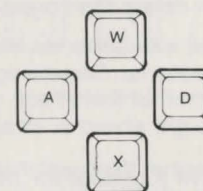

Flight attitudes and propulsive thrust, hover and rearward.

In a helicopter, this "tilting" of the main rotor blades is accomplished through the use of the "cyclic stick," which is essentially analogous to a joystick for controlling direction. The 3-D Helicopter Simulator recreates the cyclic stick using the numeric keypad of your keyboard.
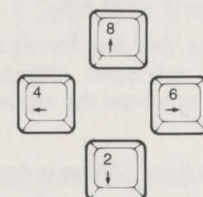

Note: The PCjr does not have a numeric keypad. We have simulated the cyclic stick using the keys shown here. Throughout the instruction manual please refer to the reference card for the keys to use on your PCjr.

Pressing the 8 key tilts the rotor blades forward creating forward movement. Pressing it again (or leaving it pressed) causes the blade to tilt even farther forward. Pressing the 2 key tilts the blade towards the rear of the helicopter. Although the blade can only tilt in one direction at a time, you can combine multiple presses. For instance, pressing 8 and then 6 will tilt the blades forward and to the right. You will find yourself moving diagonally to the right. If you wish to stop, you must restore the blade to its upright position. This could be done by the 4 key and then the 2 key.

Sierra has provided a short-cut method of centering the cyclic stick. If you press the Delete key followed by the 5 key, the cyclic stick will immediately be centered causing motion to stop.
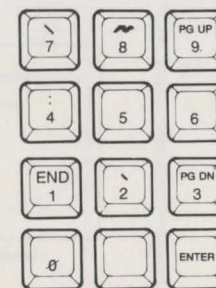
TANDY 1000

SAME AS INSERT
SAME AS DELETE

Tandy 1000 owners: on your keyboard, the Insert and Delete keys can only be reached by "shifting." For your convenience, you may use the "0" and "." keys as an alternate method.

We have provided a short-cut for those situations in which you wish to continue moving forward but not sideways. If you press the Delete key followed by the direction key you wish to cancel motion in, you will "delete" your motion in that direction. For instance, if you are going diagonally backwards (you have pressed the 2 and 4 keys), you can key in delete then press the 2 key to be going to the left only.

We observed with airplanes that once you tilt the wings, the direction of lift changes and the plane turns. Something similar happens in a helicopter. Unless you take measures to counter this effect, your helicopter will turn any time the blades are tilted other than straight ahead or straight to the side.

Torque is another thing which causes your helicopter to turn. Torque is caused by the spinning of the rotor blades.
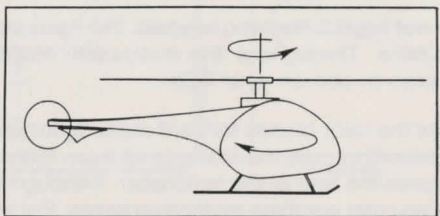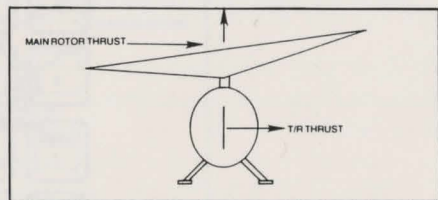

Torque wants to rotate the helicopter opposite the rotor.

Another set of rotor blades (the tail rotor) is attached to the back of the helicopter in order to counter this effect.

DIRECTION OF MAIN ROTOR

MAIN ROTOR THRUST LEFT OF VERTICAL

TORQUE REACTION
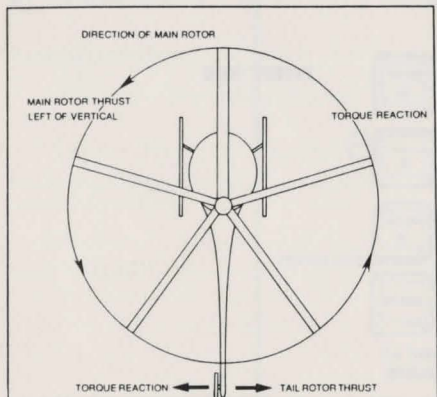
TORQUE REACTION   TAIL ROTOR THRUST

MAIN ROTOR THRUST

T/R THRUST
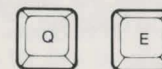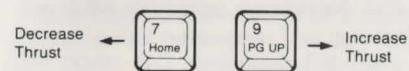
The helicopter will tend to move in the direction of the tail rotor thrust.

The tail rotor's pitch can be varied, controlling the amount by which torque causes the main body of the helicopter to turn.

Tail rotor thrust is controlled by the 7 and 9 keys.

Decrease Thrust ← [7 Home] [9 PG UP] → Increase Thrust

[Q] [E]

PCjr owners: The "Q" and "E" keys are utilized in the PCjr version.

Decreasing tail rotor thrust will cause you to turn left. Increasing it will cause you to turn right. In a real helicopter, tail rotor thrust is controlled from the foot pedals.

It is necessary to use tail rotor thrust to turn when the main rotor blades are centered. Once you are moving, the main rotor blades or the tail rotor can be used for turning.

We've provided a simple way to "center" the tail rotor. Pressing Delete followed by either the 7 or 9 key will cause the tail rotor thrust to exactly stabilize against the torque caused by the main rotor blades.

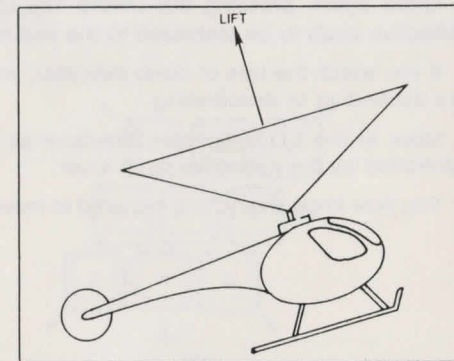You will notice while moving the helicopter that the horizon seems to raise or lower out the window as you move forward or backward. This is because the rotor blades are actually "dragging" the helicopter through the air.

You now know enough to move around the helicopter. Give it a try. If you crash or feel like starting over, press ALT-R to restart.
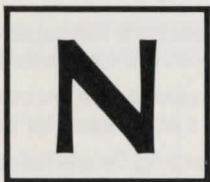

LIFT

Hovering.

LIFT
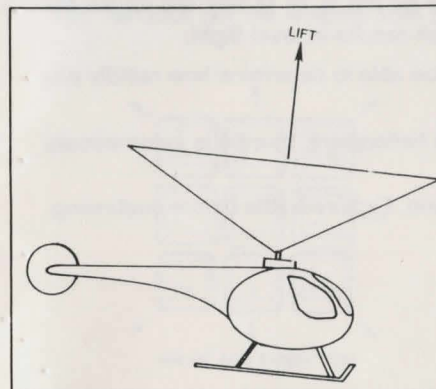
Backward flight.

Now it is time to "take to the air." All climbing and descending are done by varying the collective pitch lever. Increasing collective pitch (the angle at which the rotor blades attack the air) will cause the helicopter to climb and decreasing collective pitch will cause the helicopter to descend.

INCREASE

(ASCEND)

DECREASE

(DESCEND)

Each time you press N you increase the amount of collective pitch. Each time you press M you decrease the amount of collective pitch.

Once again, pressing the Delete key followed by the N or M key will cause the collective pitch to be stabilized to the setting which results in level flight.

If you watch the rate of climb indicator, you will be able to determine how rapidly you are ascending or descending.

Note: In the 3-D Helicopter Simulator as in real helicopters, throttle is automatically controlled by the collective pitch lever.

You now know everything required to move around. Explore a little before continuing.

ADVANCED FEATURES

Looking Around

One major disadvantage of a computer-based flight simulator is the limited screen size. In a real helicopter, you can look out the side windows or even lean forward and look down. 3-D Helicopter Simulator compensates for this by allowing you to decide which window you want to look out.

Press ALT-R to start over and then Enter to remove the title box. You should be looking at this:
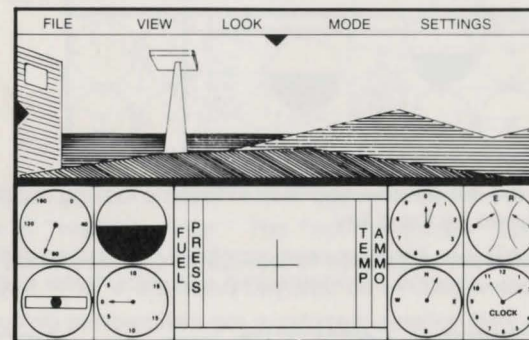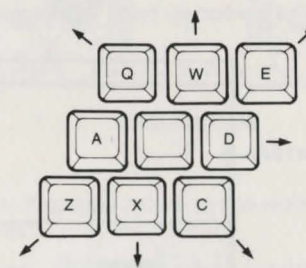

FRONT VIEW

To look out a window, press the Insert key followed by the key representing the direction you want to look.

You can look out the window from 8 locations.
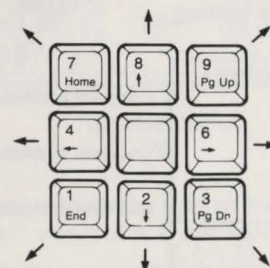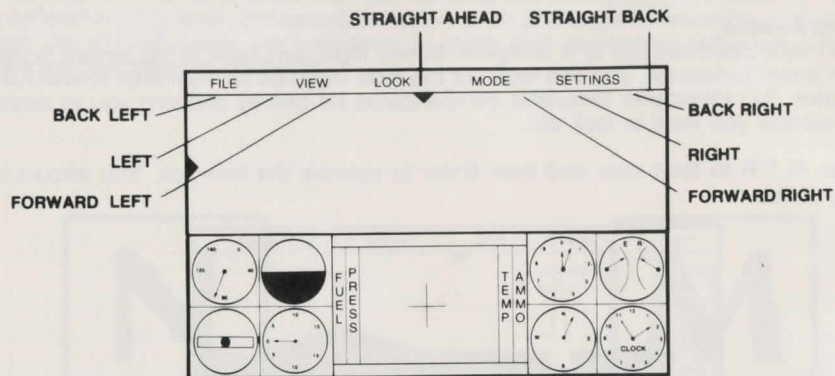

IBM PC AND TANDY 1000

PCjr

On screen, you can tell which window you are looking out via a small triangle which appears along the top border of the out-the-window display.

It will appear in one of the following eight locations:

STRAIGHT AHEAD   STRAIGHT BACK

BACK LEFT   BACK RIGHT

LEFT   RIGHT

FORWARD LEFT   FORWARD RIGHT

If, after looking out the left window, you wish to resume looking out the front window, then press Insert followed by the 8 key.

Sometimes, you will want to be able to look upward or downward in order to find something above or below you. To do this, you press the + or − keys.

INSERT
+

DELETE
−

+

−

−

+
=

TANDY 1000   PC   PCjr
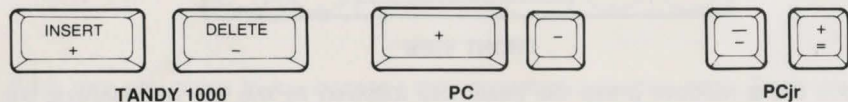
These keys may be pressed repeatedly in order to increase or decrease the viewing angle.

So that you may immediately determine your view angle, we have an indicator on the left side of the screen to help you know where you are looking.
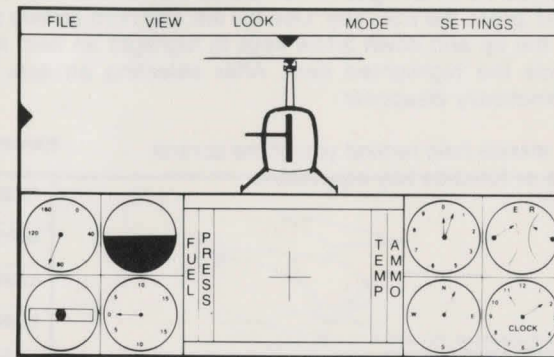
LOOKING STRAIGHT UP

INDICATOR   LOOKING STRAIGHT AHEAD

LOOKING STRAIGHT DOWN
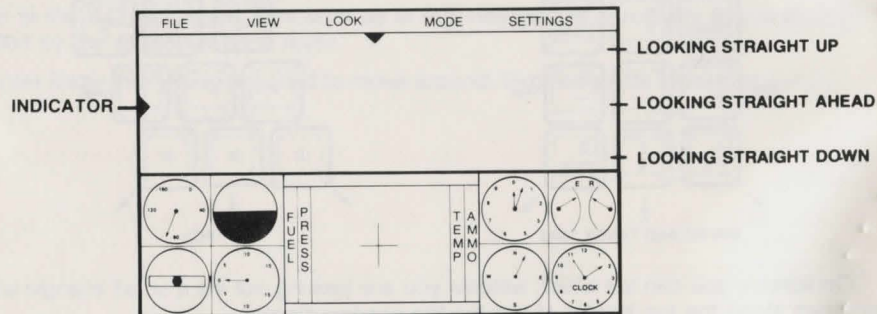
Another Way of Looking at Things

3-D Helicopter Simulator supports several additional viewpoints. To demonstrate this, 1. Press ALT-R followed by Enter.
2. Press G.

You should see the following:

You are now in "tracking mode." The "out-the-window" display is showing what someone standing behind you holding a camera would see. Go ahead and fly around. You will be able to watch your own helicopter from behind.

Two other viewing perspectives are supported: satellite view and ground view.
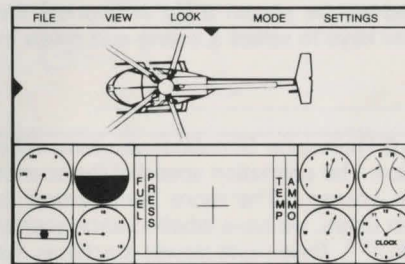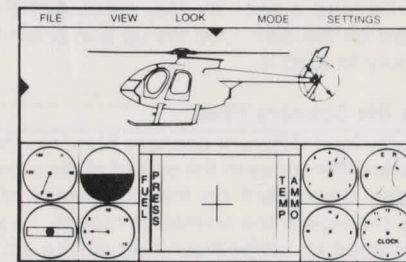
Satellite View   Ground View
"V"   "F"

Try experimenting with all three view points. You may return to the normal "out-the-window" view point at any time by entering "R".

Also, try experimenting with "looking around" while in tracking, satellite or ground view. It works but takes some getting used to. With practice, you'll find that visibility is actually superior in 3-D Helicopter Simulator to the real thing.

Pull-Down Menus

Most of the keyboard commands have been placed onto pull-down menus in order to save you from having to remember all the various keyboard commands. To pull down a menu, press the ESC key. Use the left and right arrows to select the menu to pull-down and the up and down arrow keys to highlight an item from the menu. Pressing Enter selects the highlighted item. After selecting an item from a menu, the menu will automatically disappear.

The menus help remind you of the control code or function key equivalent.

EXAMPLE:

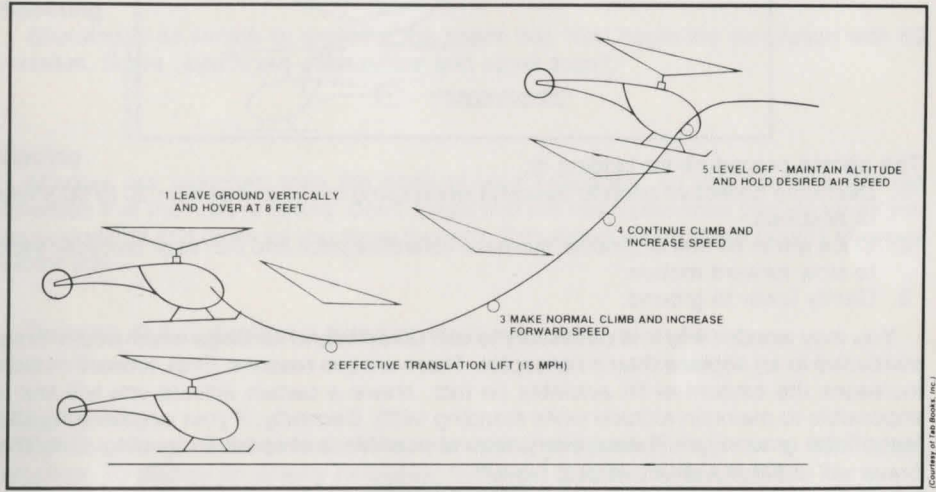| FILE	ALT-F
INFO	ALT-I
LOAD PILOT	ALT-P
LOAD ENEMY	ALT-E
QUIT	ALT-Q
RESTART	ALT-R

Bold New Worlds

3-D Helicopter Simulator allows you to fly through several different scenes included with the program, as well as through landscapes that will be created for upcoming disks. To load a scenery file, press ALT-F. You will be shown a list of scenery files included on the disk. Use the up and down arrow keys to select a scene and press the Enter key to load it.

About the Scenery Files

As you load different scenery files into the 3-D Helicopter Simulator you may notice dramatic differences in the speed of the animation. The animation speed of the scenery is largely dependent on the complexity of the scenery. The more complicated the scene, the slower the animation moves. To assist users, we have labelled each scenery file designed for faster machines with an asterisk "*". Those with slower machines may want to run only those scenery files without the "*", as the animation speed may be reduced dramatically when trying to run a "*" file.

Programmer's note: Due to the nature of the program, you may notice some inconsistencies when using alternate viewpoints. For instance, the helicopter will be able to pass through solid objects, due to the manner in which collision is detected within the program. To maximize the performance of the 3-D Helicopter on all machines, we had to make some compromises between accuracy and speed. We believe we have chosen the best possible compromise.

TAKEOFFS, LANDINGS AND AUTOROTATION

5 LEVEL OFF - MAINTAIN ALTITUDE AND HOLD DESIRED AIR SPEED

1 LEAVE GROUND VERTICALLY AND HOVER AT 8 FEET

4 CONTINUE CLIMB AND INCREASE SPEED

3 MAKE NORMAL CLIMB AND INCREASE FORWARD SPEED

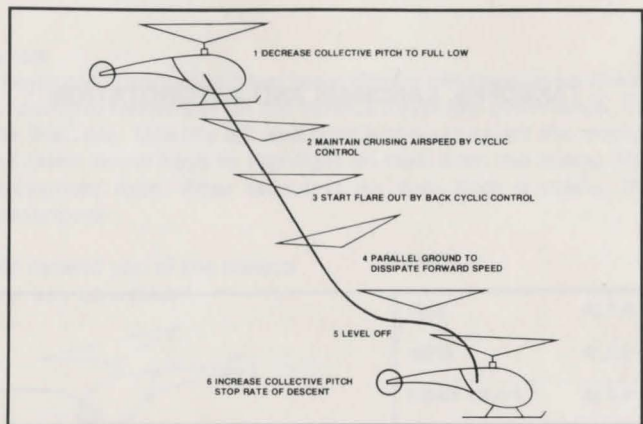2 EFFECTIVE TRANSLATION LIFT (15 MPH)

Standard takeoff.

The normal procedure for takeoff is to:
1. Apply collective pitch until you "break loose the skids."
2. Tilt the cyclic stick forward until you reach approximately 50 knots.
3. Pull back on the collective pitch to climb.

The normal procedure for landing is:

1. Decrease collective pitch to descend while using cyclic to maintain 30 to 50 knots of airspeed.
2. Once within 50 feet of ground, increase collective pitch and pull back on cyclic stick to slow forward motion.
3. Gently lower to ground.

You may wonder why it is necessary to use takeoffs and landings which seem more conducive to an airplane than a helicopter. There are two reasons. First, forward motion increases the amount of lift available (in fact, above a certain altitude you will find it impossible to maintain altitude while standing still!). Secondly, if your engine quits 100 feet off the ground, you'll want every second possible to prepare for landing. Only the brave will attempt a direct vertical takeoff.

Landings

One of the trickier maneuvers you can learn is landing on objects barely large enough to hold you.

In order to land, you must have a descent rate of below 50 feet per minute or you will crash. Start with a viewing angle of straight down and start raising it, slowly watching a building edge as you descend. It's tricky, but it's possible.

Autorotation

Should your engine quit during flight (this can happen during combat), you need not fear. Although you will not be able to climb, you will find that you still have a great deal of control over descent using the cyclic stick and the collective pitch lever. While falling, try to work your way to a refueling station for repairs, following the normal procedures for landing. For purposes of the simulation you will be able to "drive" to a refueling station if necessary, should you survive the impact.

COMBAT

Shooting

Shooting is as simple as pressing the space bar. You begin the simulation with 60 missiles. Some objects are destructible and some aren't.

Aiming

Missiles are launched from the nose of your helicopter, so you can only fire the direction that the nose is facing. Don't forget that the helicopter nose pitches up as you go backwards and down as you move forward. This allows you to shoot targets above or below you.

Pressing ALT-G displays a gunsight which will assist you in aiming.

Target Practice

Before you go head-to-head in actual aerial competition, take in a little target practice. To display an enemy helicopter for target practice, enter ALT-T.

The enemy will fly wide circles at a distance of 2000 feet. Practice shooting it down from varying altitudes, from in front and in back. If you can't easily hit this sitting duck, you will certainly have trouble during actual combat.

Combat Mode

To enter combat mode, enter ALT-C. Surprise! The enemy target doesn't fly circles anymore. Now he is on the attack!

Each time you hit the enemy with a missile, you will inflict some damage. Unfortunately, you also sustain damage when hit. This can range from no damage to gauges that malfunction to total obliteration. Tread carefully!
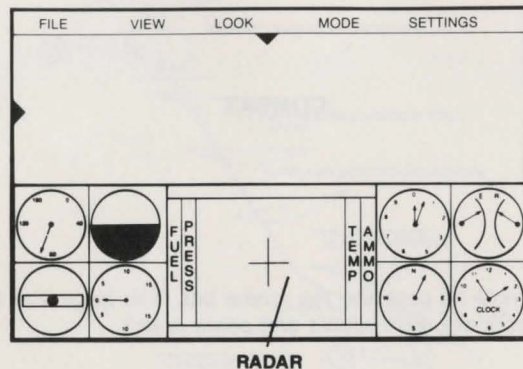
RADAR

In the center of your instrument panel is a radar screen. On it, white dots represent buildings or other landmarks. Colored dots are enemy aircraft or missiles.
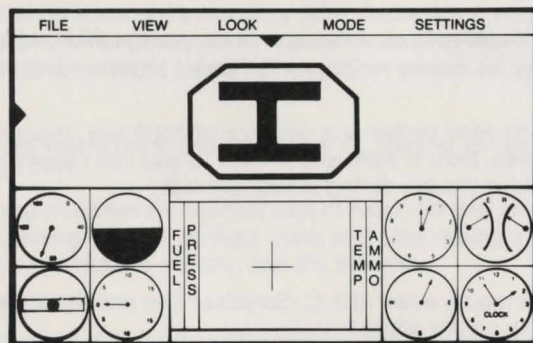
*Red - enemy missiles
*Blue - enemy helicopter below you
*Purple - enemy helicopter above you
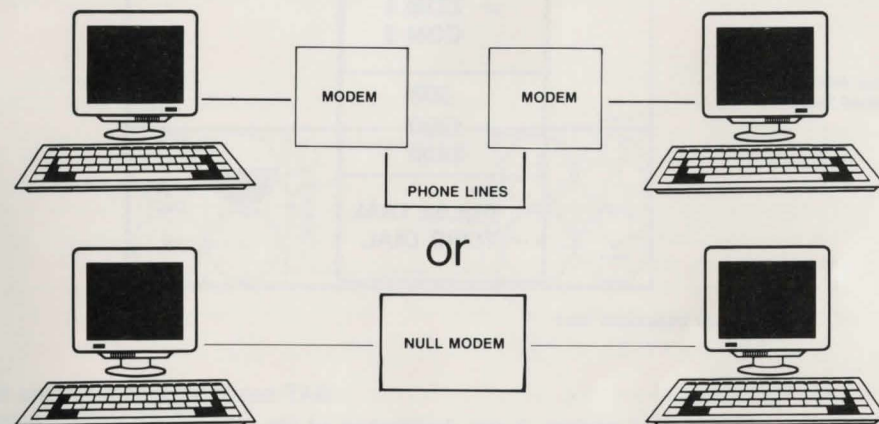Note: Colors may vary - try your computer

Refueling/Reloading

Whenever you see a refueling pad in the scenery

you may land to repair the damage you have sustained, take on ammo and refuel.

TELECOMMUNICATIONS

Requirements

The 3-D Helicopter Simulator allows you to challenge other people around the country to a very real kind of combat. In order to play, both you and your friend must own a copy of 3-D Helicopter Simulator (although you don't need to own the same kind of computer). Also, you must both either own a modem or be in the same room connected via a null modem.

Configuring

Before communicating, you must tell the 3-D Helicopter Simulator about the hardware connected to your computer. This is done via the settings pull-down menu.

```
  ✓  COM 1
     COM 2

     300
  ✓  1200
     2400

     PULSE DIAL
  ✓  TONE DIAL
```

When you installed your modem, it was designated as either Com1: or Com2:. In most cases, it will be Com1:. Try this first. If it doesn't work, call your dealer or try Com2:.

Communication requires that both computers are talking at the same speed. 1200 usually works best.

You must identify whether your phone system uses pulse dialing or tone dialing. If your phone is a push button then select tone, otherwise select pulse.

Once you make your settings, you will probably never need to set them again, unless you change modems.

Making the Connection

Via modem

One of you must dial the other. The answering party should enter ALT-A. The 3-D Helicopter Simulator will wait for 5 minutes for the phone to ring. You may press ESC if at any time you change your mind.

The calling party should enter ALT-D in order to dial the phone. You will be prompted for a phone number.

What To Do Once You Are Connected

After you hear your modem connect, wait about 10 seconds and then try sending a message to your partner to test your connection. To enter a message, press the TAB key. Everything you type until you press Enter will be transmitted.

Messages from your friend appear here.

Your messages appear here.
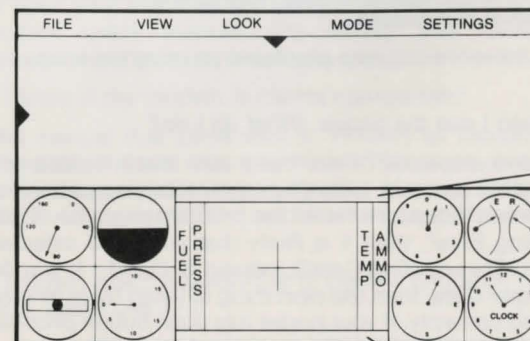
To enter a message: Press TAB
Type: PREPARE TO DIE
Press: Enter

If you do not quickly receive a response, try sending another message. If still no response, check the lights on your modem. Both "SD" (send data) and "RD" (receive data) should be blinking continuously. If not, you may have to start the connection process over.

If your friend responds, then you know that he or she is out there somewhere. Where exactly depends on the scenery. Try zooming the radar (use I and O) to find him/her, or pick a common landmark and both of you fly there.

Once you are together, you can either blast each other from the skies or you can just decide to go sightseeing together. It's up to you. We suggest that your first few sessions be spent just flying places together. Try some formation flying under bridges. Try landing side by side in a football stadium. Until you are completely comfortable flying around, you will find combat too difficult anyhow.

If one of you kills the other, you both will wind up back in your initial start positions in the scenery file you currently have loaded. You can continue to play until one of you enters ALT-H to hang up the phone.

TELECOMMUNICATIONS TROUBLE-SHOOTING

A tutorial on telecommunications including Baud rates and protocols is not practical within this manual. We recommend that you read your modem users manual for more details. Many good books have been written on telecommunications. Check with your computer dealer to see what is available.

Following are some of the more common problems you may experience and possible solutions:

Q. Nothing happens when I dial the phone. What do I do?

A. Does your modem have a speaker? If so, make sure that if it has a volume control that it is turned as high as possible. Listening to what happens when you attempt to dial is the most important indicator of what the problem might be. If you don't hear anything after pressing Enter, then it is likely that you have selected the wrong communications port. Try selecting Com2: instead of Com1:. If you do hear a dial tone when the computer dials, then the next thing to listen for is whether or not the phone is getting dialed correctly. If your house has push button phones, you should hear the dialing as a series of beeps. If it doesn't appear that the phone is dialing correctly, try selecting "Pulse" instead of "Tone" or vice-versa.

Q. I hear my modem connect but then nothing happens. What now?

A. You have a problem which cannot be solved over the phone. You need a friend who can open your machine and verify that everything is set up correctly. Consult your modem users manual. Try calling your dealer. Try running other communications software to see if you can get it to work.

Q. What should I do if my modem will not answer the phone?

A. Try checking all the dip switches in your modem to verify that "auto answer" is selected. If you still can't figure out what is wrong, then call your friend instead of having him/her call you. It is possible that your modem doesn't support auto answer or is not a true Hayes compatible.

Q. Will playing 3-D Helicopter Simulator have an adverse effect on my phone bill?

A. Whenever you are connected via modem, the phone company is billing you as if you were talking. If your friend lives outside your local dialing area, you will be incurring charges.

Q. No matter what I do, I can't get it to work and I can't hear my modem. Now what?

A. You have a problem which cannot be solved over the phone. You need a friend who can open your machine and verify that everything is set up correctly. Consult your modem users manual. Try calling your dealer. Try running other communications software to see if you can get it to work.

Q. How do I know if my modem is Hayes compatible?

A. Check the manual that came with it. Virtually all modems currently sold have a Hayes compatible mode. You may have to flip some switches to get into it. If not, you may want to consider upgrading your modem. External 1200 baud modems are available for under $100 if you hunt around. Make sure you buy one with a speaker.

Q. I have a modem which requires me to dial the phone by hand in order to establish connection. Can I use it?

A. In many cases. After you have made the connection, try entering the "H" key for local connection. We only support true Hayes Compatible modems, but this might work. If it doesn't work, you may have to purchase a Hayes Compatible modem.

TECHNICAL SPECIFICATIONS

AIRCRAFT CHARACTERISTICS

Airspeed Limitations

Maximum airspeed	109 knots
Maximum cruise airspeed at 75% power	102 knots

Airspeeds for Safe Operation

Best take-off and climb speed	60 knots
Maximum rate-of-climb speed	53 knots
Best landing approach speed	60 knots
Best autorotation speed	65 knots

General Performance

Maximum range	over 200 miles
Typical fuel consumption	7 to 8.5 gph (gallons per hour)
Gasoline mileage	up to 12 mpg (miles per gallon)
Rate of climb (at sea level)	1,000 fpm (feet per minute)
Maximum ceiling	12,000 feet
Hover ceiling	6,000 feet

Power Plant Limitations

Engine	One Lycoming Model 0-320

Weights

Gross weight	1,370 lbs.
Empty weight	861 lbs.
Fuel standard	19.2 gallons

Operating Limitations

Cylinder Head Temperature	500 degrees F
Oil Temperature	245 degrees F

Fuel Capacity

Main tank total capacity	19.8 gallons
Main tank usable capacity	19.2 gallons

**Flight and Maneuver Limitations**

Use maximum RPM during take-off, climb, or level flight below 500 feet or above 5,000.

WARNING: Avoid abrupt pull-ups (hitting 2 key) or push-overs (hitting 8 key) during forward flight. When a pull-up is followed by a push-over, a weightless (low G) condition may occur. If the aircraft starts to roll during this condition, gently apply reverse cyclic (2 key) to reduce the weightless feeling before using lateral cyclic (4 or 6 key) to stop the roll.

JOYSTICK MODE

3-D Helicopter Simulator provides support for dual joysticks.
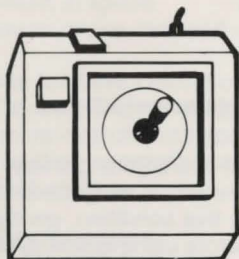
CYCLIC STICK

JOYSTICK A
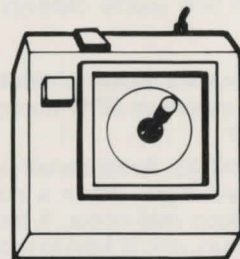
COLLECTIVE PITCH LEVER AND TAIL ROTOR PITCH

JOYSTICK B

The buttons will fire missiles.

Use the ALT-J keys to toggle between joystick and keyboard mode.